CASE IH



20 Series Axial-Flow Combine

Service Training Manual

5175 Rev. 01/2010

Book 1 of 2

NOTES:



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CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

20 SERIES AXIAL-FLOW® COMBINE



CLASSROOM WORKBOOK

Rev. 01/2010

CASE CORPORATION
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RACINE, WI 53403 U.S.A.

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PRINTED IN U.S.A.

Classroom Workbook

To The Technician: This Classroom Workbook is designed to enhance your proficiency of the Axial Flow 10 and 20 Series combines with respect to each section of the Service Training Manual. The questions and format are designed to increase your comprehension of important concepts and material that are addressed in each section of the manual. This will become your guide to finding topics in the manual after you have completed the Service Training.

The Service Training Manual and Classroom Workbook should also be utilized to address other concerns you have about related systems on the AF 10 and 20 series that may not be covered in the program that you are attending.

Use your excess time during the training program as focused, self-directed study toward the system or systems you feel you need to improve upon. If you still have questions or want a further explanation/clarification, talk with other students in your program and/or the Training Facilitator.

Make the most productive use of your time in the program. The more knowledge you have of the entire machine when you finish, the more effective you become to your employer.

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EXERCISE #1 "INTRODUCTION"

For the machine you have been assigned find the following:

	Questions/Items to find	Record Answer Here
1	Model Name/Number (ex. AF7120, AF8120)	
2	PIN Number of combine	
3	Engine Size (Cursor 9L or 10L or 13L)	
4	Engine Model Number (F*********)	
5	Where is the engine model plate?	
6	Engine PIN	
7	Where is the engine PIN plate?	
8	Engine Grid Heater? Yes or No	
9	Engine Block Heater? Yes or No	
10	GPS Receiver (None, AFS162, AFS262)	
11	Rotary air screen internal brush? Yes or No	
12	Unload Tube Length (21' or 24')	
13	Unloading Drive Type = Chain, Hydraulic or Both	
14	HDASA or PGA?	
15	Single or Two Speed PGA? (if equipped)	
16	Accuguide Ready Steering Cylinder? Yes or No	
17	Trailer Hitch? Yes or No	
18	Final Drive type (bull gear or planetary)	
19	Transmission differential lock? Yes or No	
20	Lateral Tilt Equipped? Yes or No	
21	Rock Trap? Yes or No	
22	Feeder Drive CVT or Fixed Speed?	
23	Chopper or Beater?	
24	Chopper Stationary Knife Sensor? Yes or No	
25	Cleaning system width (52" or 62")	
26	Shaker pan or auger bed?	
27	Electric in cab sieve adjust? Yes or No	
28	Self Leveling Cleaning System? Yes or No	
	AFS Yield and Moisture? Yes or No	

	Questions/Items to find	Record Answer Here

EXERCISE #1 "INTRODUCTION"

Locate the following drives. Identify if it is a belt or a chain. Record how many belts or chains MUST be removed before the drive in question can be removed. The first row is completed as an example.

Drive	Belt or Chain?	How adjusted?	Remove to replace?
8120 Engine Cooling Fan	Belt	Spring no adj	None
7120 Engine Cooling Fan			
7120 AC Compressor			
7120 Dust Screen Interm. Shaft			
Rotary Air Screen			
Cleaning Fan			
Tailings Processor			
Clean Grain			
Bubble Up Auger			
Separator			
Chopper			
Cleaning System Shaker			
Unloader			

1. Which drives are connected directly to the PTO Gearbox?

_____

2. Which shafts have a drive on each end?

_____

3. How many belts or chains are used to drive the feeder house?

_____

4. How many belts are on a 7120 or 8120 not counting the engine and rotary air

_____

5. How many drive chains are on a 7120 or 8120?

_____

EXERCISE #1 "INTRODUCTION"

6. How many belts are on the engine and rotary air screen for each machine?
   7120:
   8120:

7. Locate the decal near the battery box and answer the following question.
   When the combine batteries need to be boosted, it is done by:
   A. Attaching the booster to the first battery toward the front of the combine.
   B. Attaching the booster to the rear battery.
   C. Attaching the booster across both batteries
   D. Attaching the booster directly onto the starter motor.

8. When are the two times the buzzer on top of the engine deck area will sound?

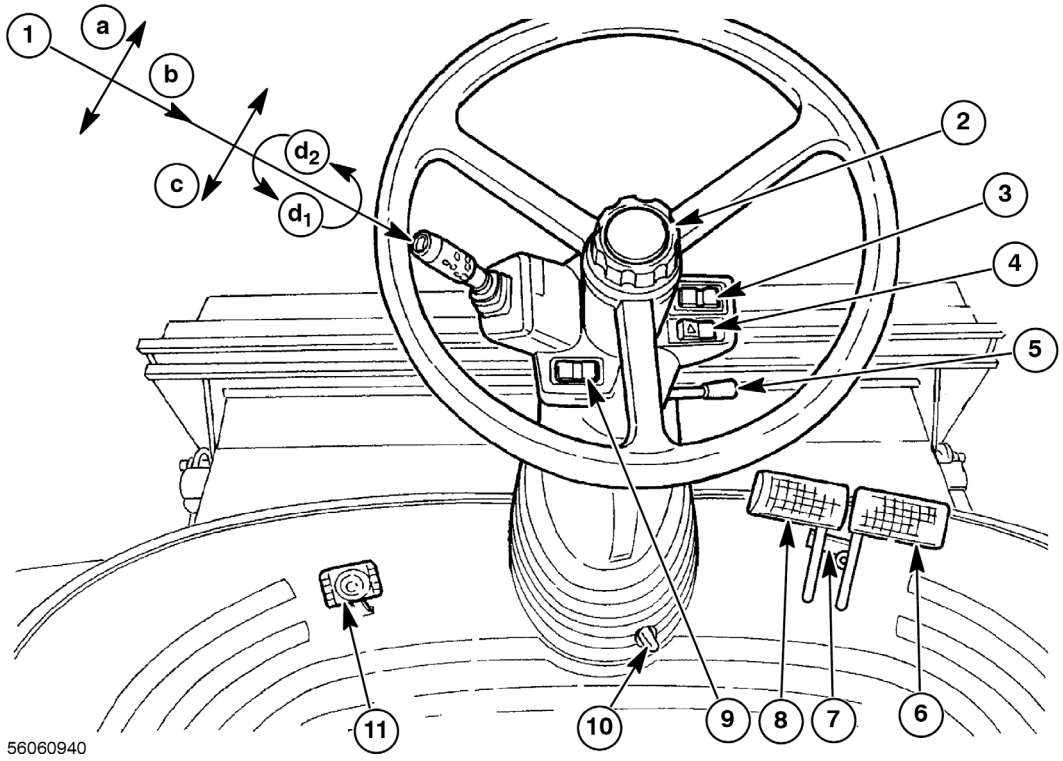
For any headers in the shop find the following:

Model	PIN	Location

Move on to Exercise #2 or another as assigned by your instructor.

EXERCISE #2 "CAB AND CONTROLS"

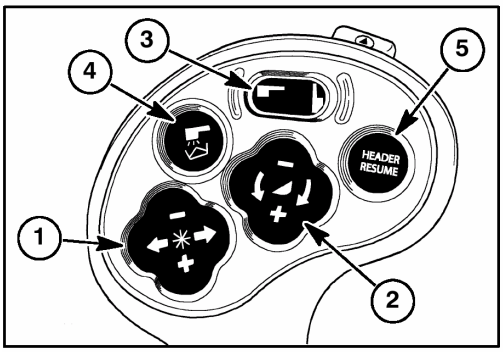
Take your Operators Manual and this exercise and sit in the seat of the AF 7120/8120 Combine that your instructor has assigned. Your mission is to become familiar with all the buttons and knobs that the operator can touch while sitting in the seat. This is your chance to 'play'. Do push the buttons & knobs to see what happens especially if you don't understand the symbols. While investigating, complete the chart below and on the following pages by writing in the FUNCTION that each has.

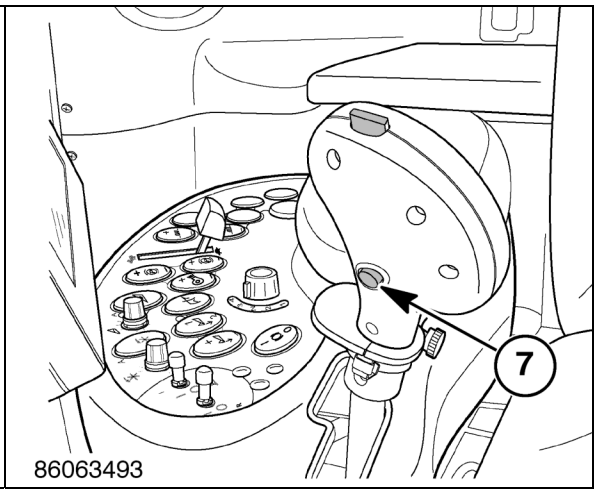


ID	Function(s)	ID	Function(s)
1A		5	
1B		6	
1C		7	
1D		8	
2		9	
3		10	
4		11	

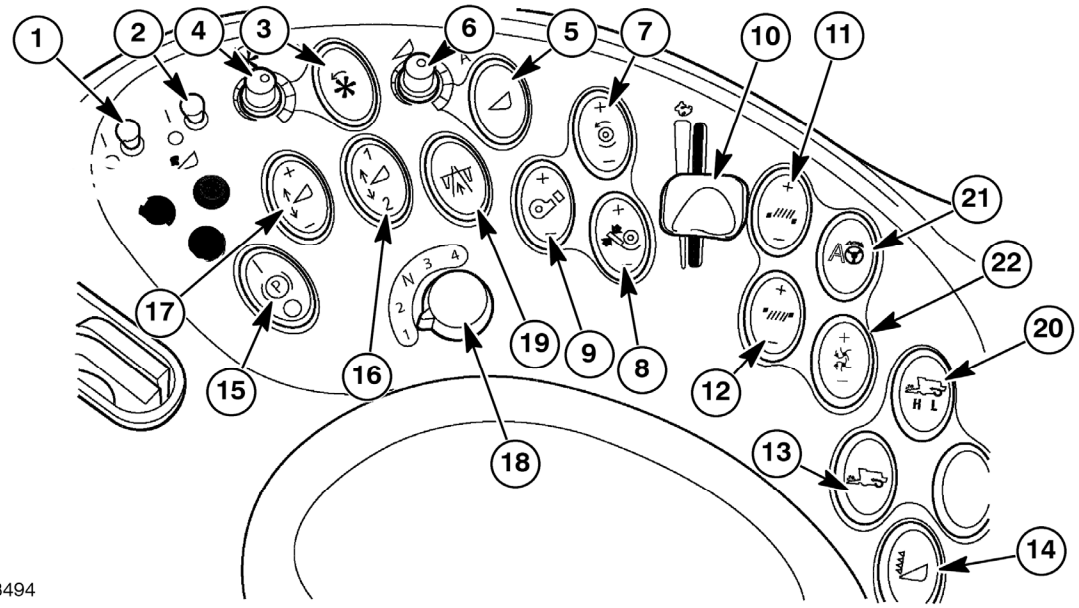
EXERCISE #2 "CAB AND CONTROLS"

1.	
2.	
3.	
4.	
5.	
	What's not labeled?



7.	What is and how do you use item 7?	

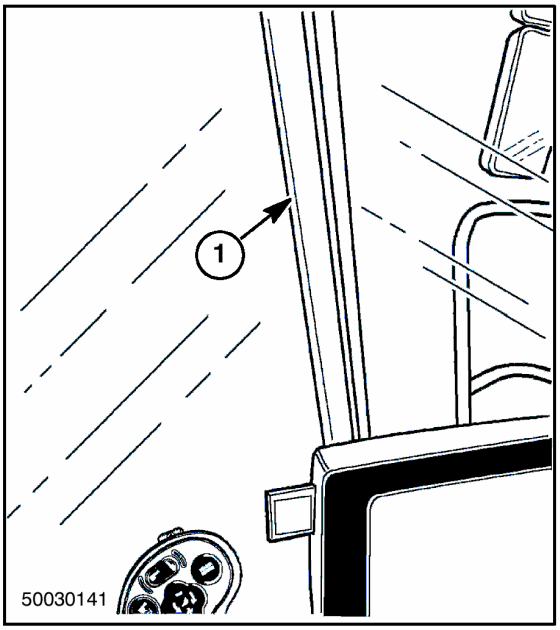
EXERCISE #2 "CAB AND CONTROLS"



ID	Function	ID	Function
1		12	
2		13	
3		14	
4		15	
5		16	
6		17	
7		18	
8		19	
9		20	
10		21	
11		22	

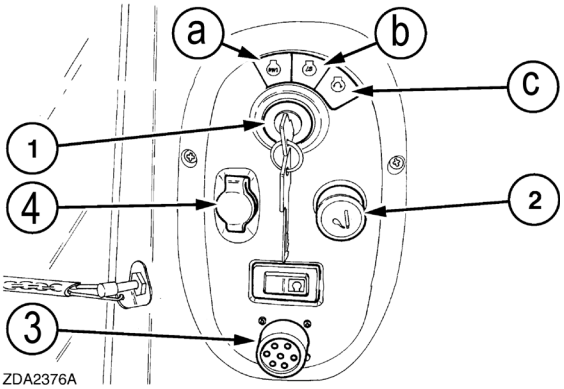
EXERCISE #2 "CAB AND CONTROLS"

On 88 Series Combines we have an A-Post. On the front right corner of the cab on 8010's built from MY03-06 we have an SSM that displayed park brake; unloader, grain tank, and shaft speed monitor information. How does the operator receive information about the items that were on the Shaft Speed Monitor now that it's gone?



Start Console

1	
2	
3	
4	



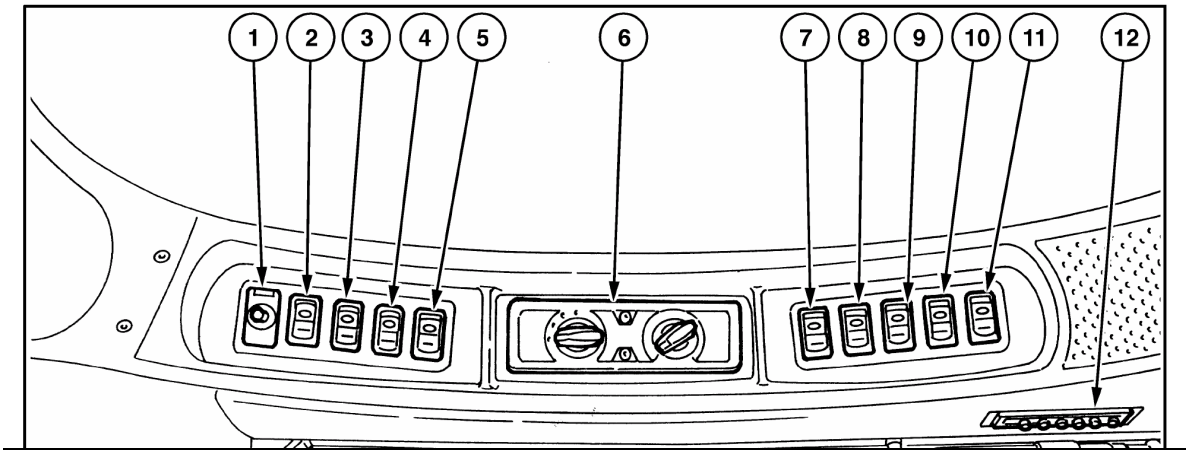
1. Can the same plug be used in #2 and #4 above? _____
2. Read Ops Manual page 4-7 daily start up procedures. On 20 series combines what should the operator watch for before cranking the engine?

_____

Remind your instructor to review cold start tips.

EXERCISE #2 "CAB AND CONTROLS"

Cab roof controls – Left side



ID	Function	ID	Function
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

1. What is behind the operator's seat?

_____

2. What is behind the panel in the left rear corner?

_____

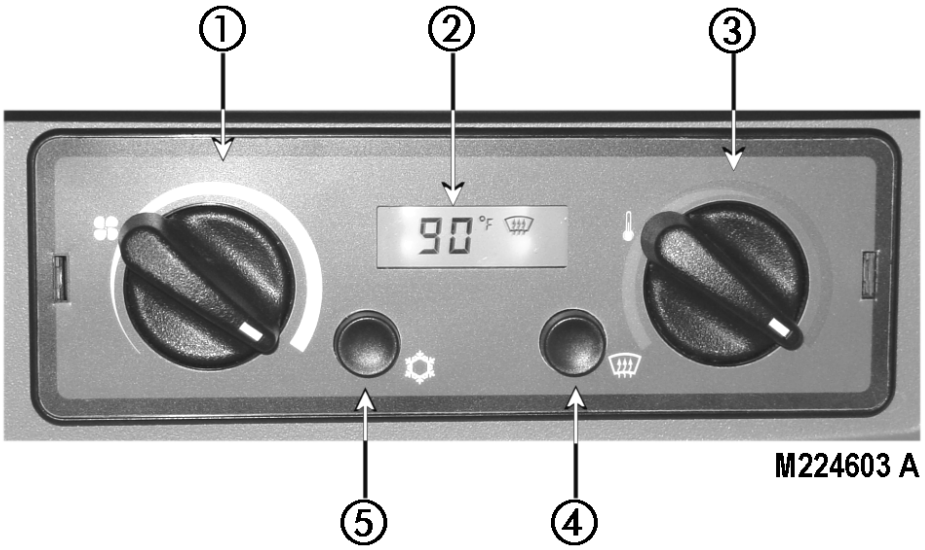
3. What adjustments can the operator make to the position of the RHC?

_____

4. What adjustments can the operator make to the position of the AFS Pro 600 Display?

_____

EXERCISE #2 "HVAC CONTROLS"



ID	Function	ID	Function
1		4.	
2		5.	
3			

1. Which system does the picture above represent? **MANUAL or ATC**

2. If the display is dark, which mode are you in?

3. Which control turns on the system?

4. Which control switches the system between ATC and Defog?

5. How does an operator know for sure that the ATC system is functioning?

EXERCISE #2 "HVAC CONTROLS"

1. While in ATC, what happens if the operator rotates the blower speed control pot?

2. How does the operator get back to ATC?

3. How does the operator achieve MAXIMUM cooling?

4. While in ATC, what does the number in the display represent?

5. If the display is alternating between an open book/wrench symbol and "02", what might be the cause?

6. In terms of operations, how similar is this system to 2500 Series combines build today?

7. Where is the cab air recirculation filter located?

8. Where is the cab air filter? When does the cab pressurization fan run?

Now move on to **Shop Exercise #3** if you already haven't completed that exercise.

EXERCISE #3 "DISPLAY NAVIGATION"

Using your Operators Manual and an AFS Pro 600, complete the following.
1. What manual(s) are required to properly set up and operate the AFS Pro 600 display units for harvesting, mapping, and guidance? (not at the house) (Hint, section 01)

1. _____

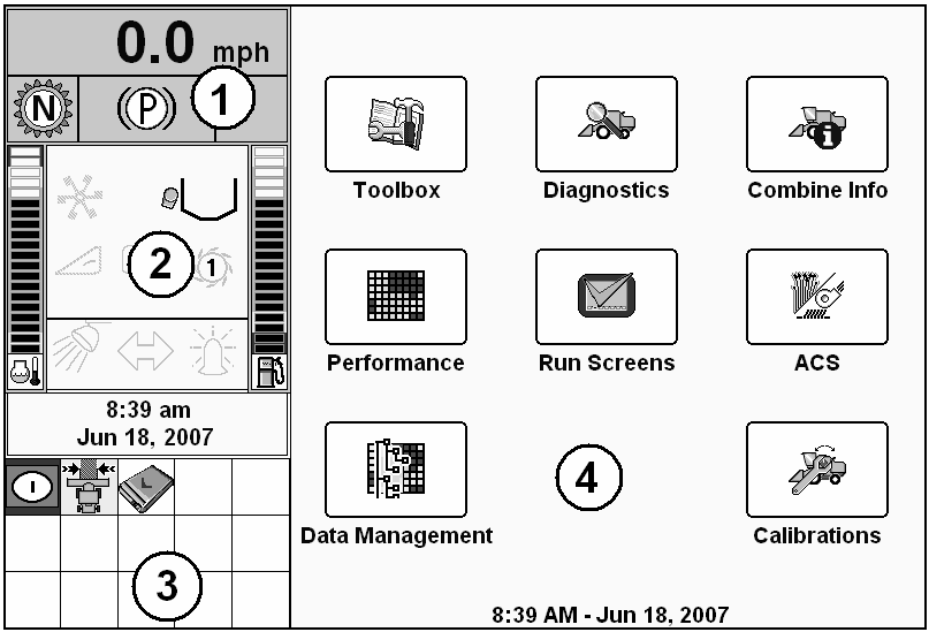
2. _____

3. _____

4. _____

5. _____

MAIN Screen



Identify the four main areas of the display screen. Ops 3-8

1. _____
2. _____
3. _____
4. _____

EXERCISE #3 "DISPLAY NAVIGATION"

Remember it is imperative that you have all the controller software versions before making contact for assistance.

You are required to locate and log the software version for all the controllers on the machine that can be accessed through the Display.

1. To locate the information refer to which operator's manual? (hint section 12)

   _____

2. To get to the screen that shows the display software information you must navigate to:
   BACK>_____>_____

Record information from this page here:

Software	Version

3. Which piece of software does not have the same version number? _____

4. Will the system work properly with these software versions? _____

   Why? _____

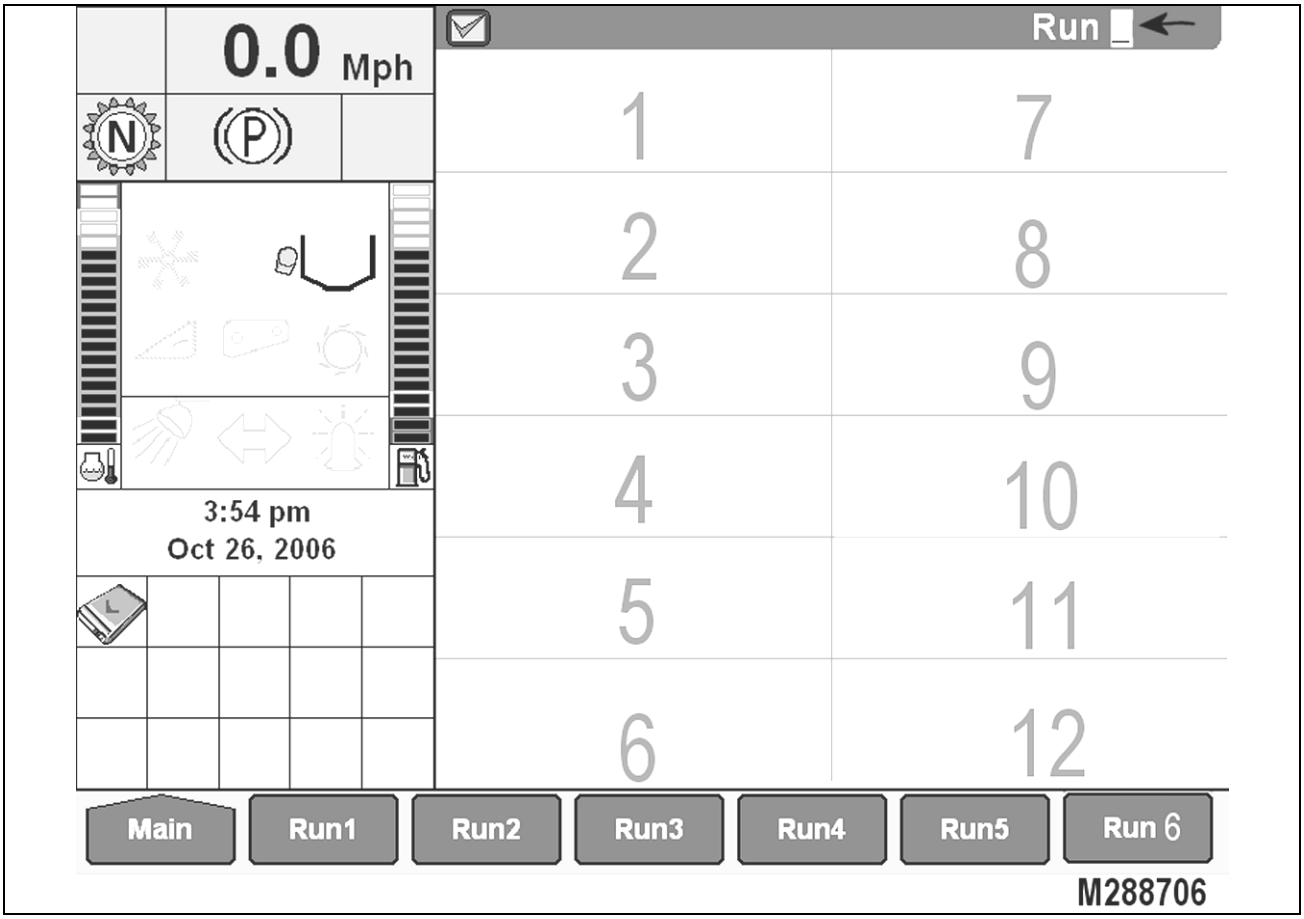
EXERCISE #3 "DISPLAY NAVIGATION"

To get to the screen that shows the controller information you must navigate to:
MAIN>_____>_____

Record information from this page here:

Controller	Status	Software Version

Navigate to **RUN5**. Write in the displayed functions in the blank screen below:



EXERCISE #3 "DISPLAY NAVIGATION"

AFS Pro 600 Color Display

When you are asked where information is found write the entire path taken to reach the answer **(Example:Main> Run > Run 4)**

1. The exercise you just completed on page 20 had you write in the displayed functions in the different cells. The cells you wrote in were numbered. Are the cells on the display numbered?

   _____

2. Where can we see what gear the combine is in?

   _____

3. What do we call the small boxes in the bottom left corner? *Reference one of the ops manuals section 2*

   _____

4. What does it mean if a box from question # 3 above is flashing?

   _____

5. What does it mean if a box from questions #3 above is grayed out?

   _____

6. Where can we check to make sure we are set for the current vehicle? *Sect 2*

   _____

7. What are the 3 choices of units available to show data in? *Sect 2*

   _____

   Where is this located?

   _____

8. On what screen can you change the LAYOUT of the RUN screens?

   _____

9. If the Current Layout is set to the DEFAULT mode, can you make any changes?

   _____

10. If the display is set to the DEFAULT mode, how many cells are on each RUN screen?

    _____

EXERCISE #3 "DISPLAY NAVIGATION"

11. Create a new CURRENT LAYOUT using the first initials of each member of your group. Example: Bob, Tom, and John are a group. BTJ is the new layout.

12. Change the RUN 5 screen to Number of Windows 1X6

13. Configure RUN5 with:
    Working Width
    None
    ENG Load
    Engine Load Graph
    Header Lat. Tilt Graph.
    HHC Tilt Sens.

14. How many items can you choose from to fill a cell on a RUN screen?

    _____

15. Does it matter how the machine is equipped?

    _____

16. What does WORKING WIDTH allow you to do?

    _____

17. What is the difference between ENG LOAD and ENG LOAD GRAPH?

    _____

18. How would you coach an operator to use the ENG LOAD?

    _____

19. What does Header Lat Tilt (Graph) show the operator?

    _____

20. Where/ How do you change the HHC Tilt Sens.?

    _____

21. Reconfigure RUN5 to the original items you recorded earlier.

22. Where are 2 places you change the HHC Raise and Lower rates?

    _____

EXERCISE #3 "DISPLAY NAVIGATION"

AFS Pro 600 Color Display

23. What size sieves does the display think are installed on the combine?

    Where did you find this information?

24. What information is on MAIN > TOOLBOX > SERVICE?

25. In general, what types of information is on the COMBINE INFO screens? Is there lots of information or very little?

26. What can you do on the Performance Profile Screen?

27. Why is the Performance Profile information important?

28. Create a Grower, Farm, Field and Task. Select Crop Type *Meadowfoam*.

29. Create a TAG. What is a TAG?

30. Review Harvest Tips in Yield Monitor Ops Manual. In what order should the sensors be calibrated?

31. How many machine calibration procedures are available?

32. Where do you find the procedural instructions to perform the calibrations?

EXERCISE #3 "DISPLAY NAVIGATION"

AFS Pro 600 Color Display

33. How do you Navigate to find Yield and Moisture calibration pages?
    MAIN>_____>_____

34. Navigate to DATA MANAGEMENT > DELETE. How many data types can be deleted on this screen?

    _____

35. Delete the Grower, Farm, Field, Task, Tag and Layout you created earlier.

Now move on to **Exercise #1 or 2 Cab and Controls** if you already haven't completed that exercise.

EXERCISE #4 "COMPARING OPERATOR CONTROLS"

Comparing the 2300's operator controls to the 20 series combines.
In this exercise you will list all the adjustments and controls that the operator would be required to make and use to control the grain header while cutting soy beans. Remember we are only looking at the feeder and header operations, forget the rotor fan sieves, etc. but do include the reel.

List: List each function and operations required
Controls: Note what the operator will use to perform these operations. (you may want to leave the 20 series column open for now)

List the functions/operations	What will the operator use to control these functions	
	2300	**20 Series**
Example: Raise Rate	Knob	Display

EXERCISE #5 "HEADER SETUP AND OPERATIONS"

The two combines in the shop require setting the header operating position to the following specifications.

Combine A (W/O Header):

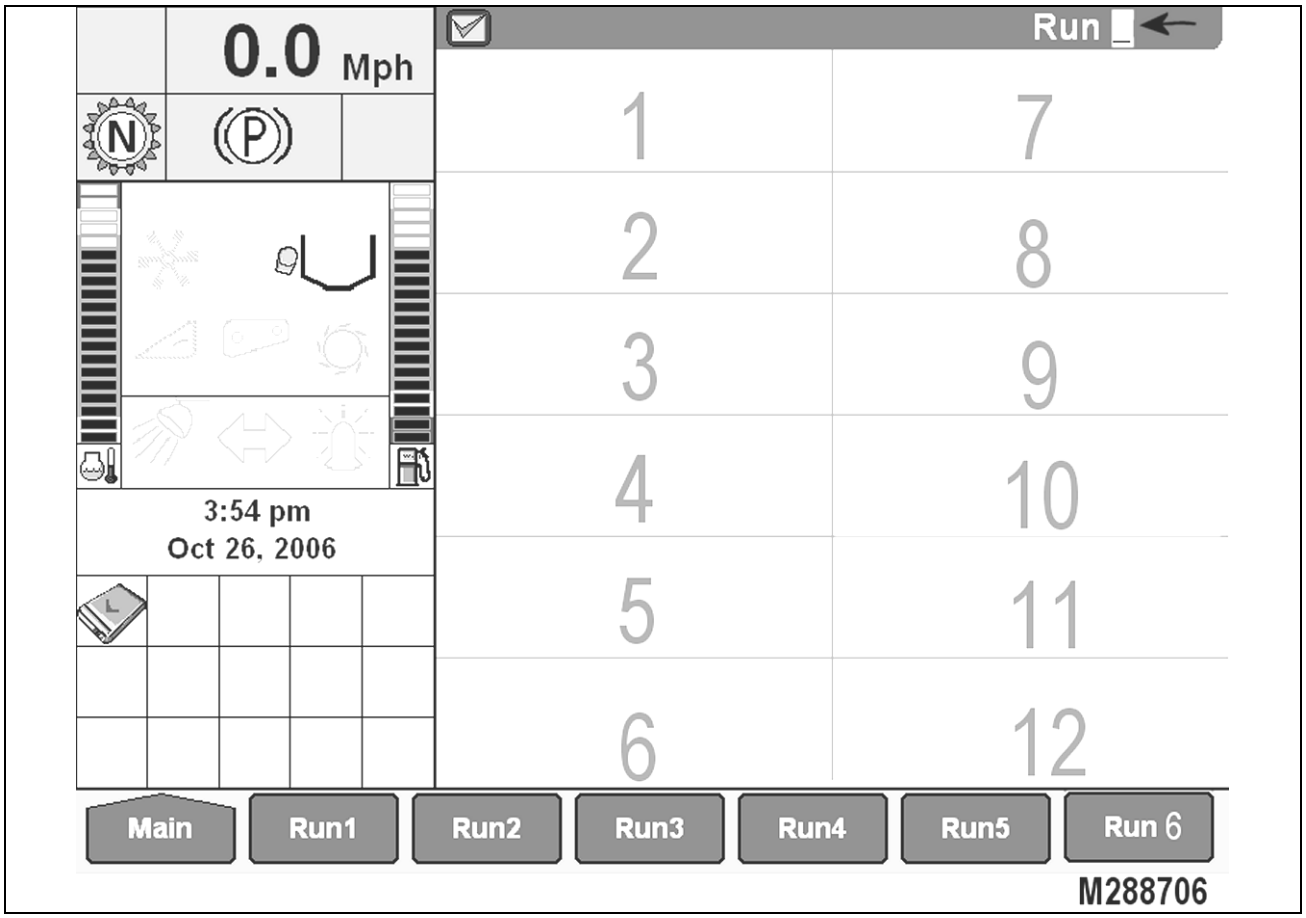
1. Machine is to be cutting standing wheat
2. The machine should be operating in RTC mode
3. Cutting Height is to be set at 21
4. Second cutting height is to be set at 39
5. Turning Height should be set at 51
6. The header is a 30 FT. 2020
7. Cutting width is 29 FT
8. Incremental distance is 1.5 ft.
9. Beeper # = 5
10. Raise Rate, 150
11. Lower Rate, 120

Combine B (W Header):

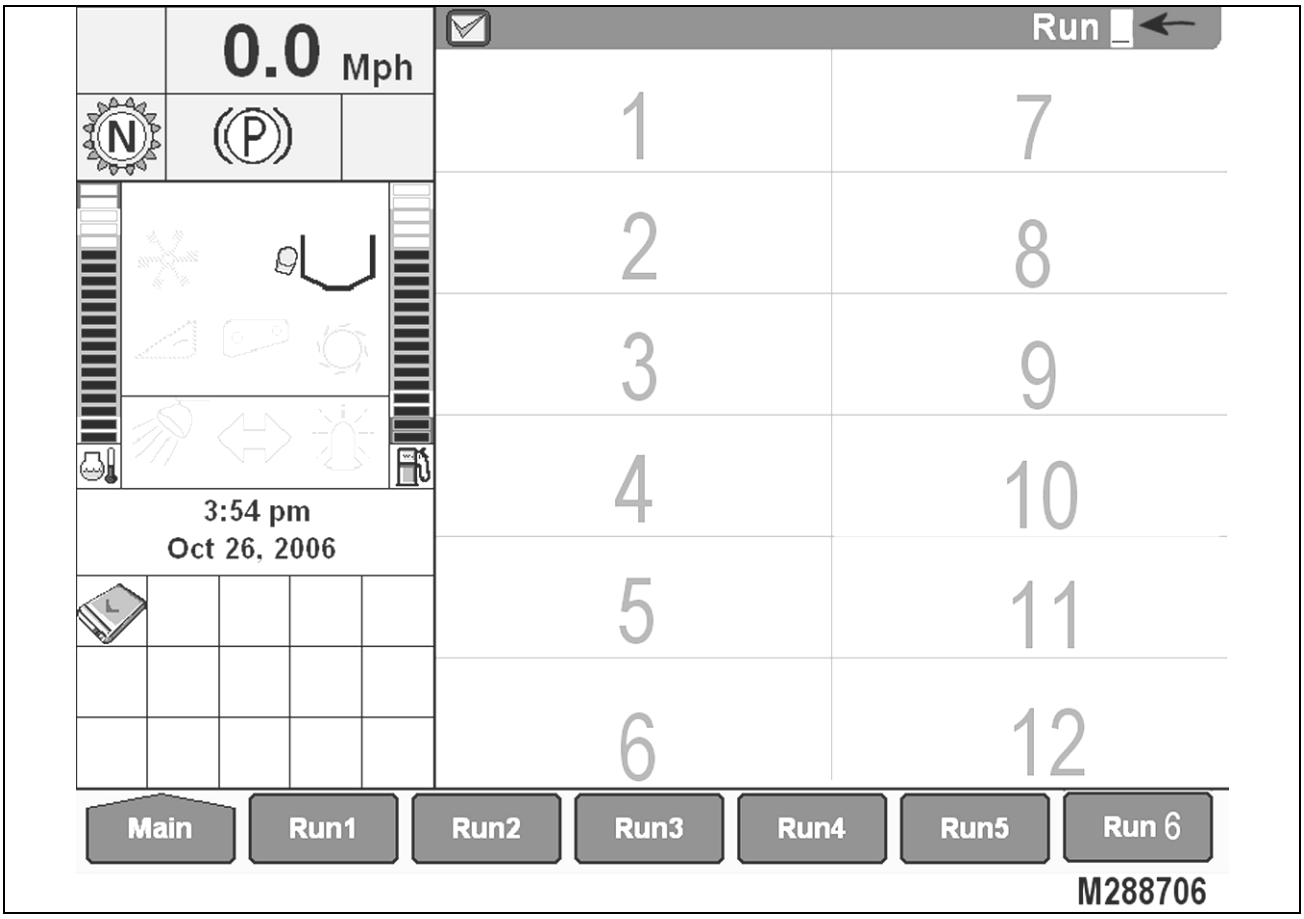
1. Machine is to be cutting Soy beans
2. The machine should be operating in ground sensing mode
3. Cutting Height is to be set at 3.1
4. Second cutting height is to be set at 10
5. Turning Height should be set at 36
6. The header is a 30 FT. 2020
7. Cutting width is 30 FT
8. Incremental distance is 30"
9. Beeper # = 5
10. Auto Header Sensitivity 130
11. Raise Rate, 180
12. Lower Rate, 180

EXERCISE #6 "DISPLAY OPTIONS FOR FEEDER/HEADER DRIVE"

Using your operator's manual fill in the blank screen below with items associated with the feeder/header adjustments. On the RUN screens, insert other items that a customer would normally want to monitor.



EXERCISE #6 "DISPLAY OPTIONS FOR FEEDER/HEADER DRIVE"



EXERCISE #7 "HEADER/FEEDER"

1. What are the five types of headers that can be defined by a header type sensor?
   a) _____
   b) _____
   c) _____
   d) _____
   e) _____

2. What switches are used on the multi-function propulsion handle to adjust the corn head adjustable stripper plates?
   a) _____
   b) _____

3. AFS area counting stops when the header is raised above the header maximum work height? (True or False)

4. The three operating modes for the header lateral tilt system are?
   a) _____
   b) _____
   c) _____

5. It strongly recommended that a header be attached to the combine when calibrating the lateral tilt system. (True or False)

6. The feeder drum lower stop can be adjusted in what positions?
   a) _____
   b) _____
   c) _____

7. How should the feeder chain be adjusted?

   _____

   _____

8. Can the twenty series feeder chain sprocket tube be installed in the 10 series combines?

   _____

9. What is the proper feeder face angle and why is it important to be properly adjusted?

   _____

10. After making any adjustments to the feeder face the feeder chain will require readjusting. True/Flase

    Why? _____

EXERCISE #8 "HEADER RECOGNITION"

Reference Material:

Operators and Header manuals, and the training information

Configure the combine for the following headers:

Corn: ▪ Hydraulic Striper Plates ▪ 12 Row ▪ Cutting 12 Row ▪ 30 inch increments ▪ Alarm at 10 ▪ 30 Inch rows ▪ With a Reel ▪ Maximum Working Height 41 ▪ _____	**Grain:** (2020) ▪ Reel Drive ▪ Width 30 foot ▪ 15 inch increments ▪ Alarm at 5 ▪ Cutting width 29.6 foot ▪ Maximum Working Height 51 ▪ _____
Draper: ▪ Reel Drive ▪ Flex header ▪ Width 36 foot ▪ 15 inch increments ▪ Alarm at 5 ▪ Cutting width 29.6 foot ▪ Maximum Working Height 30 ▪ Fore/Aft tilt ▪ _____	**Pick-Up:** ▪ Reel Drive ▪ Width 14 foot ▪ Alarm at 5 ▪ Cutting width 40 foot ▪ Maximum Working Height 41
Grain: (2010) ▪ Reel Drive ▪ Width 30 foot ▪ 24 inch increments ▪ Alarm at 5 ▪ Cutting width 29.6 foot ▪ Maximum Working Height 37	

EXERCISE #9 "THRESHING/SEPARATING"

1. How many straight separator bars are installed at the plant on the 20 series corn & bean rotor? (Select one)
   A. 0
   B. 4
   C. 8

2. Transition cone vanes are no longer serviceable separately. (True or False)

3. Which front rotor modules are recommended for higher yielding corn when plugging of the modules is encountered?

   _____

4. On 20 series combines the rotor cage vanes are shipped from the factory in what position? (circle one)
   a) Forward/Fast
   b) Mid
   c) Rear/Slow

5. The four basic adjustments that affect crop speed in the rotor/cage area are?
   a) _____
   b) _____
   c) _____
   d) _____

6. Which rotor would be recommended for harvesting rice or other crops that have a large and/or wet crop mat?

   _____
   _____

7. The threshing operation is responsible for what type of MOG in the grain tank?
   a) Material lighter then the grain
   b) Material heavier then the grain
   c) Material the same size as the grain

8. If the rotor start to run but then is stops, what items would you want to check?
   a) Feeder is running to slow
   b) The rotor is running to slow
   c) Chopper is running to slow

EXERCISE #10 "CLEANING SYSTEM"

1. Settings that affect operation of the cleaning system are located on the BACK>COMBINE screen? True or False

2. Adjusting the pre-sieve is part of the electrical sieve adjustment option? T or F

3. The best way to check cleaning system performance is to complete a _____.

4. What are the three loss meters?
   _____
   _____
   _____

5. When the display is set to Default run screens where are the loss meters?
   _____

6. How are the loss meters adjusted?
   _____

7. If a silver SKF sieve adjust actuator is installed, what must be done on the display to make it work properly?
   _____
   _____

8. The cleaning operation is responsible for what type of MOG in the grain tank?
   d) Material lighter then the grain
   e) Material heavier then the grain
   f) Material the same size as the grain

9. If too much material is on the right hand side of the cleaning system, what could be done about it?
   _____
   _____

EXERCISE #11 "GRAIN HANDLING SYSTEM"

1. What regulates the unloading rate of the standard unloading system?

2. The unloading system is protected from over load how?

3. The grain tank cross augers are driven by what size sprockets?
   Standard Drive: Front: Rear:
   Hydraulically Driven: Front: Rear:

4. On an unloading system with hydraulically driven cross augers, can the operator control the cross auger separately from the vertical auger? If so how?

5. How does the operator determine the maximum unloading rate when the machine is equipped with the hydraulically driven cross augers?

6. The lower grain tank level sensor activates at ___% full and the upper grain tank level sensor activates at ____% full?

7.

8.

EXERCISE #12 "RESIDUE HANDLING"

1. To shift the optional two-speed chopper you squeeze the plates together and allow the collar to slide out for low speed and in for high speed? True or False

2. The residue handling system can be configured in three different modes:
   a) _____
   b) _____
   c) _____
   Which mode is NOT standard on all machines? A B C

3. When making speed adjustments to the hydraulic spreader valve, safety glass should always be worn due to possible flying thrash. True or False

4. When spreading all material, the spreader is in the _____ position, the door is in the _____ position and the chaff pan is in the _____ position?

5. What determines width of spread?

_____
_____
_____

6. Where in the display do you install the in cab spreader speed adjust?
   MAIN>_____>_____>_____

7. 10._____
7. What item was added to the straw choppers stationary knife assembly? Why?

_____

EXERCISE #13 "LUBRICATION AND MAINTENANCE"

1. There are no daily lubrication points on the 20 series combines? True or False

2. The engine air filter should only be cleaned when the_____ alarm message is displayed on the monitor.

   A- Air filter blocked
   B- Service filter now
   C- Low horsepower
   D- Stop dummy

3. The combine hydraulic system, PTO gearbox and hydrostatic system share a common reservoir and filtering system? True or False

4. The 20 series is equipped with _____V batteries and uses a _____V starting system. For charging and/or jump starting, connect to the _____ battery.

5. Why should the feeder upper gear box fluid be changed regularly?

_____

_____

EXERCISE #14 "ACS EXERCISE"

Complete this exercise as a group on a combine that has a MFH with the Shift button on it.

1. Navigate to the ACS Setup screen and select the WORKING tab.

2. Choose a different Crop Type than what is currently shown and not CORN
   If the crop type you wanted is not available, where can you make it available?

   _____

3. Create a Work Condition that uses the first and last initial from each person in your group. (Example: If the group is John Smith and Bob Thomas then the Work Condition could be JSBT.)

4. Which ACS Mode are you looking at – Harvest or Headland? (circle one)

   _____

5. How can you tell which items are being controlled by ACS?

   _____

6. What color are the items outside the box when different from inside the box?

   _____

7. Start the combine and engage the Separator. What did the values inside the box do?

   _____

8. Change Rotor Speed using the switch on the RHC. What happened to the ACS Status indicator?

   _____

9. How can you reset the combine back to the ACS settings without using the buttons on the RHC? Do it.

   _____

10. How is the Headland mode activated?

    _____

EXERCISE #14 "ACS EXERCISE"

11. In what position does the feeder switch need to be to make headland work?

12. Engage the Headland mode. How do you know it is active?

13. Make the Headland mode control Fan Speed at 100 RPM lower than the default settings.

14. Are the Headland settings actual or a difference from Harvest Mode?

15. Exit Headland mode. What button does that?

16. Shut off the Feeder and Separator. If you made machine setting changes and didn't save them what would happen on the next Separator switch engagement?

17. Where can you find the active ACS Settings information for both Harvest and Headland at the same time?

18. What items are controlled on the ACS>CROP page?

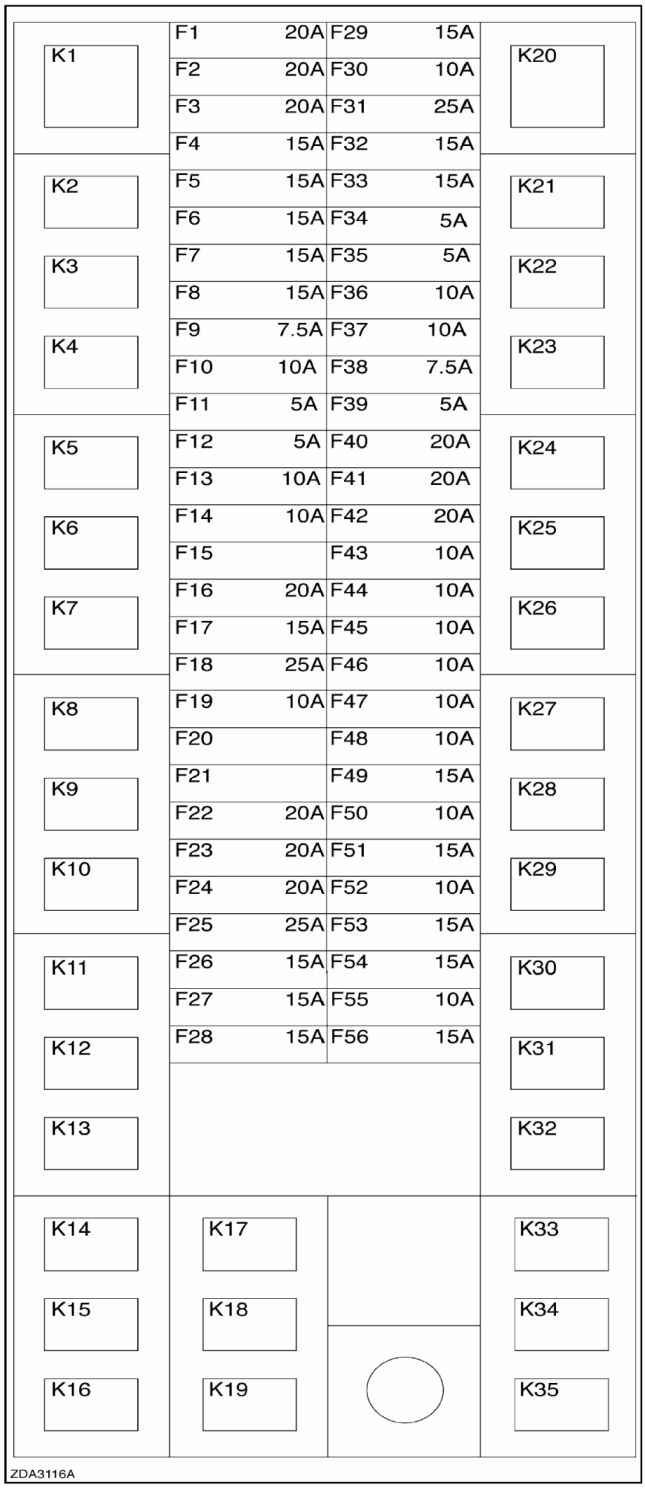
19. Use ACS to set the machine for CORN, Work Condition Default. Make sure you cycle the Separator switch to make them take effect.

20. What items need to be checked/changed outside the cab to harvest corn?

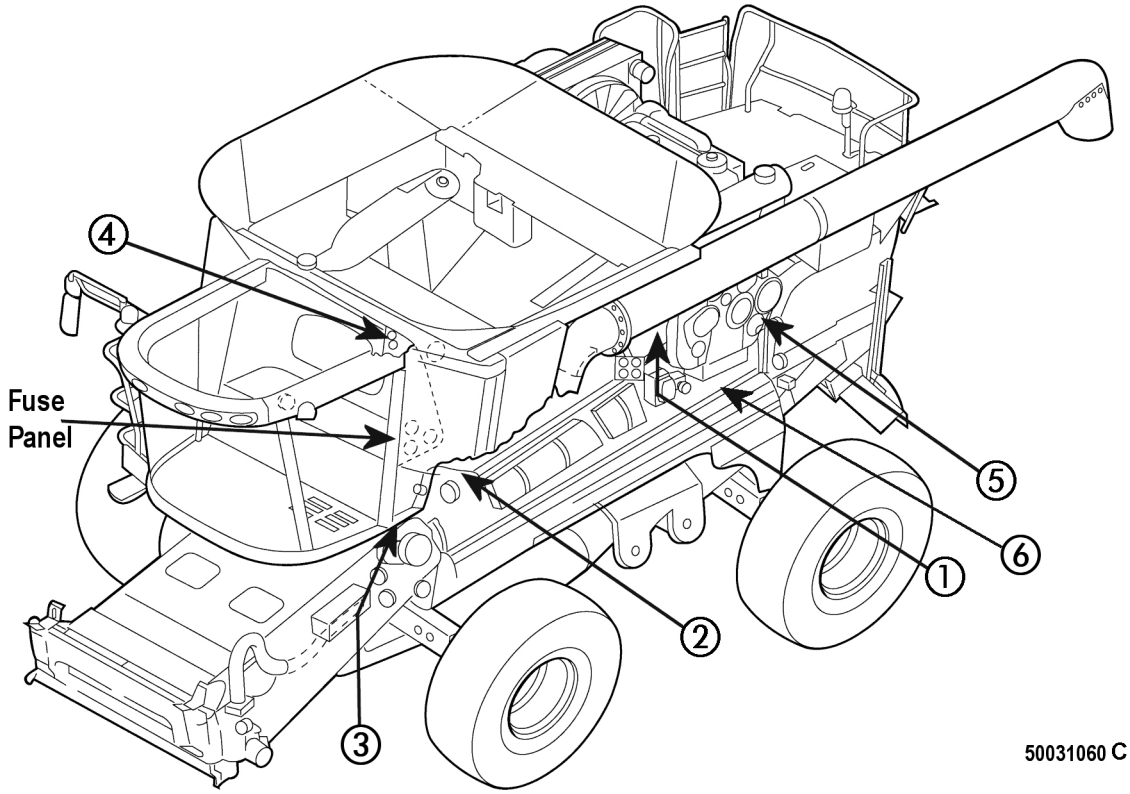
21. Delete the Work Condition you created. On what screen can you delete the Work Condition?

EXERCISE #15 "POWER DISTRIBUTION PANEL"

Mark the fuses below with an "**X**" that are powered with the KEY switch **ON** or **OFF** and with an "**O**" if powered only when the KEY switch is **ON**



EXERCISE #16 "MAIN GROUND POINTS"



	Location Descriptions
1	
2	
3	
4	
5	
6	

EXERCISE #17 "IDENTIFYING ELECTRICAL COMPONENTS"

Component Identification and Electrical Frame Exercise

In this exercise you are given a list of electrical components, using section 53 determine their proper ID (code) number, proper name and frame location for each. The terminology used in the list is NOT the same as used in section 53, part of the exercise is to become aware of the differences in the NEW verses OLD terminology.

Component	New Name	ID Number	Frame Location
Example: Feeder Lift Solenoid	Header Raise	L-11	FR-13
Fan Speed			
Feeder Manual/Auto Switch			
Cab Pressurizer Motor			
Rotor Motor Speed			
Feeder Position Sensor			
Separator Clutch Solenoid			
CCM1 Ground			
Chopper Stationary Knife Position			

EXERCISE #18 "IDENTIFYING ELECTRICAL CONNECTORS"

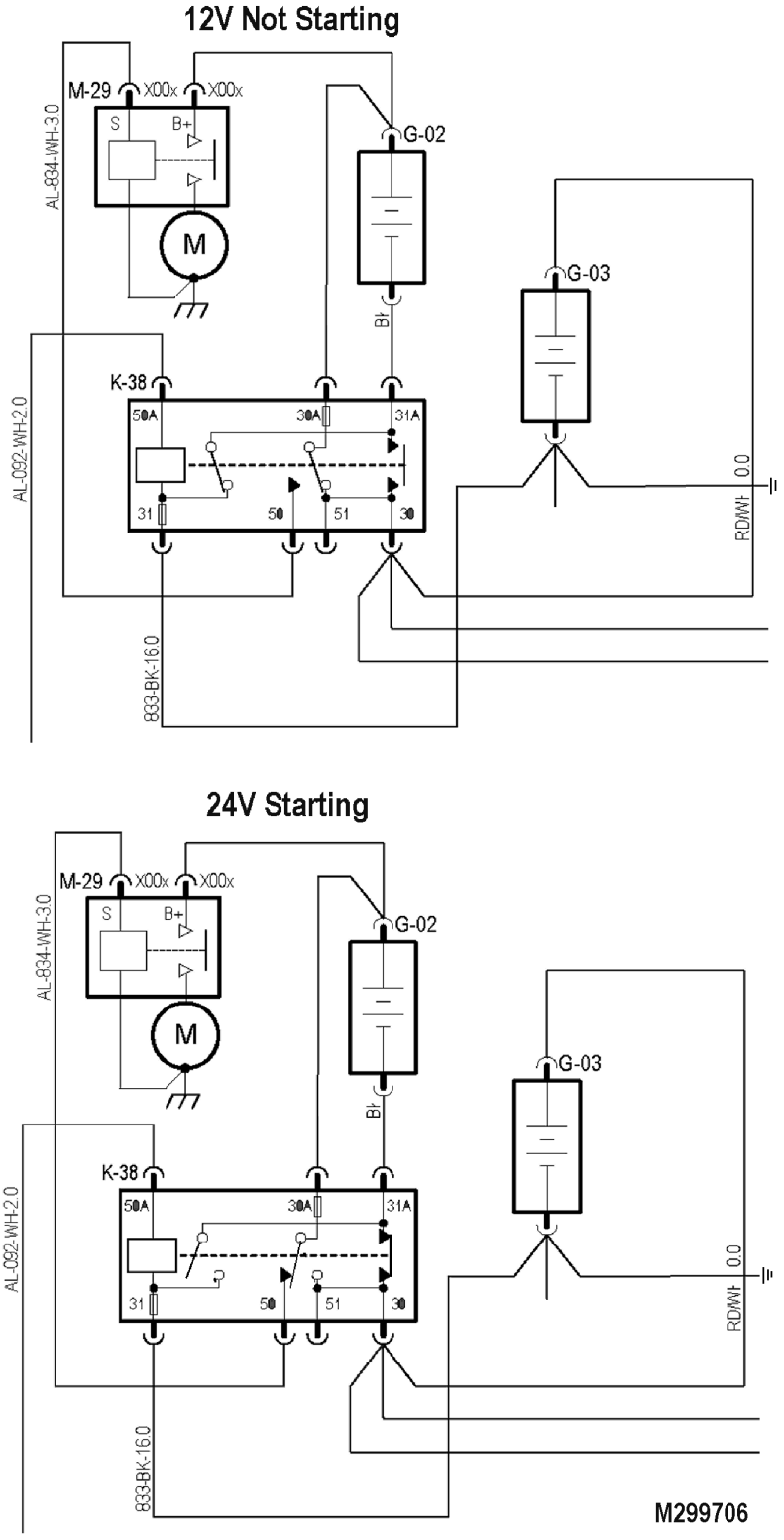
Connector Identification and Location Exercise

In this exercise you are given a list of electrical connectors, using the connector guide determine their location and major circuit that run through it.

Connector	Location	Major Circuits	Number of Terminals
X032			
X014			
X501			
X098			
X223			
X182			
X222			

EXERCISE #19 "24V RELAY TEST"

In this exercise you determine the voltage at each terminal of the 24V relay during normal running and starting operation.



EXERCISE #19 "24V RELAY TEST"

Relay Terminal	Normal Running Operation	Starting
30	12V	
30A		
31		
31A		
50		
50A		
51		

EXERCISE #20 "MULTI-FUNCTION HANDLE CIRCUITS"

Refer to the "Electrical Circuit Schematics" and test the Multi-Function hand switch that is provided. Insert the pin location that provides the voltage the pin that serves as the return signal.

Function	Supply Voltage	Return Signal
Header Raise (Example)	10	6
Header Lower		
Header Tilt CW		
Header Tilt CCW		
Resume		
Unloader OUT		
Unloader IN		
Unloader Engage		
Reel Raise		
Reel Lower		
Reel Fore		
Reel AFT		
Emergency Stop		
Shift Button		

EXERCISE #21 "ELECTRICAL SENSOR TESTING"

Sensor Schematic ID Name (Example B-99)	
Function	
Sensor	
Schematic Frame Page #	
Location	

Connector Pin Location (Circle One)	A 1	B 2	C 3	D 4	E 5	F 6
Sensor Connector Number						
Wire Color & Number						
Controller Monitoring Circuit (Example CCM1, RHM, Color Display)						
Supply Voltage (Open Circuit Voltage)						
Sensing Voltage, (Working Range Voltage if a potentiometer)						
Sensing Voltage, Against Metal, **(AM)** Not Against Metal, **(NAM)**						
Amperage While Moving (Display)						
Amperage When Stalled (Display)						
Ground Voltage (Return Voltage)						
Normally Open or Closed **(N.O. – N.C.)**						
Lamp Illuminated Against Metal, **(AM)** Not Against Metal, **(NAM)**						
Sensor Resistance (Ohms) **Not Applicable, (NA)**						

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> _____>_____>_____

EXERCISE #21 "ELECTRICAL SENSOR TESTING"

Sensor Schematic ID Name (Example B-99)	
Function	
Sensor	
Schematic Frame Page #	
Location	

Connector Pin Location (Circle One)	A 1	B 2	C 3	D 4	E 5	F 6
Sensor Connector Number						
Wire Color & Number						
Controller Monitoring Circuit (Example CCM1, RHM, Color Display)						
Supply Voltage (Open Circuit Voltage)						
Sensing Voltage, (Working Range Voltage if a potentiometer)						
Sensing Voltage, Against Metal, **(AM)** Not Against Metal, **(NAM)**						
Amperage While Moving (Display)						
Amperage When Stalled (Display)						
Ground Voltage (Return Voltage)						
Normally Open or Closed **(N.O. – N.C.)**						
Lamp Illuminated Against Metal, **(AM)** Not Against Metal, **(NAM)**						
Sensor Resistance (Ohms) **Not Applicable, (NA)**						

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> _____>_____>_____

EXERCISE #21 "ELECTRICAL SENSOR TESTING"

Sensor Schematic ID Name (Example B-99)	
Function	
Sensor	
Schematic Frame Page #	
Location	

Connector Pin Location (Circle One)	A 1	B 2	C 3	D 4	E 5	F 6
Sensor Connector Number						
Wire Color & Number						
Controller Monitoring Circuit (Example CCM1, RHM, Color display)						
Supply Voltage (Open Circuit Voltage)						
Sensing Voltage, (Working Range Voltage if a potentiometer)						
Sensing Voltage, Against Metal, **(AM)** Not Against Metal, **(NAM)**						
Amperage While Moving (Display)						
Amperage When Stalled (Display)						
Ground Voltage (Return Voltage)						
Normally Open or Closed **(N.O. – N.C.)**						
Lamp Illuminated Against Metal, **(AM)** Not Against Metal, **(NAM)**						
Sensor Resistance (Ohms) **Not Applicable, (NA)**						

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> _____>_____>_____

EXERCISE #22 "FEEDER CIRCUIT TESTING"

1.

Sensor Schematic ID Name (Example B-99)	
Function	Monitoring the Rear Ladder
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

2.

Sensor Schematic ID Name (Example B-99)	
Function	Monitoring the operator presence
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

3.

Sensor Schematic ID Name (Example B-99)	
Function	Monitors the feeder engagement
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

EXERCISE #22 "FEEDER CIRCUIT TESTING"

4.

Sensor Schematic ID Name (Example B-99)	
Function	Feeder Reverse Operation
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

5.

Sensor Schematic ID Name (Example B-99)	
Function	Monitors the Header Speed
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

6.

Sensor Schematic ID Name (Example B-99)	
Function	Controls the feeder speed
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

EXERCISE #22 "FEEDER CIRCUIT TESTING"

7.

Sensor Schematic ID Name (Example B-99)	
Function	Controls the feeder mode of operation
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

8.

Sensor Schematic ID Name (Example B-99)	
Function	Engages to drive the feeder hydraulically
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

9.

Sensor Schematic ID Name (Example B-99)	
Function	Engages to drive the feeder mechanically
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

10.

Sensor Schematic ID Name (Example B-99)	
Function	Controls the output of the feeder pump
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

11.

Sensor Schematic ID Name (Example B-99)	
Function	Monitors the position of the feeder
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

12.

Sensor Schematic ID Name (Example B-99)	
Function	Monitors the position of the cutter bar
Sensor Name	
Schematic Frame Page #	
Machine Location	

Where would you navigate to on the Color Display to monitor the sensor operations?
Main> > >

EXERCISE #23 "HYDRAULIC SYSTEM"

CHECK SHEET

INFORMATION REQUIRED		
Date: ____/____/____	PIN Number: _____	Hours: _____

TEST CONDITIONS	
Park the combine so that all hydraulic operations can be activated.	**The Parking Brake Should Be Engaged.**
The hydraulic reservoir and P.T.O. Gearbox should be properly filled and new filters installed.	Oil Temperature must be Above120^{o} F (49° C)

Testing Information

Function:	
Pump Involved	
Reservoir Involved	
Test Fitting Location	
Pressure Specifications	
Flow Specifications	

Test Results:

Engine Speed	Low Idle	High Idle
Circuit Pressure		
Circuit Flow		

Section	*Book*	
0	*1*	**General Information**: Acronyms & Abbreviations Quick Start Card Operators Manual
01	*1*	Introduction Pre-Delivery Inspection
02	*1*	Product Information
11	*1*	9L Engine
12	*1*	10.3 L & 12.9L Engine
14	*1*	Air Compressor
25	*1*	Transmission & Final Drive
29	*1*	Hydrostatic Drive
30	*1*	How to read Hydraulic Symbols
35	*1*	General Hydraulic Circuits
39	*2*	Hydraulic / Ground Drive Schematics
40	*2*	Loading The Pro-600 Display
41	*2*	“EASY” Engine Program
42	*2*	Machine Configurations
50	*1*	How to read Electrical Schematic
51	*2*	Connector Guide
53G	*2*	Electrical Schematics Y8G205101
54	*1*	AccuGuide
55	*1*	Electrical Circuit Operation
56G	*2*	How To Use Diagnostics Vers. 25.*
57G	*2*	Fault Codes
62	*1*	Feeder Operations
63	*1*	Fix Speed Feeder Drive
66	*1*	Threshing & Separating Operations
67	*1*	Cleaning & Residue Operations
74	*1*	Unloading Operations
81	*1*	Precision Farming

ACRONYMS

AFS2/600	AFS 200 & AFS Pro 600 In Cab Display Units
APSI	Absolute Pressure Per Square Inch (Includes atmospheric pressure)
BUS	The CAN Connections between Controllers
CAN	Controller Area Network
CAN_HI	Yellow Signal Wire
CAN_LO	Green Signal Wire
CCM1	Combine Control Module #1
CCM2	Combine Control Module #2
CCM3	Combine Control Module #3
CCW	Counter Clockwise
CVT	Continuously Variable Transmission
CW	Clockwise
Disp C	AFS 200 cab display
Disp C+	AFS Pro 600 cab display
ECU	Electronic Control Unit
EGM	Engine Governor Module
EST	Electronic Service Tool
ETR	Engine To Ring (CVT Drives)
FSF	Fixed Speed Feeder
Hz	Hertz (cycles per second)
I / O	Input / Output
ICDU	Integrated Cab Display Unit (two card slots)
ICDU2	Integrated Cab Display Unit (one card slot)
K	Kilo (1,000)
LS	Limit Switch
M	Mega (1,000,000)
mA	Milliamp (0.001)
MFH	Mulit-Function Handle

mm	Millimeter (0.001)
MOG	Material Other Than Grain
mS	Millisecond
mV	Milli-volt
MY	Model Year
NVM	Non-Volatile Memory
PSI	Pressure Per Square Inch
PSID	Pressure Differential
PTO	Power Take Off
PGA	Power Guide Axle
PWM	Pulse Width Modulation
RAS	Rotary Air Screen
RHC	Right Hand Console
RHM	Right Hand Module
RPM	Revolutions Per Minute
RTC	Return To Cut
RTF	Ring To Frame (CVT Drives)
SA	Swash Plate Angle
Sec	Seconds
UD+	Universal Display Unit
VCC	System Voltage (battery supply)
VDC	Volts, Direct Current
>	Greater Then >5
<	Less Then <5
~	Approximately

CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120-9120 SERIES AXIAL-FLOW COMBINE



SECTION 1 INTRODUCTION

Form 5175 01/2010

CNH America LLC
700 STATE STREET
RACINE, WI 53404 U.S.A.

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INTRODUCTION

PURPOSE OF THE TRAINING MANUAL

This manual is your guide to the AFX Series Combine Service Training Program.

You will also be able to use it when you are working on these combines in the workshop or in the field.

In writing this manual, we have assumed that you are familiar with the normal methods of servicing agricultural equipment and that detailed explanations in the use of tools and test equipment are not necessary. In the event of any difficulties, you should refer to the Service Manual and to your Service Manager.

USE OF THIS MANUAL

The information contained in this manual is supplementary to material to be found in other sources, it is not a replacement for them. You should always consult Service Manuals, Service Bulletins, Operator's Manuals and Parts Books when necessary.

This manual and the training program that it supports are both designed to help you know when and why you need to make repairs. It will also draw your attention to particular problems that you might encounter and the any special procedures that you must follow.

There is plenty of space in this manual for you to add your own notes and observations.

GENERAL INFORMATION

Model	7120	8120	9120
Engine	Iveco 9L (8.7L)	Iveco 10.3L	Iveco 13L (12.9L)
Horse Power	360 HP 385 Power Rise HP 415 Unloading Boost HP	420 HP 462 Power Rise HP	480 HP 523 Power Rise HP
High Idle	2100		
Rated RPM	2100		
Unload Rate	3.2 bu (113L) second (this may vary with sprocket combinations)		
Rotor Size	30" X 104" (0.76 mm X 2.64 mm)		
Cleaning System	52" (1.32 M) wide	62" (1.57 M) wide	
Grain Tank	315 bu. (11,100L)	350 bu. (12,335L)	

SOFTWARE

The following software is installed at the beginning of MY10 production

CONTROLLER	VERSION
Yield Monitor	25.0.
AFX Combine	25.0.
Auto Guide	25.0.
Frame Work	25.0.
Display Defaults	25.0.
PrecFarming	25.0.
Trip	25.0.
CCM1	32.9.7.0.
CCM2	32.9.7.0.
CCM3	32.9.2.0.
RHM	40.4.4.0

MODEL YEAR SERIAL NUMBER BREAKS

All serial numbers are for the beginning of the model year.
All combine P.I.N.'s start with the prefix "HAJ"

	2003	2004	2005	2006	2007	2008
7010					200001	202001
8010	0105100	0105201	0105701	0106401	200001	202001

	MY 2009	MY 2010				
71-9120	Y8G205101	Y9G207601				

HEADERS

During 2004 all header production was moved to Saskatoon which begin their PIN# with CBJ0

	2004 CBJ	2005	2006	2007	2008	2009
2010/2020	CBJ020001	CBJ020242	CBJ020701	CBJ021301	CBJ041001	CBJ049001
2016			CCC010350	CCC0022001	CCC022251	CCC002271

In 2009 grain header production was moved to MBC manufacturing at Rock Island.

	2009	2010				
2010/2020	Y9ZL50001	YAZL52001				
2016	0022701	23651				

DRAPER HEADERS

PIN# with CAB0

	2005	2006	2007	2008	2009	2010
2042	13130	013273	013387			
2052	14385	014698	014866			
2062	15137	015328	015596			
2142				Y8ZN00501	Y9ZN00701	YAZN01101
2152				Y8ZN05601	Y9ZN06001	YAZN06801
2162			Y7ZN10301	Y8ZN10601	Y9ZN11201	YAZN12401
Adapter 873		017241 or 19001	018001			

MODEL YEAR SERIAL NUMBER BREAKS

All serial numbers are for the beginning of the model year.

CORN HEADERS

PIN# with CBJ0

	2005	2006	2007	2008
22/2400	20242	30601	32001	38501

	2008	2009	2010			
3200/3400	Y85018001	Y9S018001	YAS018001			
2606XR	666534001	666568001	666586001			
2608XR	676534001	676568001	67658601			
2612XR	686534001	686568001	68658601			
2608XF	696542001	696576001				

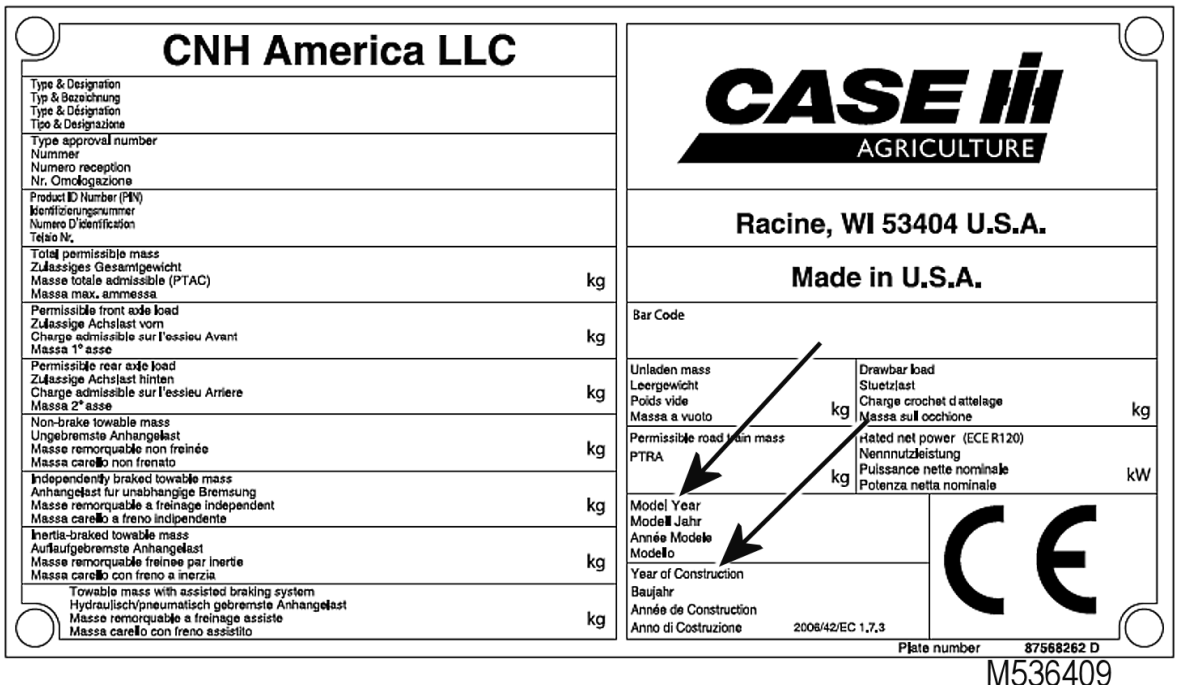
New Pin Numbers

A new 9-digit PIN number format will be started with the move of the grain headers to the MBC plant and carried throughout the company. Following is an example of the layout and information:

Example:	Y9ZL50001
Y =	Agricultural Equipment Other Then Tractors
9 =	Physical Year Of Manufacture, (this is not necessarily the model year). Starting in 2010 this character will change to a letter rather than a number. "A" =2010 "B" = 2011 "C" = 2012.
Z =	Out Sourced (built at a vendor's plant)
L =	Plant Identification, "L" = McLaughlin Body Company
50001 =	Unit's Sequence Number

SERIAL NUMBER PLATES

The serial number plate will change to a common design that has been used by other manufacturing location. The main difference will be the ability to have a model year pin number and a calendar year of manufacture indicator.



M536409

COMBINE PUBLICATIONS

ADDITIONAL INFORMATION

The Dealer Portal should be used to gain access to the latest service bulletins, technical tips and installation information available. The information that is listed through out this manual is based on the current information available the day of printing, the Dealer Portal may have updated information.

OPERATOR MANUALS

COMBINES	ENGLISH	CD
71/81/ 9120 Combine Software, Version 25.*	84215111	84215111-CD
AFS Yield Monitor AFS Pro 600, Version 25.*	84220089	84220089-CD
AFS Pro 600 Display, Version 25.**	84219887	84219887-CD
AFS AccuGuide - Pro 600 - Version 25.*	84219976	84219976-CD
AFS Field Performance Software - Version 25.*	84246752	84246752-CD
Data Card Packet		
HEADERS		
3200 Series Corn Head	87720355	
3400 Series Corn Heads	87720369	87720369-CD
2600 Series Corn Head	87662271	
2010 Series Direct Cut	87048750	
2020 Series Direct Cut	87057549	
2100's Draper & CA20 Adapter	84175524	
2016 Windrow Pickup Header	87381037	
SUPPORT INFORMATION		
Quick Start Card – 9/07	87698335	
AFS Quick Start Card – 7/2009	84220127	
AFS AccuGuide Quick Reference Guide -7/2009	84220042	
Machine Setting Calculator	PM-14423	
Draper Quick Start Card	6-17301	
Draper adjustments	DVD10921	
Pro-600 Display Operations 16.*	DVD10900	
Auto Crop Settings "ACS"	84259400	

Manual numbers are subject to change with new revisions. The old number can still be used as a reference when ordering new manual, DMC will sub to the latest version.

COMBINE PUBLICATIONS

Schematic for given year	Electrical	Hydraulic
MY2007	87688837	87688836
MY2008	84154424	84154425
MY2009	87722084	87494872
MY2010	84259752	87494873

TRAINING MANUAL	ENGLISH
Electronic Service Tool Manual	6-16170
Connector & Terminal Guide	PM-872
Combine Productivity Guide	PM-14755 (5/09)
Corn Head (3000 Series) Productivity Guide	PM-14756 (5/09)
Auger Head Productivity Guide	PM-14453 (8/08)
Draper Head Productivity Guide	PM-14455 (8/08)
Parts Marketing Guide	PM-3688 (3/09)
Combine Service Clinic Kit	PM-14685 (5/09)

These materials can be ordered from the following address.

Document Management Center
2205 Durand Ave.
Racine, WI, 53403
Telephone no. 262-636-7540
Fax no. 262-636-7530
Through the dealer portal

OTHER PUBLICATIONS

Special Service tool may be ordered through the normal part ordering system.

SPECIAL TOOLS

ENGINE TOOLS

When servicing the 9L and 10.3L Iveco engines refer to the proper engine service manual for the correct tools and usage required.

BELOW IS A COUPLE OF NEW TOOLS THAT HAVE BECOME AVAILABLE.

ENGINE BELT INSTALLATION, 380002949

The air condition belt installation tool has is also listed under the following new number: 380002949

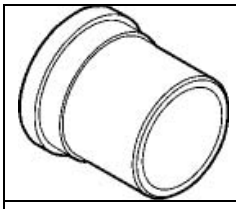
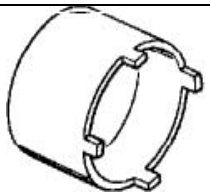
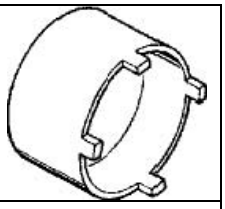
ENGINE HARNESS REPAIR KIT, 380040231

There is an electrical engine harness repair kit available. It may be used to make most repairs to the engine harness used on the Cursor engines.

Tool Number	Description	Illustration
380040231	**FPT Cursor Engine Harness Repair Kit:** • 22 Connectors • 132 pigtails • 60 butt splices • 7 terminal removal tools • 1 drawer and hanger assembly with identification decals and instructional label NOTE: ***This kit <u>does not</u> contain every connector used on FPT Cursor engines, only the most commonly replaced connectors.***	

SPECIAL TOOLS

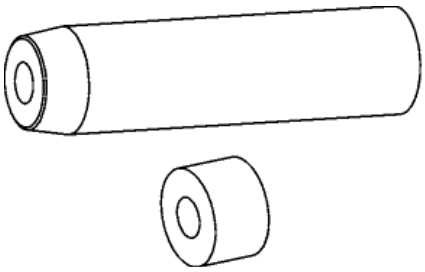
380040133 — CHASSIS TOOLS KIT

		
380000786	380001074	380001075

Kit 380040133 — Chassis Tool Kit Contents

380000786 - Steering Link Bushing Installer
380001074 - Ground Drive Transmission 45mm Nut Spanner Wrench
380001075 - Rotor Gearbox 50mm Nut Spanner Wrench

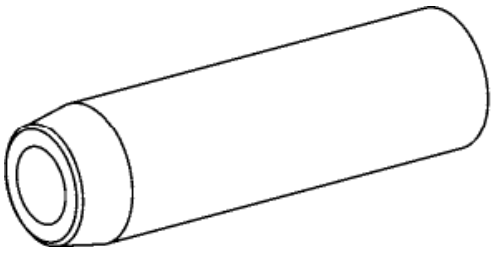
AFX PTO GEAR BOX TEFLON SEAL INSTALLER TOOLS



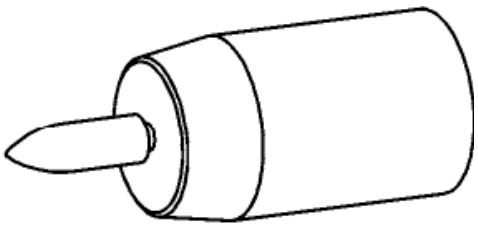
Tool 380001798 - Piston Teflon Seal Expander/Protector



Tool 380001664 — Nut-Unstake Tool



Tool 380001786 — Shaft Teflon Seal Expander/Protector with spacer (long)

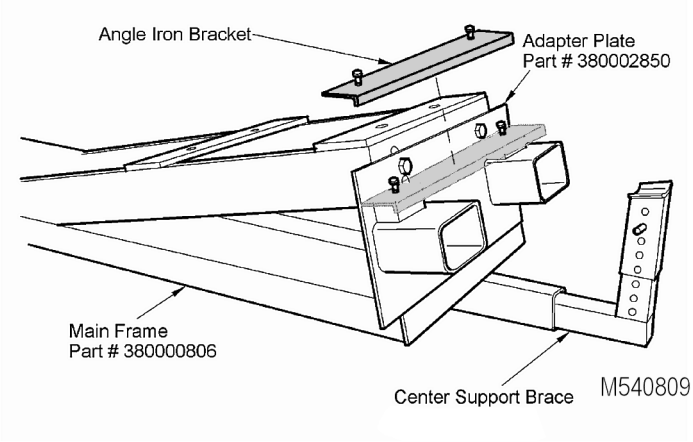


Tool 380001797 — Shaft Teflon Seal Expander/Protector (Short)

SPECIAL TOOLS

ROTOR HANDLING TOOLS

380000806 - The Rotor Assembly Handling Tool is used with 380000974 to provide the service technician with a safe method to handle, position, and control the weight of the rotor during removal, service, and installation procedures. 380000806 positions the forklift away from the combine cab to provide the technician a clearer view during removal and installation. During service, 380000806 positions the rotor off the floor, providing better access to the rotor components.



380000973 - The Rotor Locking Tool is used on Case IH AFX combines to prevent rotation of the rotor and improve stability during removal and installation.

380002850 (Old # 380000974) - The Rotor Support Adapter is used with 380000806 to safely handle the rotor during all service procedures.

SPECIAL TOOLS

NOTE: *Check your tools inventory. Your dealership may already have these tools. If not, it is recommended you order them, so you have them when the need arises.*

380000506 (CNH294168) - 60mm Nut Socket
- Originally released for MXM Series Tractors

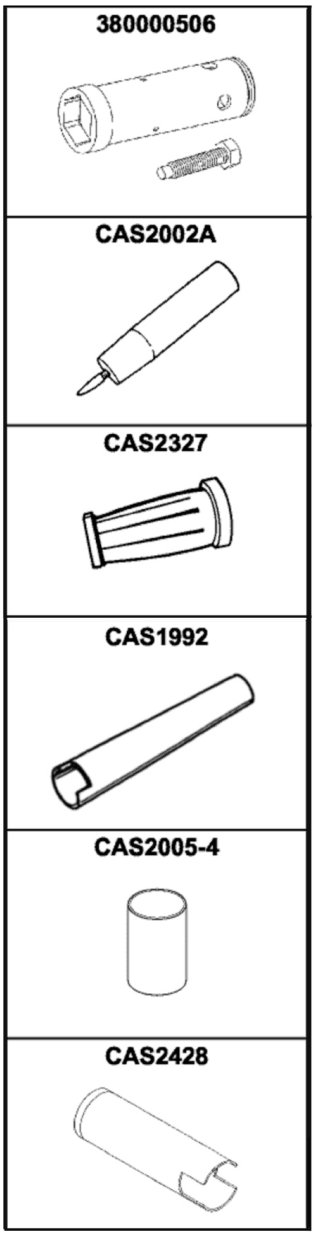
CAS2002A - Sleeve, Expander/Protector
- Originally part of Kit CAS1990 for 5100/5200 Series Tractors

CAS2327 - Expanding Seal Pusher
- Originally part of Kit CAS1990 for 5100/5200 Series Tractors

CAS1992 - Spring Compressor
- Originally part of Kit CAS1990 for 5100/5200 Series Tractors

CAS2005-4 - Seal Compressor
- Originally part of Kit CAS1990 for 5100/5200 Series Tractors

CAS2428 - Press Tool
Originally released for 9300 Series Tractors



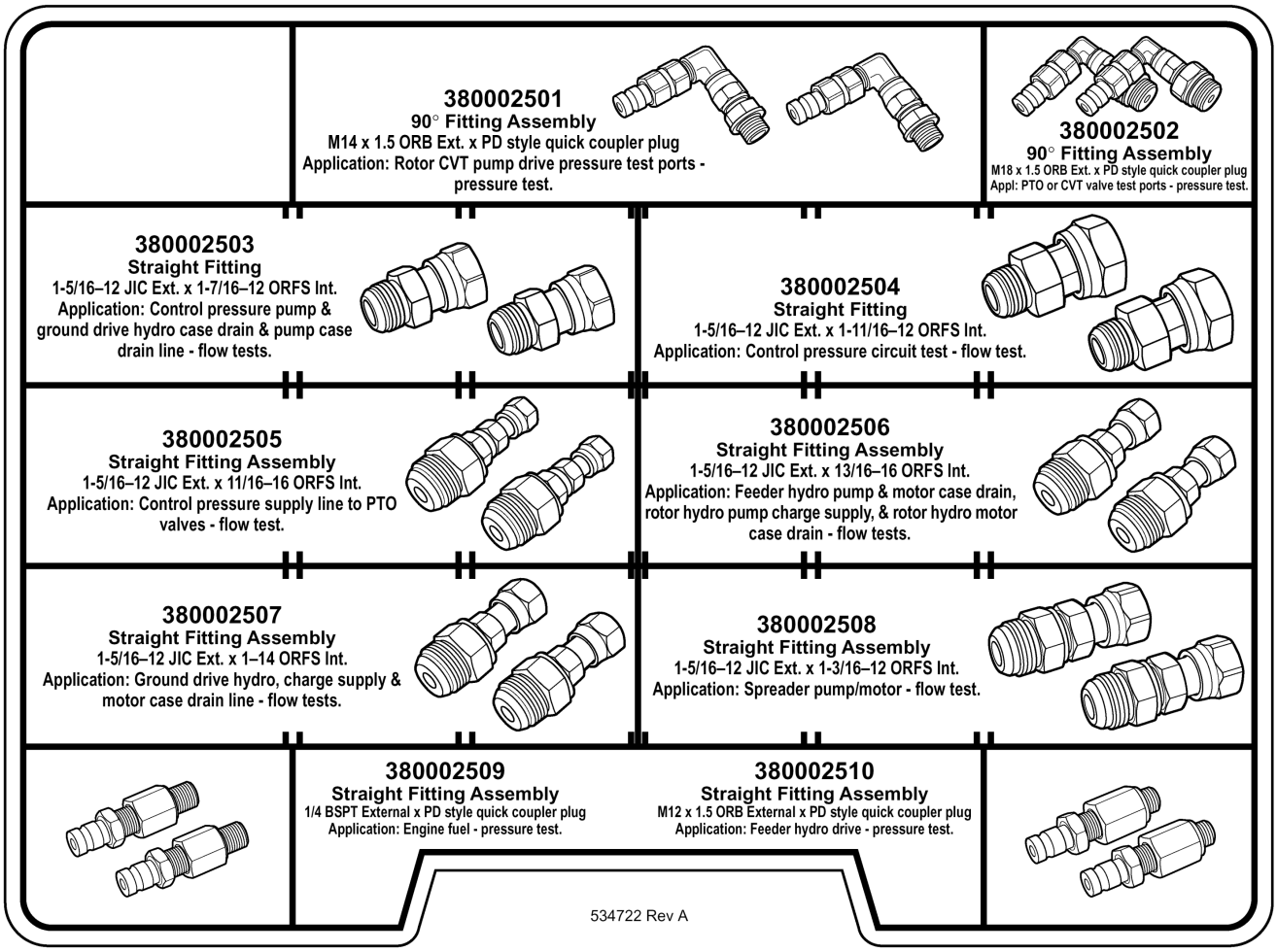
M203304

SPECIAL TOOLS

HYDRAULIC & FLOW TEST FITTINGS

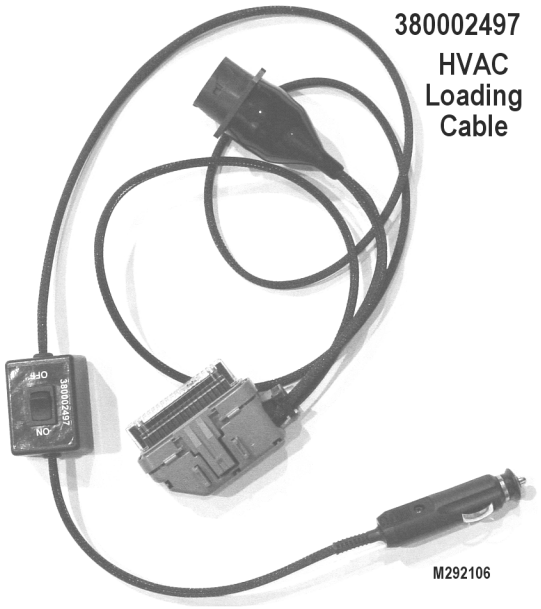
380040195 KIT

This kit includes fittings that are unique to the AFX 8010 combine. For most test these fittings will be used in combination with fittings that are included with other common kits.



SPECIAL TOOLS

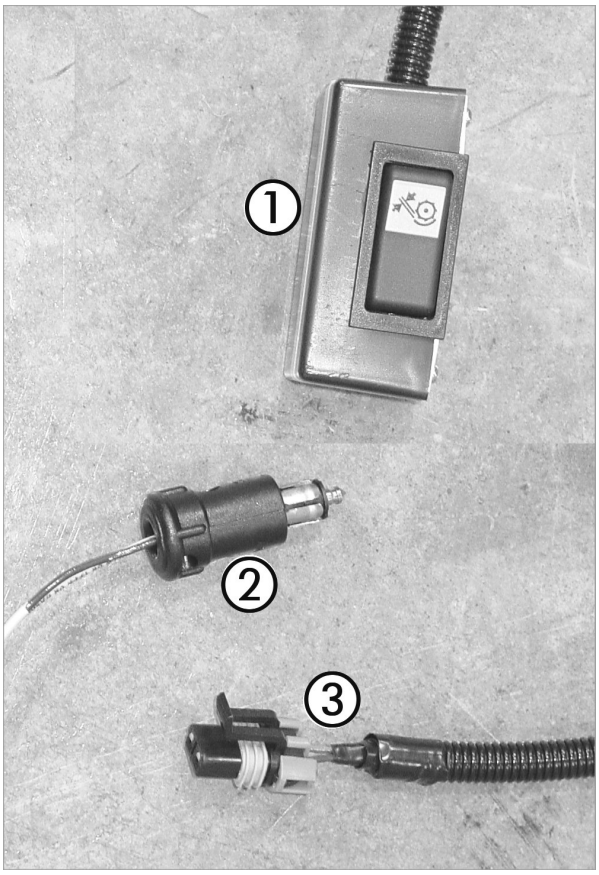
HVAC CONTROLLER SOFTWARE LOADING CABLE



When replacing a HVAC controller on the 7010, 8010 or 2300-2500's combines this cable will be required to load the proper software before the unit is installed.

SPECIAL TOOLS

REMOTE CONCAVE ADJUSTING CONTROL



When checking and making concave adjustments a remote control may be very useful for operating the concave adjustment motor. This tool may be made locally with the following component list.

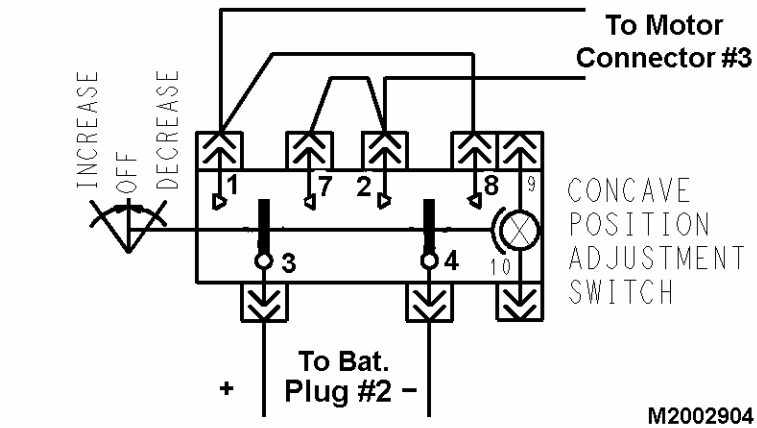
Item	Part Number	Quantity
1.	143504A1	1- 2300's Concave Switch
	Take switch to fit box	Radio Shack Project Box
	225091C1	6- Terminals
2	86508819	1- 12V Accessory plug
3.	182069A1	1- Connector
	182149A1 or 237660A1	2- Terminals
	225124C1	2- Seals
	182070A1	1- Lock

SPECIAL TOOLS

REMOTE CONCAVE ADJUSTING CONTROL

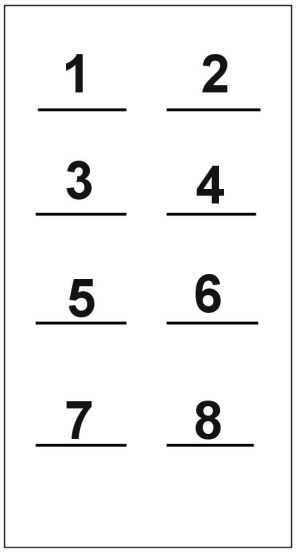
Wiring Circuit

Switch Schematic



Switch Terminal Assignments	
1.	Connect with terminal 8 and one of the terminals in connector #3
2.	Connect with terminal 7 and the open terminal in connector #3
3.	12 V from center terminals of the plug #2
4.	Ground from out side terminal of the plug #2
5.	Open
6.	Open
7.	Connect with terminal 2
8.	Connect with terminal 1

Switch Terminals

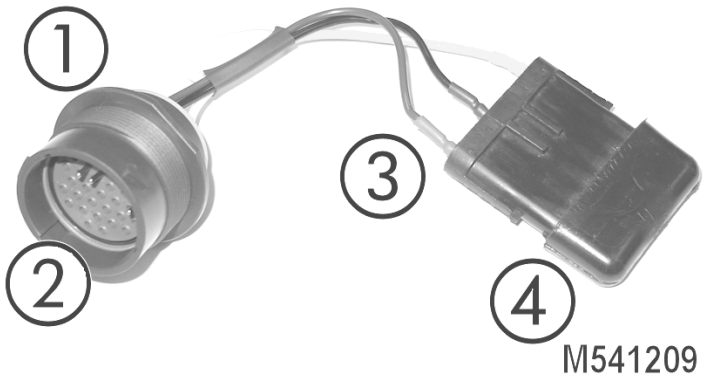


Cable Length:

Power Cable length is optional: approximately 7 foot
Motor Cable Length is optional: approximately 2 foot

SPECIAL TOOLS

PROGRAMMING HEADER TYPES



When setting up machine in the shop, it may be more convenient to program the head type settings by using a short wiring pigtail that may be assembled from the following components. Reference Section 62 for the “TYPE SENSOR” configuration for the different header types. The pigtail would be plugged into the feeder-to-header connector #32, in place of the header.

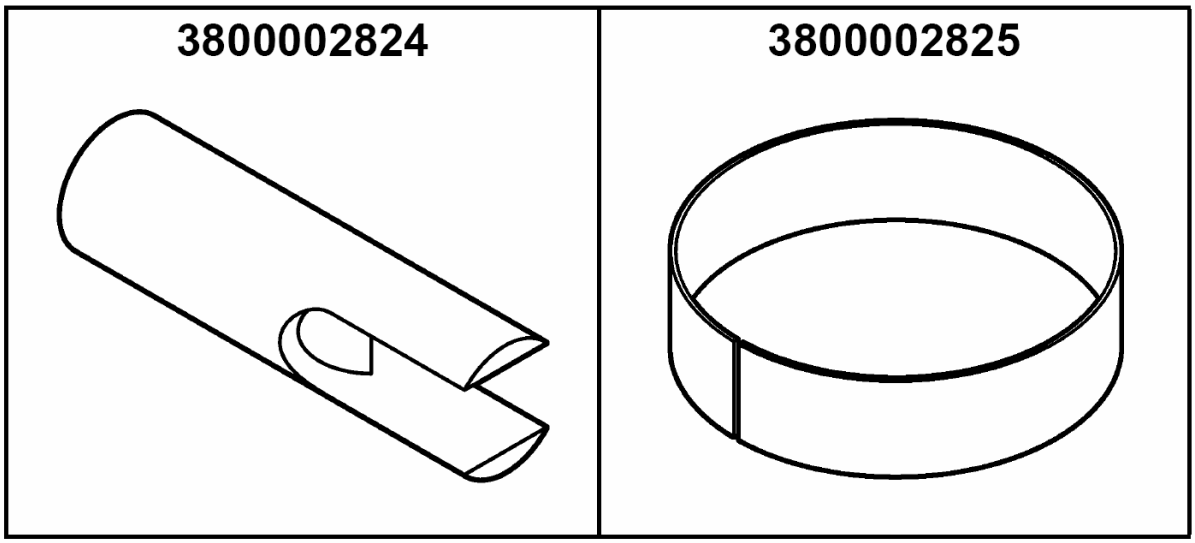
Item	Part Number	Quantity
1.	373357A1	CNH Connector
	HDP24-24-31PE	Deutsch
2	225052C1	Male Deutsch Terminals
3.	500398C1	Female Deutsch Terminals
4.	86837775	Header Type Sensor

Terminal Assignments	
Wire Color	Connector Terminal Location
Red	12
Yellow	27
Black	13

SPECIAL TOOLS

FEEDER DISC CLUTCH REMOVAL TOOL, 380040210

This tool kit is used to repair the feeder drive slip clutch with a new “friction disc” style slip clutch.



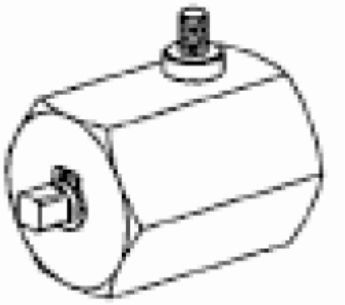
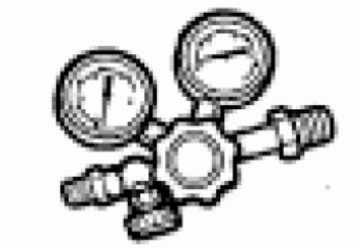
380002824 - Clutch Removal Tool allows removal of the clutch assembly from the gearbox without removing the input shaft first, saving the technician valuable time during repair procedures.

380002825 - Clutch Spring Installer is used to rebuild the friction clutch. It is used as a gauge to set the spring height on the clutch. Proper spring compression is achieved when the spring is evenly compressed against the metal band without blocking it. To do this, the bolts have to be tightened progressively until the spring contacts the metal band and then back off each nut ¼ turn.

SPECIAL TOOLS

ACCUMULATOR CHARGING TOOLS

Both the 88 Series and 20 Series Combines have changed to a new ride control header accumulator that uses a different precharge valve. The exact equipment needed was previously released for the MX Magnum Tractors in Bulletin ST03-09. Check your inventory for the tools listed below.

TOOL NUMBER	DESCRIPTION	ILLUSTRATION
380001168	Accumulator Charging Adapter (**Required Tool**) - required to quickly and safely pressure test and recharge the accumulator	
380001676 (CAS 10899-1)	Nitrogen Regulator Valve (**Recommended**) - required to adjust the Nitrogen tank pressure to the specific level of the accumulator.	
380001390	Accumulator Charging Hose (**Recommended**) - required to connect between the outlet side of the regulator valve at the Nitrogen tank and the accumulator charging adapter 380001168	

HARVESTING PRODUCTIVITY CHARTS

Example:

AFX 8010 with a 36 ft. header, 6 MPH, 150 Bu/Ac yield
2388 with a 30 ft. header, 6 MPH, 150 Bu/Ac yield

Results:

The AFX 8010 will send one more truckload of grain per hour

PRODUCTIVITY & GRAIN THROUGHPUT CALCULATOR

INPUTS		RESULTS	
Cut Width (ft)	36	Productivity (ac/hr)	26.2
Ground Speed (mph)	6	Productivity (ha/hr)	10.6
Grain Density (lbs/bu)	56	Throughput (bu/hr)	3,927
Yield (bu/acre)	150	Throughput (Ton/hr)	110.0
		Throughput (Metric T/Hr)	99.9

PRODUCTIVITY REFERENCE CHART (ACRES/HR)

	HEADER WIDTH (FT)					
MPH	15	20	25	30	36	42
2.0	3.6	4.8	6.1	7.3	8.7	10.2
2.5	4.5	6.1	7.6	9.1	10.9	12.7
3.0	5.5	7.3	9.1	10.9	13.1	15.3

Tool Number	Description	Illustration
380001168	Accumulator Charging Adapter (**Required Tool**) - required to quickly and safely pressure test and recharge the accumulator.	
380001676 (CAS10899-1)	Nitrogen Regulator Valve (**Recommended**) - required to adjust the Nitrogen tank pressure to the specific level of the accumulator.	
380001390	Accumulator Charging Hose (**Recommended**) - required to connect between the outlet side of the reguator valve at the Nitrogen tank and the accumulator charging adapter 380001168.	

3.5	6.4	8.5	10.6	12.7	15.3	17.8
4.0	7.3	9.7	12.1	14.5	17.5	20.4
4.5	8.2	10.9	13.6	16.4	19.6	22.9
5.0	9.1	12.1	15.2	18.2	21.8	25.5
5.5	10.0	13.3	16.7	20.0	24.0	28.0
6.0	10.9	14.5	18.2	21.8	26.2	30.5
6.5	11.8	15.8	19.7	23.6	28.4	33.1
7.0	12.7	17.0	21.2	25.5	30.5	35.6
7.5	13.6	18.2	22.7	27.3	32.7	38.2
8.0	14.5	19.4	24.2	29.1	34.9	40.7
8.5	15.5	20.6	25.8	30.9	37.1	43.3
9.0	16.4	21.8	27.3	32.7	39.3	45.8
9.5	17.3	23.0	28.8	34.5	41.5	48.4
10	18.2	24.2	30.3	36.4	43.6	50.9

HARVESTING PRODUCTIVITY CHARTS

THROUGHPUT REFERENCE CHART (BU/HR)

Yield (bu/A)	Productivity (Acres/Hr)									
	5	10	15	20	25	30	35	40	45	50
20	100	200	300	400	500	600	700	800	900	1,000
30	150	300	450	600	750	900	1,050	1,200	1,350	1,500
40	200	400	600	800	1,000	1,200	1,400	1,600	1,800	2,000
50	250	500	750	1,000	1,250	1,500	1,750	2,000	2,250	2,500
60	300	600	900	1,200	1,500	1,800	2,100	2,400	2,700	3,000
70	350	700	1,050	1,400	1,750	2,100	2,450	2,800	3,150	3,500
80	400	800	1,200	1,600	2,000	2,400	2,800	3,200	3,600	4,000
90	450	900	1,350	1,800	2,250	2,700	3,150	3,600	4,050	4,500
100	500	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000
110	550	1,100	1,650	2,200	2,750	3,300	3,850	4,400	4,950	5,500
120	600	1,200	1,800	2,400	3,000	3,600	4,200	4,800	5,400	6,000
130	650	1,300	1,950	2,600	3,250	3,900	4,550	5,200	5,850	6,500
140	700	1,400	2,100	2,800	3,500	4,200	4,900	5,600	6,300	7,000
150	750	1,500	2,250	3,000	3,750	4,500	5,250	6,000	6,750	7,500
160	800	1,600	2,400	3,200	4,000	4,800	5,600	6,400	7,200	8,000
170	850	1,700	2,550	3,400	4,250	5,100	5,950	6,800	7,650	8,500
180	900	1,800	2,700	3,600	4,500	5,400	6,300	7,200	8,100	9,000
190	950	1,900	2,850	3,800	4,750	5,700	6,650	7,600	8,550	9,500
200	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
210	1,050	2,100	3,150	4,200	5,250	6,300	7,350	8,400	9,450	10,500
220	1,100	2,200	3,300	4,400	5,500	6,600	7,700	8,800	9,900	11,000
230	1,150	2,300	3,450	4,600	5,750	6,900	8,050	9,200	10,350	11,500
240	1,200	2,400	3,600	4,800	6,000	7,200	8,400	9,600	10,800	12,000
250	1,250	2,500	3,750	5,000	6,250	7,500	8,750	10,000	11,250	12,500
260	1,300	2,600	3,900	5,200	6,500	7,800	9,100	10,400	11,700	13,000
270	1,350	2,700	4,050	5,400	6,750	8,100	9,450	10,800	12,150	13,500
280	1,400	2,800	4,200	5,600	7,000	8,400	9,800	11,200	12,600	14,000
290	1,450	2,900	4,350	5,800	7,250	8,700	10,150	11,600	13,050	14,500
300	1,500	3,000	4,500	6,000	7,500	9,000	10,500	12,000	13,500	15,000

CONVERSION TABLE FROM U.S. CUSTOMARY TO METRIC

Unit of Measure	Multiply	By	To Obtain: Multiply	By	To Obtain
Area:	acre	0.404686	hector (ha)	2.47105	acre
Length:	inch (in)	25.4	millimeter (mm)	0.039370	inch (in)
Length:	foot (ft)	0.3048	meter (m)	3.280804	foot (ft)
Mass:	pound (lb)	0.453592	kilogram (kg)	2.204622	pound (lb)
Power:	horsepower - U.S. customary (hp)	0.745700	kilowatt (kw)	1.34102	horsepower - U.S. customary (hp)
Pressure:	pound per square inch (PSI)	6.894757	kilopascal (kPa)	0.145038	pound per square inch (PSI)
Pressure:	pound per square inch (PSI)	0.069	Bar	14.5	pound per square inch (PSI)
Temperature:	degrees Fahrenheit (^oF)	TC = 5/9 (TF - 32)	degree Celsius (^oC)	TF = 1.8 TC + 32	degree Fahrenheit
Torque:	pound inch (lb in)	0.112985	newton meter (Nm)	8.850748	pound inch (lb in)
Torque:	pound foot (lb ft)	1.355818	newton meter (Nm)	0.737562	pound foot (lb ft)
Velocity:	mile per hour (mph)	1.609344	kilometer per hour (km/h)	0.621371	mile per hour (mph)
Volume:	cubic inch (in^3)	16.38706	cubic centimeter (cm^3)	0.061024	cubic inch (in^3)
Volume:	cubic foot (ft^3)	0.028317	cubic meter (m^3)	35.31466	cubic foot (ft^3)
Volume:	cubic yard (yd^3)	0.764555	cubic meter (m^3)	1.307950	cubic yard (yd^3)
Volume:	ounce - U.S. fluid (oz)	29.57353	milliliter (ml)	0.033814	ounce - U.S. fluid (oz)
Volume:	quart - U.S. liquid (qt)	0.946353	liter (l)	1.056688	quart - U.S. liquid (qt)
Volume:	gallon - U.S. liquid (gal)	3.785412	liter (l)	0.264172	gallon - U.S. liquid (gal)
Volume/Time:	gallon per minute (U.S.) (GPM)	3.785412	liter per minute (l/m)	0.264172	gallon per minute (U.S.) (GPM)
Horsepower:	U.S. customary horsepower (hp)	1.014	metric horsepower	0.9863	U.S. customary horsepower (hp)
Horsepower:	net engine hp (hp)	0.815	PTO observed hp		net engine hp (hp)
Horsepower:	Net engine hp (hp)	0.70	max drawbar hp		Net engine hp (hp)

Axial Flow® 7120, 8120 & 9120 Combines Pre-Delivery Checklist

CUSTOMER NAME:_____
MODEL:_____
P. I. N: **Y** _ _ _ _ _ _ _ _
WORK ORDER #:_____
UNIT RECEIVED DATE:_____
PRE-DELIVERY DATE:_____
TECHNICIAN NAME_____

The Pre-Delivery Checklist (PDI) is a comprehensive guide to preparing a machine for use. The experience of the Servicing Technician dictate the extent of it's use. PDI time is not reimbursable as a warrantable expense unless a defect in material or workmanship is present. Damage claims resulting from shipping must be made with the carrier. Shortages must be reported within 9 months from date of receipt.

Defects found during PDI that will lead to a warrantable failure are to be submitted immediately through ASIST using the following coding: "Maintenance - 00". Please include: Unit Received Date, Pre-Delivery Date, Warranty Start Date, Technician Name. Digital photos for reference are encouraged.

➡ **Symbol indicates critical process.**

UNLOADING/LOADING THE MACHINE

➡**Specific, detailed unloading/loading instructions are included with the combine shipping invoice.** ***Failure to follow these instructions can result in non-warrantable machine damage.***

➡**Track-ready Combines**– Track-ready combines are shipped from the factory with a ground speed limitation and without the tracks installed. Tires must be installed on the combine for unloading purposes. Do not remove the ground speed limitation until the tracks are installed. Refer to Service Bulletin AFX SB 009 08 for track pre-delivery and installation information.

INITIAL INSPECTION

-**Wash machine** of road salts immediately upon arrival.
-Verify combine configuration to customer order
-**Remove side panel latch retaining ties** used for shipping.
-**Verify secure latching of side panels.**

➡**Install the SMV sign.**

➡**Verify Operator's Manual is with the machine.**

-**Verify spare fuse kit** is present in fuse panel drawer.

FLUID LEVELS

-**Verify battery water level** of each cell and battery cable terminal tension.
-**Verify lower unloading auger gear case oil level** is to plug**.** (CaseIH 80W-90 Gear Lube**)**
-**Verify transmission housing lube level** is visible in sight glass. (CaseIH 80W90 Gear Lube)
-**Verify final drive housing lube level** is visible in sight glass. (CaseIH 80W90 Gear Lube)
-**Verify feeder conveyor drive gear case level** is visible in sight glass -header lowered (CaseIH Hy-Tran Ultra)
-**Verify header drive gear case level** is visible in sight glass - header lowered. (CaseIH Hy-Tran Ultra)
-**Verify tailing processor gear case oil level** is to correct plug. See Operator's Manual (CaseIH Hy-Tran Ultra)
-**Verify engine coolant level** is visible in de-aeration tank sight. Note: Use caution removing de-aeration tank cap. System may be under pressure. Protection to a minimum of -20 degrees F
-**Verify engine crankcase oil level** (factory fill) - Proper level on dipstick, proper grade for ambient temperature. (Case IH 15W-40)
-**Verify rotor gear case oil level.** Proper level on dipstick. (CaseIH Hy-Tran Ultra)
-**Verify PTO gear case oil level.** Proper level on dipstick (CaseIH Hy-Tran Ultra) With the combine standing on a level surface, run machine for 10 minuets, wait a minimum of 15 minutes after engine is turned off to check the oil level or check level before combine is operated.

1) Remove the dipstick, wipe clean and re-insert fully to get accurate reading.
2) Pull the dipstick out again and check the oil level.

The oil level should be between minimum and maximum levels marked on the blade.

-**Verify hydraulic reservoir oil level** is between marks on gauge- header lowered, unloading auger retracted. (CaseIH Hy-Tran Ultra)
-**Verify upper unloader auger gear case oil level** is to plug (CaseIH 80W-90 Gear Lube)
-**Verify inclined delivery auger gear cases oil levels** are to plug (CaseIH Hy-Tran Ultra)
-**Verify brake reservoir fluid level.** Use DOT 3 brake fluid.
-**Verify windshield washer fluid level** in reservoir

STATIC COMBINE CHECKS

-**Adjust HDASA/PRA** (heavy-duty adjustable steering axle/powered rear axle) **axle width** as required. Refer to Operator's Manual.
-**Adjust toe-in** to: 5/16-15/32" (8-12 mm)

➡**Adjust steering stops** Refer to Operator's Manual for steering stop/tire size settings.

➡**Verify tire pressure.** Refer to Operator's Manual for tire pressure by tire size.

-**Verify correct rear axle extension height/position** if the front or rear tire size has been changed,. Refer to Operator's Manual. Front to rear the machine lower frame must be level to 3° [2" (50 mm)] higher in the rear for proper cleaning system operation.

➡**Torque guide wheel hardware** - Non- PGA nuts to 302-363 lb. ft. (410-492 Nm)**,** PGA bolts/spacers 406-450 lb. ft. (550-610 Nm). Do not lube joint during installation.

➡**Torque drive wheel hardware** – All drive wheel types – torque nuts and bolts to 525-580 lb. ft. (710-790 Nm). Do not lube joint during installation.

Note: Check drive wheel mounting hardware torque after first hour of use and every 10 hours of operation until torque stabilizes

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Axial Flow® 7120, 8120 & 9120 Combines Pre-Delivery Checklist

FRONT OF COMBINE-

-Verify feeder cylinder safety stop operation.

➡**Verify feeder face adjustment**- The feeder face angle must provide the correct degree of forward tilt of header backsheet/support beam, 17 degrees, when in the field operating position. This is dependent on tire size, refer to chart in operators manual.

-Adjust lower feeder drum stop for crop to be harvested.

-Verify feeder slats clearance to the feeder face is no more than 1" (25 mm) from the metal crop deflector.

-Verify feeder chain tension is adjusted to the gauge. (Recheck after 10 hrs of operation)

-Verify feeder/header electrical wiring harness is secured away from the header drive line, yet allows for movement in the feeder pivot area.

-Verify feedplate seals to bottom/side of feeder. The wire bail should not be attached to the feedplate.

RIGHT SIDE OF COMBINE-

➡**Verify grain tank clean out doors are closed.**

➡**Verify correct threshing RH modules are installed** for crop being harvested.

-Verify adjustment of the clean grain elevator paddle chain. Latch clean-out door closed.

-Verify adjustment of clean grain elevator drive chain.

-Verify adjustment of the clean grain drive belt.

-Verify adjustment of the inclined delivery auger drive chain.

➡**Verify the fuel tank shut off valve** position is fully open.

➡**Drain water from separator filter** (if required).

-Verify tailings processor drive belt tension spring length is aligned with the end of the gage.

-Latch tailings processor clean-out door closed.

-Verify clean grain/tailings cross auger clean-out doors are correctly positioned/latched securely below the machine**.**

REAR OF COMBINE-

-Position the straw hood for the spreading preference and crop being harvested. Refer to Operator's Manual. Position spreader deflectors as needed for spreading width.

-Verify rear sieve controls operate sieves throughout the operating range Ignition key "On"

➡**Verify left/right sieve openings are the same. AF** 8120 and 9120 only

➡**Verify rear ladder sensor adjustment.** See Operator's Manual.

LEFT SIDE OF COMBINE-

-Verify beater/chopper drive belt(s) spring tension is adjusted to the gauge**.**

-Select chopper speed for crop to be harvested (if equipped).

-Verify chopper stationary knife handle detent bracket/knife height position. Adjust if required.

-Set chopper stationary knife position for crop to be harvested (if equipped).

-Verify grain scan monitor operation by tapping on sensors. Ignition key "On"

-Inspect hydraulic tubes fittings and clamps are secure.

-Select rotor gear for the crop to be harvested.

-Verify electrical harnesses are routed and secured appropriately near PTO gear case and unloader drive belt.

-Verify shaker system drive belt tension.

-Verify unloading auger drive belt tension.

-Verify unloading auger drive chain tension.

➡**Latch closed the vertical unloading auger clean out door.**

-Verify the cleaning fan cleanout door is closed.

-Verify slack in electrical harness routing near LH corner of cab to permit full cab movement.

➡**Verify correct LH threshing modules are installed** for crop being harvested.

-Verify rotor cage transport vane position for crop being harvested.

-Verify concave threshing module is leveled front to rear.

➡**Verify concave threshing module to rasp bar pinch point** is ± 2 separator bars from center module support rib. Set concave stop bolts to insure rotor to concave clearance. Calibrate instrumentation for concave zero if adjustment was made.

-Verify concave threshing module can move throughout the entire operating range w/o binding.

TOP OF COMBINE-

-Position the grain tank unloading covers for crop to be harvested.

-Verify inclined delivery auger can be latched into the field operating position.

-Verify grain tank level sensors adjustment and operation. (Ignition key "ON")

➡**Verify all charge air cooling tube clamp positioning and tension.**

➡**Verify cooling system/fuel system hoses/clamps** for routing and tension.

➡**Verify air filter to turbocharger inlet clamp** positioning and tension.

➡**Verify engine air filters and end cover radial seal** for proper positioning.

-Verify positioning of unloading auger tube to unloading auger saddle.

-Verify engine access door/hand rail latching.

-Verify cooler box door latching/sealing.

-Verify rotary air screen seal is secure, with no gaps.

➡**Verify external brush adjustment for rotary air screen.** Brushes should clear air screen with a 5mm gap.

OPERATIONAL CHECKS-
ENGINE RUNNING-CAB

➡**Verify combine configuration and latest software revision for all controllers** using EST. Consult ASIST for latest versions.

➡**Perform tire radius calibration** using the display.

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-**Verify correct time, date, unit of measure and language** on display is indicated.

➡**Clear all diagnostic codes** from the Display.

-**Verify operation of HVAC system.**
-**Verify cab pressurization** of 1/2" water minimum. Correct as required.
-**Verify engine high idle setting** of 2100 ± 20 rpm (engine to temperature, high idle, no load)
-**Verify engine low idle setting** of 1000 ± 10 rpm (engine to temperature, low idle, no load)
-**Verify header identification is correct** on display (if header installed on combine).
-**Verify the header default and programmable header types** are correctly set-up in the display with header attached and electrical harness connected.
-**Set-up any Automatic Crop Settings** (if known) into the display.
-**Perform header ground calibration of AHHC** (if header is installed and equipped with AHHC)

➡**Verify 1-4 transmission shifting** occurs**.**

SEPARATOR & FEEDER RUNNING-
HIGH IDLE RPM-

-**Verify operation of all electrical functions.**
-**Verify operation of all mechanical functions.**
-**Verify self-leveling cleaning system is functional.** Recalibrate only if needed.
-**Adjust header raise/lower rates to 4-5 secs.**
-**Adjust minimum reel speed** (if equipped with grain header)
-**Verify Auto Header Lateral Tilt** manual/auto operation.
-**Set concave** for crop to be harvested.
-**Verify rotor speed range** in gear selected. See Operator's Manual.
-**Set rotor speed** for crop to be harvested.
-**Verify feeder jackshaft speed range** 456-698 rpm(dependent on feeder drive type and header installed, refer to operators manual for speed ranges)
-**Set feeder speed** for crop/header type (if applicable).
-**Verify fan speed range** (300-1150 rpm ± 5%)
-**Set cleaning fan speed** for crop to be harvested.
-**Set sieve opening** for crop to be harvested.
-**Verify spreader speed range** (350-750 rpm ± 5%)
-**Set spreader speed** for desired spreading width.
-**Verify unloading auger swing operation.**
-**Verify unloading auger engage operation.**
-**Verify unloading "auger in" proximity switch.**
-**Verify feeder reverser operation.**
-**Verify rotor deslug operation (rotor stopped).**

SEPARATOR & FEEDER RUNNING-
HIGH IDLE RPM-COMBINE MOVING

-**Verify individual brake application** occurs.
-**Verify differential lock application** occurs (if equipped).
-**Verify power guide axle and two speed power guide axle operation** (if equipped)

AFS PROGRAMMING

-**Verify AFS harness routing and sensor placement** for shipping damage.
-**Verify PC data card is included** with the machine, if equipped with Touchscreen Display.

➡**Verify moisture sensor is mounted** on the inside of the clean grain elevator housing.

➡**Verify the flow sensor is firmly mounted** at the top of the clean grain elevator.

-**AFS Display Settings.** Refer to Operator's Manual (Use ◄► to scroll across the bottom of the Main screen to find correct selection)
  -**Main>ToolBox>Yield** Yield Monitor "Yes" is selected.
  -Verify Moisture Sensor connections by checking Crop Temp. **Main>ToolBox>Layout –** Select Current Layout>New-enter a New name-press Enter to store the name. Then select one of the Run screens and select an empty cell and enter Crop Temp. **Main>Run** screens and select the screen that Crop Temp is on and verify that this temperature is similar to the ambient temperature.
  -**MAIN>ToolBox>Header 1** Verify maximum working height has been set. Raise/lower feeder several times verifying the display beeps when it passing the set point. Number of beeps can also be set. See Operator's Manual.

-**Combine/AFS Sensor Function Check:**
  -**Transmission Sensor-**Combine in motion, feeder fully raised, view the uncalibrated Ground Speed on upper left hand corner of display.
  -**Elevator Speed Sensor-**Separator engaged, verify elevator rpm by viewing Grain elevator speed on one of Run screens. See Operator's Manual regarding data to be displayed.
-**GPS Equipped AFS Combines**
  - AFS262 Antenna Receiver**.** The AFS262 receiver is capable of receiving WAAS/EGNOS, OmniSTAR VBS, OmniSTAR HP, and RTK signals (RTK requires software upgrade to receiver). VBS, HP, and RTK correction signals require a Fee, WAAS/EGNOS is a free signal. The AFS262 receiver plant setting is for WAAS/EGNOS.
  -AFS162 Receiver receives WAAS/EGNOS only.
  -**For customers who choose satellite differential correction, reference Service Bulletin AFS SB 007-02 to obtain instructions and a contract.**
-Verify the GPS receiver/antenna is firmly mounted on the grain tank extension.
-**MAIN>Tool Box>GPS** GPS Installed "Yes" and the Connection Type is "CAN-B"
  -**Verify** DGPS Alarm is set to "YES". (if Differential correction subscription is installed) otherwise "NO".
  -Verify the receiver powers up**.**
  -**MAIN>Diagnose>RDI** View the information on the "HOME" screen to determine the receiver status.

Desktop Software Equipped AFX Combines:

-**Verify** customer awareness of personal computer and software requirements to process yield data. See back of CD sleeve

Guidance Ready equipped AFS Combines

-Verify left steering cylinder has sensor and harness is routed and secured correctly
-Verify steering valve mounted under cab left side
-Verify harness and hoses routed and secured correctly
-Verify manual disconnect sensor mounted at base of steering column and harness routed and secured correctly
-Verify NAVII controller mount is installed on cab floor under RHC.
-Verify NAVII adapter harness installed under RHC

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Guidance Complete equipped AFS Combines

-Perform all Guidance Ready items above

-Verify NAVII Controller mounted flat side up with connectors pointing towards seat pedestal.

Display Setup

MAIN>TOOLBOX>NAV

NAV II installed: Set to 'Yes'

MAIN>TOOLBOX>GPS

-Set the GPS location (For 7120/8120/9120 combines the GPS receiver is located on the grain tank)

-Set the Connection Type to CAN B

-Set appropriate DGPS Type (WAAS, XP/HP, RTK)

MAIN>TOOLBOX>DRIVE

Auto Guidance Type: Set to DGPS

MAIN>TOOLBOX>LAYOUT

-Set up a guidance run screen with the following items:

Swath Finder2x1	Swath 1 Record 2x1
Swath Number	Swath Select
GPS Status	GPS Heading
Cross Track Err	Guidance Engage*

(*Guidance Engage should be placed on multiple run screens)

MAIN> TOOLBOX> HEAD1

Set the Header Width, Target Work Width, and Header Center offset (Drapers: +1.0 ft for 36' 2062 Draper, +1.5 ft for 39' 2052 Draper) if needed.

MAIN>PERFORMANCE>PROFILE

Set up a Grower, Farm, Field, Task, and Crop Type to allow Swath record to save.

MAIN>CALIBRATIONS>NAV

-Set the correct vehicle model

-Verify Autoguidance Enables

-Verify Autoguidance Engages

-Verify Manual over ride functions

Calibrations

MAIN>CALIBRATIONS>CALIBR

Rear Wheel Position

MAIN> CALIBRATIONS>NAV

Roll Cal

➡ **SAFETY/FINAL PREPARATIONS**

-**Reference Plant final try-off testing results data** supplied with combine.

-**Verify light operation** of field, road and service lights.

-**Set outside mirrors and verify** operation (electrical actuated-if equipped)

-**Verify correct time** on radio display is indicated**.**

-**Verify Operator Presence system operation.**

-**Verify service brake pedal latch is functional.**

-**Verify neutral start function.**

-**Verify Parking Brake operation.**

-**Verify rear ladder switch operation** See Operator's Manual

-**Verify all product graphics, warning decals and shield are in place.**

-**Mount fire extinguishers**.

-**Lubricate combine** (refer to Operator's Manual)

-**Clean and wax combine.**

-**Verify Warranty Policy** statement is supplied to customer and drive wheel hardware torque statement card is attached to turn signal switch.

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PRODUCT INFORMATION

This is a Sales Education document not to be used for purposes of advertisement

20 Series Axial-Flow® Combine Enhancements for Model Year 2010



Section	Grain Harvesting
Subtitle:	20 Series Combines
Form no:	GH-2075-09
Replaces:	None
Date:	June 2009

CASE IH AGRICULTURE

INTRODUCTION

With the introduction of the 20 series Axial-Flow® combines in 2009, Case IH leads the industry in productivity enhancing machines. For producers that need the size and capacity of a Class VII, VIII or IX combine Case IH provides the broadest offering of machines in the industry. Axial-Flow® combines continue to set the standard for carefully matched systems that ensure peak operating efficiency and overall productivity. With the fewest drive components, the Axial-Flow 20 series combines are engineered for simplicity and reliability**. For Model Year 2010, Case IH engineers have enhanced and refined the 20 series Axial-Flow combine product line-up and it's feature offering to allow you to sell MORE of the Axial-Flow advantage.**

Base Unit Offering

Since the introduction of AFS AccuGuidance as a factory fit option in 2007, customer adoption of this feature has been at a strong and fast pace. Therefore, all 20 Series Axial-flow combines now incorporate AFS AccuGuidance ready components as standard equipment.

These AFS AccuGuide ready components include:

- Receiver Mount
- Steering Cylinder
- Steering Valve
- Mounting bracket for Nav II controller
- Antenna mounting bracket

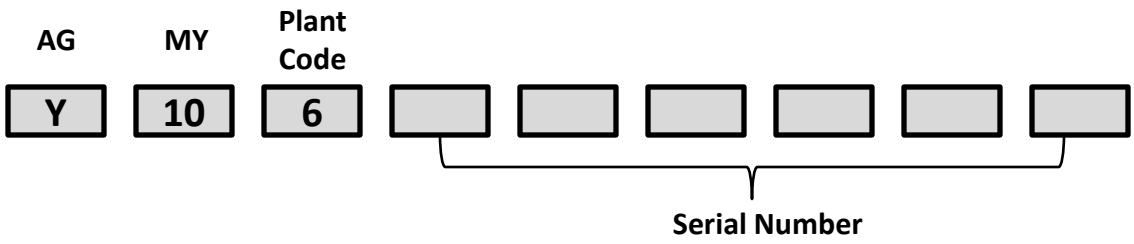
By offering AFS AccuGuidance ready as standard equipment, your customers can now enter the precision farming arena by choosing what type of differential correction suites their respective operation:

- Case IH RTK 1 inch accuracy pass to pass
- OmniSTAR HP 2-4 inch accuracy pass to pass
- OmniSTAR XP 3-5 inch accuracy pass to pass
- WAAS 6-12 inch accuracy pass to pass.

AFS AccuGuidance provides not only straight line guidance, but curves to give you total control. Giving your producer the ultimate in productivity and profit savings.

Model year 10 machines will include new serial number plates that list both the year of manufacture and Model Year of the machine.





2010 Model Year Production Serial Number Information for the 20 Series Combines

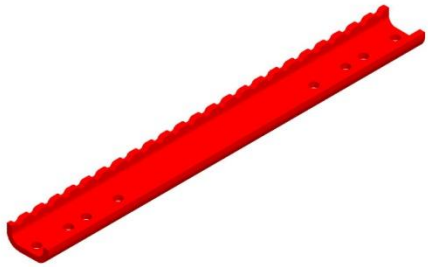
- 7120 for Model Year 2010 Y9G207601*
- 8120 for Model Year 2010 Y9G207601*
- 9120 for Model Year 2010 Y9G207601*

* All Models of the new 20 Series Axial-Flow Combines will be serial numbered consecutively.

Feeder

Feeder Chain Slat



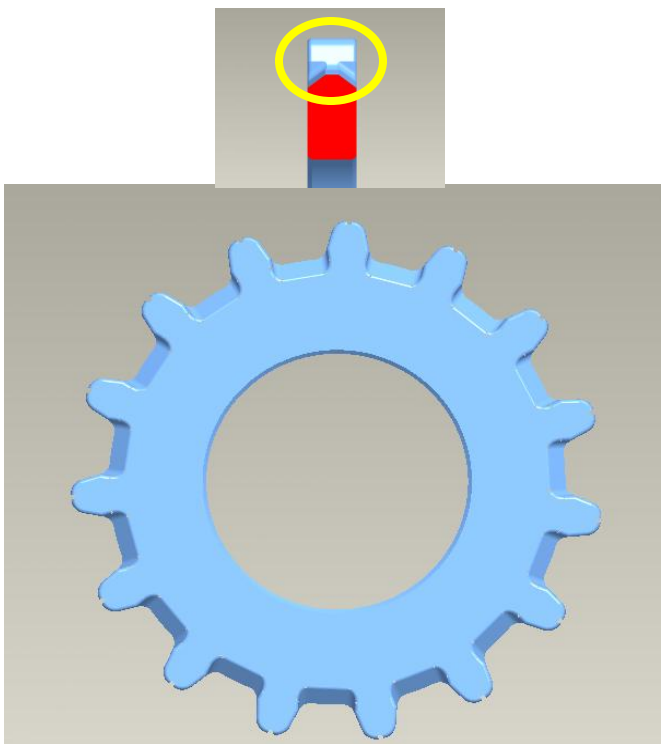


Prior Z-Slat

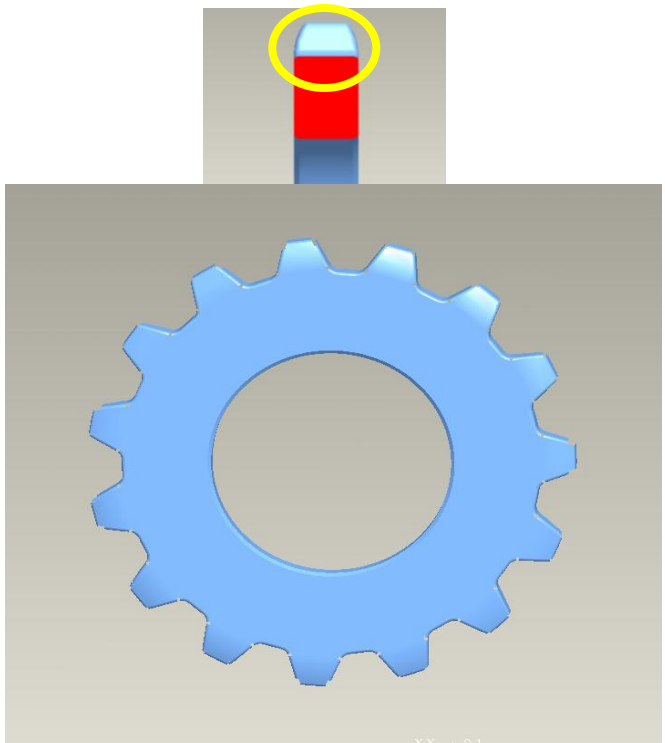
New U-Slat

To enhance the combines feeding capacity and handle today's higher yielding crops and greater volumes of material, the feeder slats have been changed from a Z-slat to a new U-slat. The new profile provides improved strength and durability for each slat. Finite element analysis confirms that the U-shaped slat is stronger under similar loading conditions. The slat is a Grade 80 material and is, 6.35 mm thick.

Top Feeder Chain Sprockets



Model Year 2010



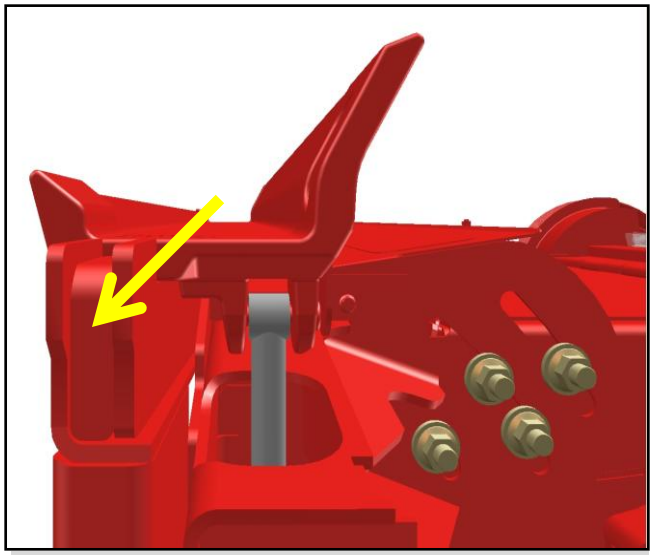
Model Year 2009

The sprockets on the top feeder shaft have been enhanced to provide greater gear tooth contact and to include a self cleaning design. The tooth profile on the top shaft sprockets now feature a beveled tooth profile that cleans crop material from the tooth. This will also resist chain jumping by keeping crop material from building up on the tooth profile. The new profile prevents crop from being trapped under the chain. Kit **8422953** is available an, contains the top shaft with new sprockets and strippers and will only service MY09 combines.

Feeder Cradle



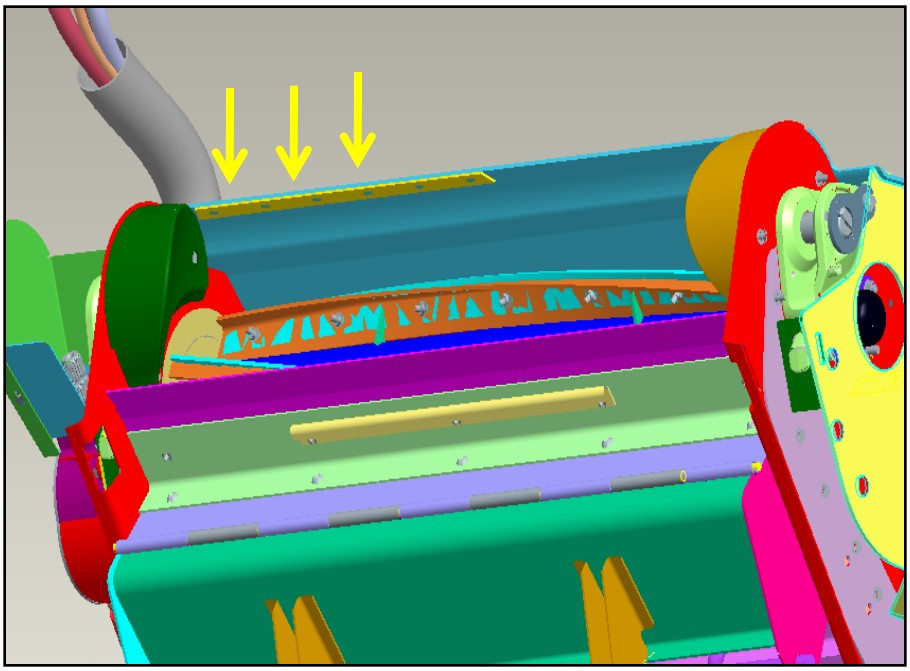
Model Year 2010



Model Year 2009

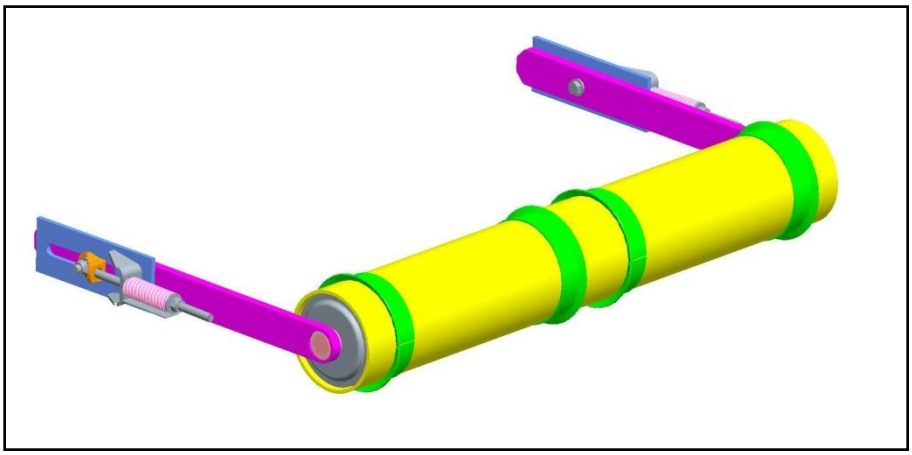
The feeder cradle has been enhanced to prevent damage when attaching and detaching headers. The prior design utilized a fabricated plate that had a recessed channel that could potentially catch on some headers. The new design features a small filler piece to make the surface smooth, ensuring easier header to feeder attachment.

Feeder Wear Strip



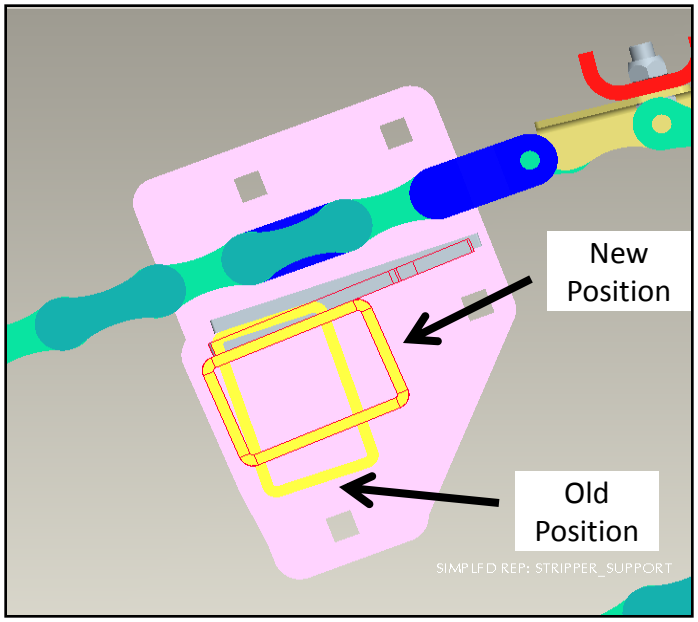
With the high volume of crop that goes through today's combine feeder house, we have extended the wear strip at the back of the feeder. The wear strip at the exit of the feeder has been lengthened approximately 100mm to the inboard direction to better match up with the crop flow wear pattern.

Enhanced Front Feeder Drum



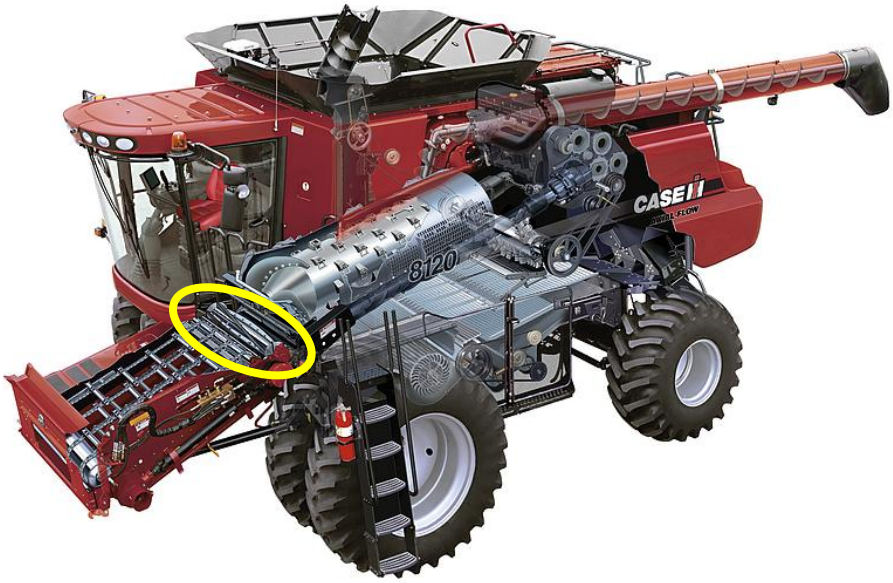
Many improvements and enhancements have been made to the feeder on 10/20 Series combines over the years. One area of improvement is the front drum and spring tensioning mechanism. A new front feeder drum kit has been released to update MY07 and prior units with the latest spring feeder chain tensioning design. This kit consists of the front drum, drum arms, bearings and spring tension mechanisms. The kit is **PN 84182198.**

Stripper Plate Mounting



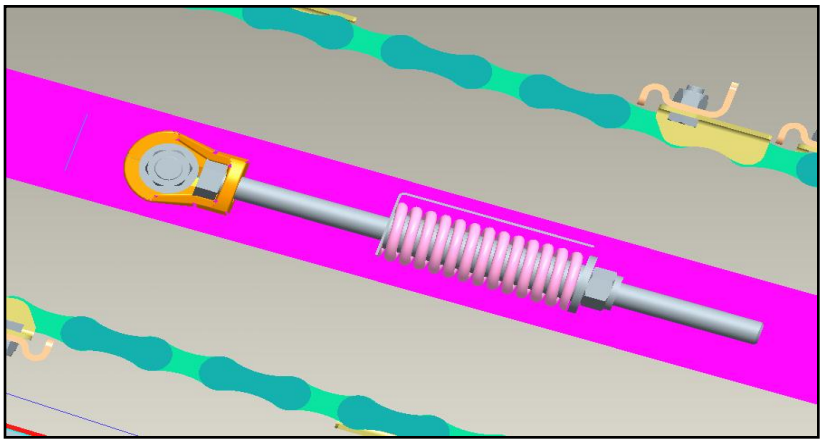
The stripper plate mounting at the back of the feeder house has been reoriented (highlighted in yellow and outlined in red) to improve overall stripper plate wear life. This revised positioning also provides additional adjustment to ensure proper stripper to top shaft clearance. This will result in enhanced stripper performance and reduced wear.

Rock Trap Beater Drive



The rock trap beater drive speed has been reduced from 1000 rpm to 700 rpm. This ensures that material makes the transition from the feeder to the transition cone while still providing rock protection. A Service Kit, # **84177488** for MY09 combines can be installed on prior year units.

Feeder Chain Tensioner



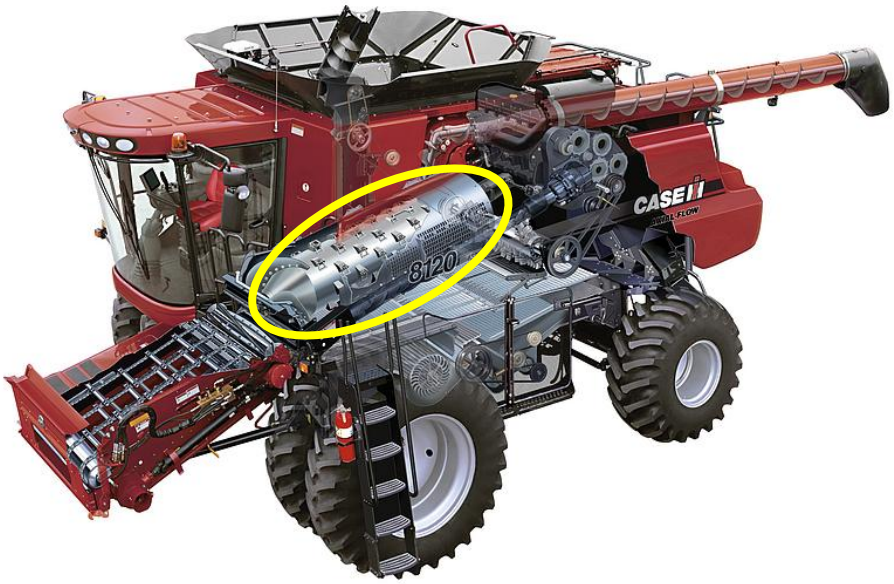
On both left and right sides of the feeder house the feeder chain tension is maintained by spring loaded tensioning mechanisms. The spring loaded feeder chain tensioners have been improved with the following updates:

- A stronger cast support replaces a sheet metal part
- An internal spacer limits travel and free motion during normal operation and prevents the spring from bottoming out during feeder reversing.
- The spring is longer to compensate for chain stretch

Note: This was part of a campaign for MY08 and MY09 units.

Threshing and Separating

AFX Rotors

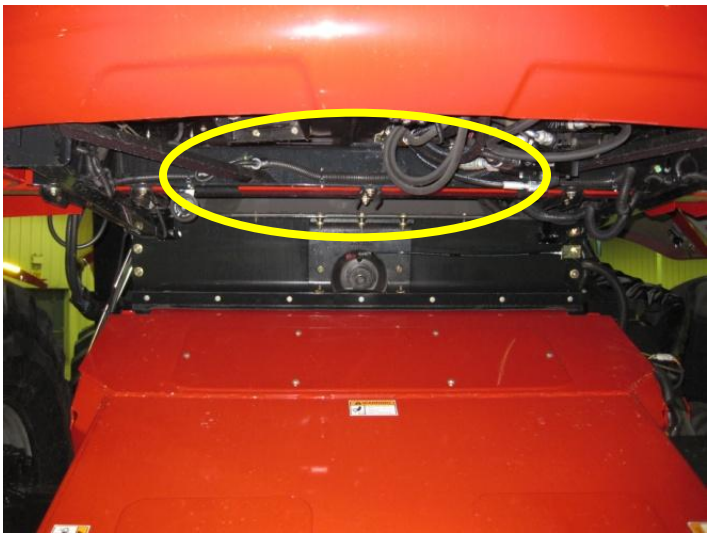


To enhance the machine configuration and provide increased separation capability the Factory Fit (FF) rotor offering has been expanded to offer rotors with straight bar configurations for the corn and soybean region.

AFX rotor only, rotor offerings

- **Section 15, Code MJ –** For corn, soybeans and small grains (includes 4 straight bars and 8 spiked bars in the separating area).
- **Section 15, Code MK –** Extended Wear Rotor, for corn, soybeans and small grains (includes 4 straight bars and 8 spiked bars in the separating area).
- Service part rotors will be extended wear spiked rasp bar only.

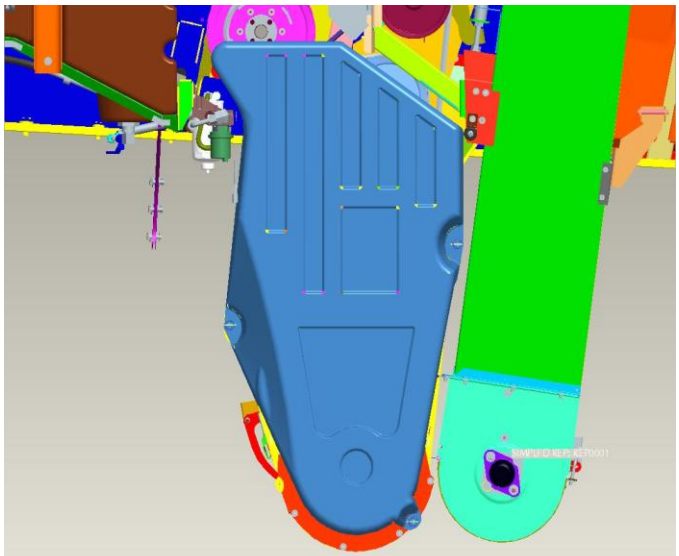
Rotor Half Moon Door



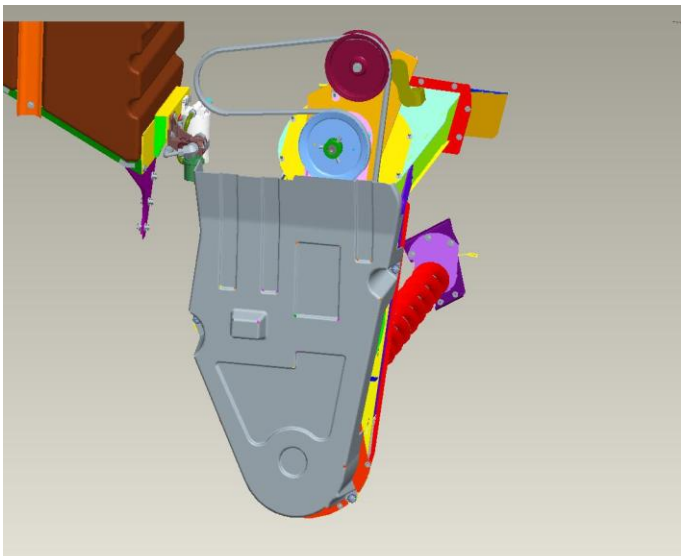
The material on the rotor half moon door has been upgraded from stainless steel to AR (Abrasion Resistance) 200 material for improved wear resistance.
The paint specifications have been updated to distinguish extended wear from standard wear components. The paint color of the bar/wire high wear modules changed from CNH dark grey to red to match the other high wear modules. (MY09)

Cleaning System

Tri-Sweep Tailings Processor



Model Year 2010



Model Year 2009

All 20 Series machines include refinements to the shielding on the Tri-Sweep Tailings Processor . The tailings shield has been modified to improve clearance to the tire, and provide additional coverage of the belts and pulleys. This also reduces the opportunity for corn cobs and debris to be thrown into the belt and cause a belt to jump the pulley.

Cleaning Fan DIA Kit



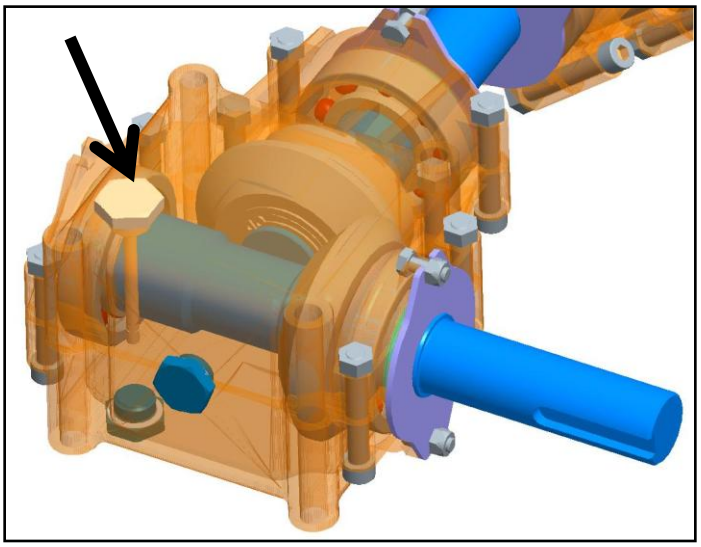
With model year 09 machines, all 20 Series machines included as standard feature, a grain fan cleanout door,. This makes it much easier to remove grain in the event that the operator inadvertently fills the fan. That feature is now available as a DIA kit to update those machines equipped with fixed fan housings. This can make it significantly easier to clean out fans if they are inadvertently filled with grain.

- **84169220** – 7010 and 7120
- **84169221** – 8010, 8120 and 9120

MY08 and prior models.

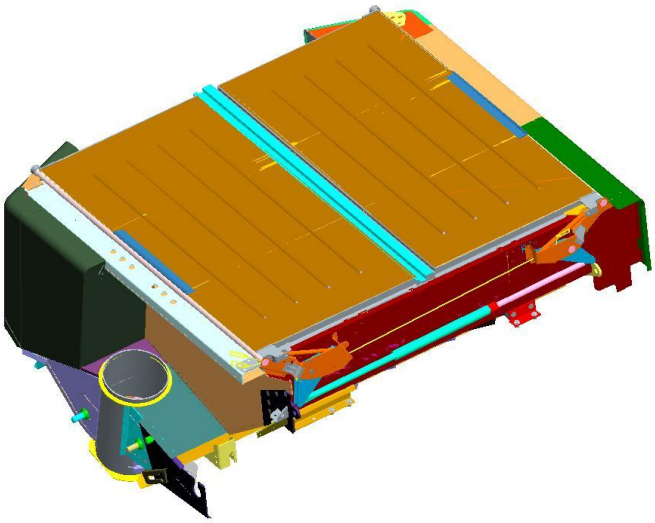
Grain Handling

Bubble-Up Gear Box



An update has been made to the gearbox that powers the grain tank vertical auger. A dipstick has been added to the grain tank bubbler gear box. This will make service and maintenance easier.

Hydraulic Folding Grain Tank Covers

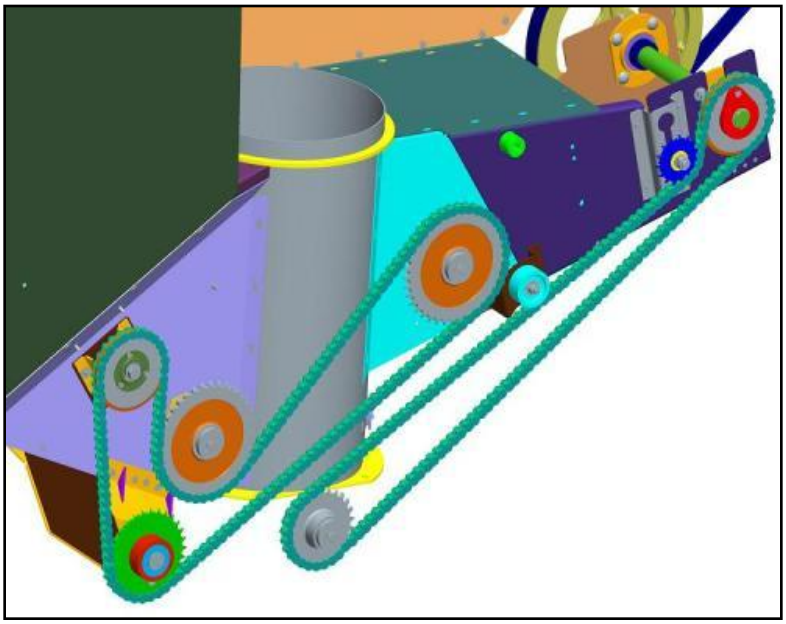


The 20 Series will now offer optional in-cab hydraulic folding grain tank covers. These covers are similar in design to the in-cab electrically folding covers found on the 88 Series. Due to the size and weight of the 20 Series covers, they are actuated hydraulically vs. electrically like the 88 Series. The capacity is 315 bu/11,100L on the 7120, and 350bu/12,330L on the 8120/9120. These optional covers are available in two versions.

7120
Code **RM** Std wear w/folding covers
Code **RN** Extend wear w/folding covers

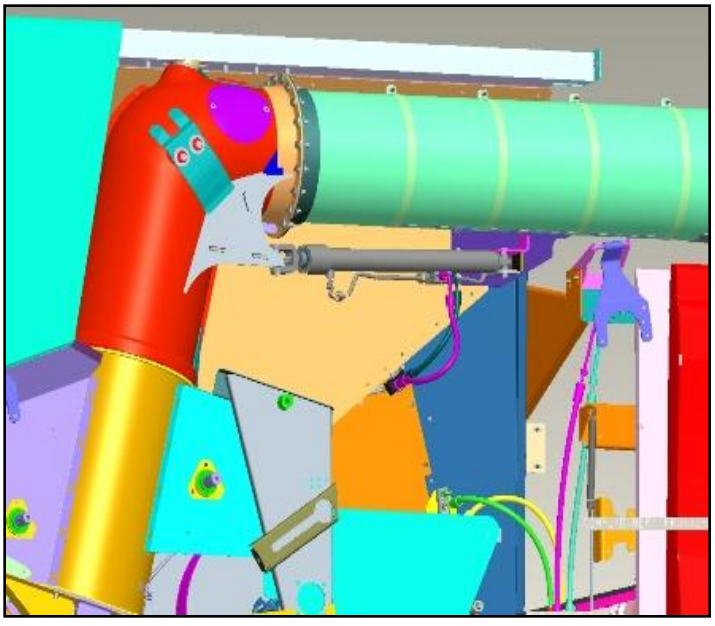
8120/9120
Code **RM** Std wear w/folding covers
Code **RN** Extended wear w/folding covers

Hydraulic Cross Auger Drive - Rice Only



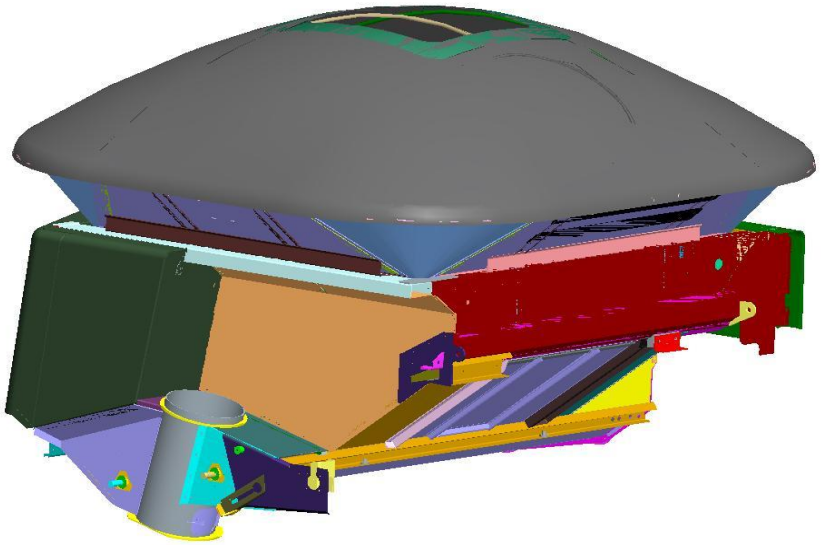
For Rice machines, a new hydraulic cross auger drive for the grain tank is available as an option. This option separates the cross auger drive from the unload tube drive. It allows independent on/off control of the cross augers. The primary application of this will be on rice machines, and will have approximately **10% to 15% less unload rate capacity** than the full mechanical drive system. The hydraulic cross auger will allow an operator to shut off flow of grain to the unloading system while still running the vertical and horizontal unloading auger tube. This is particularly important when unloading heavy wet bridging crops, that are prone to plugging and shear pin failure.

Unloading Auger Swing Cylinder



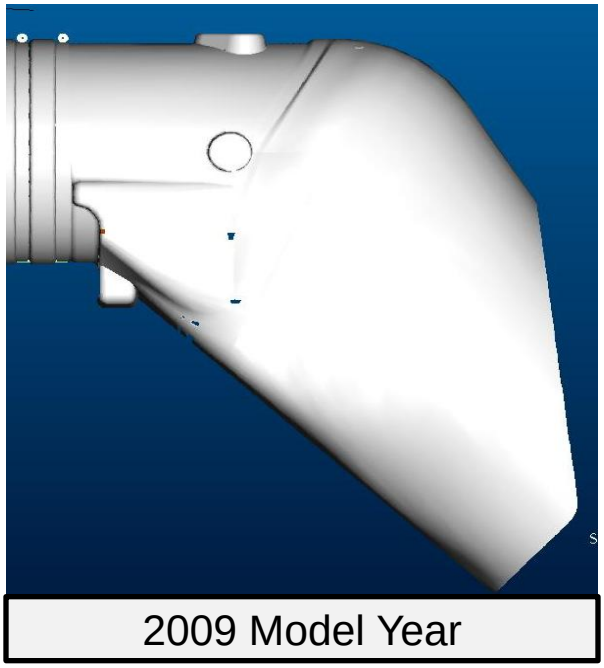
The unload auger swing cylinder bore has been increased to provide more force to swing the tube into the saddle. This ensures more consistent auger movement into the saddle. The bore has increased from 50mm to 60mm with no change in rod size. This provides more force to ensure that unloading tubes are properly seated.

Canvas Grain Tank Cover

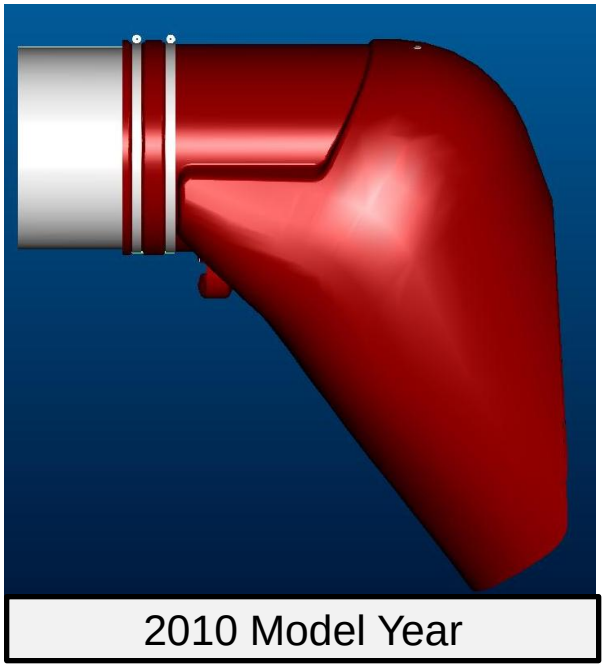


A DIA kit for a canvas grain tank cover will be available mid-summer to early fall 2009 and retrofitable to prior machines. This is a canvas grain tank cover that can be used in specially crops like canola or grass seed. These crops are extremely light and can be blown by wind or gusts directly out of the bubble up auger and/or standard grain tank.
PN 84175802 (7120) / **PN 84175803** (8120/9120)

Unloading Auger Spout



2009 Model Year

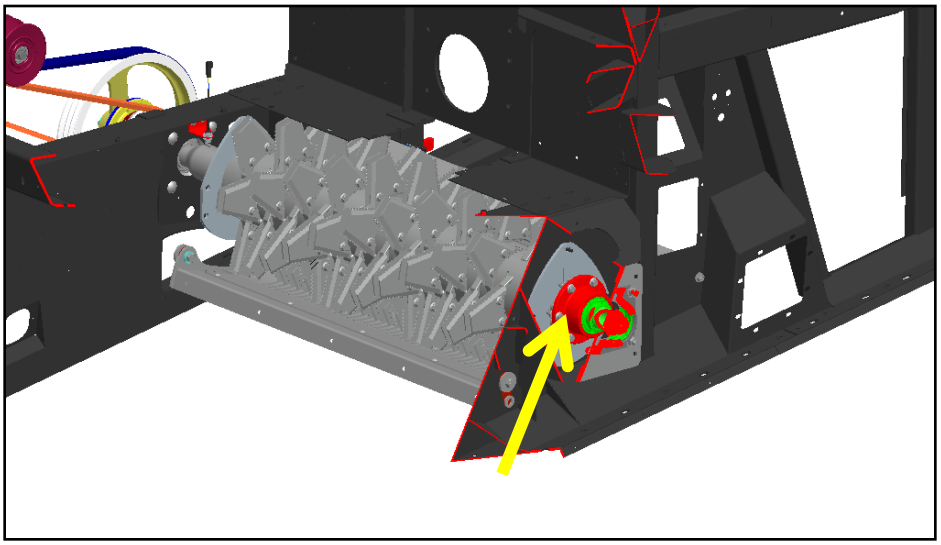


2010 Model Year

A new unload auger spout is included on all 2010 model combines. This spout includes a steeper unload angle to ensure quick grain flow from the unloading auger. The bottom floor of the spout is more vertical, minimizing the risk of trapping grain. The bottom of the new spout is approximately 75mm lower than the MY09 spout, and discharge reach has been decreased by 75mm. There are no changes between MY09 and MY10 for the grain retention door.

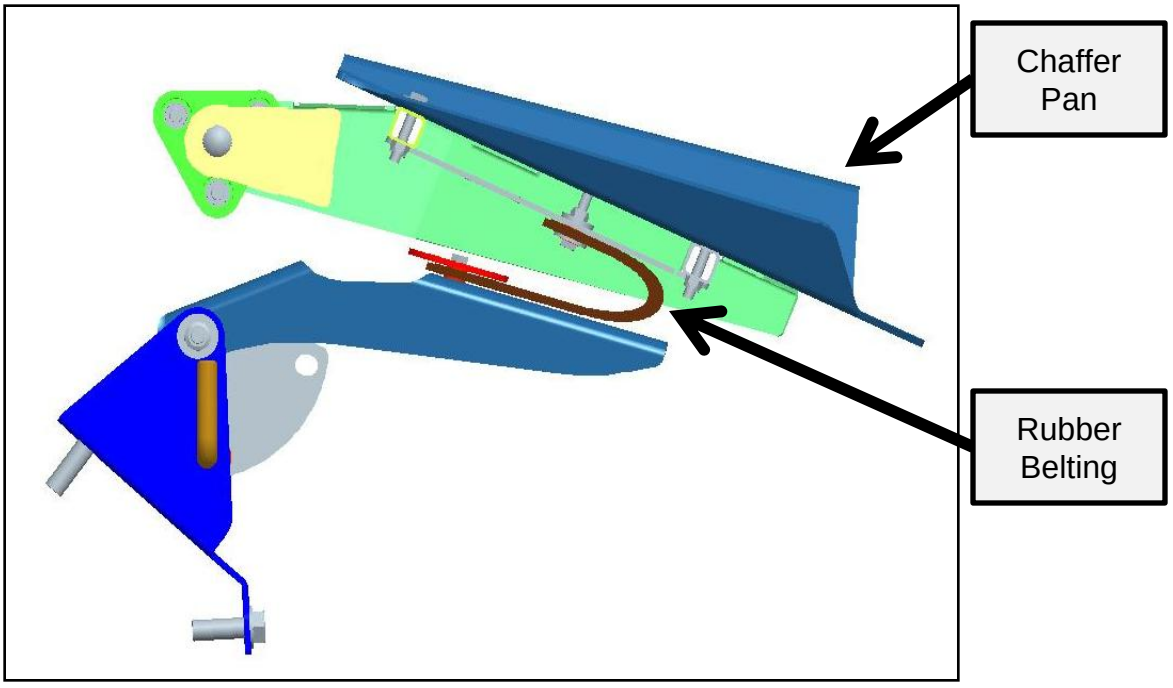
Residue Management

Chopper Bearing



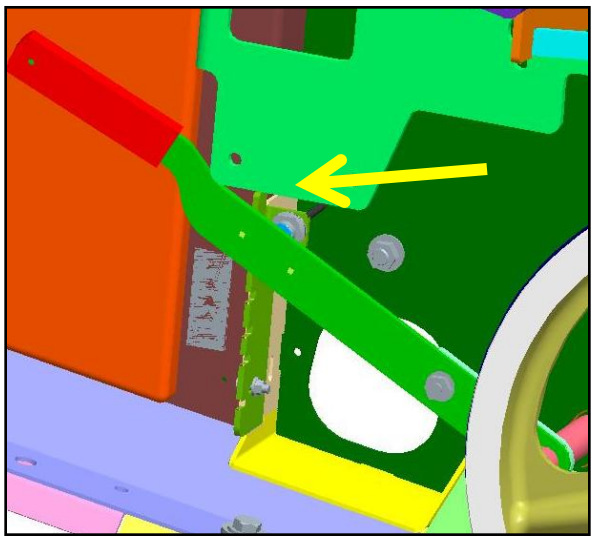
The right side chopper bearing housing has been upgraded to a stronger casting made from ductile iron with 55,000 psi yield strength versus the current grey iron with 30,000 psi yield strength. This is an 83% higher strength casting and will provide a more robust design, while increasing service overall life.

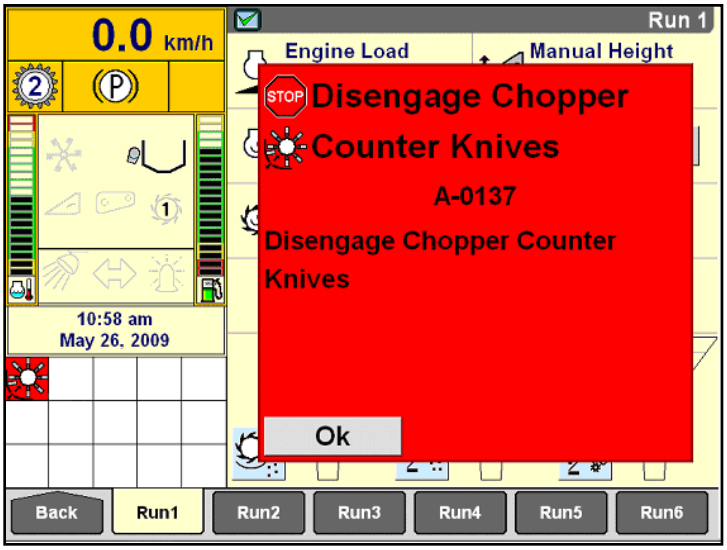
Chaff Pan Support



The chaff pan support has been changed from a steel tube design to a rubber belting support. The rubber belting provides a more robust design that resists vibration with improved durability.

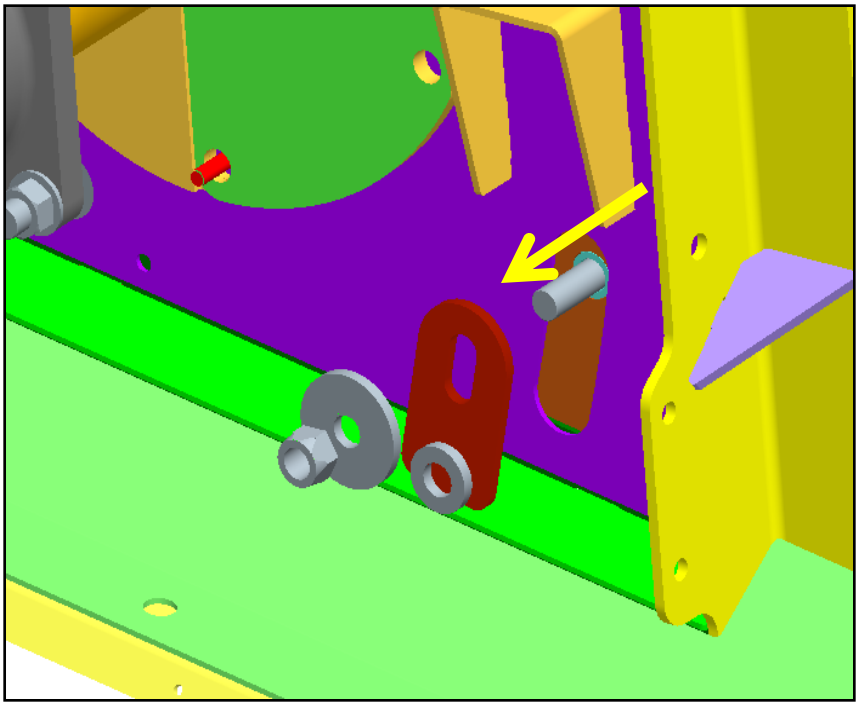
Counter Knife Bank





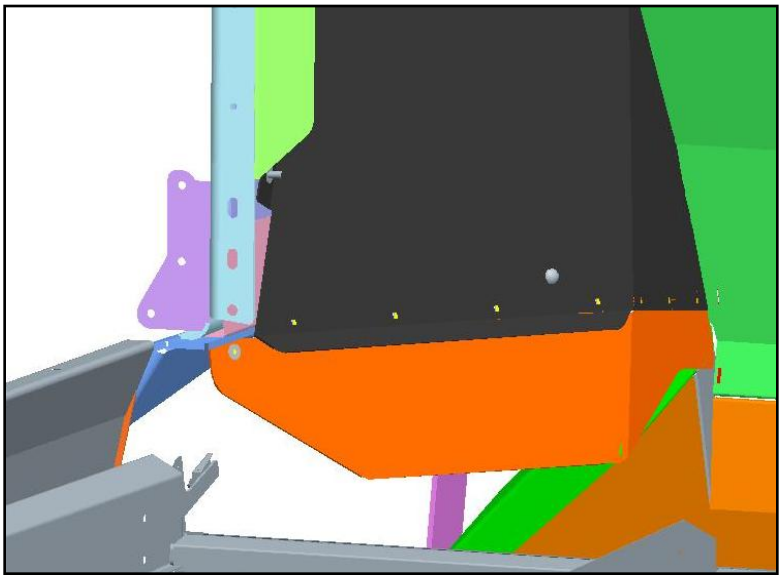
A sensor has been added to detect the position of the counter knife bank. These changes will sense when the knife bank is in a fully retracted position. In addition the combine now monitors if the chopper is in either Low (800rpm) or High (3000rpm) speed rage, and alerts the operator if the chopper speed is in a non-recommended setting condition based upon machine settings. A Pop-Up message will alert the operator of the machine condition.

Chopper Pan Adjustment Range



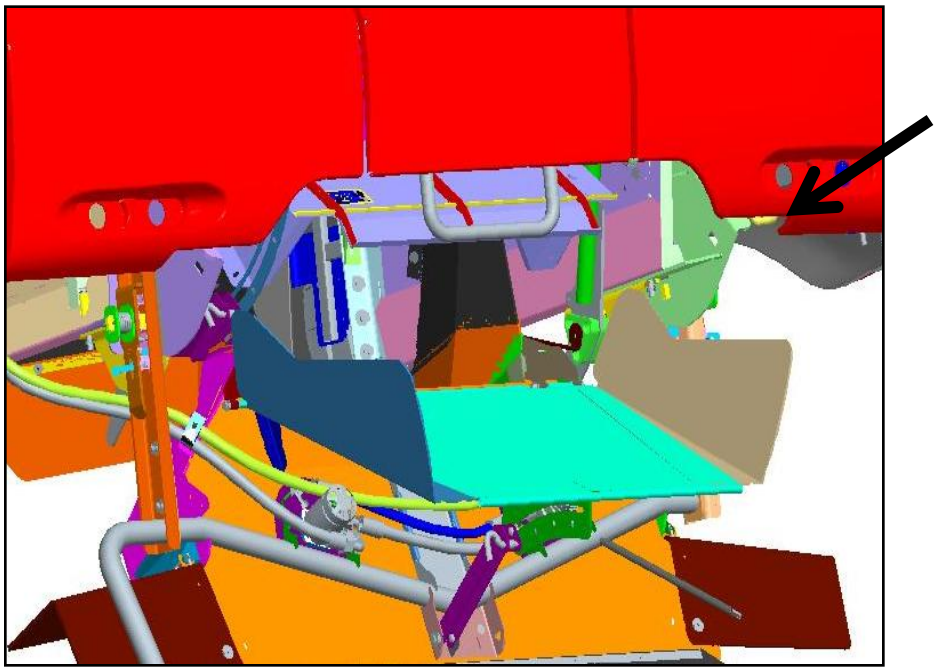
A change has been made to the chopper adjustment range of the chopper pan. A redesigned linkage piece limits the adjustment range of the chopper pan. This improvement will ensure that customers do not over adjust the chopper pan and provides even more consistent chop quality.

Straw Hood

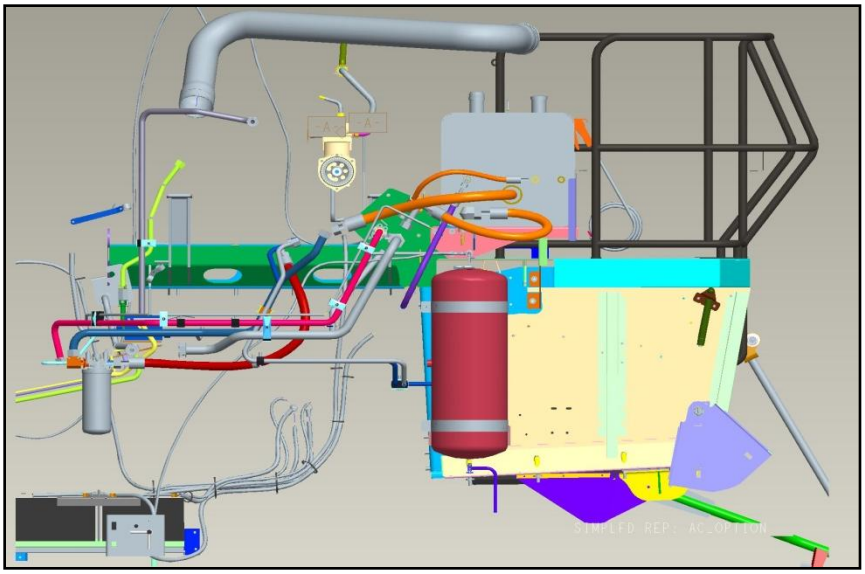


The rubber curtain on the straw hood has been redesigned. The new curtain extends forward toward the cleaning system, and provides improved material flow from the cleaning system to the spreader. This change will reduce material being emitted up and towards the rotary screen, and reducing screen plugging and extending overall cleaning intervals. The old curtains will be retained for servicing prior units but the new curtains could be installed on the prior units with additional parts. These parts will directly fit on MY09 units

Windrow Chute



The height of the side deflector on the windrow chute has been increased approximately 4 inches. This provides additional material control in heavy crop conditions, improving overall windrow formation.



Engine Driven Air Compressor

For customers that need access to air to clean the engine compartment or blow off a machine, an optional engine driven air compressor will be available for 2010 as a Factory Fit (FF) option for the 8120 and 9120. **Section 29 Code WM.**

- Initial availability will be on the 8120 and 9120 models.
- 7120 compressor availability will be January 2010.

DIA kits will be available for units starting with MY10 production. This kit is not retro-fittable to prior models due to changes in engine accessory drives area.

7120-PN **84182756**
8120-PN **84182759**
9120-PN **84182753**

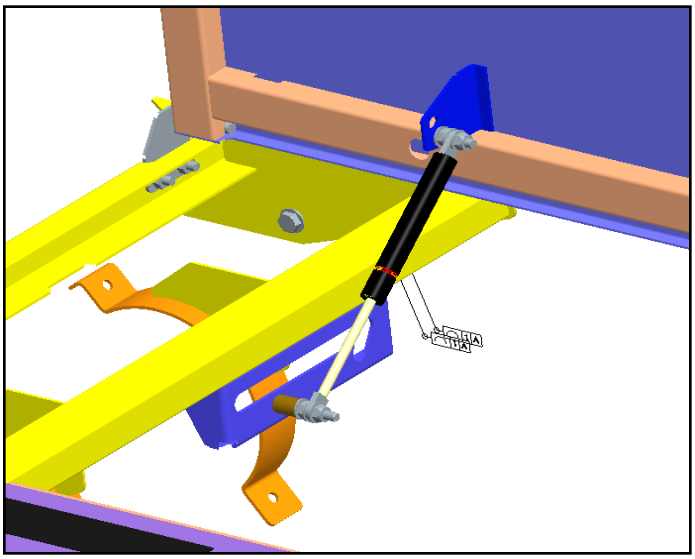
The system will have 5 outlets.

- Engine deck area.
- Below the battery box on the left side.
- On top of the operators platform.
- Under the operators platform on the left side.
- Behind the clean grain elevator on the right side.

The system has the following specifications:

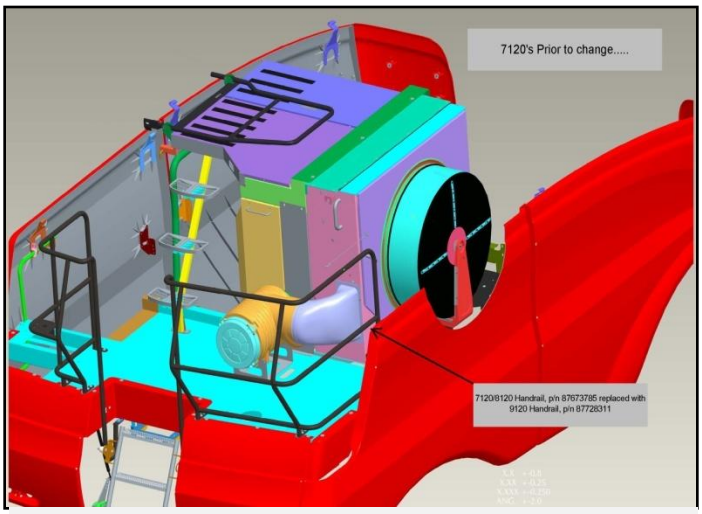
- 8.3 bar (120 psi) regulated pressure
- 60 L (16 gal) tank
- 198 lpm (7 cfm) @ 1000 rpm / 396 lpm (14 cfm) @ 2000 rpm
- Self coiling air hose – 6 m (20 ft) usable length
- An air nozzle will be provided to utilize with the self coiling air hose and the various outlets.

Engine Cover Struts

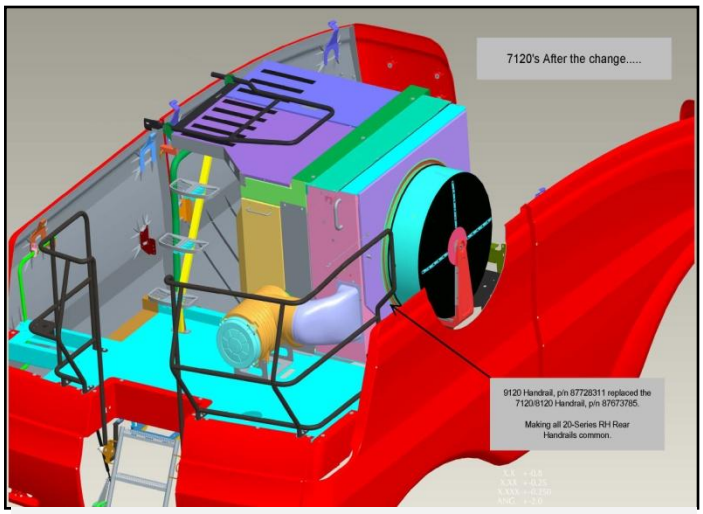


Gas struts have been added to the engine covers of the 7120/8120 combines. These assist in opening the covers and in ensuring that they close smoothly. The design is now similar to the 9120 engine covers.

Engine Deck Hand Rail



2009 Model Year



2010 Model Year

The engine deck hand rail is now common between all three 20 Series machines for model year 2010. This provides common parts, as well as common appearance between models.

Tires

There are new tire updates to the tire offering for 20 Series combines.

•Additional tire suppliers are being added to select tire sizes. Refer to the tire section of the price list for additional details.

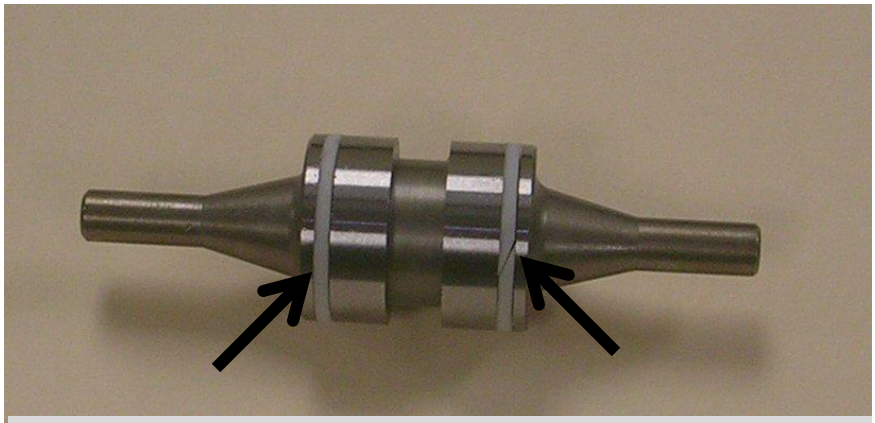
•18.4-30IND-160A8-14PR, has been eliminated from the product offering.

•The 1050/50R32 178A8 HF3, has been eliminated due to low demand.

•The 620/70 R42 LI160 A8 dual tires have been eliminated due to load limitations. It has been replaced with a higher capacity 620/70 R42 LI166. This will be the only 620 dual offering.

•Flow limiters will be made standard on 2 speed powered guide axle units. These flow limiters will help prevent rear wheel slip out in certain conditions.

Hydraulics



New Spool Valve – Header Lateral Tilt Circuit

Improvements have been made to the spool valve used in the header lateral tilt circuit. Wear rings have been added to the spool to act as guides. This will improve the reliability and durability of this circuit. There will be a new service part available in the future.

Cab and Controls

Red Leather Training Seat



New for 2010 are updates to the red leather seat option. When you order code **SR** it will now include a red leather training seat. The trainers seat will have the following refinements for the 2010 season. They include:

- A longer seat pan with more cushion material at the front.
- The rear seat back has additional material in the lumbar area and a shallower upper back rest.

These refinements provides additional support where the back needs it and will make it more comfortable for individuals being trained to operate the machine.

Desktop Version 9 Software



The desktop software is now version 9.

- Added support for extended trip/performance data
- Enhanced boundary file export for use during guidance.
- Added support for spiral guidance pattern.
- Enhanced wizards.

4 GB AFS Data Card



The AFS data card memory has been increased to 4 GB capacity. This will provide additional capacity for larger mapping requirements. It is still recommended to download maps on a daily basis to prevent inadvertent data loss.

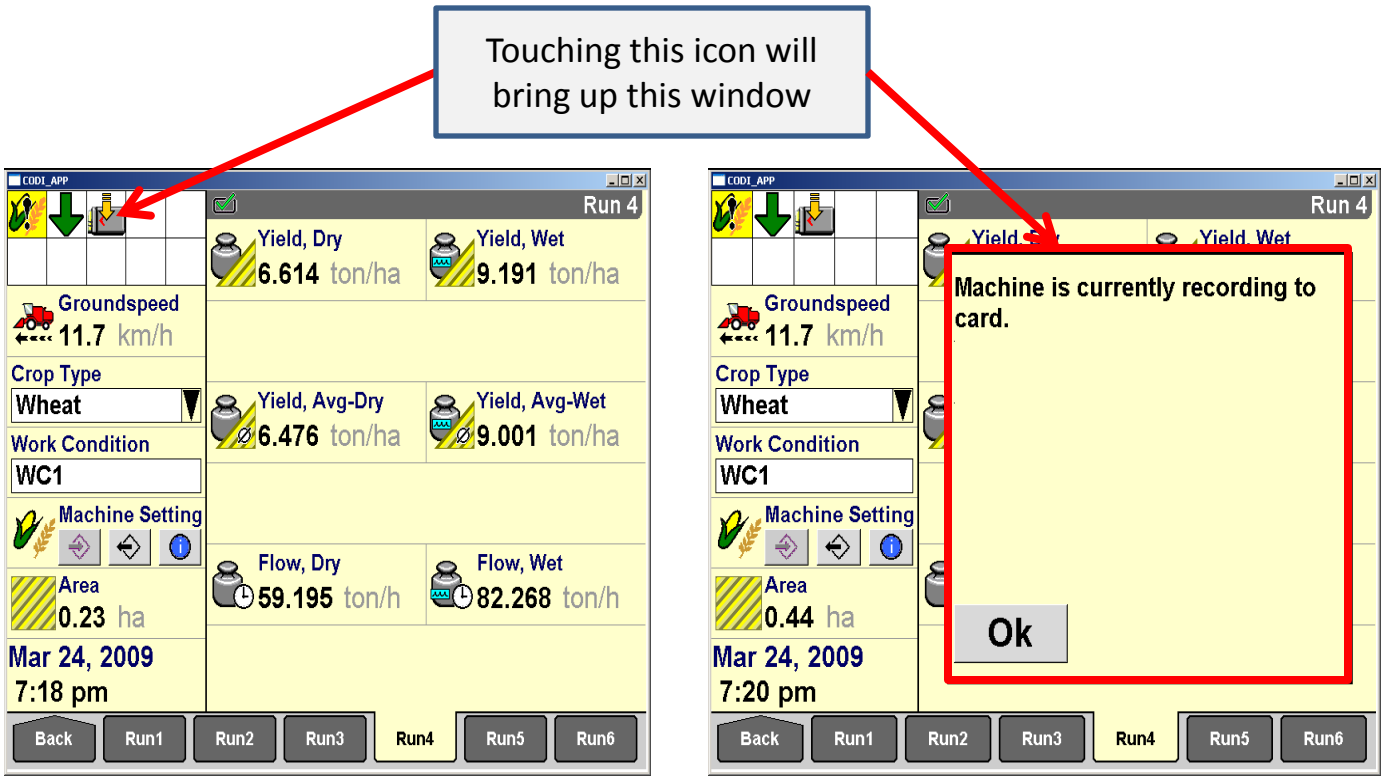
If your customers are still running a version older than v8.0x, they must migrate their respective data one version at a time. Please contact Technical Support with any issues or concerns about the migration process.

Note: migrating versions prior to v8.0x, is not supported

AutoGuidance Re-engagment



The method to re-engage the combine auto-guidance has been changed to a double click on the multi-function handle “shift” key from pressing the header resume button. The ‘Resume’ button operates as it did previously, controlling only the header height.



Additional help screen functionality has been added for units equipped with the Pro-600 display. If the operator touches the “status icon” symbol on the left side of the display, a pop-up window with additional text information will be displayed providing more detail on what the status icon symbol is indicating. **MY10**

For example, touching the icon on the left side of the display will bring up a pop-up window that provides additional detail of the item being monitored.

Summary

In this document, we have covered the major changes to the 2010 model year 7120, 8120 and 9120 Axial- Flow combines. At Case IH we continually strive to produce the ultimate products for you and your customers and react to dealer and customer input. The Axial-Flow 20 series combines deliver on the expectations of overall productivity and ultimate through-put capacity. **Sell the Axial-Flow advantage and to see these advantages first hand log onto ADVANTAGECASEIH.COM**

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CASE IH AGRICULTURE

GRAIN HARVESTING

PRODUCT INFORMATION

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Case IH
Header Enhancements for Model Year 2010



Section	Grain Harvesting
Subtitle:	Headers
Form no:	GH-2076-09
Replaces:	None
Date:	June 2009

CASE IH AGRICULTURE

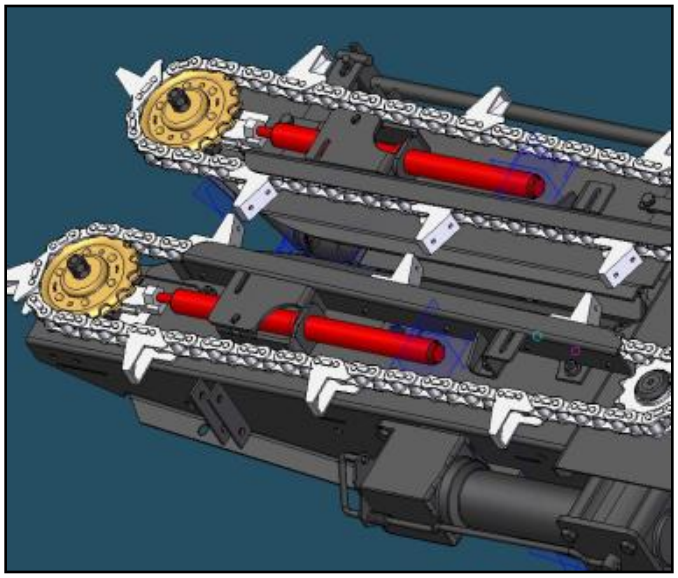
INTRODUCTION

The Case IH header line-up leads the industry in high performance, reliable and rugged headers to meet those highest demands from your customers. These headers are engineered and specifically tailored to match the higher productivity needs of the Axial-Flow combine.

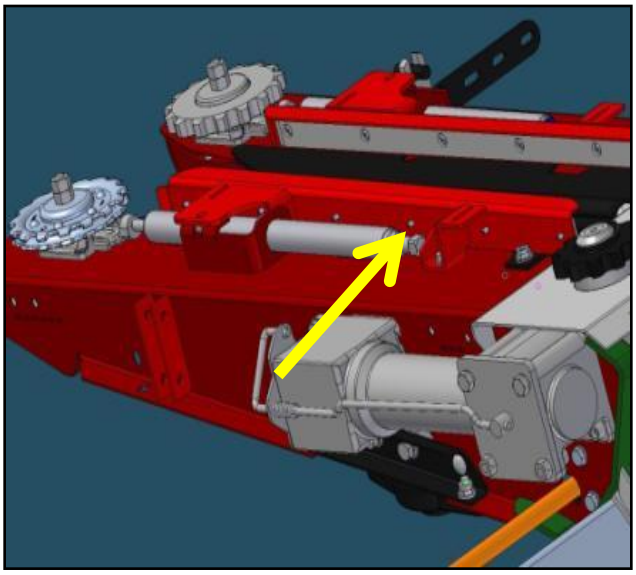
For Model Year 2010, the product offering has been enhanced to make the your harvest season for your customers even more productive and reliable than ever before.

2600 Series Chopping Corn Header

Gathering Chain Tensioner



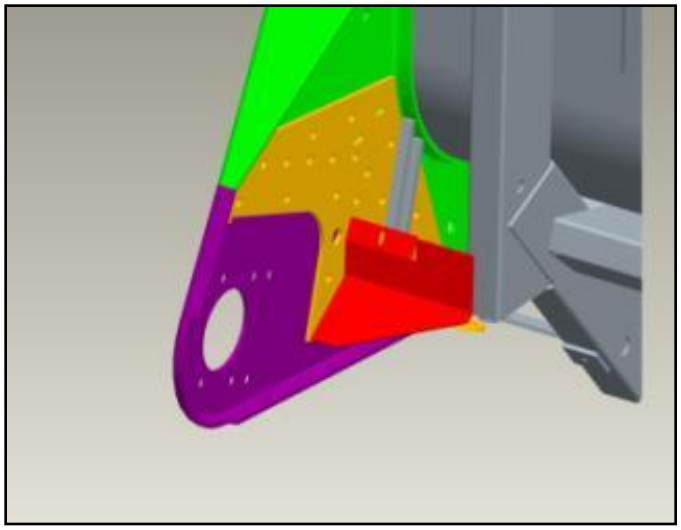
2009 Tensioner



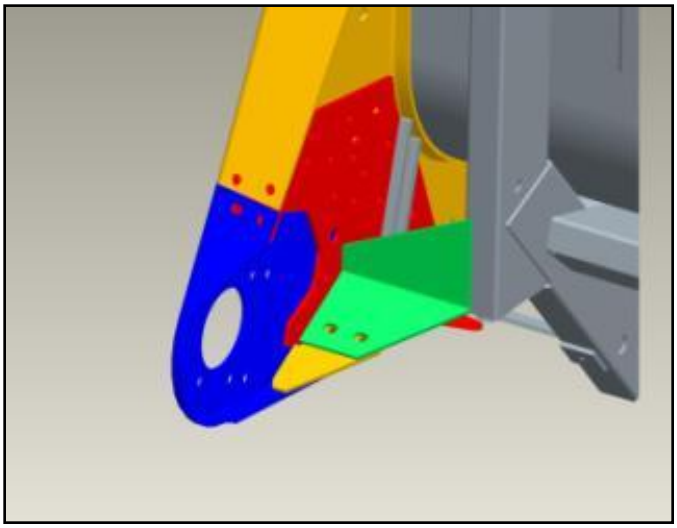
2010 Tensioner

For 2010 the gathering chain tensioner on the 2600 series has been revised to include a new tensioning mechanism with a bolt adjustment. The new tensioner provides a wider range of adjustment and can be increased in tension as chains age and stretch.

Re-enforced End Sheets



2009 Model Year



2010 Model Year

For the 2010 model year the 2606 and 2608 will incorporate changes similar to the 2612 models. Header end sheets will be reinforced on the 6, 8 and 8 row flip up headers. In addition Rislan coating will be added to the PTO shafts for all headers. This ensures that the shaft can truly move as the header tilts.

Polymer End Dividers for 2600 series rigid corn heads



Polymer end dividers are now standard equipment and are incorporated into the 2600 series rigid chopping corn heads. These dividers are similar to the 32/3400 series corn heads. Note: the end dividers for the folding corn heads are made of steel.

Hydraulically driven spiral augers - rigid corn heads



Optional Hydraulically Driven Spiral Augers are now offered as Factory Fit (FF) option for the 2600 series rigid chopping corn head. These options can be ordered in **Section 6** of the 2600 chopping corn head price book. The folding chopping corn heads will continue to use the belt driven spiral augers.

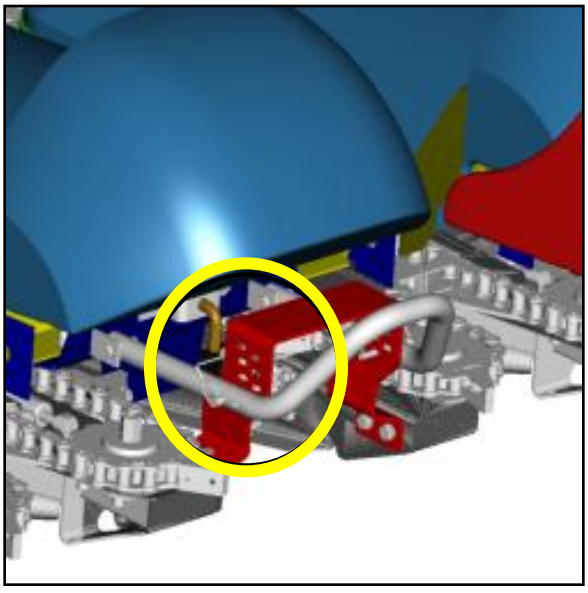
Stalk Stompers



As crop genetics continue to evolve and stalks become even tougher, producers are looking for attachments that will aid in the deflection or flattening of stalks away from either their tires or tracks. Stalk Stompers will be available as a parts accessory kit (TBC) and will bolt to the back of the corn head and flatten stalks in front of the drive tires and or tracks.

3000 Series Corn Headers

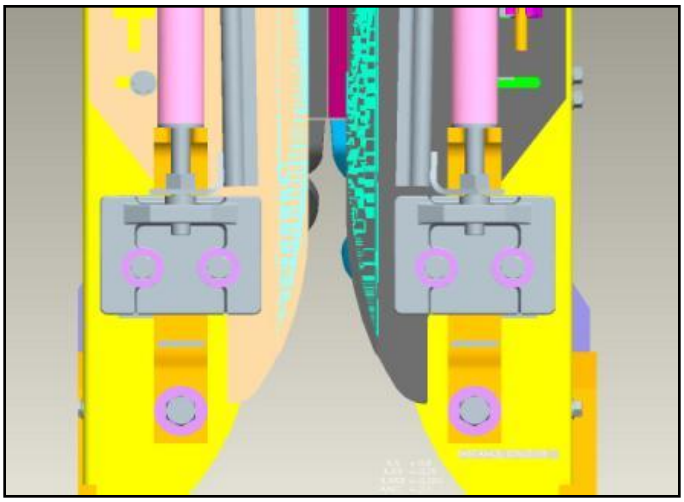
Floating Pin





All 3000 series corn heads will use a new floating pin in the header dividers. The new pins utilize a handle/cam arrangement for divider height adjustments. The pins will reduce overall premature wear caused by the potential of pin vibration.

Deck Plates



The standard adjustable hydraulic stripper deck plates allow for increased grain savings and promote grain quality. Through continued design enhancements, the deck plate profile has been modified for crop conditions that have smaller sizes of corn ears. The modified profile narrows the gap between the LH and RH plate to minimize potential ear loss in those type of conditions.

2010/2020 Auger Heads

Currently there are no changes planed for 2010 and 2020 Auger Heads.

2015 Pick-Up Head

These heads are currently discontinued.

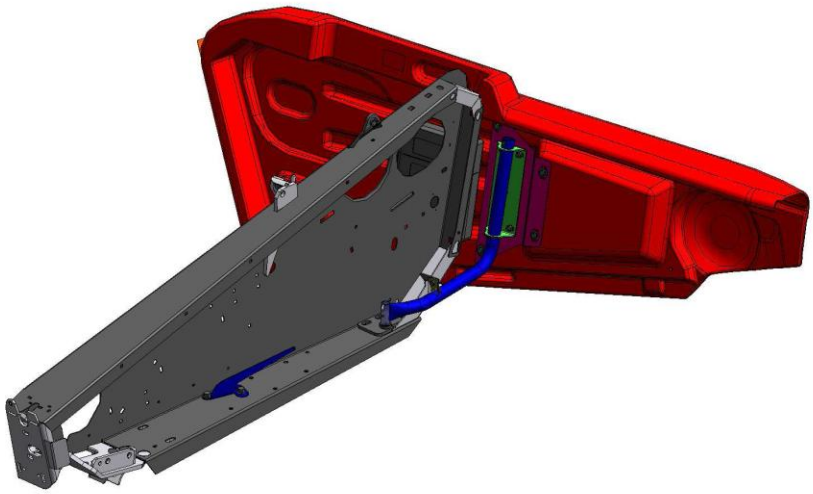
2016 Pick-Up Head

Currently there are no changes planed for 2016 Pick-Up Heads.

2142/2152/2162 Draper Headers



Closed



Open

ALL 2142/52/62 Draper headers will receive Hinged End Shields for 2010. This hinged design improves overall service to both ends of the header. These end shields will fit on 2009 and prior model year headers but will not incorporate the hinge design.

2 Stage Opening Design

- Easier to Remove/Install Shield
- Less handling damage
- Easier access to Knife Drive

Trailering Hitch



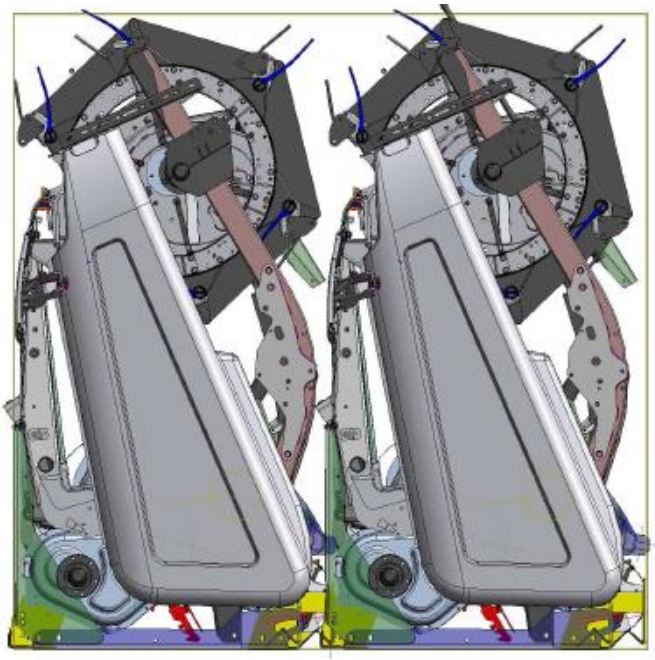
Left Side



Right Side

For 2010 the storage position for the trailering hitch has been repositioned and is now split between the left and right sides of the header. This makes overall deployment of the hitch easier and faster.

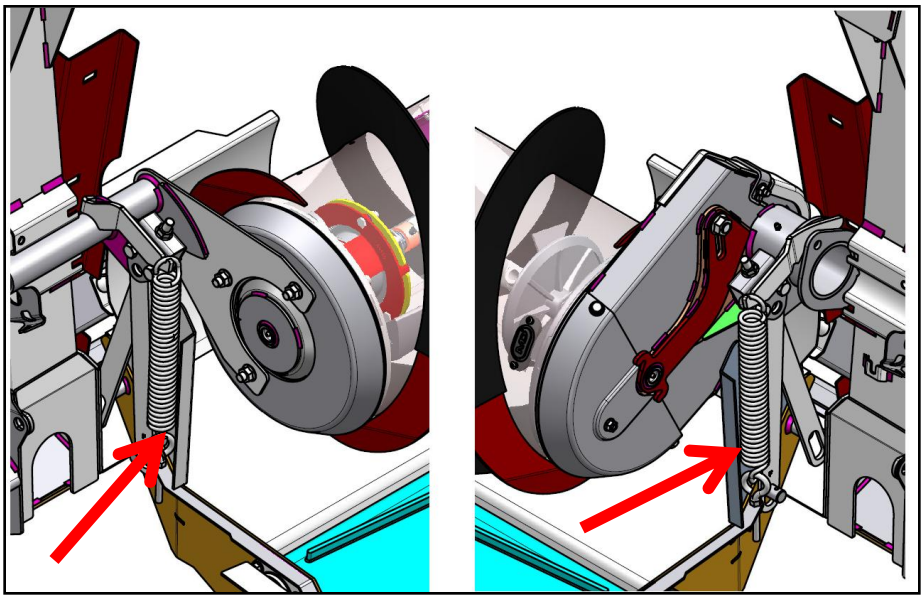
A parts kit will be available for 2009 and older drapers to relocate the hitch, this is applicable on 30’ and larger size headers.



ALL 2142/2152 Draper Headers will be shipped 2 per truck in North America. These heads will be on a shipping stand in the upright position. Once unloaded, these headers will require some additional setup (2 ½ - 3 ½ hrs).

2162 FLEXDRAPER will continue to be shipped One unit per truck for North America. This is due to the overall total package dimensions of the flex draper header and adapter.

Feed Auger Springs



The feed auger used in the 2162 Flex Draper now includes auger springs for added crop control as standard equipment. The left and right springs apply roughly 200 lbs (90 KG) of tension to the feed auger.

The auger will apply more uniform and consistent compression of crop material, which will enhance overall feeding. The feed auger will still float, providing protection to it and added durability .

Top Link Kit – 88 Series Non-Rock Trap Combines





A kit has been released that can be added to 88 Series non-rock trap feeders. A shorter (mechanical or hydraulic) center links with a revised center anchor must be ordered for any 50/60/7088 machines equipped with a non-rock trap feeder.

The kits eliminates potential interference between the draper header adapter and the cab shroud/glass.

The following kit numbers will be available.

Center Link for Non-Rock Trap Equipment 5088, 6088 and 7088

415237006 Mechanical center link (Required for non-rock trap 5088, 6088 and 7088 Combines), (provides new mounting brackets and shorter mechanical adjustable link)

415238006 Hydraulic center link required for non-rock trap 5088, 6088 and 7088 Combines (provides new mounting brackets and shorter hydraulic cylinder top link)



For 2010 the Serial Number plate has been relocated, it is now on the LH Inner End Sheet.

This makes it easier to access the PIN plate when header is in transport, in upright shipping position, or in a shipping configuration.

Summary

Case IH continues each and every year to strive to bring new levels of overall ease, increased productivity and overall profitability to each and every Case IH customer. This solid foundation of product improvements will allow your customers to meet and exceed their expectations in those areas of performance and productivity for unmatched harvest performance.

Take this opportunity to review these changes and sell the Axial-Flow Advantage.

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CASE IH AGRICULTURE

PRODUCT INFORMATION

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GRAIN HARVESTING

Axial-Flow® 8120 and 9120 Track Ordering Guide and Assembly Planning



- ***Increased Productivity***
- ***Reduced Soil Compaction***
- ***Increased Traction***
- ***21mph Transport Speed***

Book 1:	Grain Harvesting
Section:	Combines
Form No:	GH-2069-09
Replaces:	None
Date:	February 2009

CASE IH AGRICULTURE

INTRODUCTION

The performance and reliability that Case IH customers have come to expect from the QUADTRAC® tractor is now available on combines. The rubber track design provides optimal flotation and traction in the toughest harvest conditions. The tracks also minimize compaction in soft soil to provide increased yield and a better no-till seed bed. The tracks are perfect for the customer who is looking for increased productivity in tough ground conditions or wants reduced compaction.

The tracks can be ordered from the factory on 8120 and 9120 combines or can be added to 8010, 8120 and 9120 combines as a dealer attachment. The tracks are driven by not only friction between the drive wheel and track, but a series of positive drive lugs on the track, which intersect with a series of lugs on the drive wheel as well. The design ensures that slippage cannot occur between the drive wheel and track. The rubber track assembly features a center pivot design that gives equal pressure to the ground front to rear.

A more comfortable ride is achieved by having a low pivot point to oscillate over uneven ground such as terraces and levees. Each track is able to oscillate independently 10° up and 10° down for a smoother ride. The power guide axle and track system is matched to provide peak performance. With other aftermarket tracks, in tough conditions, the rear tires may drag due to insufficient oil flow. The tracks are automatically hydraulically tensioned to provide increased track life and lower maintenance. The track life is expected to be about the same or better than tires. If a track would have to be changed it can be accomplished in about ¾ hour. All these features are available while still maintaining the 21mph transport speed.



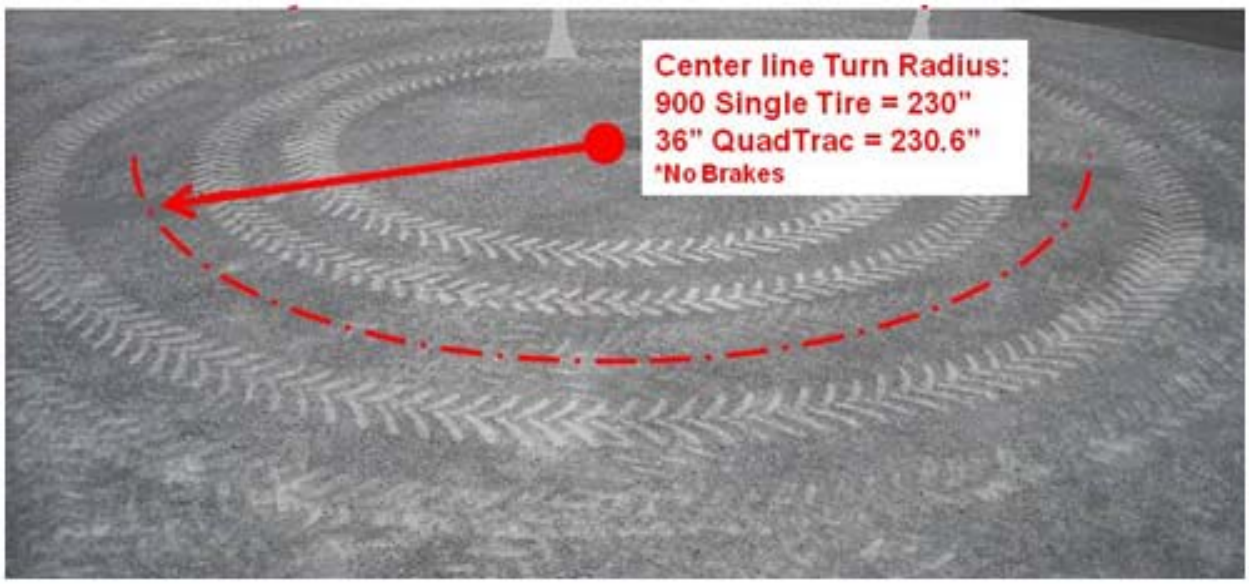






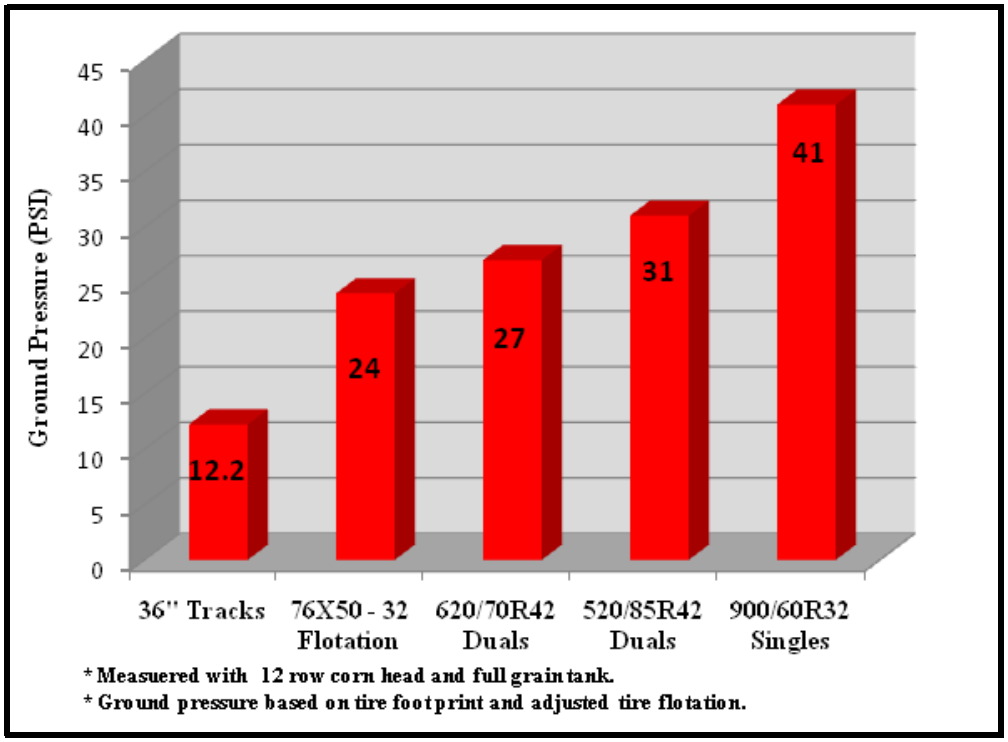
UNPARALLELED TURNING RADIUS

The turning radius of a track machine is comparable to a single tire machine. The track combine's turning radius is 230.6" or 19.2 ft. which is more than adequate to turn with Case IH headers.



LESS COMPACTION, GREATER FLOTATION, GREATER TRACTION

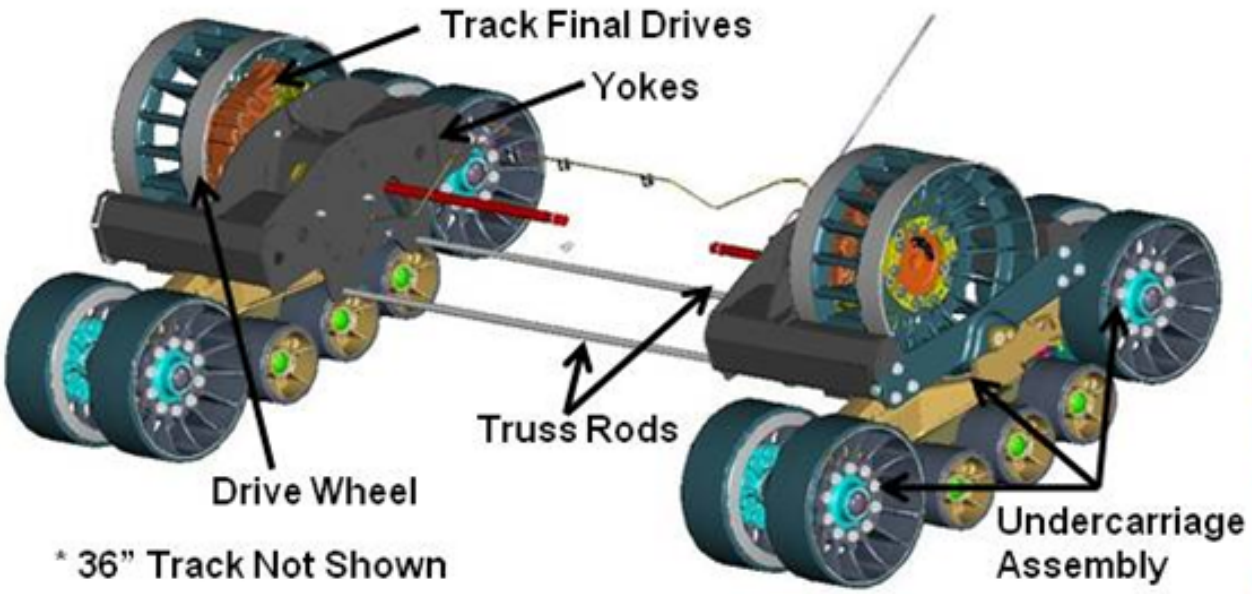
The ground pressure of the 36" track is 12.2 psi which is about 50% less than an equally equipped combine on flotation tires. The graph below shows the ground pressure comparison between the different tire options.



WHOLEGOODS ORDERING

The following order codes need to be ordered to have a combine built track ready from the factory.

Track Order Guide			
Model	**Section**	**Code**	**Description**
8120 & 9120	5	EW	No Drive Tires
	7	JE	30" Platform Extension
	9	KF or KG	2-Speed Powered Rear Axle
	10	TR	Track Propulsion System (Track Final Drives, 2 Truss rods, plumbing for hydraulic track tensioning)
	11	AA	No Extensions
	Factory Supplied Accessories	415219006	36" Rubber Track Assembly (Armorlug Tracks, Undercarriage, 2 truss rods, track drive shafts, yokes, hardware)



DELIVERY OF COMBINE FROM FACTORY

When the combine comes from the factory the tracks will not be installed or be shipped with the combine. The combine will have the track final drives installed on the unit, so a set of tires will be required to unload the machine.



The track final drives are an integral part of the design so the track assembly will not come pre-assembled. Due to the speed on the track final drives, the transmission will be locked in first gear. Do not operate the machine in any other gear until the tracks are installed. The track components will be targeted to arrive in the same month of combine delivery. The components could arrive before or after delivery, depending on when the combine was shipped. Since the combine contains the track final drives the tracks will not be assembled. The track components will come on multiple crates/pallets:









The track assembly time will vary depending on dealer's familiarity with tracks but a good estimate would be two technicians 1.5 days. If a copy of the instructions is required ahead of time, a full set of assembly instructions are available in ASIST, 87755888 for 8120 and 9120; 8010 uses 84129460 and 87755888. The fully assembled tracks weigh about 6,200 lbs per side, so keep in mind the type of equipment required. When a combine equipped with tracks is fully assembled, it will weigh approximately 48,500 lbs depending on fuel and machine specifications.

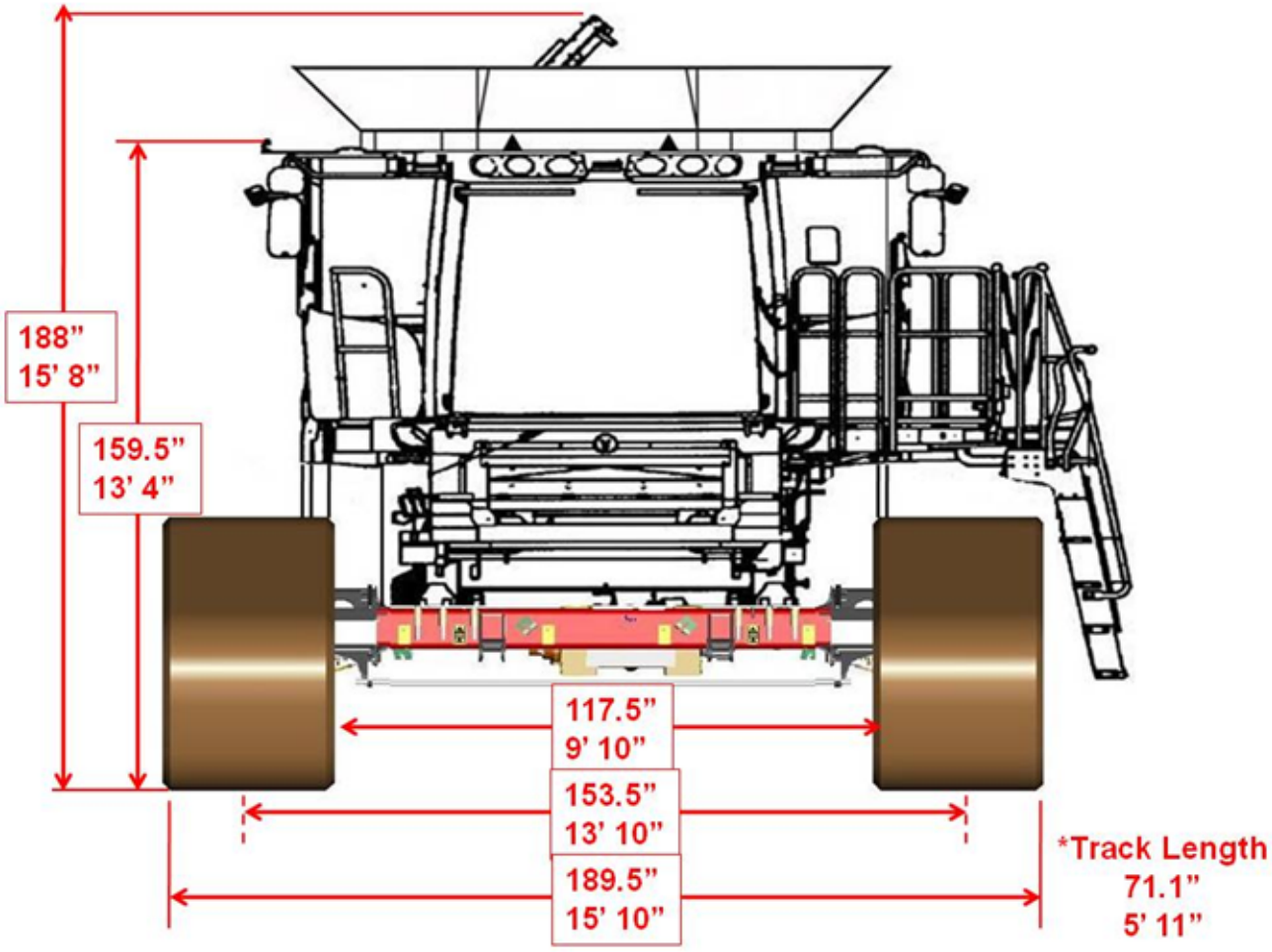
The fully assembled tracks can be removed easily for shipping or if wheels need to be installed. There are 2 tapered guide pins/dowels (see next picture) per side to make installation/removal of the track assemblies easier. The yoke/track assembly bolts to the same front axle used for wheeled machines and bolts the same way as the axle extension for duals. If tires are going to be installed, planetary final drives need to be used with the appropriate drive shafts, axle extensions and hardware. The planetary final drives from a wheeled machine ***will not*** fit into the track assembly as the mounting is different and the track will not align with the undercarriage. The track final drives ***cannot*** be used with wheels because the drive ratio is too high and the machine will not be able to propel itself through the field.



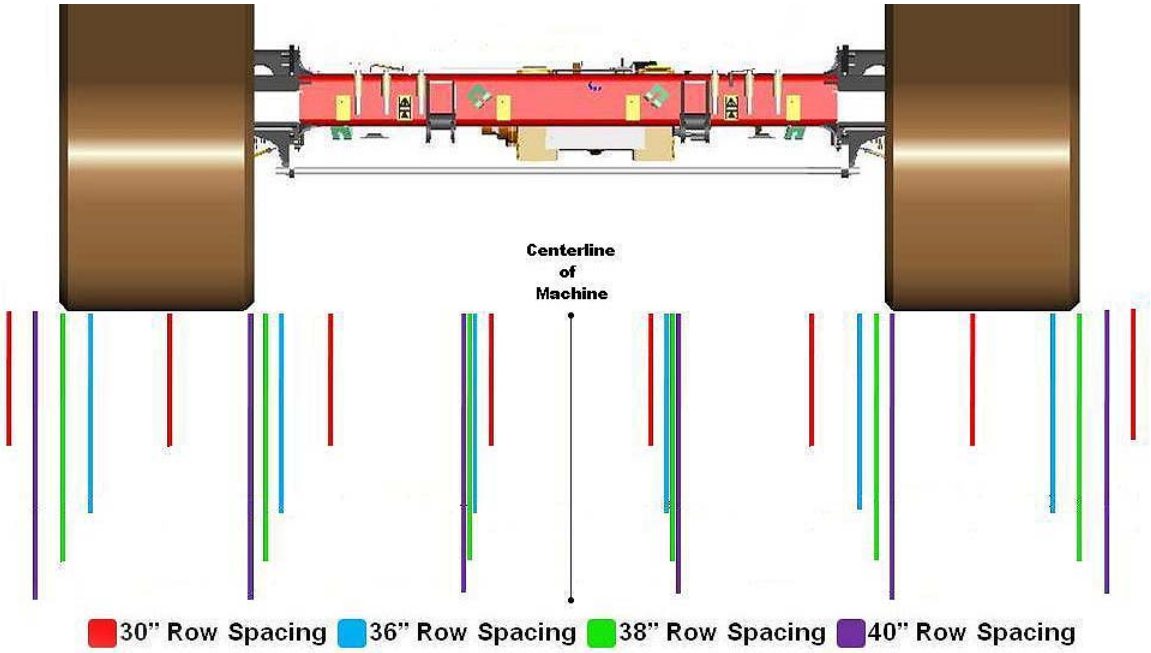


DIMENSIONS/ROW SPACING

The overall machine dimensions are comparable to a dualed machine.



The tracks are available in one spacing only and the row spacing is as follows:



AFTER SALES TRACK OFFERING

The tracks can be added to an existing 8010, 8120 or 9120 combine that were ordered as wheeled versions. The kits are ordered through parts and a special order writing has been setup. The combine is highly recommended to be equipped with a 2-speed powered rear axle and will require 30" operator deck extensions. The power guide axle can be added by ordering kits 87744740 for a 8120 or 9120 and 84083478 for a 8010. The 2-speed can be added with kit number 84110799. The following kits need to be ordered when fitting tracks to an existing wheeled combine. New platforms and fan shields are required if tracks are being installed on a 8010 combine.

Dealer Installed Track Attachment		
Model	**Part Number**	**Description**
8010, 8120 & 9120	87477345	Track Kit (Mounting Hardware, Track Final Drives, Hydraulic Lines/Hoses)
8010, 8120 & 9120	84130512	Rubber Tracks, Yokes & Undercarriage
8010	84129453	Fan Shield and Platform Track Kit
Note: Machine will need 30" platform extension if not ordered with machine		

ADDITIONAL INFORMATION

Although the track design for the combine is based off the proven QUADTRAC for a tractor, the 2 assemblies are not interchangeable. The 36" rubber track, drive wheel, idlers and boogies are identical but the actual undercarriage weldment and yoke are different. The combine requires a bull gear final drive to drive the wheel and is geared specifically for the combine application.

SUMMARY

Case IH continues to strive to meet Axial-Flow combine customers' needs for increased productivity. The track offering provides increased traction, flotation and reduced compaction while maintaining 21 mph transport speed to keep transport time to a minimum. Case IH also realizes the ever changing customer needs by building in the flexibility to either add or remove tracks no matter how the combine was equipped from the factory.

The information presented herein is intended for sales education purposes and is intended for the use of CNH America LLC, its affiliates, and its independent dealers only. This information is to be treated as CONFIDENTIAL and is not to be used for advertising purposes. Competitive comparisons are based on competitive information known at time of printing. Sources of information include published industry specifications and data. General statements made herein are the opinions of the authors concluded from supporting data.

Note: Specifications are stated in accordance with industry standards or recommended practices, where applicable.

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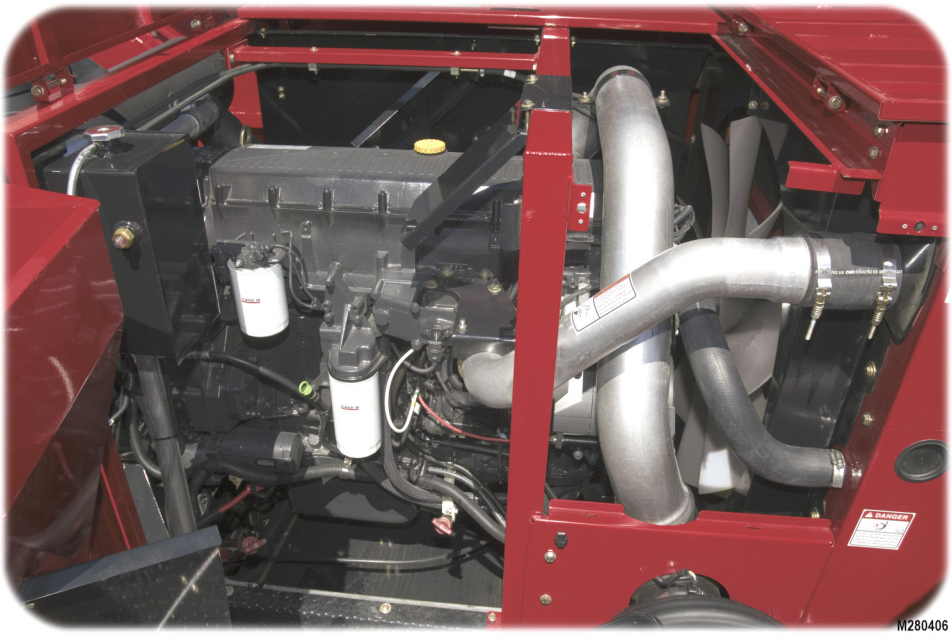
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CASE IH AGRICULTURE

CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 SERIES AXIAL-FLOW COMBINE



SECTION 11 CNH (IVECO) 9L ENGINE

Form 5175 Rev. 01/2010

CNH America LLC
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RACINE, WI 53404 U.S.A.

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INTRODUCTION

PURPOSE OF THE TRAINING MANUAL

This manual is your guide to the Engine Familiarization Training Program.

You will also be able to use it when you are working on these combines in the workshop or in the field.

In writing this manual, we have assumed that you are familiar with the normal methods of servicing agricultural equipment and that detailed explanations in the use of tools and test equipment are not necessary. In the event of any difficulties, you should refer to the Service Manual and to your Service Manager.

Use Of This Manual

The information contained in this manual is supplementary to material to be found in other sources, it is not a replacement for them. You should always consult Service Manuals, Service Bulletins, Operator's Manuals and Parts Books when necessary.

This manual and training program has been designed to help you make required repairs. It will also draw your attention to particular problems that you might encounter and the any special procedures that you must follow.

There is plenty of space in this manual for you to add your own notes and observations.

Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember.



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

MAJOR CHANGES

2009

- Due to using a waste gate turbo, a spark arrester muffler is available and may be required due to regulation.

2008

- New engine data sets for revised performance
- Electronic Grid heater activation indicator and alarm added
- Coolant level sensor removed (running change)

2007

First year for the 9L engine

SPECIFICATION

COMPONENT	SUPPLY VOLTAGE	WORKING RANGE	RESISTANCE: OHMS AT 70°F (21°C)
Fuel Temp. Sensor	5V	3.4V-75°F	2.2K-70°F
Fly Wheel RPM Sensor			880-920
Cam Position Sensor			880-920
Coolant Temp. Sensor	5V	0.6-2.4V	2.5K-70°F
Boost Air Temp. Sensor Boost Pressure Sensor	5V	2.8-4.2V	2.5K-70°F
Oil Temp. Sensor Oil Pressure Sensor	5V	2.8-4.2V	2.5K-70°F
Fuel Level Sensor	5V		Empty: 315-345 Full: 5-10
Throttle Control	5V	Low Idle: <0.72V High Idle: > 2.27V	4K+-20%
Terminators			120 Ohms
Engine Weight			Approx. 2400 Lb.
Fuel Pressure Regulator Solenoid	PWM	N.O. Valve	3.2 Ohms
Fuel Pressure Sensor	5V		
Injector Solenoid		12-15 amps	0.5-0.6 Ohms (engineering sees injectors with 0.3-0.8 as being good)

Grid Heater Performance	
32°F / 0° C	1.5 seconds
14°F / -10° C	5
5°F / -15° C	10
-4°F / -20° C	15
9°F / -23° C	20

GENERAL INFORMATION

The 7010 Axial-Flow combine utilizes an Case 9L engine built by Iveco to provide the required power, performance, fuel economy, torque rise, and power growth that today's customers demand. The engine is a six cylinder turbo charged and air-to-air after cooled diesel engine.

The engine uses an electronically controlled high pressure common rail fuel system, with a cam shaft controlled EGR operation to meet current emission regulations. A high pressure pump is used to charge and maintain pressure in the common rail, and solenoid operated injections are used to determine timing and fuel metering to the engine. Any CaseIH authorized servicing dealer must service the engine.

MAJOR FEATURES:

- Full-Authority electronic fuel injection engines using a turbo charged air to air charge air cooler to provide the required performance.
- Four valves per cylinder increase the movement of air into the combustion chamber and exiting into the exhaust, resulting in improved performance and efficiency.
- A rated speed and rated power at 2100 RPM improves fuel efficiency, reduces noise and provides for overall reliability and durability of the engine.

GENERAL INFORMATION

CURSOR 9 ENGINE

DESCRIPTION	SPECIFICATIONS		
Engine Model	F2C0684 *B901		
Displacement	8.7 L (530 in^3) (Called “Cursor 9)		
Bore X Stroke	4.6” X 5.3” (117mm X 135mm)		
Firing Order	1-4-2-6-3-5		
Rated Speed	2100 RPM		
Power Rating	2100 RPM	1950 RPM	Unloading 1950 RPM
After PIN HAJ200001			
Power Boost Mode	360 (268 kW)	390 (290 kW)	415 (310 kW)
Power Rise Mode	360 (268 kW)	415 (310 kW)	415 (310 kW)
Oil Pressure	72 PSI (5 bar) High Idle, 35 PSI (2.5 bar) Minimum		
Thermostat	Start to open 176° F (80° C) Full at 203° F (95°C)		
ECU (Bosch)	EDC7 UC31		
Current Software	69010926		
System Type	High Pressure Common Rail (CR)		
Injector Type	CRIN 3		
Fuel Charge Pressure (Elec. Pump)	>7 PSI (>0.5 bar)		
Current ECU Data Set			

GENERAL INFORMATION

Engine Control Unit Module

The engine control unit is mounted on the right hand side of the engine (rear side). It communicates with the rest of the combine's controllers by way of the data bus. The integrated engine control unit monitors engine performance parameters, such as oil pressure, oil, fuel and air temperature, and uses that data to constantly optimize engine performance.

This data is constantly compared to normal parameters and alerts the operator if a problem is detected. These faults are stored in memory and displayed on the display unit. If service is needed, these fault codes guide the service technician through the repair process.

The system uses Bosch CRIN 3 injectors and a Bosch CP3.3 high-pressure fuel pump. The control system provides variable timing, high-pressure fuel control and a constant engine speed feature.

GENERAL INFORMATION

ENGINE PROTECTION SYSTEM

The engine system's electronic control provide for engine protection by reducing the power output and/or shutting down the engine before major damage occurs. Areas that will influence the engine protection system are:

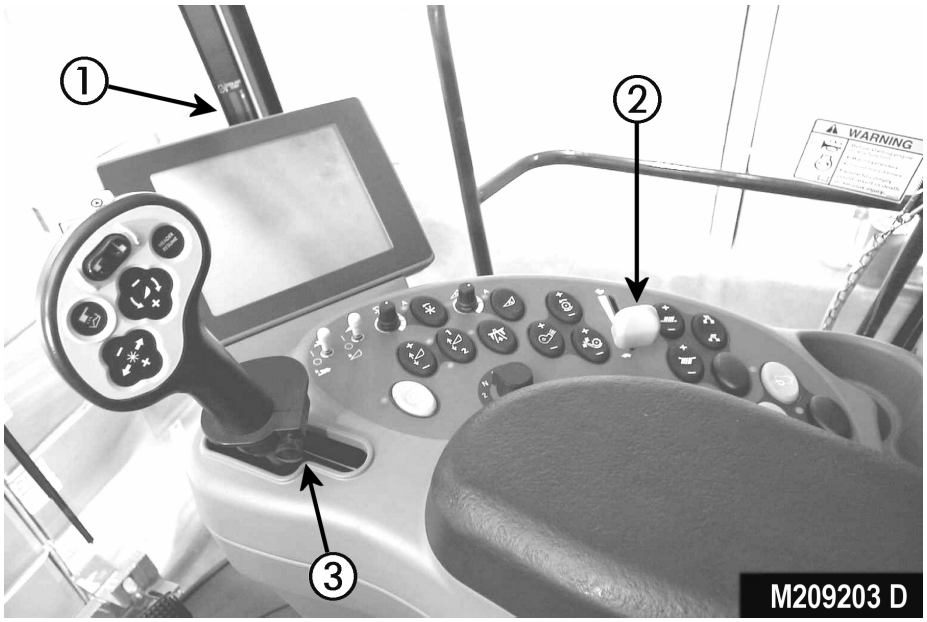
Function	Condition	Action (Torque Reduction)
Coolant Temperature	>222°F / >106°C >232°F / >112°C	0-50% Progressive 50%
Intake Air Temperature	>175°F / >80°C >190°F / >90°C	0-50% Progressive 50%
Engine Oil Temperature	>222°F / >106°C >232°F / >112°C	0-50% Progressive 50%
Fuel Temperature	>256°F / >125°C >266°F / >130°C	0-50% Progressive 50%
Low Temperature at Startup		High Idle reduced
High Altitude	<13 PSI / <0.9 bar	Reduced
Data Bus communication down		25%

THE FOLLOWING SENSOR FAILURES WILL ALSO CAUSE A TORQUE REDUCTION:

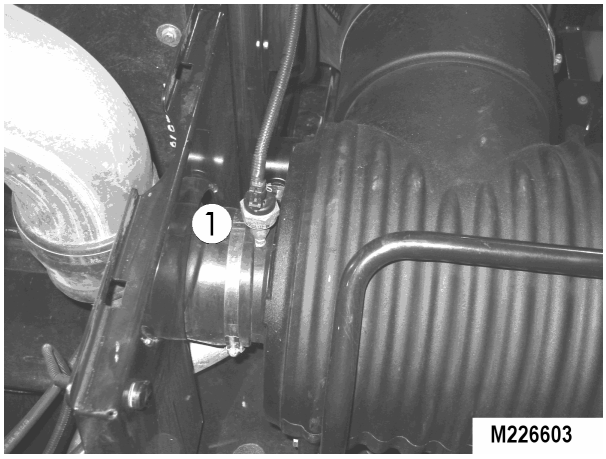
Function	Action
• Ambient pressure sensor • Engine speed sensor • Fuel pressure sensor • Fuel pressure monitoring – First Step • Fuel pressure power stage actuator • Shut off self test failure	~20% Torque Reduction
Power supply for sensors	20-40%
• Fuel pressure monitoring First Step • Fuel pressure power stage actuator • Fuel pressure sensor	High Idle Speed Limited
• Fuel pressure monitoring Second Step • Monitoring of rail pressure relief valve • Internal ECU monitoring defective	Engine Shut-Down

COMPONENTS AND LOCATION

OPERATOR CONTROL CENTER



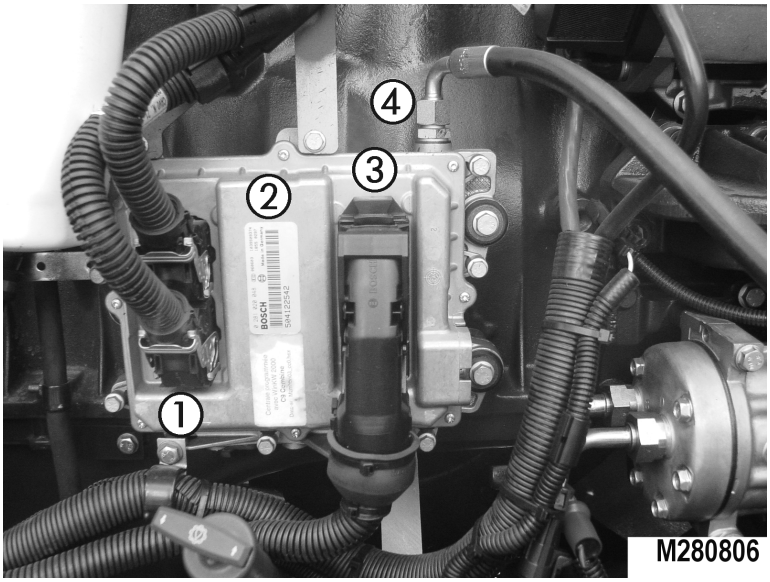
1.	Coolant and Fuel Gauges, in cab display
2.	Throttle Control Potentiometer
3.	Neutral Start Switch



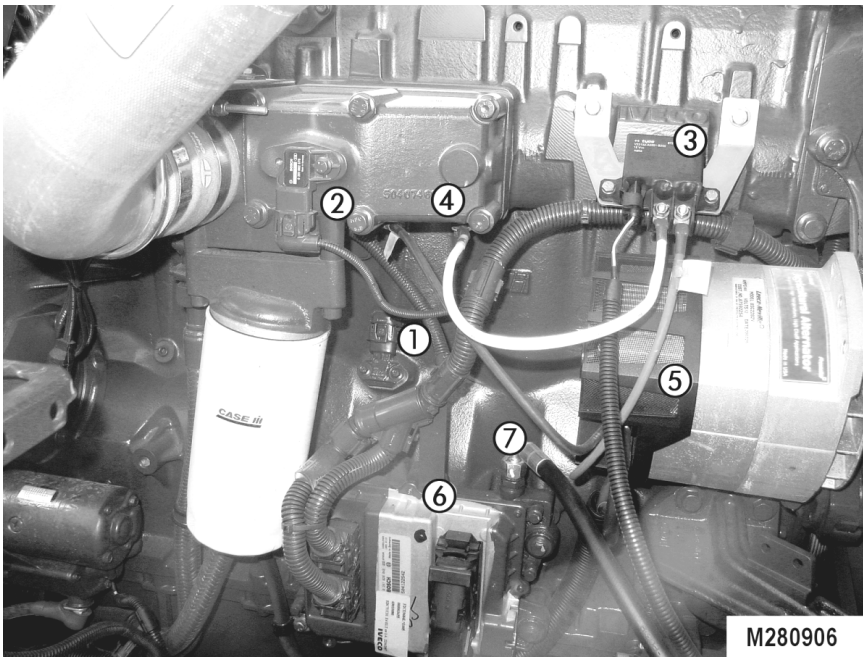
1.	Air Filter Restriction Sensor, S-61

COMPONENTS AND LOCATION

1.	Engine Harness Connection
2.	ECU & Serial Number
3.	Chassis Harness Connection
4.	Fuel Supply to ECU Cooling

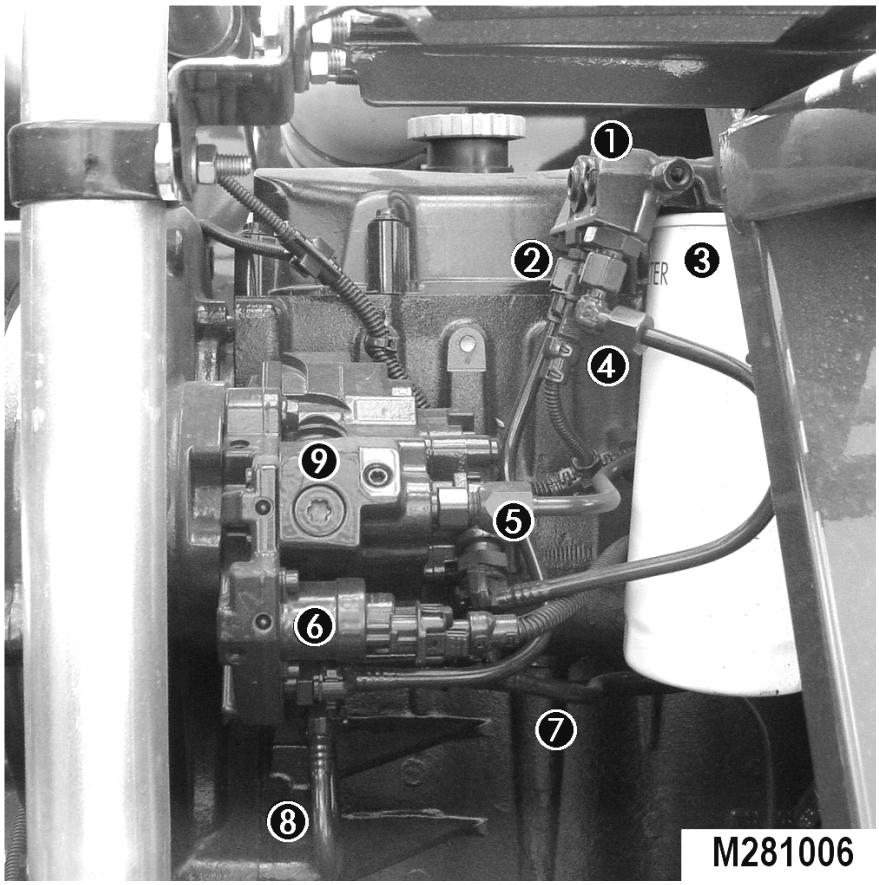


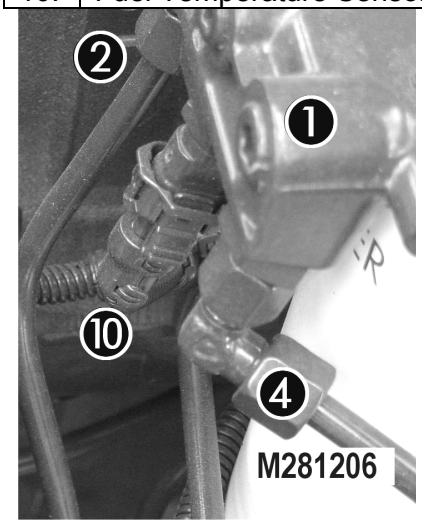
1.	Engine Oil Pressure & Temperature Sensor
2.	Boost Pressure & Intake Temperature
3.	Grid Heater Relay
4.	Power From Heater Relay to Grid Heater
5.	Power To Grid Heater Relay
6.	ECU (Engine Control Unit)
7.	Fuel Supply to ECU Cooling



COMPONENTS AND LOCATION

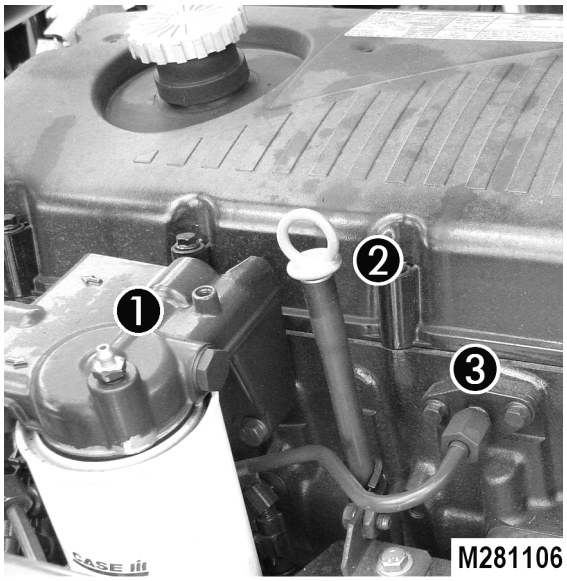
1.	Charge Pressure Test Port
2.	Fuel to Filter
3.	Fuel Filter
4.	Fuel from Filter
5.	High Pressure Outlet
6.	Control Valve
7.	Fuel Supply Line from ECU plate
8.	Fuel Return Line
9.	Charge & High Pressure Pump
10.	Fuel Temperature Sensor





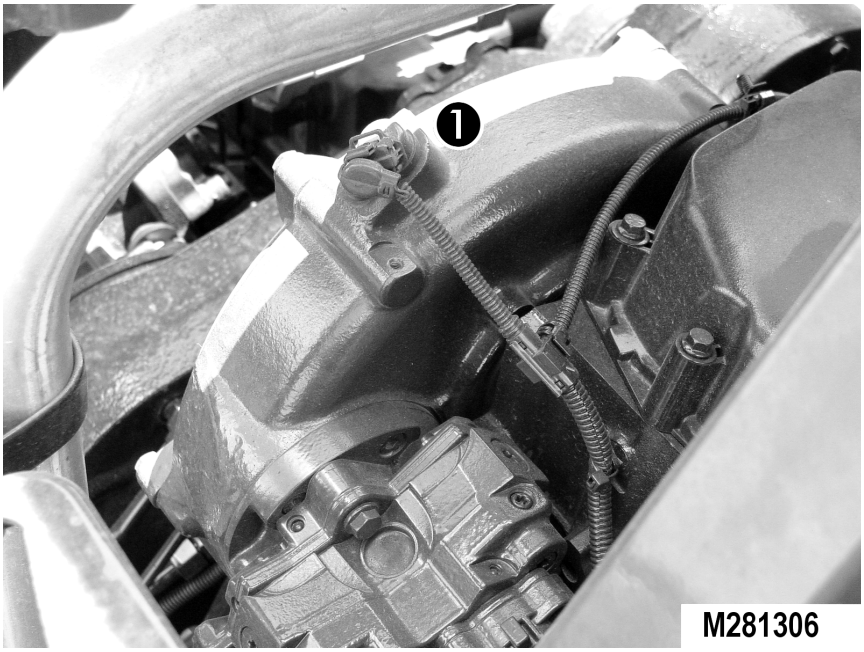
1.	Filter Air Bleed
2.	Engine Oil Dip Stick
3.	High Pressure Line to Common Rail

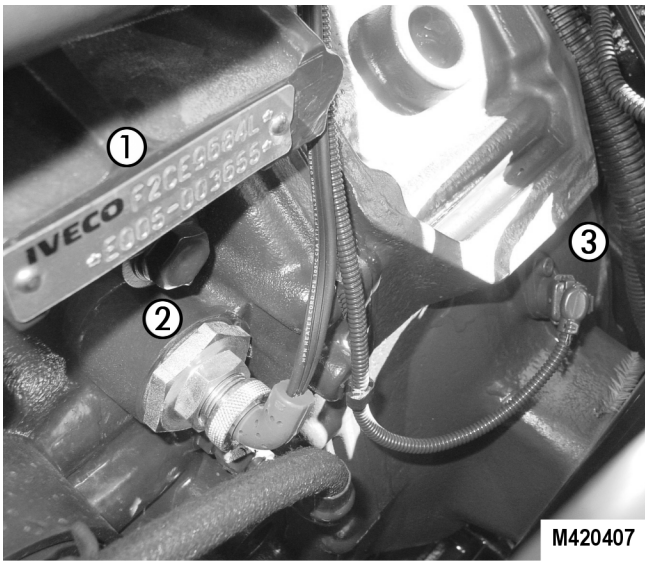
The filter base is also equipped with a filter clog sensor.



COMPONENTS AND LOCATION

1.	Cam Position Sensor

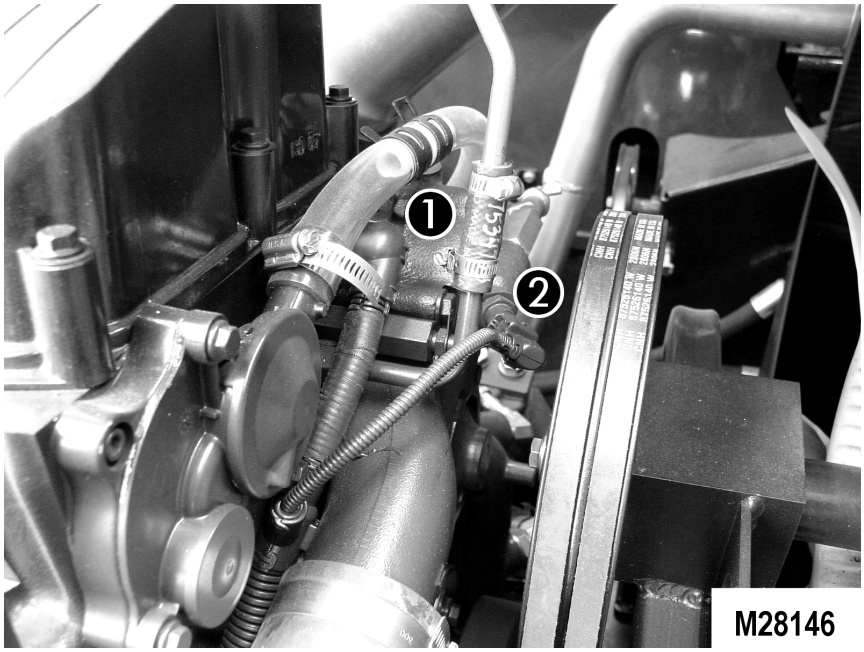




1.	Engine ID Plate
2.	Block Heater
3.	Flywheel Position Sensor

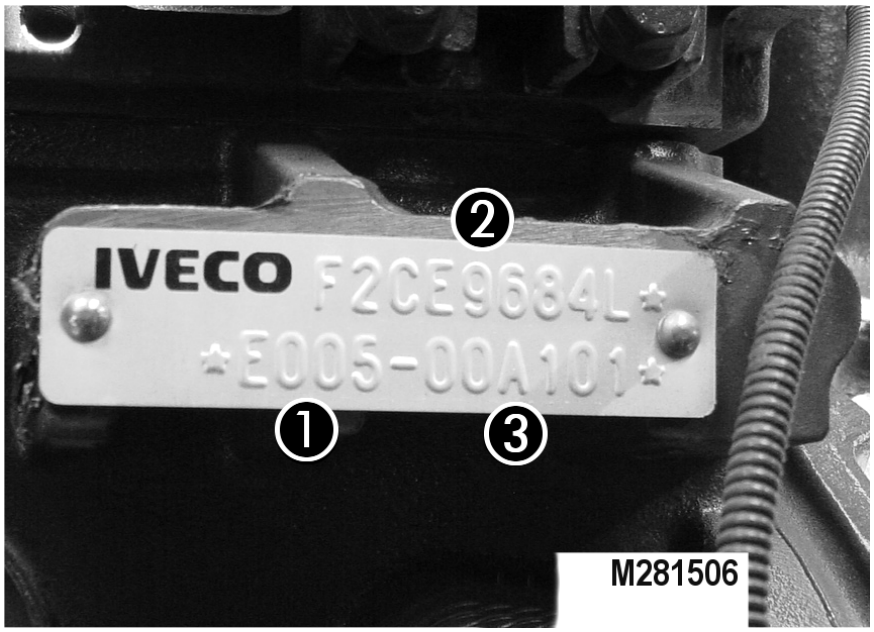
COMPONENTS AND LOCATION

1.	Injector Harness Connector
2.	Coolant Temperature Sensor



Engine Pin Number Plate

1.	
2.	Engine Family Number
3.	Pin Number



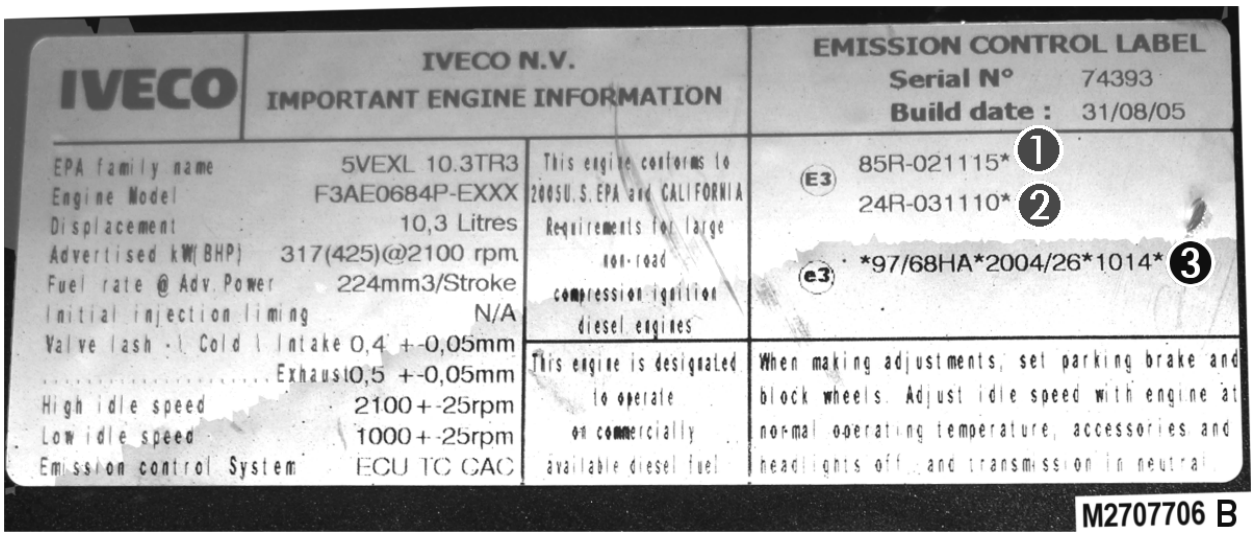
COMPONENTS AND LOCATION

ECU (ENGINE CONTROL UNIT) NAME PLATE



1.	Engine Type	4.	ECU Type and Date Loaded
2.	Engine Pin #	5.	Iveco Part Number
3.	Software Data Set #		

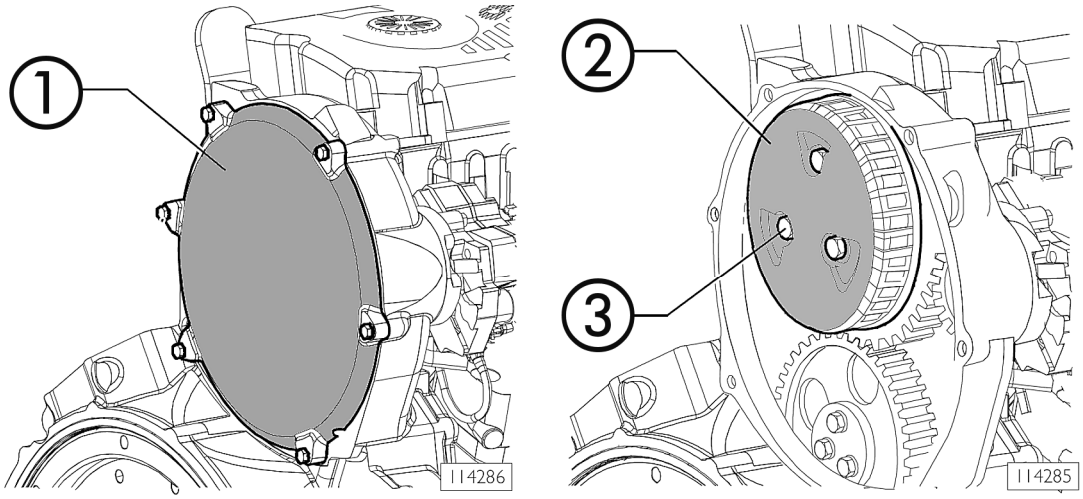
ENGINE PLATE



1 – 3.	Are for the European Emissions Certification

COMPONENTS AND LOCATION

CRANKCASE BREATHER



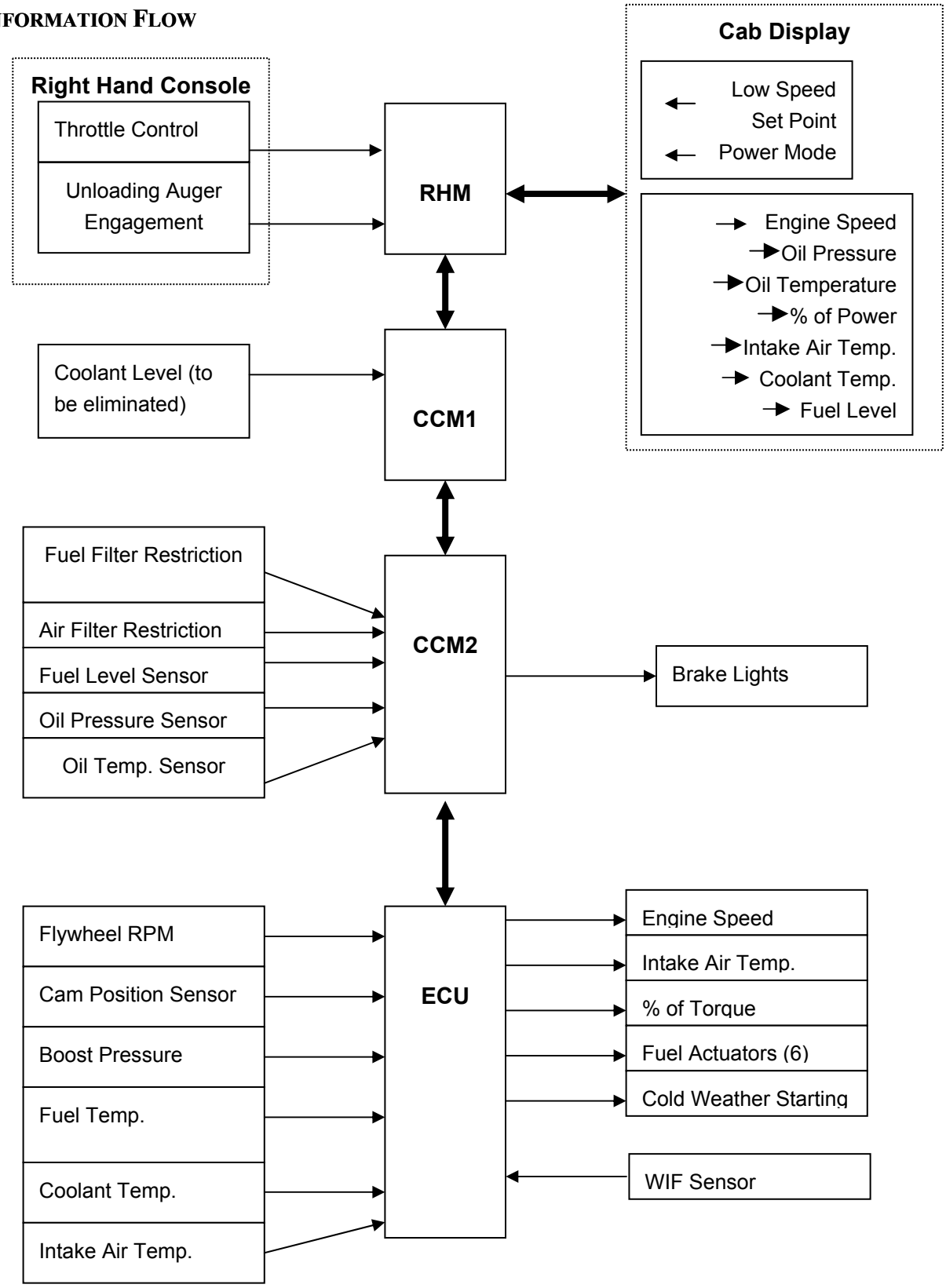
M536209

1.	Rear Cam Gear Cover	3.	Filter Retaining Bolts
2.	Crank Case Breather		

The engine uses a crank case breather attached to the camshaft driven gear. It will filter out the oil from the blow-by gasses; the vapor then flows down through the center of the camshaft to the front of the engine and is expelled. The filter needs to be serviced every 600 hours.

ENGINE COMMUNICATIONS

INFORMATION FLOW



ENGINE COMMUNICATIONS

INFORMATION FLOW

The engine communications, controls and monitoring functions are split between several controllers. The engine control unit is in complete control of the engine performance, but considers inputs from various other controls and sensors.

RIGHT HAND CONSOLE, PROVIDES FOR OPERATOR INPUTS

Throttle Control, R-21

The Throttle Control is used by the operator to request a specific engine speed between 1000 - 2100 RPM.

The sensor is provided a 5V supply at terminal C from the RHM connector X026 terminal 16. The sensor's terminal A is connected back to the RHM connector X027 terminal 6 for a return. The sensor's sensing with terminal B is directed back to the RHM connector X027 terminal 10.

Location: Located in the right hand console

Unloading Auger engagement, S-73

(Used on 7120 Only) Unloading Auger engagement, when the operator engages the unloading auger the engine will use an alternative control chart (provided by the CCM2) to provide for additional power if required. The boost is available as long as the engine coolant and boost air temperatures and the engine speed and load are with in their normal operating range. The power boost on the 7120 is not time limited. This boost can be verified by monitoring the engine power on the DISPLAY, which can go as high as 117% during power boost.

Location: Located in the MFH

AFS200 / AFS PRO 600 DISPLAY

The display provides for two way communication for the operator, input and for displaying messages.

- The operator may adjust the low speed warning for any speed between 1800–2050 RPM. The alarm will come from the factory set at 2000 RPM. When the operator loads the engine down (with the separator running) to the set point a priority 2 alarm will sound. If the set point is at 1800 RPM the alarm will be disabled.
- The AFS200 / AFS Pro 600 may display the current engine speed, intake manifold temperature, oil pressure and % of power being used if selected and placed on one of the RUN screens.
- The AFS200 / AFS Pro 600 provides the operator the ability to operate the engine in one of two different torque curves.

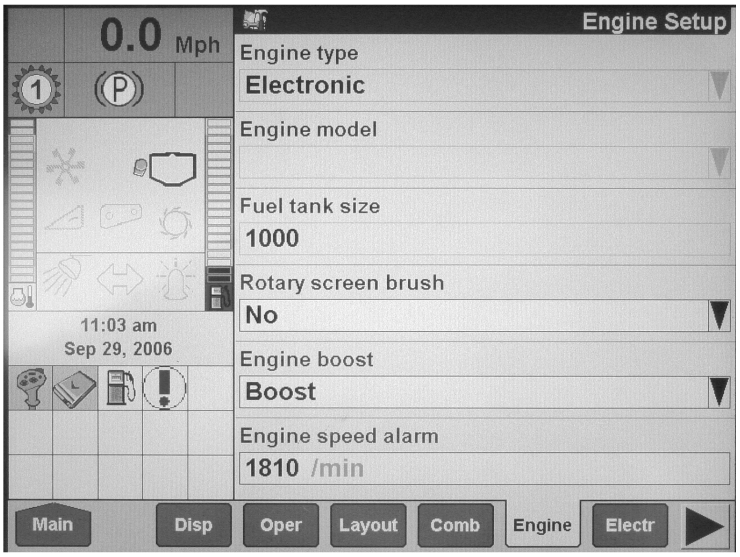
ENGINE COMMUNICATIONS

AFS200 / AFS PRO 600 DISPLAY, (CON'T)

(Used on 7120 Only) Using the BACK>TOOLBOX>ENGINE>ENGINE BOOST menu, the operator may toggle between the Power Rise and Power Boost modes. Refer to the spec page earlier in this section. (AFS 600 example)

Power Rise Mode: Would be recommended for heavy operations where the load in erratic; providing for more recover power for sudden loads.

Power Boost Mode: Would be recommended for steady load, but require frequent unloading on the go operations.



M283006

CCM1

Coolant Level Sensor, S-67

The coolant level sensor will monitor the coolant level in the overflow tank, if the sensor should loose contact with coolant it will close. The switch directs a signal to the CCM1. Low coolant level will signal a priority 2 alarm. For 2007 the switch must be installed with the ARROW pointing DOWN, the switch OPENS with low coolant level.

IMPORTANT: When installing the switch be sure to verify the correct position of the switch for the software installed. Test the operation by connecting the switch to the harness and manually activating the switch while monitoring the display.

The switch is supplied 5 volts from CCM2 connector X016 terminal J2-27 to terminal B of the switch, the switch is supplied a reference ground at terminal A.

Location: Located in the over flow tank

ENGINE COMMUNICATIONS

CCM2

Air Filter Restriction, S-61

The air filter restriction sensor is used to monitor the condition of the air filter. Should the filter become too restrictive approximately 60 mbar (24 inches of water) for efficient engine performance the N/O switch will close, directing a signal to the CCM2.

A 5V supply provided by the CCM2 connector X016 terminal J2-24 is directed to the filter switch S-61 terminal 2, terminal 1 is connected to a reference ground at CCM2 connector X016 terminal J2-14. As long as the filter restriction is low and the switch is closed (N/C) the voltage on the signal wire is directed through the filter switch to the ground provided by the CCM2 connector X016 terminal J2-14. If the switch opens due to high filter restriction, the ground will be lost and the signal wire voltage will increase to the supply voltage.

Location: Located at the outlet of the air filter canister

Water In Fuel B-59

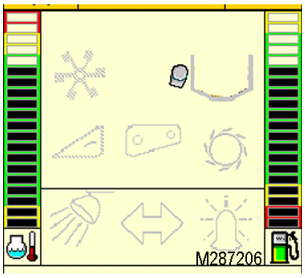
The WIF sensor circuit monitors the level of water that has accumulated in the base of the pre-filter. The sensor is supplied 12V at connector X424 terminal 3 and a chassis ground at connector X424 terminal 1. When the water level in the pre-filter reaches the sensor contacts, the water will provide an electrical connection across the contacts. This will direct the voltage signal that is being directed out of the ECU connector X193 terminal 42 to the sensors terminal 2 to the chassis ground.

Location: Located at the base of the water separator fuel filter

ENGINE COMMUNICATIONS

The Fuel Level circuit is used to monitor the fuel that is left in the fuel tank. The working zones are as listed:

Fuel Level Gauge, (located on the Pro600 display)

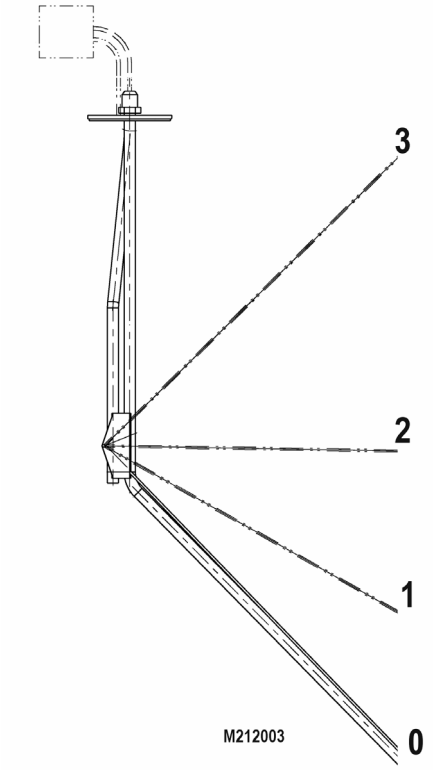


The fuel lever sensor monitors the fuel level and is broken down into three zones.
Green Zone: between 20-100% (approximately >16 gal) of tank capacity
Yellow Zone: between 10-19% (approximately <16 gal > 5 gal) of tank capacity. Priority 1 alarm
Red Zone: first 9-0% (approximately <5 gal) of tank capacity. Priority 2 alarm

Fuel Level Sensor, R-01

The fuel gauge does not provide a linear level display on float position. The circuit provides for three different zones.
Zones:

0: 315-345 Ohms
1: 185-225 Ohms
2: 108-128 Ohms
3. 5-10 Ohms



The resistance will progressively increase/decrease as the float moves from these points.

Terminals
1: Return
2: Signal

Location: Upper right hand side of the fuel tank.

ENGINE COMMUNICATIONS

CCM2, CON'T

Engine Oil Pressure / Temperature, B-75

The Engine oil pressure sensor is used to monitor the engine oil pressure. If the engine oil pressure should drop below 14 PSI (1 bar) for 3 seconds a priority 2 alarm will be activate. If the pressure should remain below this setting for an additional 7 seconds a priority 3 alarm is activated and the engine will shut down. If the engine is restarted and the pressure is still low the engine will shut down in 30 seconds.

The Oil Temperature sensor is used to monitor the engine oil temperature. If the temperature should climb above 258 deg F(126 deg C) for 3 seconds a priority 2 alarm will be activate. When above 266 deg F (130 deg C) a warning message is activated and a priority 3 alarm is activated and the engine will shut down. If the engine is restarted and the temperature is still high the engine will shut down in 30 seconds.

The sensor is supplied 5V from the ECU connector X516 terminal 32 at the senor terminal 3. The sensor is provided a reference ground at terminal 1 from the ECU connector X516 terminal 24.

Pressure

The ECU monitors the variable voltage signal from the sensor at connector X516 terminal 27.

Temperature

The ECU monitors the variable voltage signal from the sensor at connector X516 terminal 28.

Location: Above the engine oil cooler

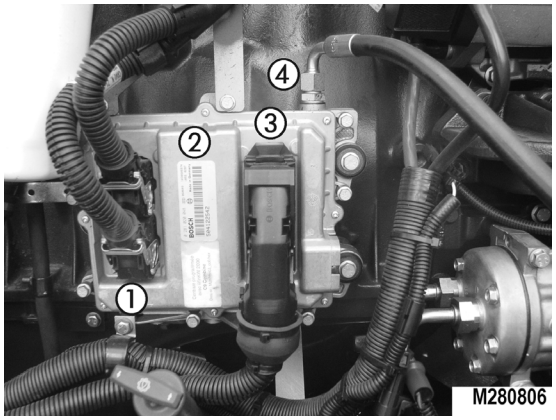
Brake Lights, L-11 and L-12

When a priority 3 alarm is activated the rear brake lights are also activated to provide anyone that may be following the machine that it will be stopping.

Location: Located right and left rear RED lamps

ENGINE COMMUNICATIONS

ENGINE CONTROL UNIT, (ECU) A-01



1.	Engine Harness Connection
2.	ECU & Serial Number
3.	Chassis Harness Connection
4.	Fuel Supply to ECU Cooling

The ECU monitors inputs that other controllers on the data bus, monitors engine operations, place engine information on the data bus and control the engine fuel system.

The engine control unit determines and controls the timing and volume of fuel delivered to the engine. A heat exchanger mounting pad cools the unit. The fuel from the electric transfer pump flows through the heat exchanger, cooling the control unit.

Using the EASY program (in the EST) ECU software may be installed and/or updated; a password may have to be requested using the ASSIST system before the software may be loaded. The software in the control unit is capable of producing full rated horsepower; it is the CCM2's software that commands the ECU to use the standard power curve (Power Rise) or the unloading power curve (Power Boost).

The ECU will provide fault codes that may assist the technicians with troubleshooting.

Fuel Temperature, B-36

The fuel temperature sensor B-36 is used to monitor the fuel temperature and to provide a signal for the cold weather starting grid.

The ECU supplies a 5 volts from connector X516 terminal 35 (which is the signal wire) to the sensor's terminal 2. The sensor's terminal 1 is connected back to a common ground at the ECU terminal 17. As the fuel temperature increases, the resistance of the sensor decreases, causing the supply voltage to decrease.

Location: Refer to previous component listing in this section

ENGINE COMMUNICATIONS

ENGINE CONTROL UNIT, (ECU) A-01

Coolant Temperature, B-44

The Coolant Temperature sensor monitors the engine temperature. If the coolant temperature should climb above 215°F (102°C) for 2 seconds a priority 2 alarm will be activated. If the temperature climbs above 239°F (115°C) for warning message will be activated. If the temperature stays above 239°F (115°C) for 2 seconds a priority 3 alarm will be activated and the engine will shut down. If the engine is restarted and the temperature is still high the engine will shut down in 30 seconds.

When the coolant temperature is above 215°F (102°C) the controller will reduce the fuel flow, reducing the power output.

The ECU connector X516 terminal 15 supplies a 5V power supply to the temperature sensor terminal 1. The sensor's terminal 2 is connected back to the ECU terminal 26. As the temperature of the coolant increases, the sensor's resistance decreases, placing a larger current draw on the supply from the ECU.

Location: See picture on page 11-10

Grid Heater, R-09

The Grid Heater is used to provide for cold weather starting. The grid heater will automatically be activated when the key switch is placed in the RUN position; if a fuel, oil or coolant temperature sensor reads less then 40°F (5°C). An audible alarm is given when the key switch is turn to the **RUN** position and the grid heater is activated, a rapid pulsing audible alarm is given with it is time to crank the engine.

Location: Located in side the intake manifold

Engine RPM, B-05

The engine RPM sensor (crankshaft sensor) is used to assist in determining engine timing and provides an engine speed signal. If the sensor should fail the engine will run using the cam sensor alone, but performance may be reduced.

The ECU connector X516 terminal 19 (which is the signal wire) supplies a 0.25V power supply to the crankshaft sensor terminal 1. The sensor's terminal 2 is provided a return ground to the ECU connector X516 terminal 23. A signal is generated as the gear on the flywheel passes the sensor.

Location: Located on the lower left center of the block (behind oil filter)

ENGINE COMMUNICATIONS

ENGINE CONTROL UNIT, (ECU) A-01, CON'T

Engine Camshaft Position Sensor, B07

The camshaft sensor is used for engine timing and fuel injection. The signal is only picked up after the engine has reached 50 RPM.

The engine cam gear sensor (B-07) is used by the ECU to monitor the engine speed and to provide for cam position to determine fuel timing. Once engine RPM increases above 50 RPM, the ECU will permit the engine to start. If the sensor has failed, the ECU will use the flywheel sensor to determine TDC; at which time a small amount of fuel will be injected into number one cylinder and when it attempts to fire (learning compression stroke) the flywheel sensor will pickup the increased RPM and let the engine start. Power will be reduced.

The ECU connector X516 terminal 9 (which is the signal wire) supplies a 0.25V power supply to the cam sensor terminal 1. The sensor's terminal 2 is provided a return back to the ECU connector X516 terminal 10. As the cam gear passes the sensor, a signal is generated.

Location: Located on the right side of the cam gear housing

Engine Boost Pressure / Intake Temperature, B-41

The **boost** pressure sensor is used by the ECU to determine possible fuel delivery rates. As boost pressure increases so may the fuel delivery rate for additional power. If boost pressure increases above 2750-2950 mbar (40-43 PSI) the controller will reduce the fuel flow, reducing the power output. This is absolute pressure and not PSI, see explanation later in this section.

The **intake** manifold temperature sensor (IMT) is used to monitor the efficiency of the Air-to-Air cooler and to provide a signal for the cold weather starting grid. High air temperature will NOT shut down the feeder drive as it did with the 2388. When the air temperature is above 150°F (65°C) the controller will reduce the fuel flow, reducing the power output.

The sensor is supplied 5V from the ECU connector X516 terminal 33 at the senor terminal 3, the sensor is provided a reference ground at terminal 1 from the ECU connector X516 terminal 25.

Pressure

The ECU monitors the variable voltage signal from the sensor at connector X516 terminal 34.

Temperature

The ECU monitors the variable voltage signal from the sensor at connector X516 terminal 36.

Location: In the intake manifold housing

ENGINE COMMUNICATIONS

Engine Control Unit, (ECU) A-01, con't

Fuel Actuators 1-6, L-33-39, (Injector)

The fuel actuators (injector solenoids) are used to control the amount of fuel that is delivered to the cylinders. The solenoids should be in the range of 0.5-0.6 ohms and may be checked at the cylinder head connection. Engineering has reported that they have see good injectors in the range of 0.3-0.8 ohms. There is one actuator for each cylinder.

Location: Located in under the valve cover on the injector

Electrical Frame: 4

Electrical schematic designates the Actuator by Firing Order rather then by location.

Actuator	Cylinder	ECU Conn. - X515
# 1	#1	4 & 13
#2	#4	3 & 14
#3	#2	6 & 11

Actuator	Cylinder	ECU Conn. - X515
#4	#6	2 & 15
#5	#3	5 & 12
#6	#5	1 & 16

ENGINE COMMUNICATIONS

ENGINE CONTROL UNIT, (ECU) A-01, CON'T

KEY SWITCH CONTROLS

Electrical Fuel Pump, M-23

The fuel pump is used to transport the fuel from the main fuel tank to the engine fuel filter. If the pump should become weak or non-operational it will effect system bleeding and starting performance. The fuel pump will only operate continually until the engine is started; approximately 15 seconds after the engine is running the pump will be stopped.

The fuel pump operation is controlled by the CCM2 and relay K-07. The relay is supplied B+ voltage from fuse F-28 at terminal 3. When the CCM2 is activated, it will direct 12V out connector X015 terminal J1-12, activating the fuel pump relay. The fuel pump relay once activated will direct B+ voltage out terminal 5 to the fuel pump terminal A, the motor is provided a chassis ground at terminal B. Once the CCM2 controller receives an RPM signal, it will disable the fuel pump relay.

Location: Located under the right hand fuel tank

Fuel Filter Clogged Sensor, S-76

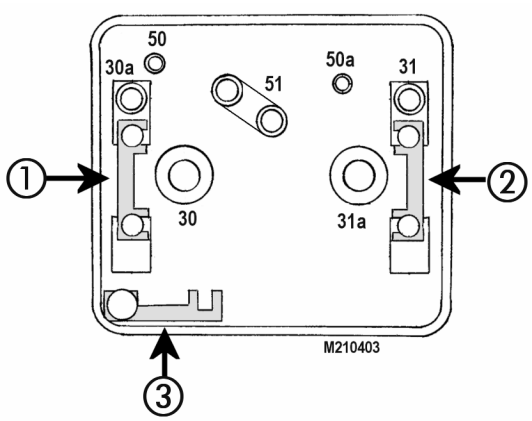
The fuel filter clogged sensor S-76 is used to monitor the condition of the final filter; it will NOT indicated if the water seperator filter is plugged.

The CCM2 supplies 5 volts from connector X016 terminal J2-36 (which is the signal wire) to the sensor's terminal B. The sensor's terminal A is connected back to a common ground at the CCM2 connector CCM2 X016 terminal J2-14. If the switch closes for 5 seconds, an alarm will be activated. The switch is a normally open switch, closing at a 22 psi differential pressures.

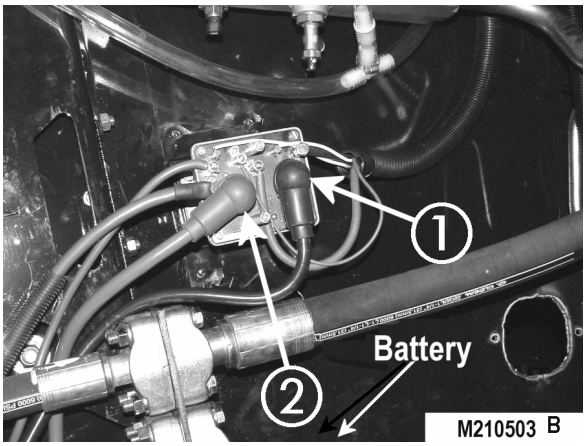
Location: Engine Mounted Fuel Filter base

CRANKING

12/24 VOLT SWAP RELAY

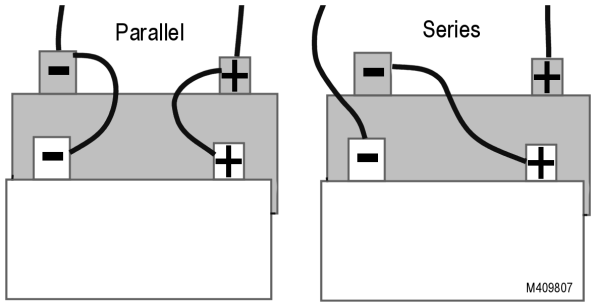


1. Front Battery B+ Charging Fuse
2. Front Battery B- Charging Fuse
3. Spare 80 amp Fuses (2)



1. Negative Cable From Front Battery, 31A
2. Positive Cable From Rear Battery, 30

The 12/24 volt relay is used to change the battery connections from a parallel circuit to a series circuit for starting.



FUSES

The unit incorporates two fuses to protect the system. If the contacts inside the relay fail to activate in the correct sequence either battery could be short-circuited, if this should happen one of the fuses would blow to protect the system.

Fuse 1: Fuse number one protects the B+ side of the circuit. It prevents 24V from entering the main electrical system, directing it to the starter solenoid only.

If it fails the relay will close, BUT 24V will not be directed out terminal 50 to the starter solenoid. The relay will click once.

Fuse 2: Fuse number two protects the B- side of the circuit. It prevents the front battery from a direct short.

If it should fail the 12/24V relay will loose its ground through terminal 31, it will only close momentarily. The relay will chatter.

STARTING: "MODEL YEAR 2007"

REFERENCE SCHEMATIC FRAMES:

Frames: #1, 2, 9,17, 25, 29, 38

KEY COMPONENTS IN CIRCUIT:

Batteries G02 & G03, Key Switch S2, Neutral Switch S-22, Neutral Start Relay K-23, Start Relay K-15, 12/24V Swap Relay K-38, Starter M-29, Engine Control Unit (ECU) A-01, Fuel Pump M-23, Fuel Pump Relay K-07, Fuses F-01, 28, 38, 48

24V STARTING CIRCUIT OPERATION

Key Switch "OFF"

When the Key Switch is in the OFF position B+ power from fuse F-01 is directed to the ECU connector X193 terminals 2,3 8 and 9 anytime the batteries are connected. This power will be used by the ECU for operations and during the last few seconds of shut down to write information from the volatile memory to the non-volatile memory "Keep Alive Memory".

Key Switch "RUN"

REMEMBER The Battery Disconnect Switch (Euro only) must be closed before attempting to start the vehicle.

When the Key Switch is placed in the RUN position (the MFH is in NEUTRAL), power is directed out:

Terminal 4: Not part of the starting operation

Terminal 5: to ECU connector X193 terminal 40 to power up the controller. When the controller receives power at terminal 40 it will perform a self-test and power up the rest of the controller.

Terminal 6: is used to power up the controllers and acc. relays.

REMEMBER The Grid Heating operation is automatically controlled by the ECU, the operator should give the heating process at lest 15 seconds before attempting to crank the engine.

STARTING

Key Switch "RUN", con't

Power is also directed from CCM2 connector X015 terminal J1-12 to the Fuel Pump relay K-07 terminal 1. The relay is also supplied B+ power from fuse F-28 at terminal 3. The relay is provided a chassis ground at ground point #3. When the relay is activated, B+ is directed out terminal 5 to the fuel pump M-23 connector X183 terminal A. The motor is provided a chassis ground at terminal B. The fuel pump will operate until the engine has started; shutting down approx. 15-30 seconds after an engine RPM signal is received.

Key Switch "Start"

Terminal 2 to the Neutral Start Relay K-23 terminal 3 and onto the CCM2 connector X015 terminal J1-21. The Neutral Start relay has NOT been activated yet. The power to the CCM2 provides information that the engine is in the cranking mode; to disregard a voltage drop that may otherwise trigger a controller shut down or fault code.

Fuse #48 directs power to the Neutral Switch terminal 1. As long as the MFH is in the NEUTRAL zone the switch will be closed, the switch is a N/C switch for this circuit. The Neutral Switch directs power out terminal 2 to the Neutral Start Relay K-23 terminal 1, activating the relay. The Neutral Start relay will direct power from terminal 3 out terminal 5 to the Start Relay K-15 terminal 1.

The Start relay K-15 is supplied power from fuse 26 at terminal 3. When the Start relay actives it will direct the power supply at terminal 3 out terminal 5 to the 12/24V Swap Relay K-38 terminal 50A. With the Swap Relay activated, the 12V supply from the Rear battery G-03 **POS** post at terminal 30 is directed out terminal 31A to the NEG post of the Front battery G-02 to create 24V. The POS on the Front battery is connected to the Starter Solenoid B+ post. 24V power is also directed out terminal 50 to the Starter Solenoid terminal S to activate the Solenoid, cranking the engine. The connection between 31A and 31 is also opened.

When power was directed from the key switch to the Neutral Start Relay is was also directed to the CCM2 terminal J1-21, telling the controller to place a message on the data bus that the system was in a cranking mode and to disregard any low voltage readings.



IMPORTANT: What about the Separator and Feeder being engaged during cranking? The software incorporates logic to prevent Separator and Feeder engagement if the control switches are place in the ON position before there is engine RPM registered.

STARTING AIDS

REFERENCE SCHEMATIC FRAMES:

Frames: 01, 02, 29

KEY COMPONENTS IN CIRCUIT:

Batteries (G-03), Fuse 1, ECU, Grid Heater Relay (K-39), Grid Heater (R-09), Key Switch (S-02)

The engine incorporates an automatically activated Cold Weather Starting aid to assist in the starting of the engine when ambient temperature falls below 50 deg F (10 deg. C).



IMPORTANT: Do NOT mix cold weather stating fluid with the Grid Heater, unwarranted sever engine damage may result from it.

OPERATION

When trying to start the engine during cold weather, the cold weather starting aid may automatically be activated. The grid heater timer is preprogrammed into the ECU. When tuning the key switch instruct the operator to stop in the RUN position for 15-30 seconds before attempting to crank the engine. The heater activation indicator is displayed on the cab display unit and will be activated for a duration that is proportional to the temperature. DO NOT attempt to crank the engine while the grid heater is activated.

CIRCUIT

When the key switch S-02 is turned to the **RUN** position 12V will be supplied to the ECU connector X193 terminal 40. The ECU will determine whether the grid heater is required, the ECU will direct voltage out connector X193 terminal 75 to the grid heater relay K-39 terminal 1.

The grid heater relay K-39 terminal B+ is supplied full battery power from the alternator B+ terminal. When the relay is activated the B+ power supply is directed out to the grid heater R-09 terminal 1. The heater terminal 2 is provided a chassis ground at the engine grounding point (5).

STARTING AIDS



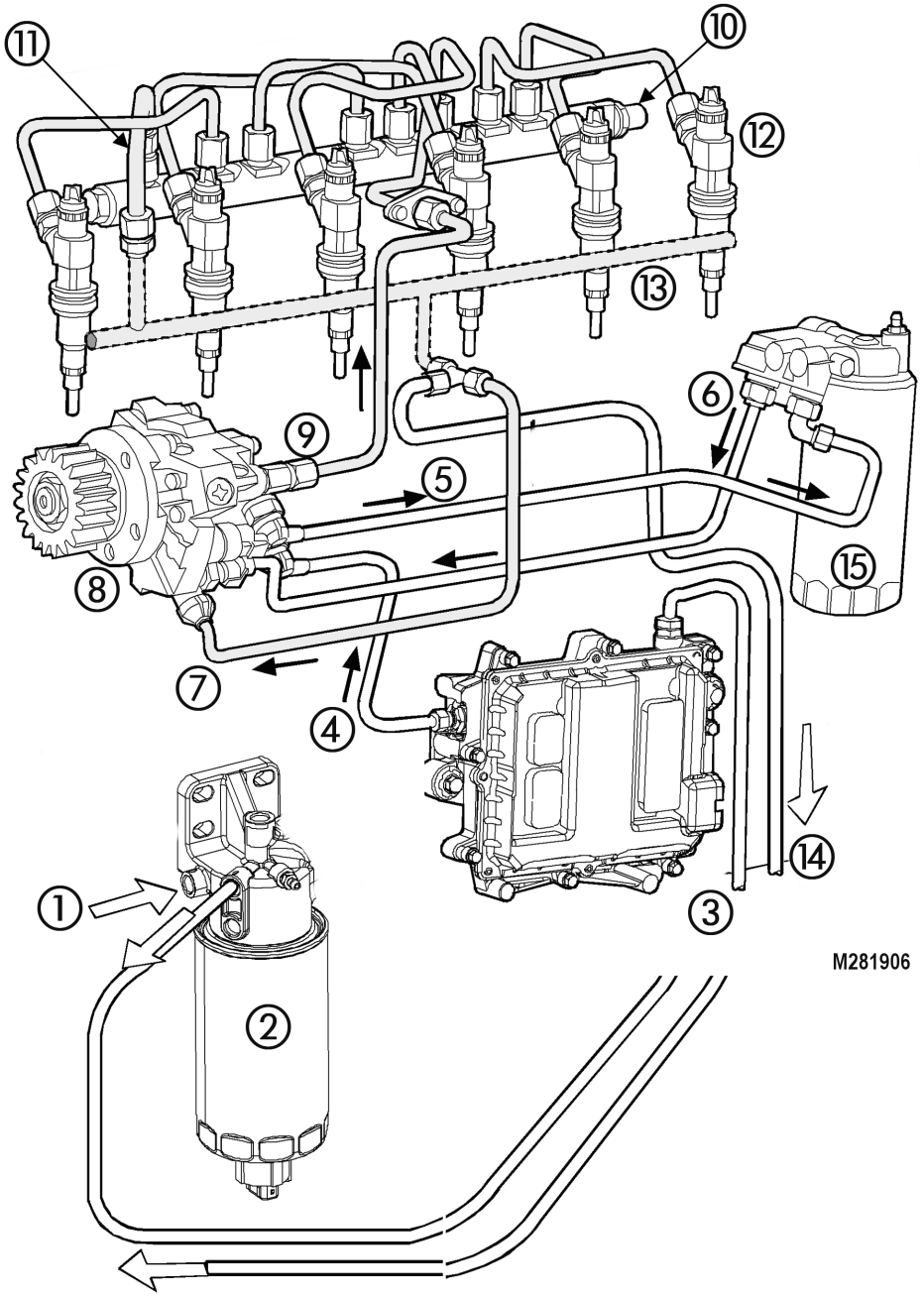
Wait a Minute... Is there a suggested procedure to use in starting the engine during very cold weather? During very cold weather cranking the engine should be performed a little differently. Past experience has been to let the grid heater operate until the Grid Heater indicator tone has changed and only crank the engine for 5-10 seconds to pull the heated air into the engine and recycle the key switch to reactivate the grid heater a second time. Follow this procedure for a total of three grid heating periods before trying to start the engine.

ENGINE CONTROL UNIT (ECU)

ENGINE MONITORING

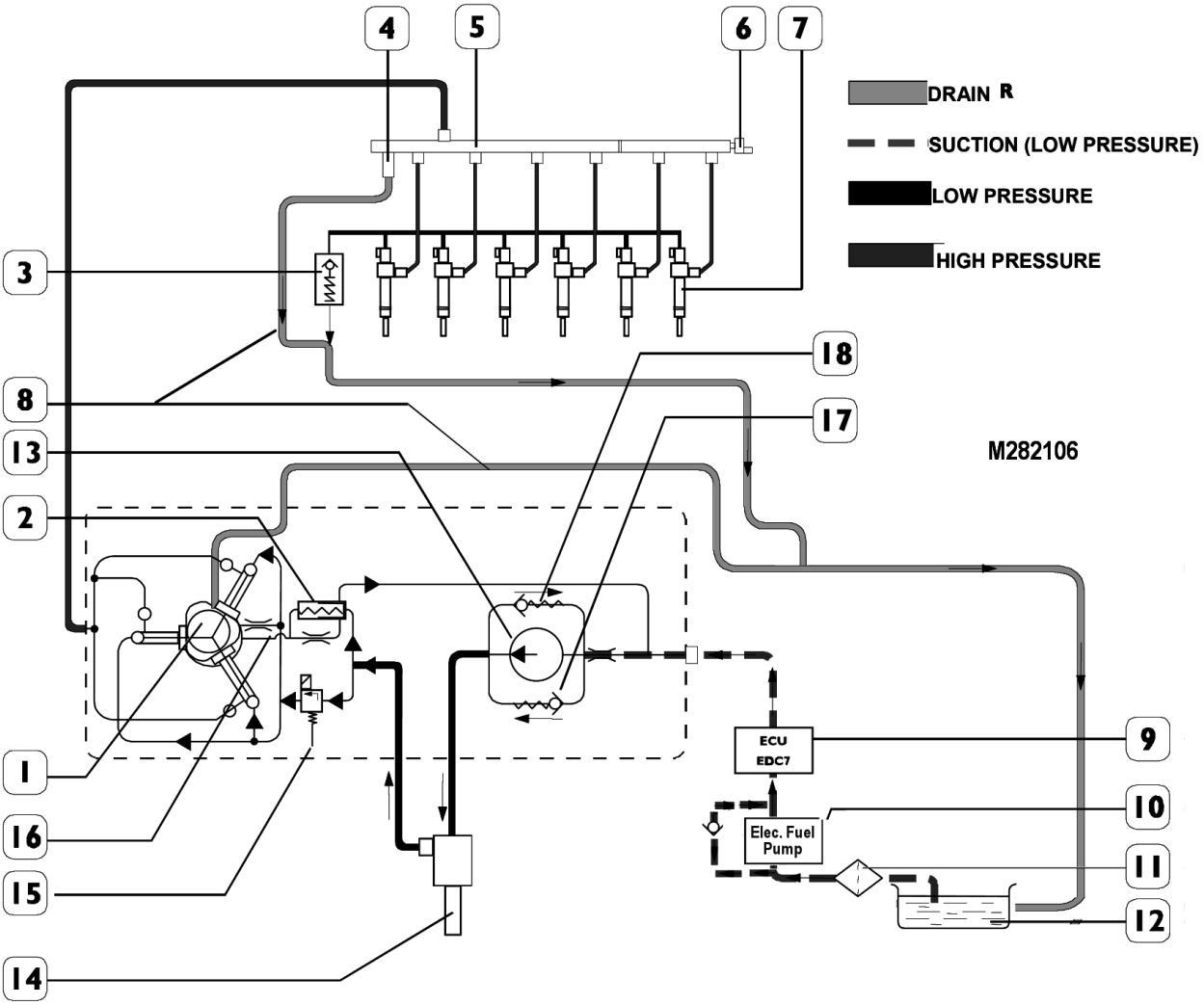
The engine operation is monitored and controlled by the ECU and the CCM2; messages are placed on the data bus for the AFS PRO 600 unit to display.

FUEL SYSTEM



1.	Fuel from Electric Transfer Pump	9.	High Pressure to Common Rail
2.	Water Separator Filter	10.	Common Rail Pressure Sensor
3.	Supply fuel to ECU Cooling Plate	11.	Common Rail Relief
4.	Supply from ECU plate to Charge Pump	12.	Injector
5.	Charge pump to Final Filter	13.	Return Passages
6.	Clean fuel to High Pressure Pump	14.	Return to Tank
7.	Return from Charge Pump	15.	Final Filter
8.	CP 3.3 Fuel Pump		

FUEL SYSTEM



1.	High Pressure Pump	10.	Electric Transfer Pump and By-Pass
2.	Charge Pump Relief 70 PSI (5 bar)	11.	Water Separator Filter
3.	Return Check 28 PSI (2 bar)	12.	Fuel Tank
4.	High Pressure Relief	13.	Charge Pump
5.	Common Rail (under valve cover)	14.	Final Fuel Filter
6.	Rail High Pressure Sensor	15.	Pressure Regulating Solenoid
7.	Injectors	16.	Returns
8.	Return lines	17.	Electric Pump By-Pass Valve for Air Bleeding
9.	ECU Heat Exchanger Plate	18.	Charge Pump Relief (filter by-pass)

This is a generic drawing of the fuel system; the unit may vary slightly from this layout.

FUEL SYSTEM

KEY SWITCH IN THE "ON" POSITION, "ENGINE NOT RUNNING"

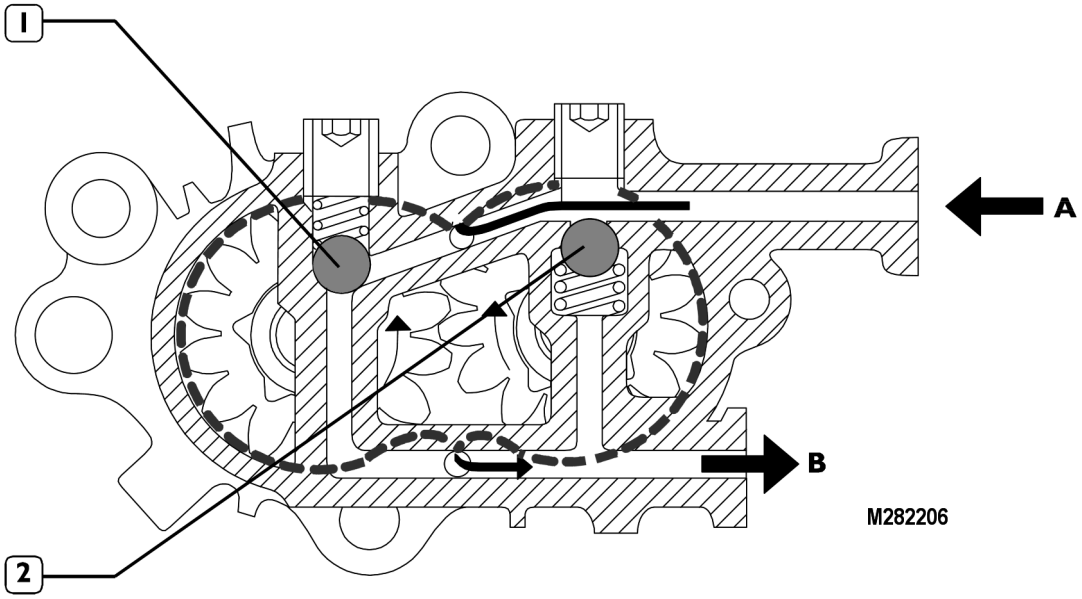
The electrical transfer pump (10) draws fuel from the tank, through the water separator filter (11) and directs it to the ECU heat exchanger base (9). The heat exchanger provides cooling for the ECU. The fuel travels to the fuel charge pump (13) which will open a by-pass valve (17) to permit system bleeding. Fuel flow will continue to the final filter (14) and on to the pressure regulating solenoid (15) and the charge relief (2).

KEY SWITCH IN THE "ON" POSITION, "ENGINE RUNNING"

The fuel pump (13) will direct its flow to the fuel filter (14), back seating the electric transfer pump by-pass valve (17) and through the filter to the pressure regulating solenoid (15). The charge pump should maintain approximately >75 PSI (5 bar) which is set by the charge relief (2). The high pressure pump supply is metered by the pressure regulating solenoid (16) to control the rail pressure. The high pressure pump's outlet supplies the common rail (5) and injectors. The high pressure system is protected by a relief valve (4) in case the pressure regulating solenoid (15) should fail. The high pressure system should maintain a pressure between 250 – 1800 bar. The injector and common rail return (8) is directed back to the fuel cooler and fuel tank.

FUEL SYSTEM

CHARGE PUMP

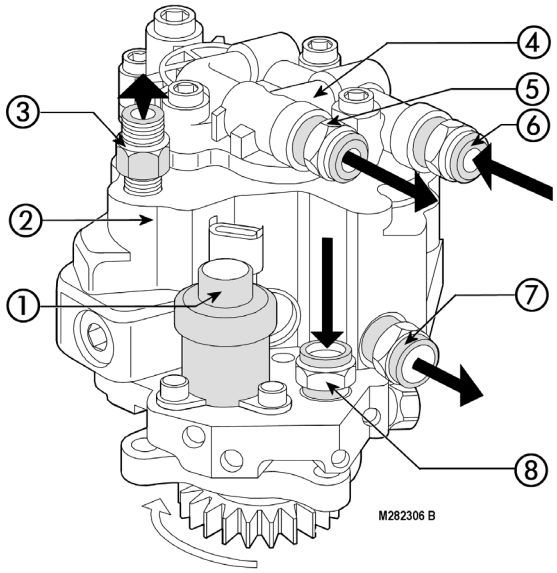


1.	Charge Pump / Filter By-Pass	A	Supply Port
2.	Electric Pump By-Pass	B	Outlet Port

HIGH PRESSURE PUMP

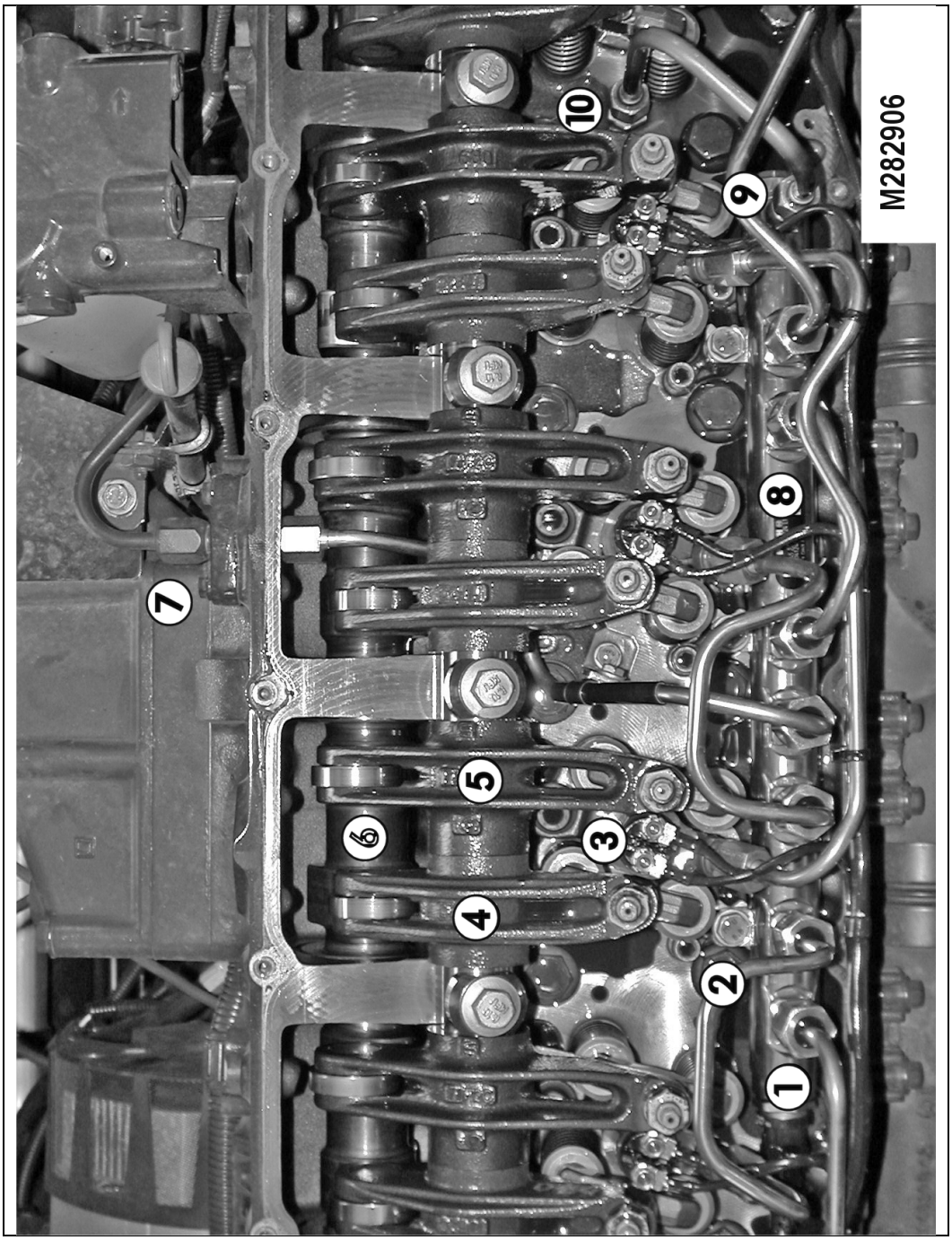
Case / Cooling Fuel Return

1.	Pressure Regulating Solenoid
2.	High Pressure Pump
3.	High Pressure to Common Rail
4.	Charge Pump
5.	Charge Pump Outlet to Filter
6.	Charge Pump Supply (from ECU)
7.	Pump Case/Cooling Return
8.	Charge from Filter



FUEL SYSTEM

HIGH PRESSURE COMPONENTS



1.	Rail Pressure Sensor	6.	Cam Shaft
2.	High Pressure Line to Injector #2	7.	High Pressure Line from Pump
3.	#3 Injector	8.	High Pressure Common Rail
4.	Intake Valve Rocker	9.	Common Rail Relief Valve
5.	Exhaust Valve Rocker	10.	Common Rail Return Line

HOW TO MONITOR FOR POWER

Use the Electronic Service tool (EST) and the Pro 600 display when monitoring the engine performance for a power complaint.

ITEMS TO INVESTIGATE:

1. Is the machine equipped and adjusted properly for the crop being harvested?
2. What are the operating conditions: field, operator, expectations, comparing to?
3. What is the actual fuel consumption rate?
4. Does the exhaust show smoke?

The following items will require monitoring:

STEPS TO FOLLOW

1 Display

Battery Voltage	Air Filter
Engine Load	Engine Speed
Boost Air Temperature	Boost Pressure
Atmospheric Pressure	Fuel Temperature
Fuel Rate	Coolant Temperature
Engine OverHeating	Engine Derate Level
Engine Oil Pressure	Engine Oil Temperature

2 Manual Gauges

Checking Fuel Pressure
Check Actual Boost Pressure

3 EST>EASY Tool

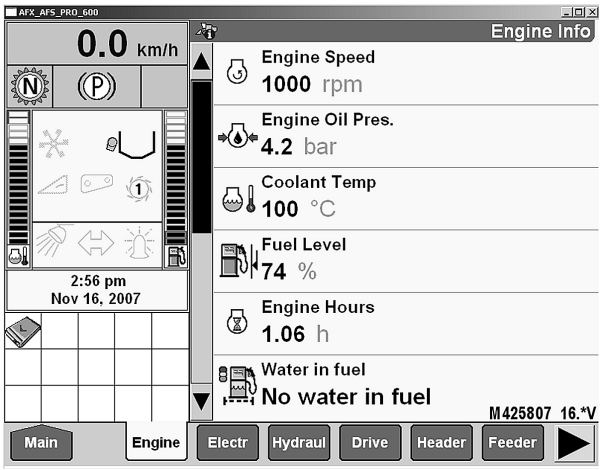
Battery Voltage	Engine Revs
Advance Injection	Ambient Pressure
Boost Air Temperature	Boost Pressure
Coolant Temperature	Fuel Temperature
Injected Fuel Quantity	Engine Oil Temperature
Oil Pressure	Total Engine Torque
Cylinder Air Mass	Rail Pressure
Rail Pressure Set Point	MPROP%

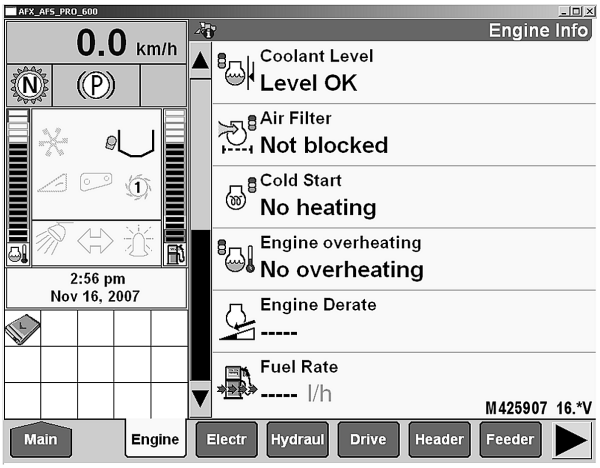
Using the EASY tool log the actual data using the graph option and attach the file to an assist when requesting assistance.

HOW TO MONITOR FOR POWER

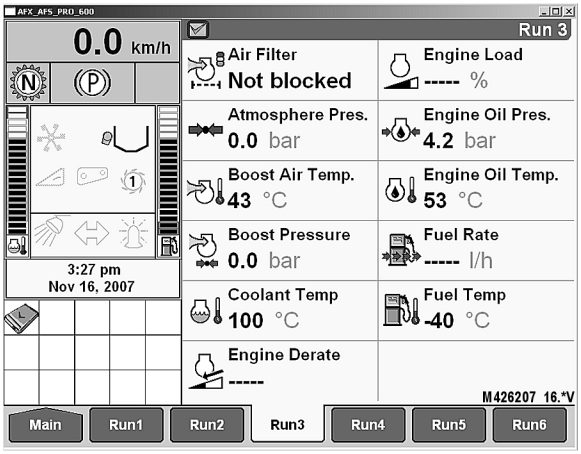
STEP 1: DISPLAY READOUTS

Navigate using MAIN>COMBINE INFO>ENGINE, most of the onboard engine monitoring system can be found here.





Navigate using MAIN>TOOLBOX>LAYOUT: and pick a screen to program the following items on the screen for monitoring.



HOW TO MONITOR FOR POWER

STEP 1: DISPLAY READOUTS

ATMOSPHERIC PRESSURE

Atmospheric pressure is a measurement of the current atmosphere pressure. This will change due to the altitude above sea leave. The ECU uses this information in determining fuel delivery.

BOOST PRESSURE

Boost Pressure is a measurement of the pressure that is being created by the turbo charger. The ECU uses this information in determining fuel delivery. It has been experienced that an injector can prevent the boost pressure from reaching the target pressure.

COOLANT TEMPERATURE

When coolant temperature increases above 102°C / 215°F the engine control unit can reduce the fuel delivery.

HOW TO MONITOR FOR POWER

STEP 1, CON'T

ENGINE OVERHEATING STATE

ENGINE AIR FILTER STATE

ENGINE DEGRADATION LEVEL

This is an indicator if the software has the engine derated for some reason, the reason will not be evident. This will just be a reference number, example 1-4

ENGINE OIL PRESSURE

ENGINE LOAD

Use the display RUN screen to monitor the engine power. This is an indication of the amount of fuel delivered to the engine. A normal reading will be 100% before the engine speed begins to drop below 2100 RPM, and when loaded should climb to approximately 105% when NOT unloading. While unloading on the go the power % may increase to approximately 117% level.

COOLANT TEMPERATURE

AIR INTAKE TEMPERATURE

AIR INTAKE PRESSURE

Intake pressure should increase to 50-52 PSI (3340-3580 mbar) when the engine is under full load.

ENGINE OIL PRESSURE

When engine oil pressure falls below a safe limit, normally around 14 PSI, the engine control unit can reduce the fuel delivery.

HOW TO MONITOR FOR POWER

STEP 1, CON'T

ENGINE OIL TEMPERATURE

FUEL RATE

FUEL TEMPERATURE

INTAKE MANIFOLD TEMPERATURE

When air intake temperature increases above 65°C / 150°F the engine control unit can reduce the fuel delivery. This would be an indication that the coolers require cleaning.

HOW TO MONITOR FOR POWER

STEP 2: FUEL SUPPLY

For the engine to perform properly there must be an adequate supply of clean fuel. When fuel starvation occurs engine horsepower may be reduced, the operator should use the AFS Pro 600 display to monitor the engine power.

- The % Engine Power on the display normally can build to around 107% when normally harvesting, but during starvation will not normally exceed 100-102% accompanied by a significant drop in engine rpm.
- Using the EST (Electronic Service Tool) monitor the Boost Pressure reading. Under full load normal boost pressure will be in the 37-43 PSI (2.5-2.9 bar) range. Low boost may be an indicator of restricted fuel. **Be sure to read how to understand the boost pressure readings later in this section**.



Wait a Minute... What is the Engine Load display telling me? The reading is an indication of the power being consumed compared to the rated power. (The length of time the nozzles are injecting fuel into the cylinder by monitoring the solenoids duty cycle.) This provides an indication of load.



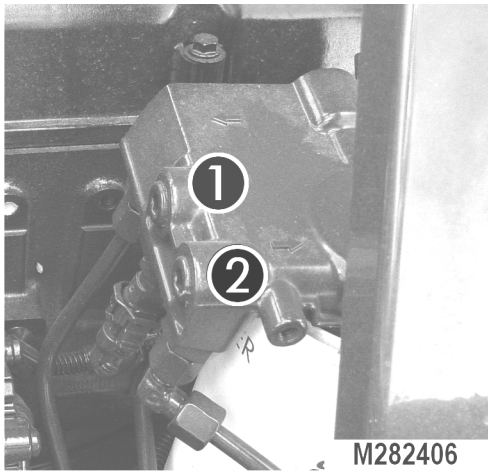
REMEMBER: It is recommended to replace the chassis (water separator) fuel filter after the combine has accumulated 10-15 engine hours of operation.

FUEL SUPPLY

STEP 2: FUEL SUPPLY

FUEL SYSTEM RESTRICTION TEST

System restriction can be determined by the following test procedure. Use the following steps:



1. Relieve the fuel system pressure by loosening the bleed screw.
2. Remove plug, item #1 (this is after the filter), with a 7mm hex wrench and insert a 3/8" X 19 MBSPT (British Standard Pipe Taper) to ¼"X18 FNPT adapter (Parker number 1/4X1/4F3HGS) for the diagnostic coupler. A second gauge could be placed in port #2 (before the filter), to check the condition of the filter. The two gauge readings must be within 20 PSI of each other.
3. Connect a fuel pressure gauge 0-20 bar (0-300 psi) to the diagnostic coupler.
4. Engine OFF, key ON, the electric fuel pump will supply 0.62 bar (9 psi) to the fuel charge pump.
5. Engine running, the charge pump pressure is regulated to approximately 5 bar (72 psi). Verify 5 bar (72psi) is maintained during full load engine operation.

HOW TO MONITOR FOR POWER

STEP 3: ELECTRONIC SERVICE TOOL (EST)

TURBO BOOST PRESSURE

Boost pressure may be monitored one of two different ways, on the EST parameter screen or through the EASY parameter screens.

"EST" SCREEN

Boost Pressure is easiest monitored with the EST using the parameters found under the CCM2. The EST reports the boost pressure in what is call "absolute pressure" it includes the 14.7psi (1bar) of atmospheric pressure. Remember to reduce the reading by 14.7 to get the actual boost increase reading.

"EASY" ENGINE PROGRAM

Boost Pressure may also be monitored using the EASY engine program. When monitoring the boost pressure in the EASY program on the EST. it may be difficult to understand what the displayed reading represents. The EST reports the boost pressure in what is call "absolute pressure" it includes the 14.7psi (1bar) of atmospheric pressure and is displayed in the measurement of **mbar**.



Wait a Minute... So how am I suppose to understand and use this reading for proper diagnostic work?

FIRST THE DISPLAY

The EASY program displays the boost pressure in a measurement of mille-bar (mbar). One mbar represents 0.001bar, so 1000mbar represents 1bar.
Example: A reading of 2675mbar will equal 2.675 bar.

WHAT IS A BAR

A bar is a measurement based off the atmospheric pressure. Atmospheric pressure is normally 14.7 psi, so 1 bar equals 14.7psi.
Example: 2675mbar = 2.675 bar so 2.675 bar X 14.7 psi = 39.3 psi.

HOW TO MONITOR FOR POWER

STEP 3: ELECTRONIC SERVICE TOOL (EST)

TURBO BOOST PRESSURE, CON'T

FINAL READING

The measurement is displayed in ABSOLUTE PRESSURE, which means that it is including the normal atmospheric pressure with the boosted pressure. For this reason, we will have to reduce the displayed reading by one atmospheric pressure.

Example: 2675mbar = 2.675 bar 2.675 X 14.7 = 39.3 psi, (this is absolute pressure) that must be reduced by one bar to get to actual boost pressure
2.675 bar – 1 bar = 1.675 bar actual boost
Actual boost = 1.675 bar X 14.7 psi = 24.6 psi

NORMAL BOOST PRESSURE

Normal ABSOLUTE boost pressure as displayed on the EST parameter list, remember to reduce the reading by 14.7 psi.

Normal	EST Parameter list PSI	EASY mBar
Harvesting **NOT** unloading	39-41	2653-2789
Harvesting **WHILE** unloading	42-43	2857-2925

HOW TO MONITOR FOR POWER

STEP 3: ELECTRONIC SERVICE TOOL (EST), CON'T

FUEL RAIL PRESSURE

One key item to monitor when it comes to engine performance is the "Commanded Rail Pressure" and the "Actual Rail Pressure". Anytime that the actual pressure is not within 200 psi (13.5 bar) of the commanded pressure a fault code will be generated. The actual pressure is not such a concern as the relationship between the two.

A second key item is to monitor the duty cycle of the pressure regulator. The regulator is supplied PWM and the duty cycle will vary depending on the engine load. Remember that the regulator is a normal OPEN valve, to limit fuel pressure the valve must be closed; because of this the duty cycle may be just the opposite as expected. The more fuel required to maintain the pressure - the lower the duty cycle required.

Example: Common Duty Cycles

Low Idle	36-38%
High Idle	34-36%
High Load	29-31%

If a reading remains below ~27% for an extended period of time a fault code will be generated.

WHAT CAN CAUSE THE CONDITION

Pressure Below Commanded

This can be caused by a number of conditions, listed below is some of the common items to check for. Don't overlook the obvious item, fuel starvation.

- Fuel blockage anywhere between the tank and the charge pump
- Charge pump and/or relief
- Regulating solenoid
- Rail relief valve
- High pressure circuit leakage to the return circuit

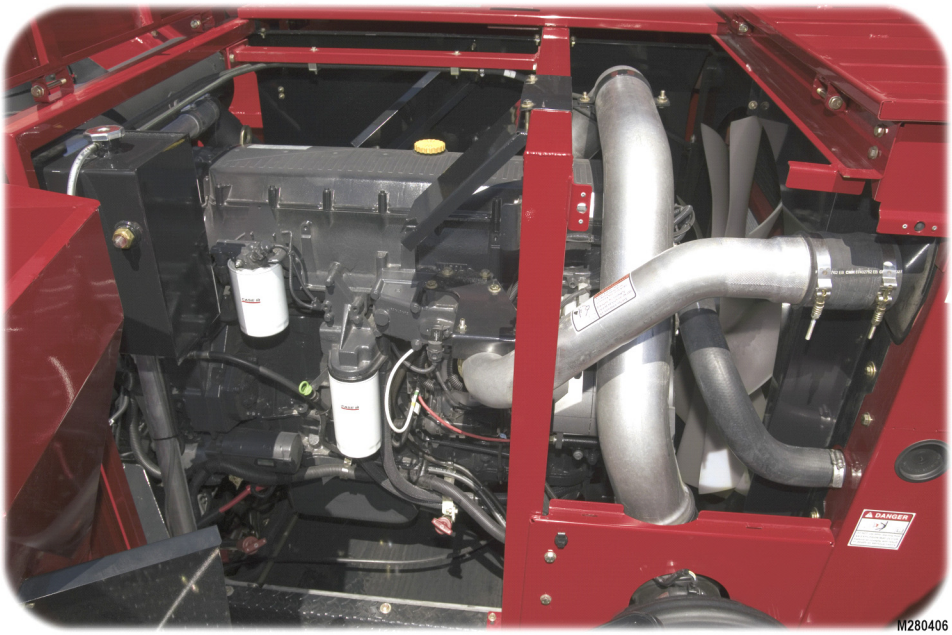
Pressure Above Commanded

This is normally limited to sticking pressure regulating solenoid.

CASE IH
AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

8120 - 9120 SERIES AXIAL-FLOW COMBINE



SECTION 12 CNH (IVECO) 10.3/13 L ENGINE

Form 5175 Rev. 1/2010

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INTRODUCTION

PURPOSE OF THE TRAINING MANUAL

This manual is your guide to the Engine Familiarization Training Program.

You will also be able to use it when you are working on these combines in the workshop or in the field.

In writing this manual, we have assumed that you are familiar with the normal methods of servicing agricultural equipment and that detailed explanations in the use of tools and test equipment are not necessary. In the event of any difficulties, you should refer to the Service Manual and to your Service Manager.

Use Of This Manual

The information contained in this manual is supplementary to material to be found in other sources, it is not a replacement for them. You should always consult Service Manuals, Service Bulletins, Operator's Manuals and Parts Books when necessary.

This manual and training program has been designed to help you make required repairs. It will also draw your attention to particular problems that you might encounter and the any special procedures that you must follow.

There is plenty of space in this manual for you to add your own notes and observations.

Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember.



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

MAJOR CHANGES

2009

- A fuel restriction sensor has been added to monitor filter condition
- Unloading boost selection has be removed, the Power Rise is on all the time

2008

- New engine data sets for revised performance
- Electronic Grid heater activation indicator and alarm added
- 9010 - Fuel filter restriction sensor activated
- Coolant level sensor removed (running change)

2007

- Engine fault codes are recognized by the AFS200/AFS PRO 600

2006

- The engine changed to a Tier III level
    - New camshaft starting at engine S/N 82159 to reduce smoke levels
- The Grid Heater lamp was deactivated during the pre-heat cycle
- Operator Selectable Power Setting
- Water In The Fuel sensor added
- Fuel transfer pump operation is limited to the first few seconds after engine starting

SPECIFICATION

COMPONENT	SUPPLY VOLTAGE	WORKING RANGE	RESISTANCE: OHMS AT 70°F (21°C)
Fuel Temp. Sensor	5V	3.4V-75°F	2.2K-70°F
Fly Wheel RPM Sensor			880-920
Cam Position Sensor			880-920
Coolant Temp. Sensor	5V	0.6-2.4V	2.5K-70°F
Boost Air Temp. Sensor	5V	2.8-4.2V	2.5K-70°F
Boost Pressure Sensor	5V		
Oil Pressure Sensor			
Oil Temp. Sensor			
Fuel Level Sensor	5V		Empty: 315-345 Full: 5-10
Throttle Control	5V	Low Idle: <0.72V High Idle: > 2.27V	4K+-20%
Terminators			120 Ohms
Engine Weight			Approx. 2400 Lb.
Injector Solenoid		12-15 amps	0.5-0.6 Ohms (engineering sees injectors with 0.3-0.8 as being good)

GENERAL INFORMATION

The 8120 Axial-Flow combine utilizes a 10.3 L and the 9120 utilizes the 13L engine built by Iveco to provide the required power, performance, fuel economy, torque rise, and power growth that today's customers demand. The engine is a six cylinder turbo charged and air-to-air after cooled diesel engine.

The engine uses electronically controlled mechanical injection pumps for each cylinder and has been designed to meet current emission regulations. The injection system on this engine is a high-pressure type with the pump/injector operated by an overhead camshaft. Unlike conventional injection systems (with a single injection pump), the new injector pump injection system reduces particulate levels due to the high pressures generated.

The sophisticated electronic management system also reduces other pollutants. Any CaseIH authorized servicing dealer must service the engine.

MAJOR FEATURES:

- Full-Authority electronic fuel injection engines using a turbo charged air to air charge air cooler to provide the required performance.
- Four valves per cylinder increase the movement of air into the combustion chamber and exiting into the exhaust, resulting in improved performance and efficiency.
- A rated speed and rated power at 2100 RPM improves fuel efficiency, reduces noise and provides for overall reliability and durability of the engine.

GENERAL INFORMATION

DESCRIPTION	SPECIFICATIONS	
Engine Model	F3AE0684J*B901	
Displacement	10.3 L (629 in^3)	12.9 L (788 in^3)
Rated Speed	2100 RPM	
Power Rating PIN Y8G205001 -	2100 RPM	1950 RPM
8120	420 HP 313 kW	462 HP 344 kW
9120	480 HP 358 kW	523 HP 390 kW
Oil Pressure	72 PSI (5 bar) High Idle, 35 PSI (2.5 bar) Minimum	
Thermostat	Start to open 176° F (80° C) Full at 203° F (95°C)	
Fuel System: ECU Type		
> HAJ106401 (Tier 3)	7UC31	
Tier 3 Software Data Set	8120	9120
	69006726	
Fuel Charge Pressure	72 PSI (5 bar)	

ENGINE BLOCK

The engine block unitizes a uniquely designed main bearing assembly. It is a standard wet sleeve design, but all main bearing caps are designed into one unit. The sub-crankcase provides a great deal of block strength and main bearing stability.

24 valve Cylinder head

The use of four valves per cylinder increases intake exhaust and port size, and increases the breathing capabilities of the engine. The fuel injector is positioned in the center of the combustion chamber, which maximizes the air to fuel mixture, improving engine performance.

Overhead Cam

The overhead roller cam provides wider lobes, reduces the parts required, and minimizes the stress on the valve train, which improves durability, reliability, and performance. The camshaft is used to control the injectors as well as the valve train assembly.

Boost Pressure-Controlled Wastegate Turbocharger

The controlled wastegate turbocharger, which maximizes fuel-air mixture creates a wide, constant power range and eliminates mechanical lags. The result is improved fuel economy and with increased power growth and performance.

GENERAL INFORMATION

Engine Control Unit Module

The engine control unit is mounted on the right hand side of the engine (rear side). It communicates with the rest of the combine's controllers by way of the data bus. The integrated engine control unit monitors engine performance parameters, such as oil pressure, oil, fuel and air temperature, and uses that data to constantly optimize engine performance.

This data is constantly compared to normal parameters and alerts the operator if a problem is detected. These faults are stored in memory and displayed on the Universal Display unit. If service is needed, these fault codes guide the service technician through the repair process.



REMEMBER: The back side of the controller is submerged in diesel fuel for cooling, so when removing the control there will be a loss of diesel fuel.

GENERAL INFORMATION

ENGINE PROTECTION

The engine system's electronic control provide for engine protection by reducing the power output and/or shutting down the engine before major damage occurs. Areas that will influence the engine protection system are:

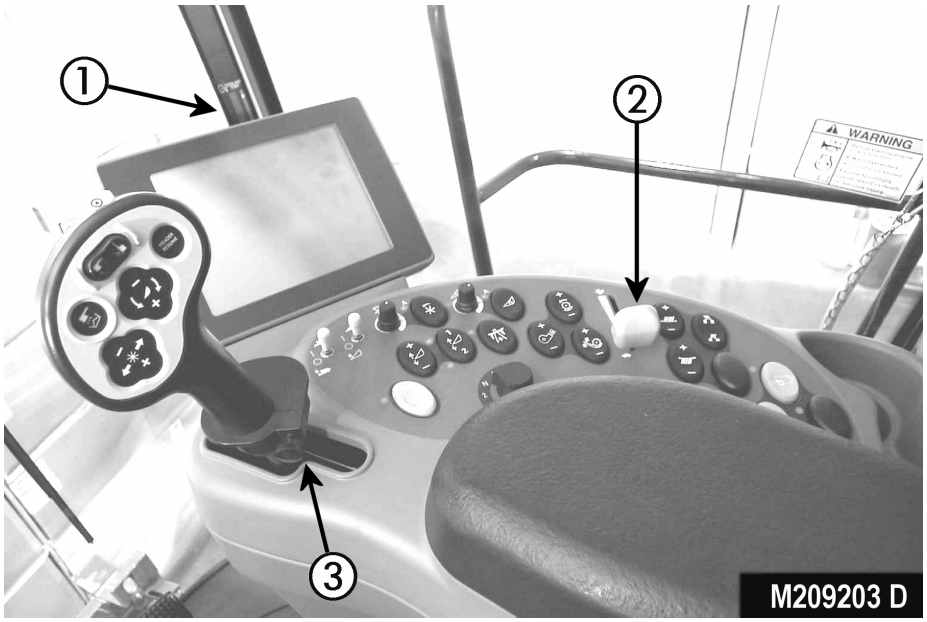
Function	Condition	Action (Torque Reduction)
Coolant Temperature	>222°F / >106°C >232°F / >112°C	0-50% Progressive 50%
Intake Air Temperature	>175°F / >80°C >190°F / >90°C	0-50% Progressive 50%
Engine Oil Temperature	>222°F / >106°C >232°F / >112°C	0-50% Progressive 50%
Fuel Temperature	>256°F / >125°C >266°F / >130°C	0-50% Progressive 50%
Low Temperature at Startup		High Idle reduced
High Altitude	<13 PSI / <0.9 bar	Reduced
Data Bus communication down		25%

THE FOLLOWING SENSOR FAILURES WILL ALSO CAUSE A TORQUE REDUCTION:

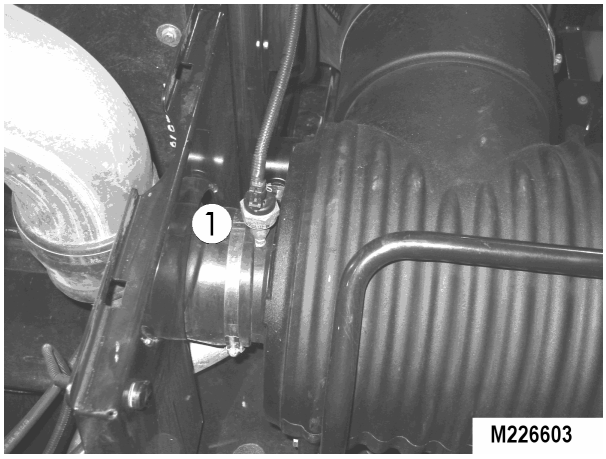
Function	Action
• Ambient pressure sensor • Engine speed sensor	~20% Torque Reduction
Power supply for sensors	20-40%
• Internal ECU monitoring defective	Engine Shut-Down

COMPONENTS AND LOCATION

OPERATOR CONTROL CENTER

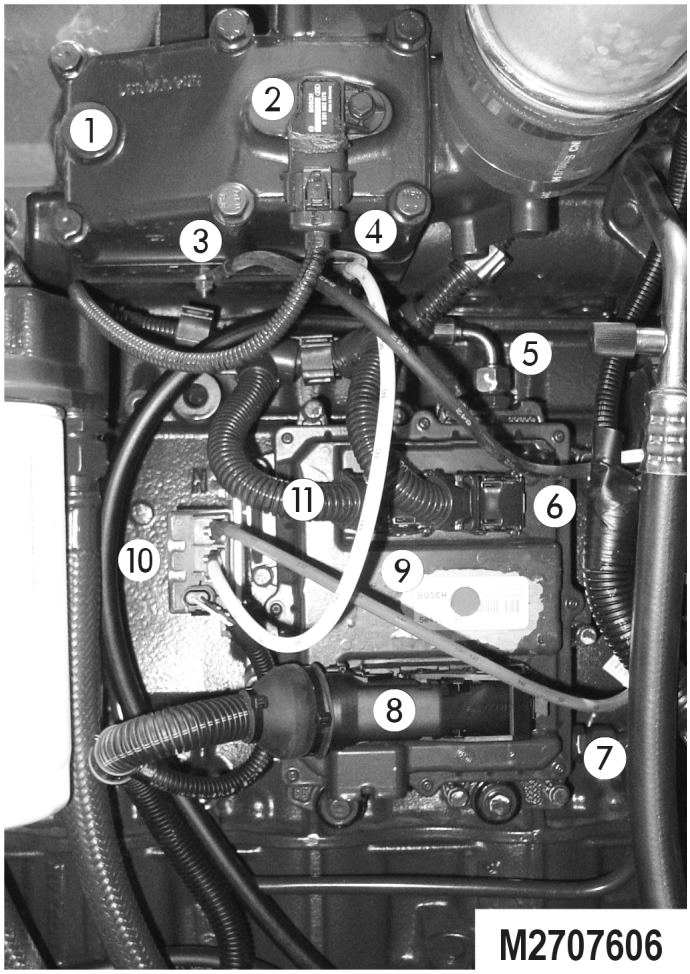


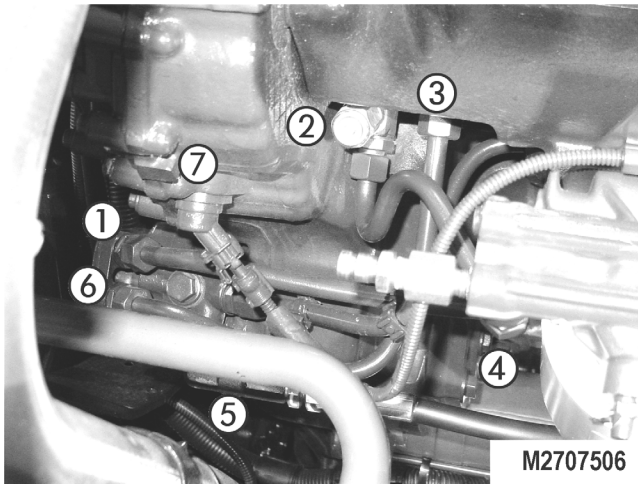
1.	Coolant and Fuel Gauges, in the cab display
2.	Throttle Control Potentiometer
3.	Neutral Start Switch



1.	Air Filter Restriction Sensor, S-61

COMPONENTS AND LOCATION

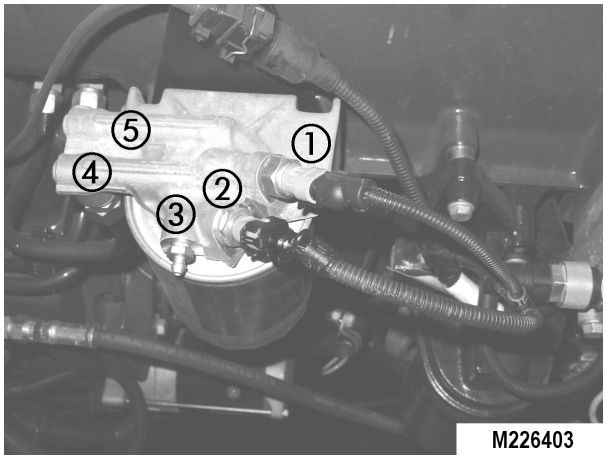




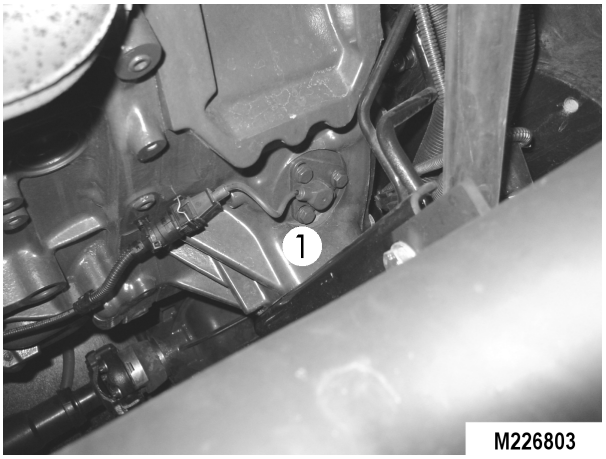
1.	Intake Manifold
2.	Boost Air Temperature / Pressure Sensor, B-41
3.	Grid Heater Ground
4.	Grid Heater Supply
5.	ECU Heat Exchanger Inlet
6.	Engine Harness Connection, (X515)
7.	ECU Heat Exchanger Outlet
8.	Chassis Harness Connection, (X193)
9.	ECU & Serial Number
10.	Grid Heater Relay, K-39
11.	Engine Harness Connection, (X516)

1.	Supply Pump Out to Filter
2.	Supply to Engine and Snubber Valve
3.	Gallery Return
4.	Filter Outlet to Engine
5.	Return to Cooler, Then tank
6.	Inlet to Supply Pump
7.	Cam Gear Position Sensor, B-07

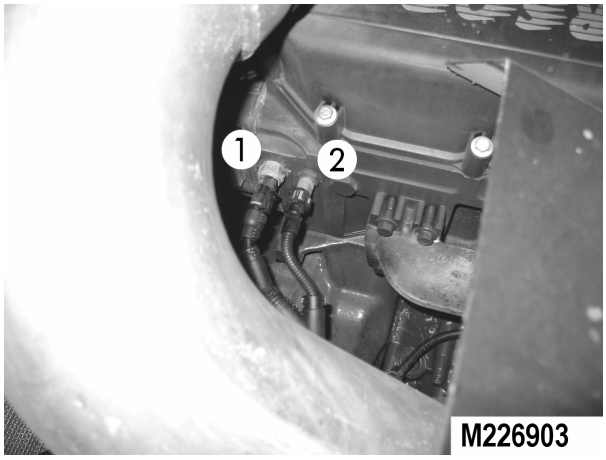
COMPONENTS AND LOCATION



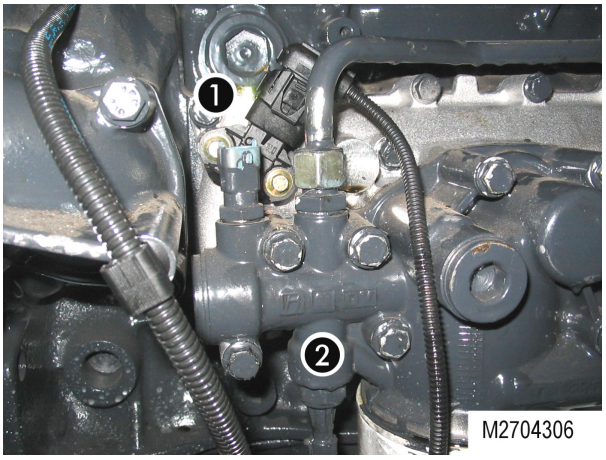
1.	Fuel Filter Restriction Switch S-76
2.	Fuel Temperature Sensor, B-36
3.	Air Bleed Screw
4.	Fuel Outlet to Common Rail
5.	Fuel Inlet from Supply Pump



1.	Crankshaft Position Sensor, B-05

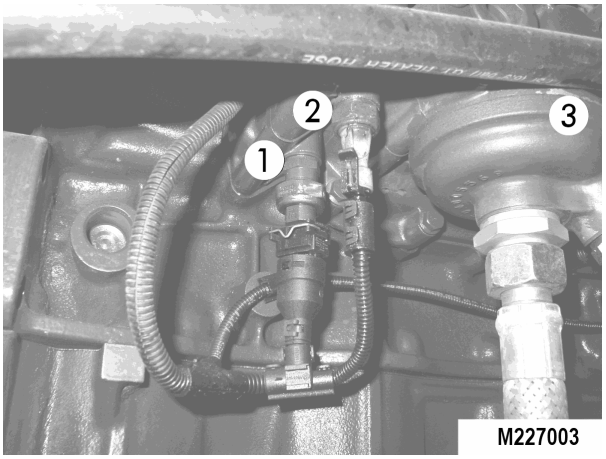


1.	Coolant Temp. Sensor, (Not Used)
2.	Coolant Temperature Sensor, (B-44)



1.	Oil Pressure / Temperature Sensor, B-75

COMPONENTS AND LOCATION



1.	Oil Pressure Sensor, (N/A)
2.	Oil Pressure Sensor, (N/A)
3.	Engine Oil Adapter TO Filter

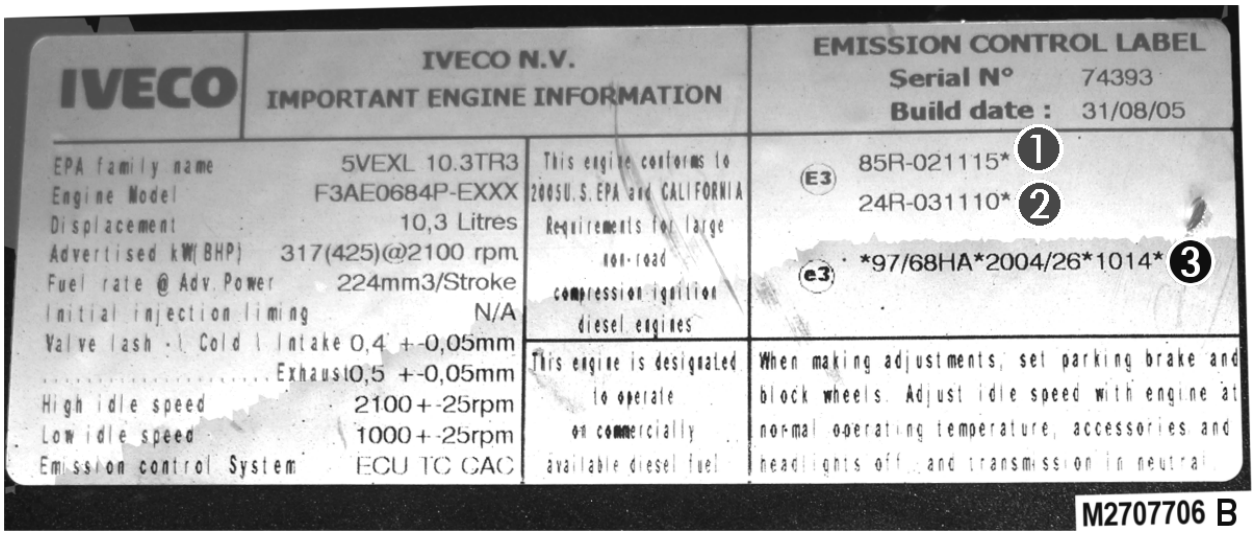
COMPONENTS AND LOCATION

ECU (ENGINE CONTROL UNIT) NAME PLATE



1.	Bosch Part Number
2 & 4.	Using #2 and the last four digits from #4 create the controllers Pin #
3.	NA
5.	Iveco Part Number

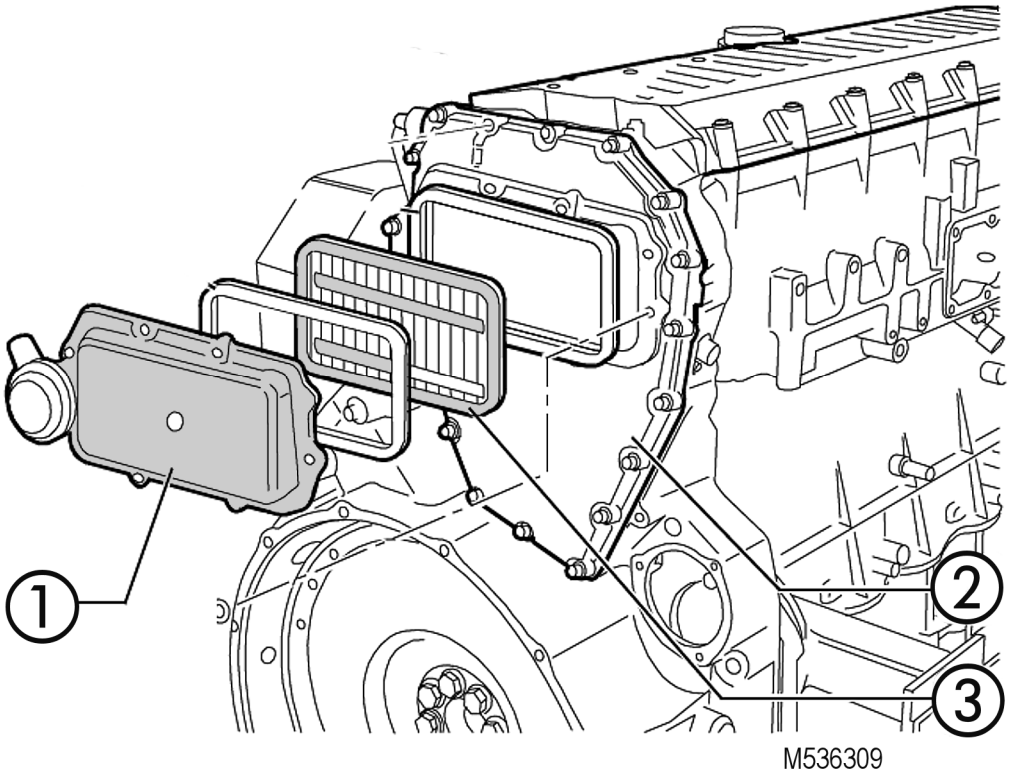
ENGINE PLATE



1 – 3.	Are for the European Emissions Certification

COMPONENTS AND LOCATION

CRANKCASE BREATHER

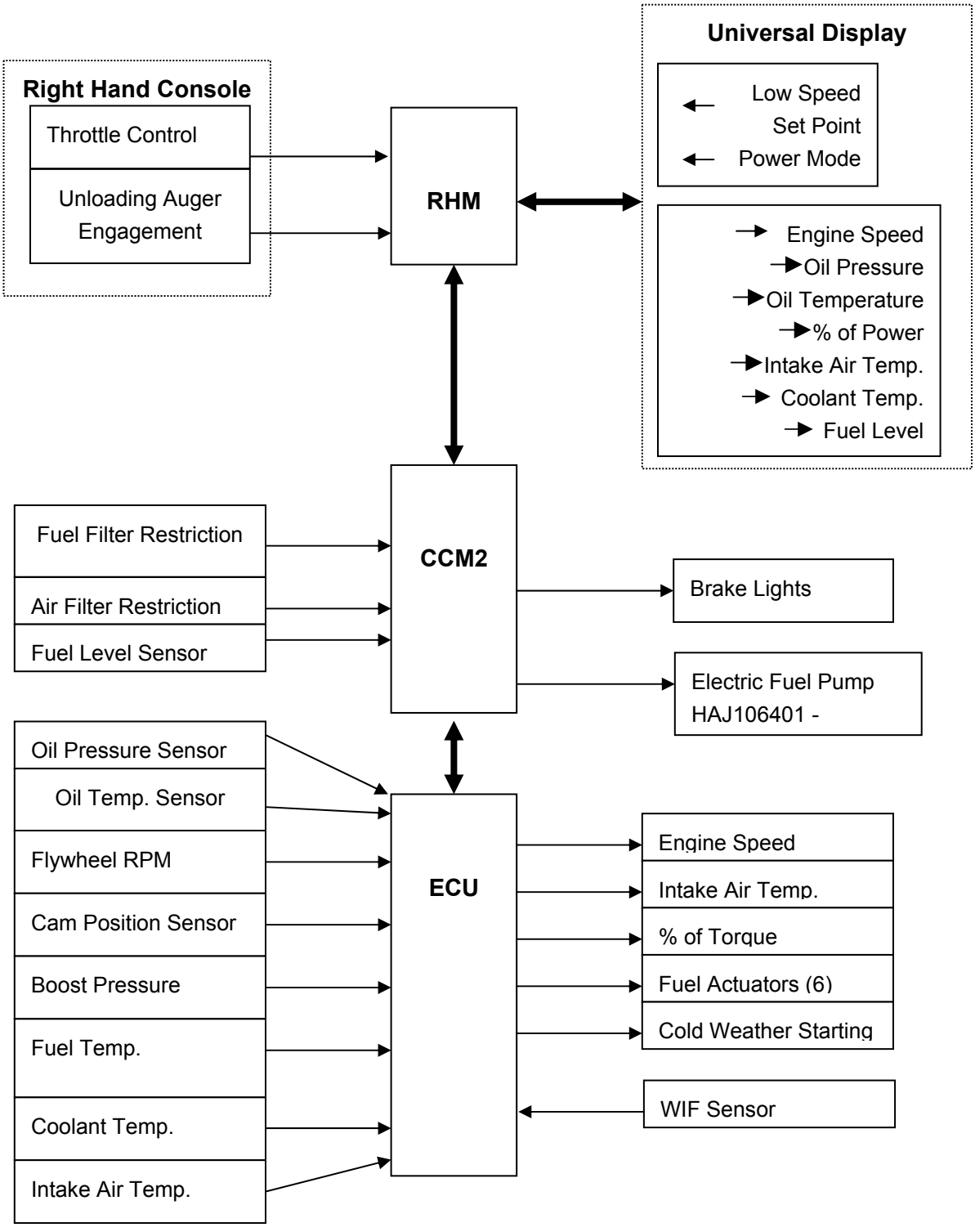


1.	Crank Case Breather Cover & Pressure Indicator	3.	Crank Case Breather
2.	Cam Gear Train Cover		

The engine uses a crank case breather mounted to the cam gear train cover. It will filter out the oil from the blow-by gasses and requires servicing every 600 hours.

ENGINE COMMUNICATIONS

INFORMATION FLOW



COMPONENT OPERATIONS

INFORMATION FLOW

The engine communications, controls and monitoring functions are split between several controllers. The engine control unit is in complete control of the engine performance, but considers inputs from various other controls and sensors.

RIGHT HAND CONSOLE, PROVIDES FOR OPERATOR INPUTS

Throttle Control, R-21

The Throttle Control is used by the operator to request a specific engine speed between 1000 - 2100 RPM.

The sensor is provided a 5V supply at terminal C from the RHM connector X026 terminal 16. The sensor's terminal A is connected back to the RHM connector X027 terminal 6 for a return. The sensor's sensing with terminal B is directed back to the RHM connector X027 terminal 10.

Location: Located in the right hand console

Unloading Auger engagement, S-73

(NOT USED ON 8120-9120's) Unloading Auger engagement, when the operator engages the unloading auger the engine will use an alternative control chart (provided by the CCM2) to provide for additional power if required. The boost is available as long as the engine coolant and boost air temperatures and the engine speed and load are with in their normal operating range. The power boost on the 8010 is not time limited. This boost can be verified by monitoring the engine power on the DISPLAY, which can go as high as 117% during power boost.

Location: Located in the MFH

AFS200 / AFS PRO 600 DISPLAY

The display provides for two way communication for the operator, input and for displaying messages.

- The operator may adjust the low speed warning for any speed between 1800–2050 RPM. The alarm will come from the factory set at 2000 RPM. When the operator loads the engine down (with the separator running) to the set point a priority 2 alarm will sound. If the set point is at 1800 RPM the alarm will be disabled.
- The AFS200 / AFS Pro 600 may display the current engine speed, intake manifold temperature, oil pressure and % of power being used if selected and placed on one of the RUN screens.
- The AFS200 / AFS Pro 600 provides the operator the ability to operate the engine in one of two different torque curves.

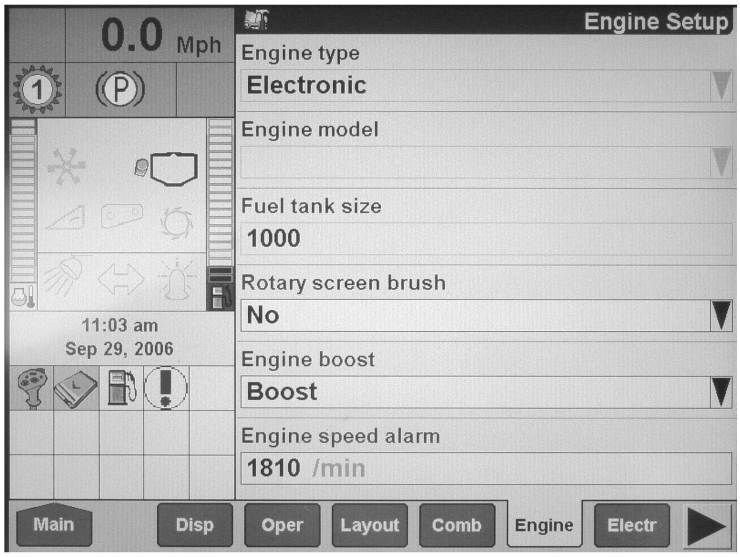
COMPONENT OPERATIONS

AFS200 / AFS PRO 600 DISPLAY, (CON'T)

(NOT USED ON 8120-9120's) Using the MAIN>TOOLBOX>ENGINE>ENGINE BOOST menu, the operator may toggle between the Power Rise and Power Boost modes. Refer to the spec page earlier in this section. (AFS 600 example)

Power Rise Mode: Would be recommended for heavy operations where the load in erratic; providing for more recover power for sudden loads.

Power Boost Mode: Would be recommended for steady load, but require frequent unloading on the go operations.



M283006

COMPONENT OPERATIONS

CCM2

Air Filter Restriction, S-61 (CCM2)

The air filter restriction sensor is used to monitor the condition of the air filter. The air filter restriction sensor S-61 is monitored by the CCM2. If the air filter restriction increases above 61 mbar (24 inches of water) for 10 seconds, a placed message on the data bus as to the filter quality.

A 5V supply provided by the CCM2 connector X016 terminal J2-24 is directed to the filter switch S-61 terminal 2, terminal 1 is connected to a reference ground at CCM2 connector X016 terminal J2-14. As long as the filter restriction is low and the switch is closed (N/C) the voltage on the signal wire is directed through the filter switch to the ground provided by the CCM2 connector X016 terminal J2-14. If the switch opens due to high filter restriction, the ground will be lost and the signal wire voltage will increase to the supply voltage.

Location: Located at the outlet of the air filter canister

Water In Fuel B-59

The WIF sensor circuit monitors the level of water that has accumulated in the base of the pre-filter. The sensor is supplied 12V at connector X424 terminal 3 and a chassis ground at connector X424 terminal 1. When the water level in the pre-filter reaches the sensor contacts, the water will provide an electrical connection across the contacts. This will direct the voltage signal that is being directed out of the ECU connector X193 terminal 42 to the sensors terminal 2 to the chassis ground.

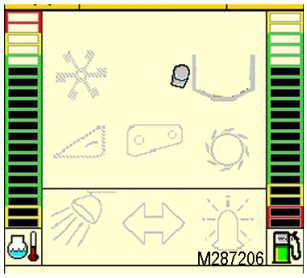
Location: Located at the base of the water separator fuel filter

COMPONENT OPERATIONS

CCM2, CON'T

The Fuel Level circuit is used to monitor the fuel that is left in the fuel tank. The working zones are as listed:

Fuel Level Gauge, (located on the Pro600 display)

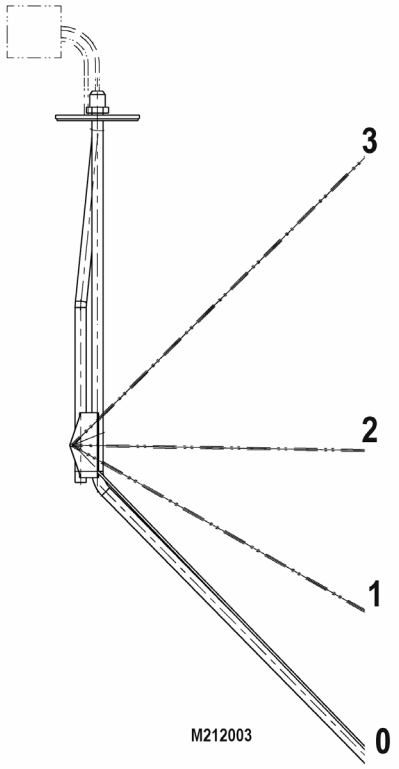


The fuel lever sensor monitors the fuel level and is broken down into three zones.
Green Zone: between 20-100% (approximately >16 gal) of tank capacity
Yellow Zone: between 10-19% (approximately <16 gal > 5 gal) of tank capacity. Priority 1 alarm
Red Zone: first 9-0% (approximately <5 gal) of tank capacity. Priority 2 alarm

Fuel Level Sensor, R-01

The fuel gauge does not provide a linear level display on float position. The circuit provides for three different zones.
Zones:

0: 315-345 Ohms
1: 185-225 Ohms
2: 108-128 Ohms
3. 5-10 Ohms



The resistance will progressively increase/decrease as the float moves from these points.

Terminals
1: Return
2: Signal

Location: Upper right hand side of the fuel tank.

COMPONENT OPERATIONS

CCM2, CON'T

Engine Oil Pressure / Temperature, B-75

The Engine oil pressure sensor is used to monitor the engine oil pressure. If the engine oil pressure should drop below 14 PSI (1 bar) for 3 seconds a priority 2 alarm will be activate. If the pressure should remain below this setting for an additional 7 seconds a priority 3 alarm is activated and the engine will shut down. If the engine is restarted and the pressure is still low the engine will shut down in 30 seconds.

The Oil Temperature sensor is used to monitor the engine oil temperature. If the temperature should climb above 258 deg F(126 deg C) for 3 seconds a priority 2 alarm will be activate. When above 266 deg F (130 deg C) a warning message is activated and a priority 3 alarm is activated and the engine will shut down. If the engine is restarted and the temperature is still high the engine will shut down in 30 seconds.

The sensor is supplied 5V from the ECU connector X516 terminal 32 at the senor terminal 3. The sensor is provided a reference ground at terminal 1 from the ECU connector X516 terminal 24.

Pressure

The ECU monitors the variable voltage signal from the sensor at connector X516 terminal 27.

Temperature

The ECU monitors the variable voltage signal from the sensor at connector X516 terminal 28.

Location: Above the engine oil cooler

COMPONENT OPERATIONS

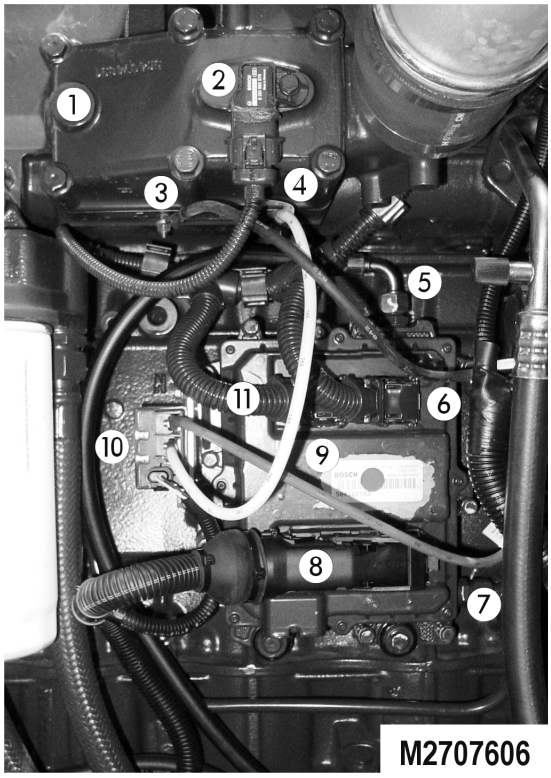
CCM2, CON'T

Brake Lights, L-11 and L-12

When a priority 3 alarm is activated the rear brake lights are also activated to provide anyone that may be following the machine that it will be stopping.

Location: Located right and left rear RED lamps

ENGINE CONTROL UNIT, (ECU), (A-01)



6.	Engine Harness Connection, (X515)
8.	Chassis Harness Connection, (X193)
9.	ECU & Serial Number
10.	Grid Heater Relay, K-39
11.	Engine Harness Connection, (X516)

The ECU monitors inputs that other controllers on the data bus, monitors engine operations, place engine information on the data bus and control the engine fuel system.

The engine control unit determines and controls the timing and volume of fuel delivered to the engine. A heat exchanger mounting pad cools the unit. The fuel from the electric transfer pump flows through the heat exchanger, cooling the control unit.

Using the EASY program (in the EST) ECU software may be installed and/or updated; a password may have to be requested using the ASSIST system before the software may be loaded. The software in the control unit is capable of producing full rated horsepower; it is the CCM2's software that commands the ECU to use the standard power curve (Power Rise) or the unloading power curve (Power Boost).

The ECU will provide fault codes that may assist the technicians with troubleshooting.

COMPONENT OPERATIONS

ENGINE CONTROL UNIT, (ECU) A-01

Coolant Temperature, B-44

The ECU monitors the Coolant Temperature sensor. The temp. meter should register up to 101°C for the green zone, 102-115°C for the yellow and 116-°C for the red. If the coolant temperature should climb above 222°F (106°C) for 2 seconds a priority 2 alarm will be activated. When the coolant temperature is above 222°F (106°C) the controller will reduce the fuel flow, reducing the power output. If the temperature climbs above 239°F (115°C) a warning message will be activated. If the temperature stays above 239°F (115°C) for 2 seconds a priority 3 alarm will be activated and the engine will shut down. If the engine is restarted and the temperature is still high the engine will shut down in 30 seconds.

The ECU connector X516 terminal 15 supplies a 5V power supply to the temperature sensor terminal 1. The sensor's terminal 2 is connected back to the ECU terminal 26. As the temperature of the coolant increases, the sensor's resistance decreases, placing a larger current draw on the supply from the ECU.

Location: See picture on page 11-10

Grid Heater, R-09

The Grid Heater is used to provide for cold weather starting. The grid heater will automatically be activated when the key switch is placed in the RUN position; if a fuel, oil or coolant temperature sensor reads less then 40°F (5°C). An audible alarm is given when the key switch is turn to the RUN position and the grid heater is activated, a pulsing second audible alarm is given with it is time to crank the engine.

Location: Located in side the intake manifold

Fuel Temperature, B-36

The fuel temperature sensor B-36 is used to monitor the fuel temperature and to provide a signal for the cold weather-starting aid and the ECU to calculated proper fuel delivery.

The ECU supplies 5 volts from connector X516 terminal 35 (which is the signal wire) to the sensor's terminal 2. The sensor's terminal 1 is connected back to a common ground at the ECU terminal 17. As the fuel temperature increases, the resistance of the sensor decreases, causing the supply voltage to decrease.

Location: Fuel Filter base

COMPONENT OPERATIONS

ENGINE CONTROL UNIT, (ECU) A-01

Fuel Filter Clogged Sensor, S-76

The fuel filter clogged sensor S-76 is used to monitor the condition of the final filter; it will NOT indicated if the water seperator filter is plugged.

The CCM2 supplies 5 volts from connector X016 terminal J2-36 (which is the signal wire) to the sensor's terminal B. The sensor's terminal A is connected back to a common ground at the CCM2 connector CCM2 X016 terminal J2-14. If the switch closes for 5 seconds, an alarm will be activated. The switch is a normally open switch, closing at a 22 psi differential pressures.

Location: Engine Mounted Fuel Filter base

COMPONENT OPERATIONS

ENGINE CONTROL UNIT, (ECU) A-01

Engine RPM, B-05

The ECU uses the engine flywheel sensor (B-05) to monitor the engine speed and to provide for engine position to assist with fuel timing. The circuit uses a sensor to provide a signal to the ECU to determine crankshaft position and speed. If the sensor should fail the engine will run using the cam sensor alone, but performance may be reduced.

The ECU connector X516 terminal 19 (which is the signal wire) supplies a 0.25V power supply to the flywheel sensor terminal 1. The sensor's terminal 2 is provided a return ground to the ECU connector X516 terminal 23. A signal is generated as the gear on the flywheel passes the sensor.

Location: Located on the upper left side of the flywheel housing

IMPORTANT: If the sensor is to be removed do NOT LOOSEN THE SENSORS MOUNTING PLATE, ONLY THE SENSOR.

Engine Camshaft Position Sensor, B07

The camshaft sensor is used for engine timing and fuel injection. The signal is only picked up after the engine has reached 50 RPM.

The engine cam gear sensor (B-07) is used by the ECU to monitor the engine speed and to provide for cam position to determine fuel timing. Once engine RPM increases above 50 RPM, the ECU will permit the engine to start. If the sensor has failed, the ECU will use the flywheel sensor to determine TDC; at which time a small amount of fuel will be injected into number one cylinder and when it attempts to fire (learning compression stroke) the flywheel sensor will pickup the increased RPM and let the engine start. Power will be reduced.

The ECU connector X516 terminal 9 (which is the signal wire) supplies a 0.25V power supply to the cam sensor terminal 1. The sensor's terminal 2 is provided a return back to the ECU connector X516 terminal 10. As the cam gear passes the sensor, a signal is generated.

Location: Located on the right side of the cam gear housing

COMPONENT OPERATIONS

ENGINE CONTROL UNIT, (ECU) A-01, CON'T

Engine Boost Pressure / Intake Temperature, B-41

The **boost** pressure sensor is used by the ECU to determine possible fuel delivery rates. As boost pressure increases so may the fuel delivery rate for additional power. If boost pressure increases above 2750-2950 mbar (40-43 PSI) the controller will reduce the fuel flow, reducing the power output. This is absolute pressure and not PSI, see explanation later in this section.

The **intake** manifold temperature sensor (IMT) is used to monitor the efficiency of the Air-to-Air cooler and to provide a signal for the cold weather starting grid. High air temperature will NOT shut down the feeder drive as it did with the 2388. When the air temperature is above 150°F (65°C) the controller will reduce the fuel flow, reducing the power output.

The sensor is supplied 5V from the ECU connector X516 terminal 33 at the senor terminal 3, the sensor is provided a reference ground at terminal 1 from the ECU connector X516 terminal 25.

Pressure

The ECU monitors the variable voltage signal from the sensor at connector X516 terminal 34.

Temperature

The ECU monitors the variable voltage signal from the sensor at connector X516 terminal 36.

Location: In the intake manifold housing

COMPONENT OPERATIONS

ENGINE CONTROL UNIT, (ECU) A-01, CON'T

Fuel Actuators 1-6, L-34-39, (Injector)

The fuel actuators (injector solenoids) are used to control the amount of fuel that is delivered to the cylinders. The solenoids should be in the range of 0.5-0.6 ohms and may be checked at the cylinder head connection. Engineering has reported that they have seen good injectors in the range of 0.3-0.8 ohms. There is one actuator for each cylinder. On the electrical schematic, they are numbered by their firing order, NOT by their location.

Location: Located under the valve cover on the injector

Electrical Frame: 4

Electrical schematic designates the Actuator by Firing Order rather then by location.

Actuator	Cylinder	ECU Conn. - X515
L-34	#1	4 & 13
L-35	#4	3 & 14
L-36	#2	6 & 11

Actuator	Cylinder	ECU Conn. - X515
L-37	#6	2 & 15
L-38	#3	5 & 12
L-39	#5	1 & 16

COMPONENT OPERATIONS

ENGINE CONTROL UNIT, (ECU) A-01, CON'T

KEY SWITCH CONTROLS

Electrical Fuel Pump, M-23

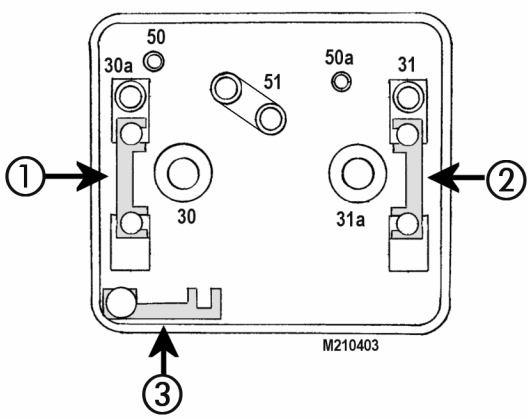
The fuel pump is used to transport the fuel from the main fuel tank to the engine fuel filter. If the pump should become weak or non-operational it will effect system bleeding and starting performance. The fuel pump will only operate continually until the engine is started; approximately 15 seconds after the engine is running the pump will be stopped.

The fuel pump operation is controlled by the CCM2 and relay K-07. The relay is supplied B+ voltage from fuse F-28 at terminal 3. When the CCM2 is activated, it will direct 12V out connector X015 terminal J1-12, activating the fuel pump relay. The fuel pump relay once activated will direct B+ voltage out terminal 5 to the fuel pump terminal A, the motor is provided a chassis ground at terminal B. Once the CCM2 controller will disable the fuel pump relay within 15 seconds of receives an RPM signal.

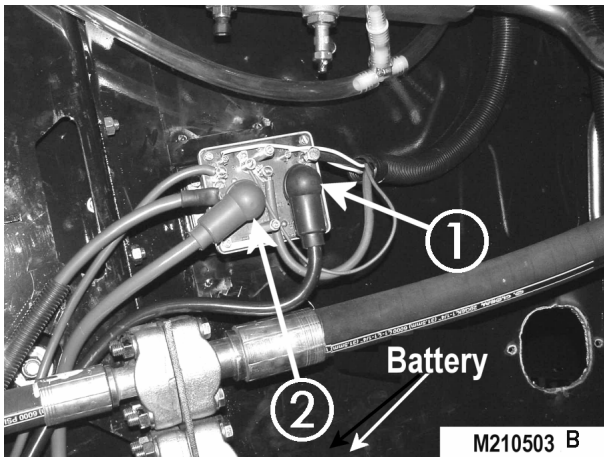
Location: Located in under the right hand fuel tank

CRANKING

12/24 VOLT SWAP RELAY

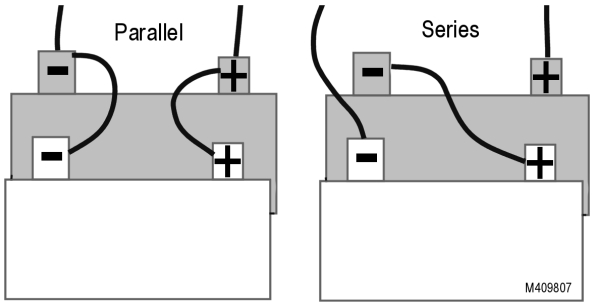


1. Front Battery B+ Charging Fuse
2. Front Battery B- Charging Fuse
3. Spare 80 amp Fuses (2)



1. Negative Cable From Front Battery, 31A
2. Positive Cable From Rear Battery, 30

The 12/24 volt relay is used to change the battery connections from a parallel circuit (12v) to a series circuit (24v) for starting.



FUSES

The unit incorporates two fuses to protect the system. If the contacts inside the relay fail to activate in the correct sequence either battery could be short-circuited, if this should happen one of the fuses would blow to protect the system.

Fuse 1: Fuse number one protects the B+ side of the circuit. It prevents 24V from entering the main electrical system, directing it to the starter solenoid only.

If it fails the relay will close, BUT 24V will not be directed out terminal 50 to the starter solenoid. The relay will click once.

Fuse 2: Fuse number two protects the B- side of the circuit. It prevents the front battery from a direct short.

If it should fail the 12/24V relay will loose its ground through terminal 31, it will only close momentarily. The relay will chatter.

STARTING: "MODEL YEAR 2007"

REFERENCE SCHEMATIC FRAMES:

Frames: #1, 2, 9,17, 25, 29, 38

KEY COMPONENTS IN CIRCUIT:

Batteries G02 & G03, Key Switch S2, Neutral Switch S-22, Neutral Start Relay K-23, Start Relay K-15, 12/24V Swap Relay K-38, Starter M-29, Engine Control Unit (ECU) A-01, Fuel Pump M-23, Fuel Pump Relay K-07, Fuses F-01, 28, 38, 48

24V STARTING CIRCUIT OPERATION

Key Switch "OFF"

When the Key Switch is in the OFF position B+ power from fuse F-01 is directed to the ECU connector X193 terminals 2,3 8 and 9 anytime the batteries are connected. This power will be used by the ECU for operations and during the last few seconds of shut down to write information from the volatile memory to the non-volatile memory "Keep Alive Memory".

Key Switch "RUN"

REMEMBER The Battery Disconnect Switch (Euro only) must be closed before attempting to start the vehicle.

When the Key Switch is placed in the RUN position (the MFH is in NEUTRAL), power is directed out:

Terminal 4: Not part of the starting operation

Terminal 5: to ECU connector X193 terminal 40 to power up the controller. When the controller receives power at terminal 40 it will perform a self-test and power up the rest of the controller.

Terminal 6: is used to power up the controllers and acc. relays.

REMEMBER The Grid Heating operation is automatically controlled by the ECU. Whenever the key switch is moved out of the **OFF** position, it should **ALWAYS** be left in the **RUN** position momentarily to give the ECU time to power up. If the grid heater is required, there will be an alarm tone at this time. The operator should wait for the second tone to signify that the heating cycle is completed before attempting to start the engine.

STARTING

Key Switch "RUN", con't

Power is also directed from CCM2 connector X015 terminal J1-12 to the Fuel Pump relay K-07 terminal 1. The relay is also supplied B+ power from fuse F-28 at terminal 3. The relay is provided a chassis ground at ground point #3. When the relay is activated, B+ is directed out terminal 5 to the fuel pump M-23 connector X183 terminal A. The motor is provided a chassis ground at terminal B. The fuel pump will operate until the engine has started; shutting down approx. 15-30 seconds after an engine RPM signal is received.

Key Switch "Start"

Terminal 2 to the Neutral Start Relay K-23 terminal 3 and onto the CCM2 connector X015 terminal J1-21. The Neutral Start relay has NOT been activated yet. The power to the CCM2 provides information that the engine is in the cranking mode; to disregard a voltage drop that may otherwise trigger a controller shut down or fault code.

Fuse #48 directs power to the Neutral Switch terminal 1. As long as the MFH is in the NEUTRAL zone the switch will be closed, the switch is a N/C switch for this circuit. The Neutral Switch directs power out terminal 2 to the Neutral Start Relay K-23 terminal 1, activating the relay. The Neutral Start relay will direct power from terminal 3 out terminal 5 to the Start Relay K-15 terminal 1.

The Start relay K-15 is supplied power from fuse 26 at terminal 3. When the Start relay actives it will direct the power supply at terminal 3 out terminal 5 to the 12/24V Swap Relay K-38 terminal 50A. With the Swap Relay activated, the 12V supply from the Rear battery G-03 **POS** post at terminal 30 is directed out terminal 31A to the NEG post of the Front battery G-02 to create 24V. The POS on the Front battery is connected to the Starter Solenoid B+ post. 24V power is also directed out terminal 50 to the Starter Solenoid terminal S to activate the Solenoid, cranking the engine. The connection between 31A and 31 is also opened.



IMPORTANT: What about the Separator and Feeder being engaged during cranking? The software incorporates logic to prevent Separator and Feeder engagement if the control switches are place in the ON position before there is engine RPM registered.

STARTING AIDS

REFERENCE SCHEMATIC FRAMES:

Frames: 01, 02, 29

KEY COMPONENTS IN CIRCUIT:

Batteries (G-03), Fuse 1, ECU, Grid Heater Relay (K-39), Grid Heater (R-09), Key Switch (S-02)

The engine incorporates an automatically activated Cold Weather Starting aid with alarm, to assist in the starting of the engine when ambient temperature falls below 40 deg F (5 deg. C).



IMPORTANT: Do NOT mix cold weather stating fluid with the Grid Heater, unwarranted sever engine damage may result from it.

OPERATION

When trying to start the engine during cold weather, the cold weather starting aid may automatically be activated. The grid heater timer is preprogrammed into the ECU. When tuning the key switch instruct the operator to stop in the **RUN** position and listen for an alarm tone, this will alert the operator when the grid heater is being activated. The alarm will continue to cycle at approx. 1 each second, when the heating period is approaching the end the alarm will change to a faster cycle. The key switch should remain in the **RUN** position until a alarm is silent, this will signal the operator when it is time to crank the engine. The heater activation indicator is displayed on the cab display unit and will be activated for a duration that is proportional to the temperature. DO NOT attempt to crank the engine while the grid heater is activated. Once the engine is started the grid heater may be reactivated for up to 6 minutes. Since the grid heater may draw over 200 amps, the system voltage will be low anytime the grid heater is active.

CIRCUIT

When the key switch S-02 is turned to the **RUN** position 12V will be supplied to the ECU connector X193 terminal 40. The ECU will determine whether the grid heater is required, the ECU will direct voltage out connector X193 terminal 75 to the grid heater relay K-39 terminal 1.

The grid heater relay K-39 terminal B+ is supplied full battery power from the alternator B+ terminal. When the relay is activated the B+ power supply is directed out to the grid heater R-09 terminal 1. The heater terminal 2 is provided a chassis ground at the engine grounding point (5).

STARTING AIDS



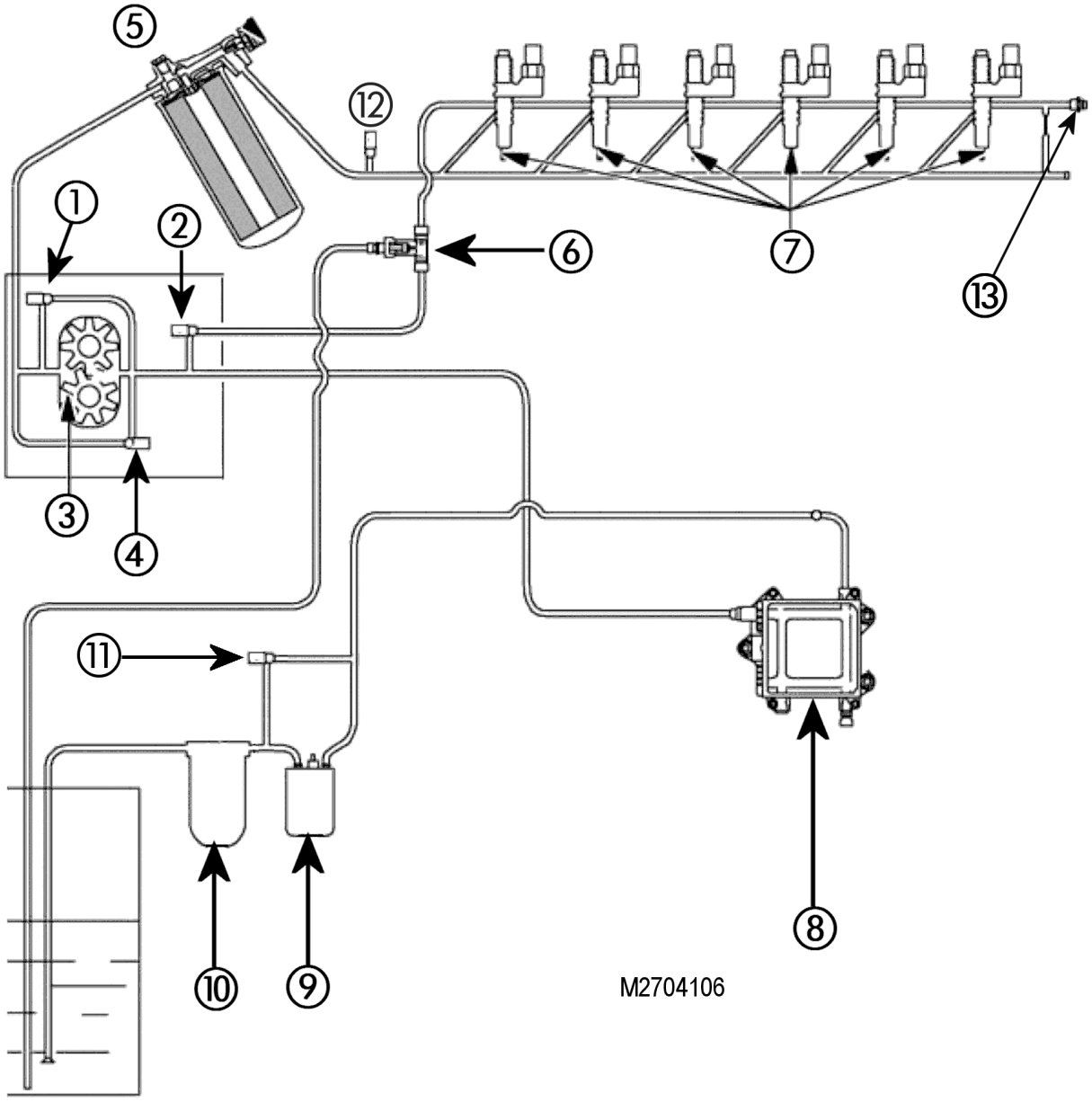
Wait a Minute... Is there a suggested procedure to use in starting the engine during very cold weather? During very cold weather cranking the engine should be performed a little differently. Past experience has been to let the grid heater operate for approximately 30 seconds, only crank the engine for 5-10 seconds to pull the heated air into the engine, and recycle the key switch to reactivate the grid heater a second time. Follow this procedure for a total of three grid heating periods before trying to start the engine.

CHARGING CIRCUIT

See the “Electrical Circuit” section for information.

FUEL SYSTEM

TIER III



1.	Electric Pump Relief /Pump By-Pass	8.	ECU Heat Exchanger
2.	Fuel Return Check (3.5 bar)	9.	Electric Transfer Pump
3.	Fuel Pump	10.	Water Separator Filter
4.	Fuel Pump Relief (5 bar / 72 PSI)	11.	Transfer Pump By-Pass Check (pump mount)
5.	Fuel Filter	12.	Accumulator (Snubber Valve)
6.	1 mm Bleeding Orifice / Check	13.	Rail Front Bleed Port
7.	Injectors		

FUEL SYSTEM

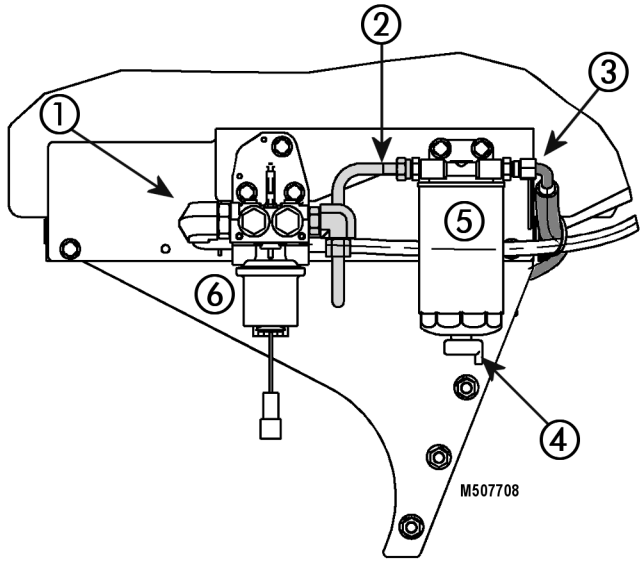
KEY SWITCH IN THE "ON" POSITION, "ENGINE NOT RUNNING"

The electrical transfer pump (9) draws fuel from the tank and directs it to the ECU heat exchanger base (8). The heat exchanger provides cooling for the ECU. The fuel travels to the fuel charge pump by-pass valve (1) which will open and permit system bleeding. Return fuel will open the 1 mm orifice/check valve (6), completing the flow back to the fuel tank. The electric transfer pump operates any time the key switch is in the **RUN** or **START** position. The 1 mm orifice/check valve (6) should maintain approximately 0.5 bar (7-9 psi) and keep the fuel from draining for the rail when not running. This operation also provides for fuel system bleeding.

KEY SWITCH IN THE "ON" POSITION, "ENGINE RUNNING"

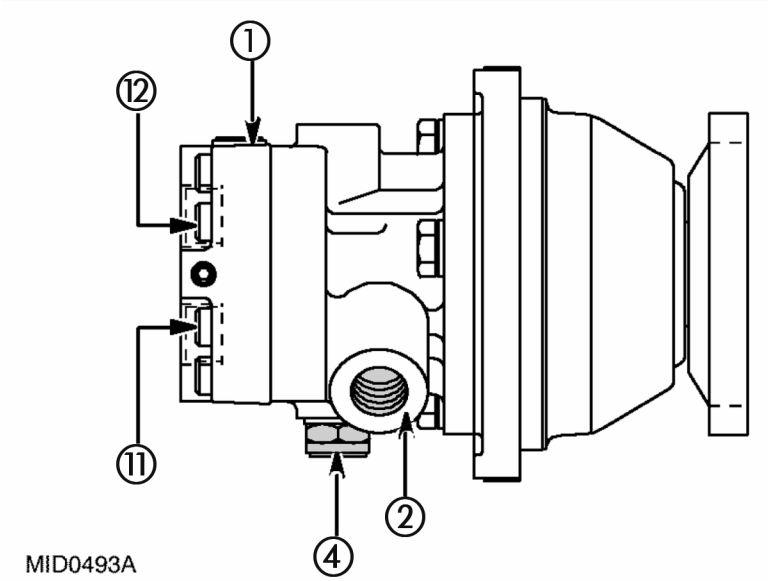
When the fuel pump (3) is operating, the outlet pressure will close the electrical transfer pump's by-pass valve (1), and direct its flow to the fuel filter (5) and on to the injector rail. The supply side is protected by relief valve (4), which will limit the fuel pump supply to approximately 5 bar (72 PSI). A spring loaded accumulator (12) is installed at the cylinder head connection to smooth out the pressure spikes that are created from the gear charge pump. A return check valve (2) will maintain the fuel rail and return pressure at 3.5 bar (50PSI). A portion of the return will flow back through the 1 mm orifice/check (6) through the fuel cooler and back to the fuel tank.

Approximately 15 seconds after the engine has started to run the electric fuel transfer pump (9) will be deactivated. Fuel will be draw through the one way check (11) by the charge pump (3). The fuel pressure will have a slight reduction when the electrical pump is deactivated.

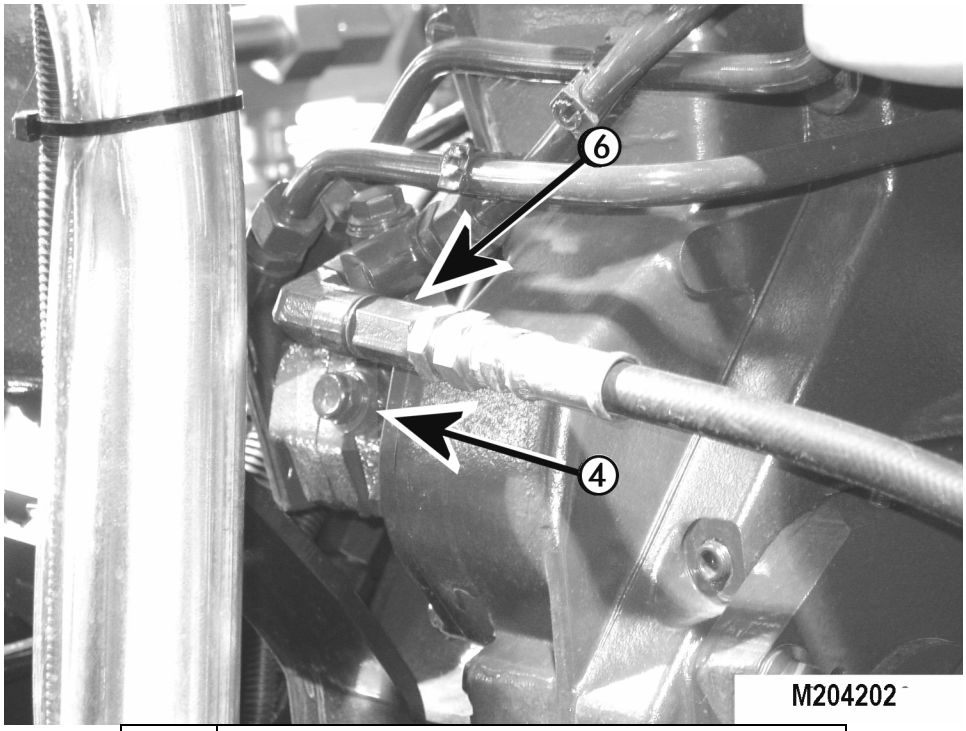


1.	Fuel OUT to ECU Plate
2.	Connection between Filter and Pump
3.	Fuel IN from Tank
4.	Water In Fuel Sensor and Drain
5.	Water Separator Filter
6.	Fuel Pump and By-Pass Check

FUEL SYSTEM



1.	Electric Pump Relief Valve	11.	Fuel **IN** Supply From Tank
2.	Fuel From Head Return Galley Check (3.5 bar)	12.	Fuel **OUT** to Fuel Filter
4.	Fuel Pump Relief (5 bar)		

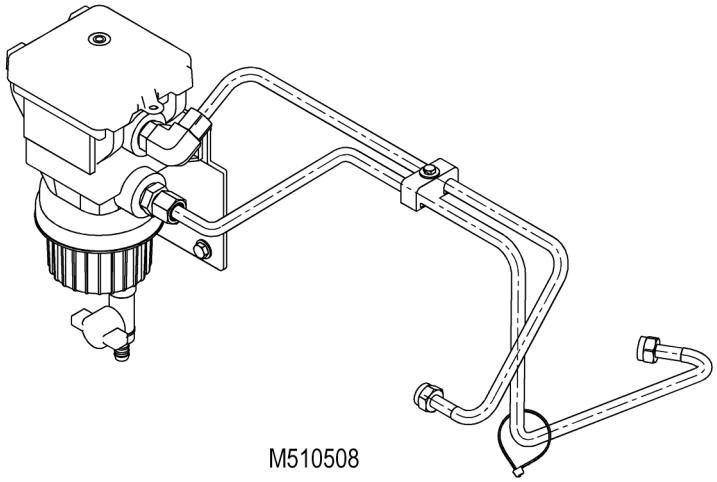


4.	Fuel Pump Relief (5 bar)
6.	1 mm Orifice/Check (Return to Fuel Cooler)

FUEL SYSTEM

WATER SEPARATOR FILTER

There is an additional water separator filter available P# 87755811 that can be installed. It should increase the filter change interval where dirty or water contaminated fuel is used.



HOW TO MONITOR FOR POWER

Use the Electronic Service tool (EST) and the Pro 600 display when monitoring the engine performance for a power complaint.

ITEMS TO INVESTIGATE:

1. Is the machine equipped and adjusted properly for the crop being harvested?
2. What are the operating conditions: field, operator, expectations, comparing to?
3. What is the actual fuel consumption rate?
4. Does the exhaust show smoke?

The following items will require monitoring:

STEPS TO FOLLOW

1 Display

- Battery Voltage
- Engine Load
- Boost Air Temperature
- Atmospheric Pressure
- Fuel Rate
- Engine OverHeating
- Engine Oil Pressure
- Air Filter
- Engine Speed
- Boost Pressure
- Fuel Temperature
- Coolant Temperature
- Engine Derate Level
- Engine Oil Temperature

2 Manual Gauges

- Checking Fuel Pressure
- Check Actual Boost Pressure

3 EST>EASY Tool

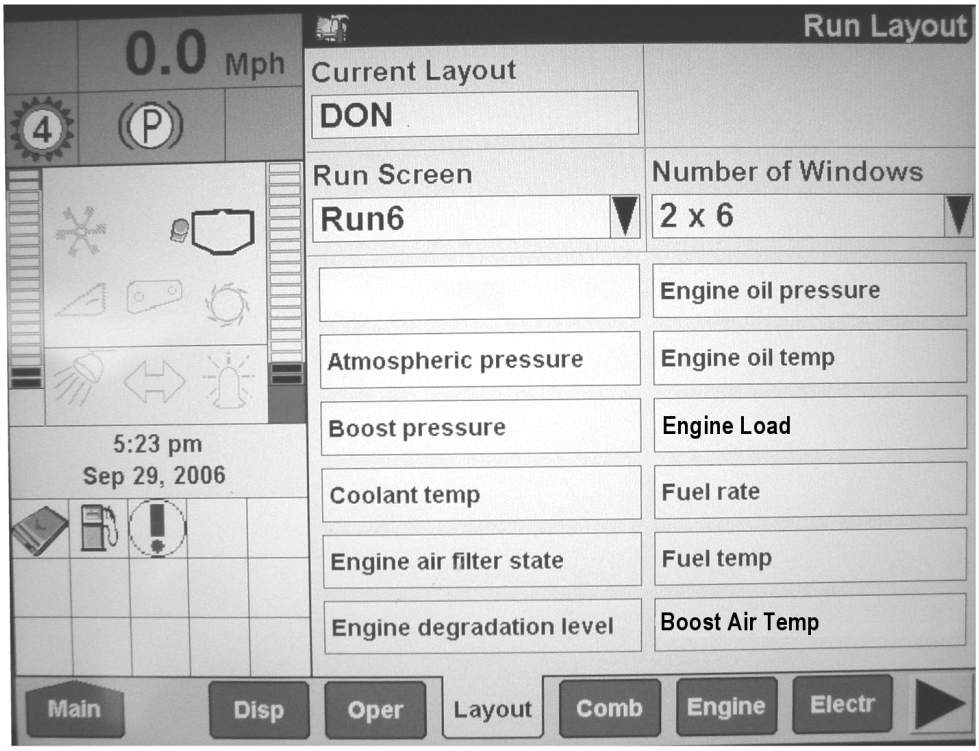
- Battery Voltage
- Advance Injection
- Boost Air Temperature
- Coolant Temperature
- Injected Fuel Quantity
- Oil Pressure
- Cylinder Air Mass
- Engine Revs
- Ambient Pressure
- Boost Pressure
- Fuel Temperature
- Engine Oil Temperature
- Total Engine Torque

Using the EASY tool log the actual data using the graph option and attach the file to an assist when requesting assistance.

HOW TO MONITOR FOR POWER

STEP 1: DISPLAY READOUTS

By navigate to BACK>COMBINE INFO>ENGINE, most engine functions may be monitored on the display screen. Most items can also be placed on a RUN screen. Following is a suggested list of items to monitor.



M411607

ATMOSPHERIC PRESSURE

Atmospheric pressure is a measurement of the current atmosphere pressure. This will change due to the altitude above sea leave. The ECU uses this information in determining fuel delivery.

BOOST PRESSURE

Boost Pressure is a measurement of the pressure that is being created by the turbo charger. The ECU uses this information in determining fuel delivery. It has been experienced that an injector can prevent the boost pressure from reaching the target pressure.

BOOST (INTAKE) TEMPERATURE

The intake temperature should not be above >167F, above this the engine degradation could occur.

HOW TO MONITOR FOR POWER

STEP 1, CON'T

COOLANT TEMPERATURE

When coolant temperature increases above 102°C / 223°F the engine control unit can reduce the fuel delivery.

ENGINE AIR FILTER STATE

ENGINE DEGRADATION LEVEL

This is an indicator if the software has the engine derated for some reason, the reason will not be evident. This will just be a reference number, example 1-4

ENGINE OIL TEMPERATURE

Engine oil temperature needs to be below 257F.

ENGINE POWER

Use the display RUN screen to monitor the engine power. This is an indication of the amount of fuel delivered to the engine. A normal reading will be 100% before the engine speed begins to drop below 2100 RPM, and when loaded should climb to approximately 105% when NOT unloading. While unloading on the go the power % may increase to approximately 117% level.

AIR INTAKE PRESSURE

Intake pressure should reach 40-43 PSI (2750-2950 mbar) when the engine is under full load.

FUEL RATE

FUEL TEMPERATURE

Fuel temperature needs to be below 212°F.

HOW TO MONITOR FOR POWER

STEP 2: FUEL SUPPLY

For the engine to perform properly there must be an adequate supply of clean fuel. When fuel starvation occurs engine horsepower may be reduced, the operator should use the Pro 600 display to monitor the engine power.

- The % Engine Power on the display normally can build to around 107% when normally harvesting, but during starvation will not normally exceed 100-102% accompanied by a significant drop in engine rpm.
- Using the EST (Electronic Service Tool) monitor the Boost Pressure reading. Under full load normal boost pressure will be in the 37-43 PSI (2.5-2.9 bar) range. Low boost may be an indicator of restricted fuel. **Be sure to read how to understand the boost pressure readings later in this section**.



Wait a Minute... What is the Engine Power display telling me? The reading is an indication of the power being consumed compared to the rated power. (The length of time the nozzles are injecting fuel into the cylinder by monitoring the solenoids duty cycle.) This provides an indication of load.



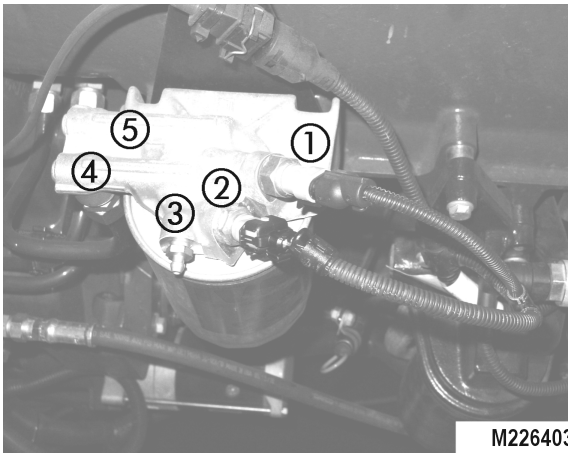
REMEMBER: It is recommended to replace the chassis (water separator) fuel filter after the combine has accumulated 10-15 engine hours of operation.

HOW TO MONITOR FOR POWER

STEP 2: FUEL SUPPLY, CON'T

System restriction can be determined by the following test procedure. Use the following steps:

1. Relieve the fuel system pressure by loosening the bleed screw, item #3.
2. Remove plug, item #4 (this is after the filter), with a 7mm hex wrench and insert a ¼" X 19 MBSPT (British Standard Pipe Taper) to ¼"X18 FNPT adapter (Parker number 1/4X1/4F3HGS) for the diagnostic coupler. A second gauge could be placed in port #5 (before the filter), to check the condition of the filter. The two gauge readings must be with 20 PSI of each other.
3. Connect a fuel pressure gauge 0-20 bar (0-300 psi) to the diagnostic coupler.
4. Engine OFF, key ON, the electric fuel pump will supply 0.62 bar (9 psi) to the fuel rail.
5. Engine running, the common rail fuel pump pressure is regulated to approximately 5 bar (72 psi). Verify 5 bar (72psi) is maintained during full load engine operation.



Typical readings with new filter

Condition	Port 4	Port 5
Key ON	5.1	5.0
Cranking	15.0	14.9
Low Idle	65.0	63.5
High Idle	78.0	75.0

1.	Fuel Restriction Sensor (not used)	4.	Filter Outlet to Common Rail
2.	Fuel Temperature Sensor	5.	Filter Inlet from pump
3.	Bleed Screw		

REMEMBER: Stating with PIN HAJ106401 the electric transfer pump will only operate for 30 seconds once the engine is started.

HOW TO MONITOR FOR POWER

STEP 3: ELECTRONIC SERVICE TOOL (EST)

TURBO BOOST PRESSURE

Boost pressure may be monitored one of two different ways, on the EST parameter screen or through the Atlas parameter screens.

"EST" SCREEN

Boost Pressure is easiest monitored with the EST using the parameters found under the CCM2. The EST reports the boost pressure in what is call "absolute pressure" it includes the 14.7psi (1bar) of atmospheric pressure. Remember to reduce the reading by 14.7 to get the actual boost increase reading.

"EASY" ENGINE PROGRAM

Boost Pressure may also be monitored using the Atlas engine program. When monitoring the boost pressure in the Atlas program on the EST. it may be difficult to understand what the displayed reading represents. The EST reports the boost pressure in what is call "absolute pressure" it includes the 14.7psi (1bar) of atmospheric pressure and is displayed in the measurement of **mbar**.



Wait a Minute... So how am I suppose to understand and use this reading for proper diagnostic work?

FIRST THE DISPLAY

The Atlas program displays the boost pressure in a measurement of mille-bar (mbar). One mbar represents 0.001bar, so 1000mbar represents 1bar.
Example: A reading of 2675mbar will equal 2.675 bar.

WHAT IS A BAR

A bar is a measurement based off the atmospheric pressure. Atmospheric pressure is normally 14.7 psi, so 1 bar equals 14.7psi.
Example: 2675mbar = 2.675 bar so 2.675 bar X 14.7 psi = 39.3 psi.

HOW TO MONITOR FOR POWER

STEP 3: ELECTRONIC SERVICE TOOL (EST)

TURBO BOOST PRESSURE, CON'T

FINAL READING

The measurement is displayed in ABSOLUTE PRESSURE, which means that it is including the normal atmospheric pressure with the boosted pressure. For this reason, we will have to reduce the displayed reading by one atmospheric pressure.

Example: 2675mbar = 2.675 bar 2.675 X 14.7 = 39.3 psi, (this is absolute pressure) that must be reduced by one bar to get to actual boost pressure
2.675 bar – 1 bar = 1.675 bar actual boost
Actual boost = 1.675 bar X 14.7 psi = 24.6 psi

NORMAL BOOST PRESSURE

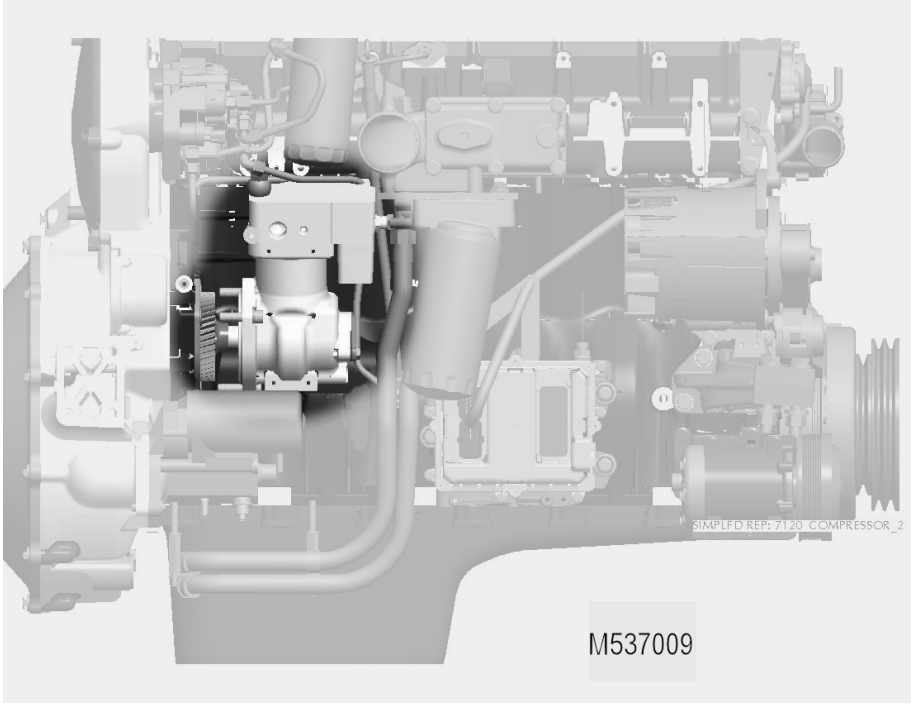
Normal ABSOLUTE boost pressure as displayed on the EST parameter list, remember to reduce the reading by 14.7 psi.

Normal	EST Parameter list PSI	Atlas mBar
Harvesting Full Load	42-43	2857-2925

IMPORTANT: If the turbo is fitted with a waste gate and the boost pressure is below specification, an inspection of the wastegate for proper operations should be made. When pressurizing the wastegate actuator, 26 PSI (1.77 bar) should create approximately 0.03"-0.05" (0.43-1.96 mm) movement of the control rod.

AGRICULTURAL EQUIPMENT SERVICE TRAINING

20 SERIES
AXIAL-FLOW COMBINE



SECTION 14 AIR COMPRESSOR

Form 5175 1/2010

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INTRODUCTION

Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember.



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

SPECIFICATION

COMPRESSOR

COMPONENT	WORKING RANGE
Compressor	Wabco Single Cylinder
Output Capacity	Appro. 18 cfm (31 m^3/hr)
Lubrication	Engine Crankcase Supplied
Cooling	Engine Cooling System

PRESSURE REGULATING VALVE

COMPONENT	WORKING RANGE
Valve	Wabco 9753030720
Signal Pressure	120 psi (8.2 bar)
System Relief	150 psi (10 bar)

DISTRIBUTION

COMPONENT	WORKING RANGE
Reservoir Tank	16 gal (60 l)
Air Hose ID	0.28 inches (7 mm)
Air Tool Access Point	5

GENERAL INFORMATION

The 20 series Axial-Flow combines may be equipped with an optional Air Compressor that may be used for any function that requires compressed air. This could be from blowing off the machine to operating air tools.

The system is equipped with a 16 gal (60L) reservoir tank and 5 quick coupler outlets around the machine. The airlines are the standard truck type nylon airlines with press fittings.

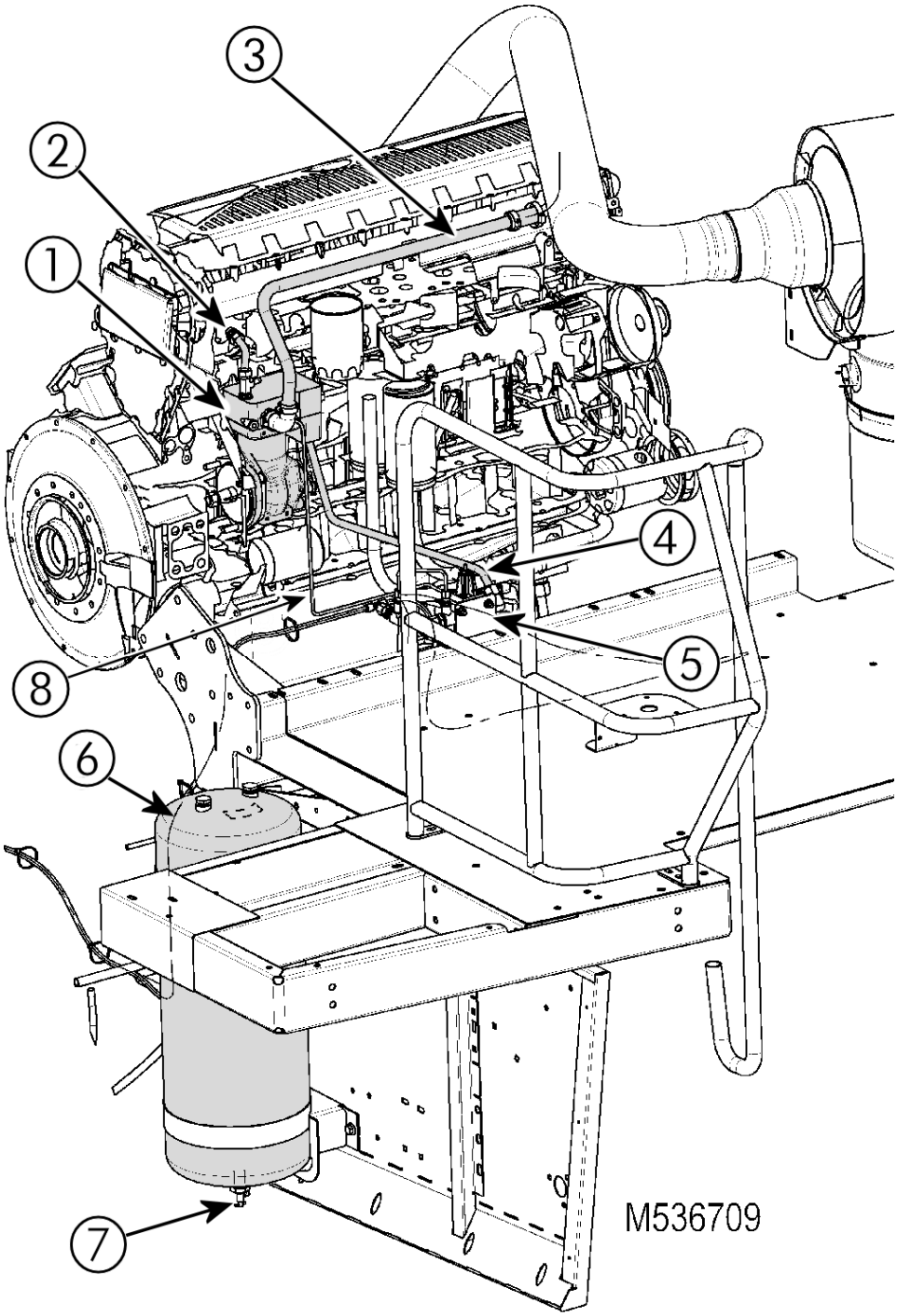
Service Outlet Location:

- Mounted below the left hand cab platform
- Mounted above the right hand cab platform
- Mounted on the service light panel next to the battery tray
- Mounted next to the pressure regulator
- Mounted on the right hand side in front of the tailings processor

The reservoir tank is equipped with a water drain port, which requires draining at least weekly to prevent the buildup of moisture in the tank and system.

COMPONENTS AND LOCATION

SYSTEM LAYOUT



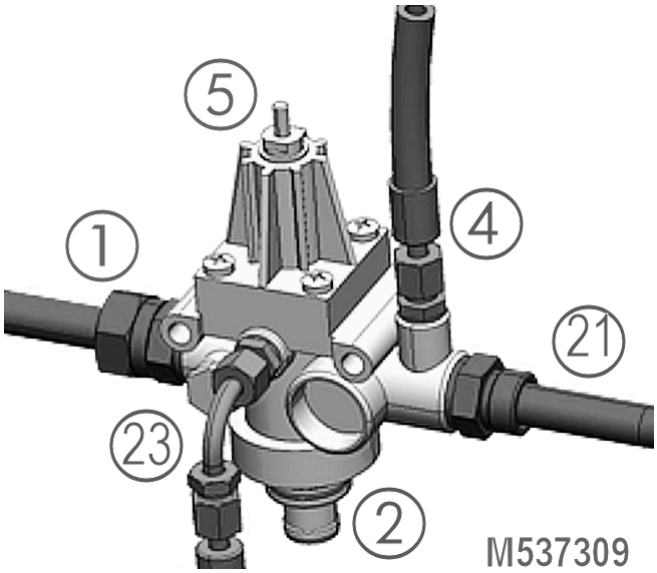
1.	Compressor Pump	5.	System Pressure Relief
2.	Coolant Line	6.	Air Reservoir Tank
3.	Pump Fresh Air	7.	Water Drain Valve
4.	Pump Discharge to Relief	8.	Signal Line

COMPONENTS AND LOCATION

KEY COMPONENTS IN CIRCUIT:

PRESSURE REGULATOR VALVE

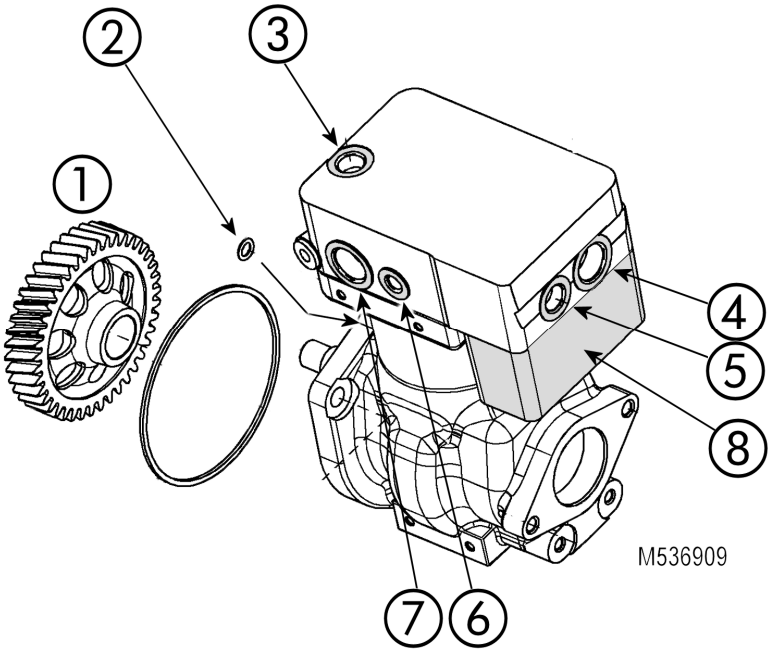
1.	Inlet from Compressor
2.	Exhaust
4	Signal Circuit Supply Port
5	Pressure Adjustment
21	Outlet to System
22	Not Used
23	Signal Port TO Compressor



COMPRESSOR & PORTS

1.	Pump Drive Gear
2	Engine Oil Pressure Supply O'Ring
3	Engine Coolant
4	Air Out to Regulator & System
5.	Engine Coolant line
6.	Signal Line from Pressure Regulator
7.	Air Supply Port from Air Cleaner Pipe
8.	Displacement Chamber

The drive gear may be different for different engine types.



SYSTEM OPERATION

KEY COMPONENTS IN CIRCUIT:

GENERAL OPERATION

The signal line (23) from the pressure regulator isolated from the system pressure by the regulating valve, it will not be charged anytime the system pressure is below 120 psi (8 bar). This will permit the pump to go to the maximum volume output, the displacement chamber will be isolated from the pump output circuit.

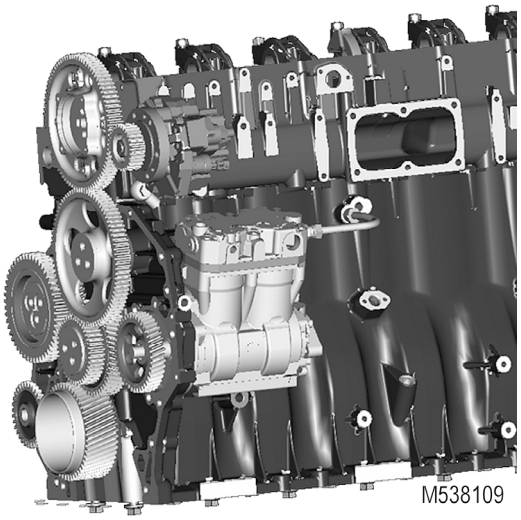
As the pressure in the system increased, it is monitored by the system pressure-regulating valve (5), which is set at 120 psi (8 bar). Once the pressure setting is reached, the valve will open port (4) to the signal line, directing a signal back to the pump. The signal will activate the displacement chamber valve in the cylinder head. At this time the pump will pull and discharge air into the displacement chamber (8), the pump will produce less air volume (approximately 70% less) and require less power to operate.

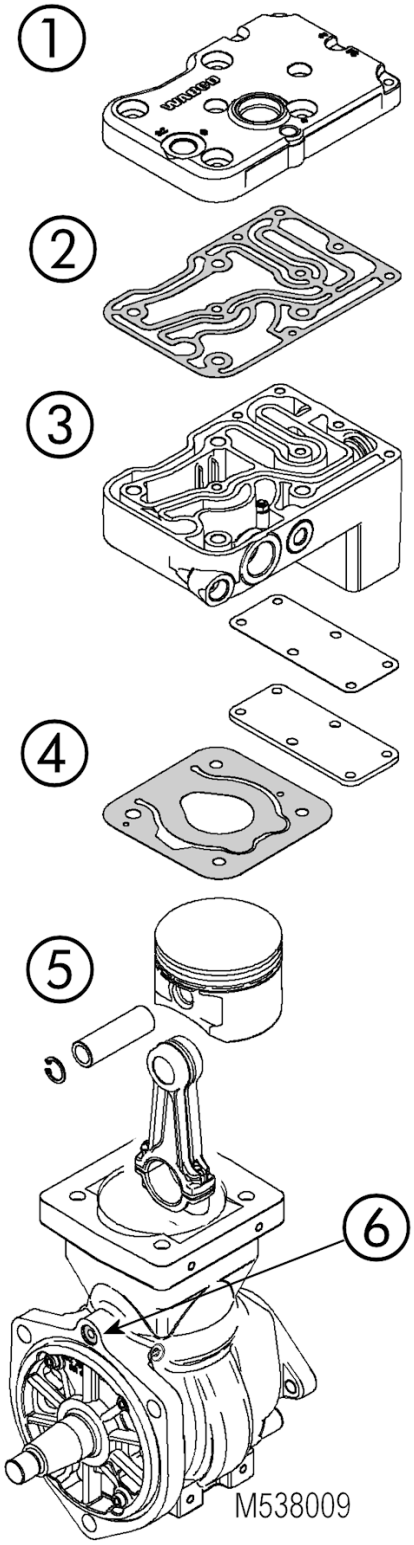
If the system pressure should increase above 150 psi (10 bar), the pressure regulator will open an exhaust valve and discharge air from its bottom port (2).

SYSTEM OPERATION

PUMP OPERATION

1.	Valve Cover
2.	Valve Gasket
3.	Cylinder Head
4.	Head Gasket W/Intake Reed Valve
5.	Crankcase Unit
6.	Engine Supply Port





SYSTEM OPERATION

PUMP OPERATION

LUBRICATION

The engine lubrication system also supplies the compressor crankcase (6) with a continuous flow of flushing oil; the flow is regulated by engine passage size. The pump is supplied through a port just above the drive gear, which is sealed with an o'ring. The crankcase return is free to flow back through ports around the drive gear. Checking or maintaining the proper oil level is not required.

COOLING

The compressor cylinder head is water cooled from the engine cooling system, approximately 1.5 gpm flow. Since this is a water cooled air compressor, it must not be over looked if coolant enters the engine crankcase, or if coolant is blown out of the radiator. Both conditions have been experienced in the trucking industry.

AIR

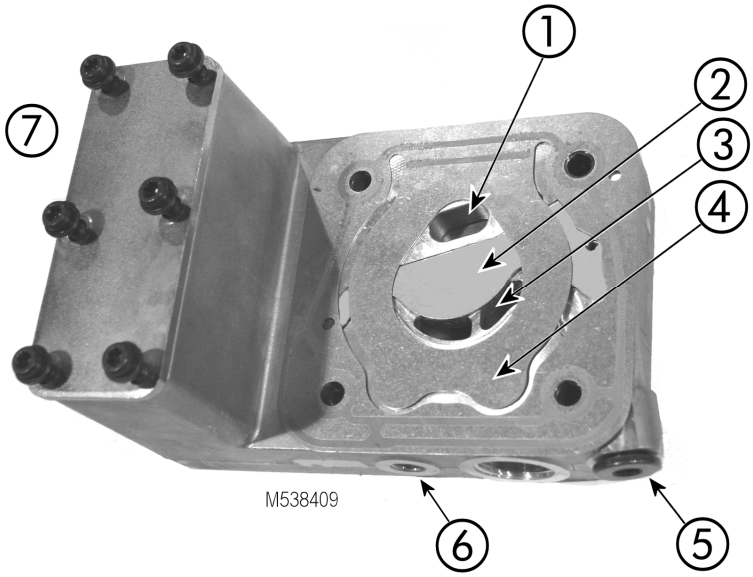
The air pump portion consists of two main components; a non-serviceable crankcase assembly and the cylinder head. The cylinder head is the only component that may require servicing.

The cylinder head includes the air inlet and outlet ports, inlet and outlet reed valves, and the displacement valve (for the displacement chamber). There are no adjustments to be made or checked.

SYSTEM OPERATION

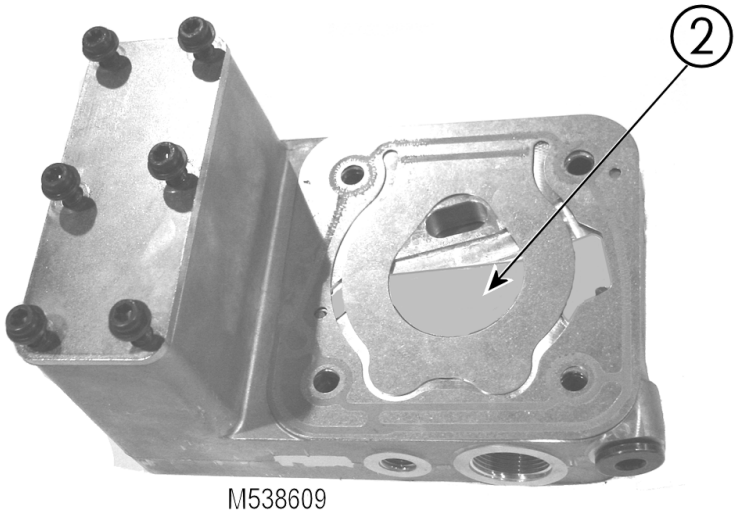
PUMP HEAD OPERATION

DISPLACEMENT CHAMBER VALVE "OPEN"



1.	Piston Exhaust Port to Exhaust Reed Valve
2.	Displacement Reed Valve
3.	Ports to Displacement Chamber
4.	Piston Intake Reed Valve
5.	Displacement Reed Control Spring
6.	Signal Inlet Port
7.	Displacement Chamber

DISPLACEMENT CHAMBER VALVE "CLOSED"



There is no adjustment required for the displacement control piston and spring assembly (5) due to being pilot operated by the signal line.

SYSTEM OPERATION

PUMP HEAD OPERATION

The cylinder head contains various valves for controlling the pumps output.

REED VALVES

The intake reed valve (4) is integral with the cylinder head gasket. It is drawn open by the piston and forced closed by the discharge of the piston.

The exhaust valve (1) uses a series of wavy springs plates to close the reed valve. The springs do not require much effort, the discharge air press will hold the exhaust valve on its seat.

DISPLACEMENT VALVE AND CONTROL

The displacement valve (2) either blocks or opens the passage to the displacement chamber (7). With the valve CLOSED, the total piston output flows out the exhaust valve. When the valve is OPEN, the piston cycles the air in and out of the chamber.

The control piston (5) is spring loaded to hold the valve closed. When the regulating valve directs a signal to the pump, it will force the control piston to open the valve.



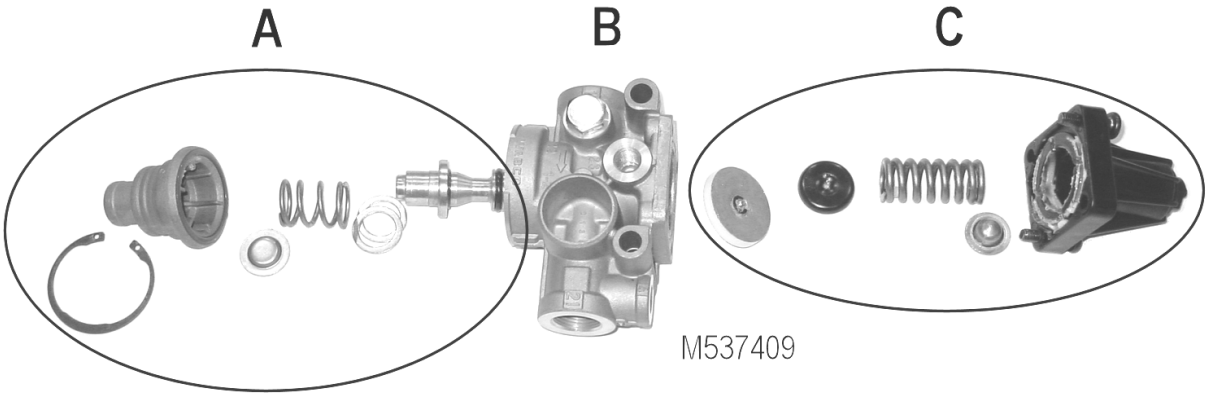
IMPORTANT: If the cylinder head is removed for any reason, be careful not to let the displacement valve (2) fall out of place.

DISPLACEMENT CHAMBER

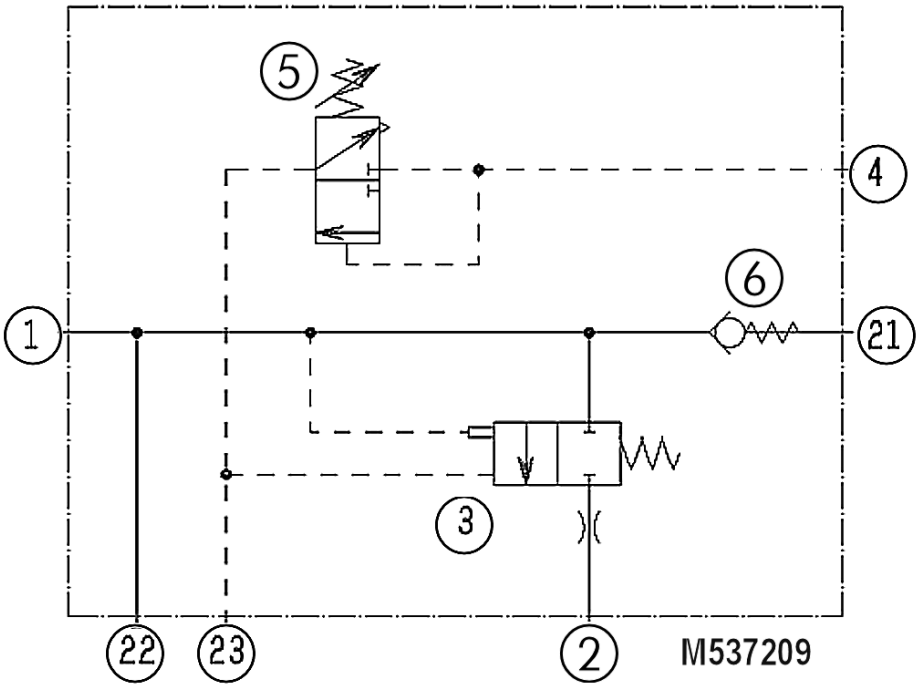
The displacement chamber just works as an accumulator.

SYSTEM OPERATION

PRESSURE REGULATOR OPERATION



A	Relief Valve - Above 150 psi	C	Signal Circuit - 120 psi
B	Main Body		



1.	Supply From Compressor	6.	System Load Check
2.	Exhaust Port	21.	Main Outlet to System
3.	System Relief Valve	22.	Not Used
4.	Signal Circuit Supply Port	23	Signal Port to Compressor
5.	Signal Control Valve		

SYSTEM OPERATION

PRESSURE REGULATOR OPERATION

The pressure regulator incorporates two separate relief valves that are not interactive.

Signal Circuit

The signal circuit uses an adjustable spring to set the opening pressure of the Valve (5). The system pressure is monitor through a pilot line to the non-spring end of the valve. When the pressure builds above 120 psi (8 bar), the valve will be forced against the spring, opening a passage way between port (4) and port (23). The signal is directed to the pump to control the pump recirculation valve, reducing the pump's output.

Main Relief, Exhaust

The signal circuit is used to reduce the volume of air that the compressor puts out. It does not shut it down; because of this the pressure will continue to increase (at a slower rate) above the signal circuit setting. When the pressure increases above 150 psi (10 bar) the relief will open. This will open a passage between port (1) and port (3), exhausting the excess air out port (3) until the pressure is once again below the setting point.

PRESSURE TEST

To test the relief setting, a gauge should be connected into one of the five service outlet port and monitor the pressure.

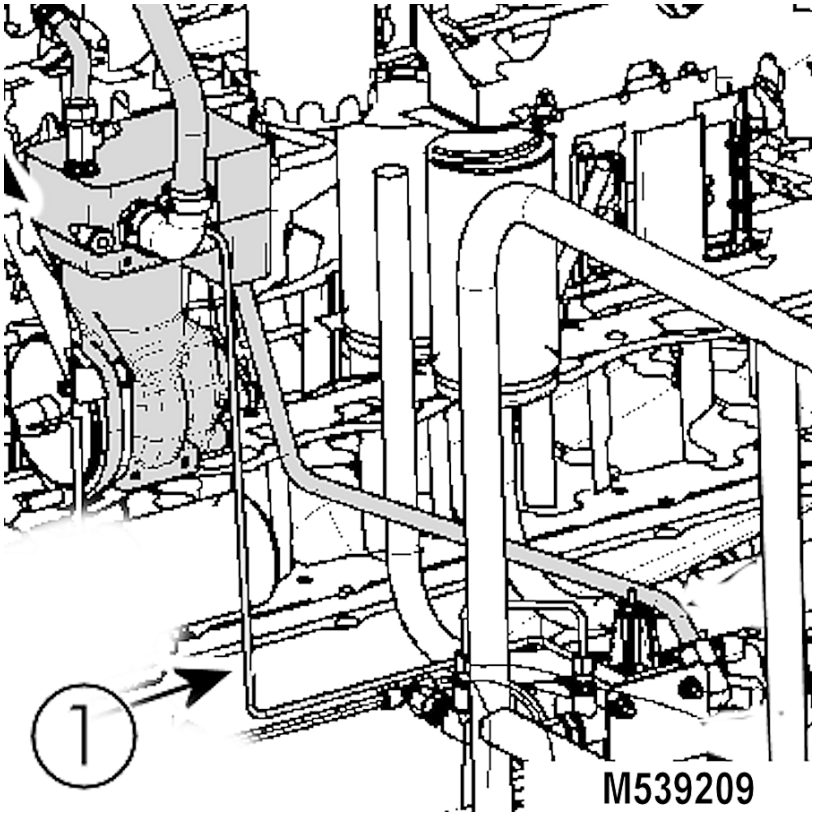
SYSTEM TESTING PROCEDURES

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2 SYSTEM EXHAUST PRESSURE SETTING ---------- 20

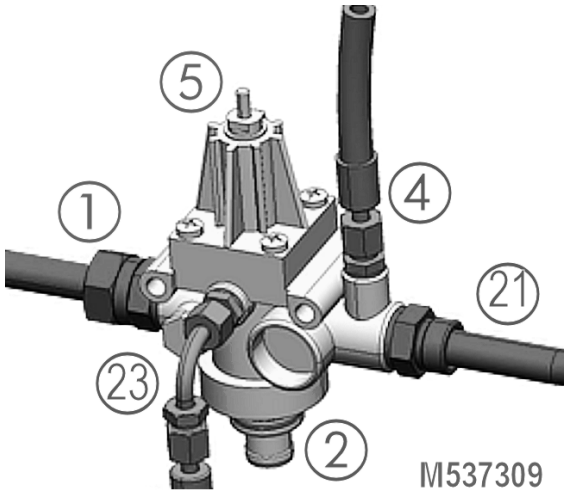
1 SIGNAL PRESSURE SETTING

SIGNAL LINE



1.	Signal Line

REGULATOR



23.	Signal Line

1 SIGNAL PRESSURE SETTING

This test is used to determine the pressure that a signal is directed to the compressor to open the displacement chamber valve. The signal line should be charged whenever the pressure is above 120 psi (8 bar). The following test will be used to set and verify the regulator spring setting.

TEST PROCEDURE

1. Remove the signal line either at the pump or at the pressure regulator and install a tee fitting. Attach a 20 bar (300 psi) gauge to the tee fitting so that the signal pressure may be monitored.
2. Attach a 20 bar (300 psi) gauge to one of the service outlet couplers so that the system pressure can be monitored.
3. Start the engine and let the pressure in the system build up.

TEST RESULTS

- The signal line gauge should be reading 0 psi (0 bar) anytime that the system pressure is below 120 psi (8 bar).
- When the system pressure exceeds 120 psi (8 bar) the signal line pressure should jump to equal system pressure.

ADJUSTMENT

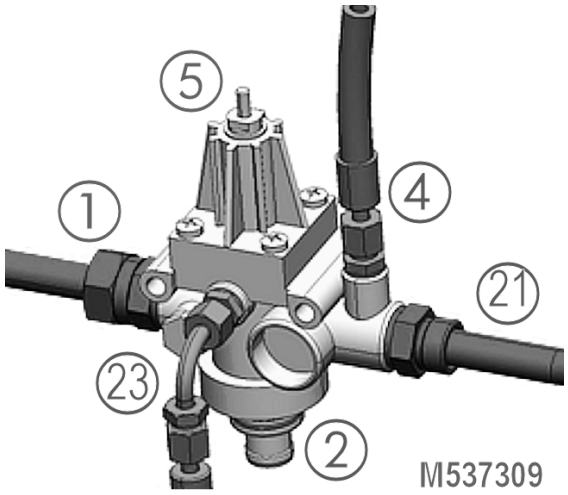
Adjust the regulator at point (5) so that when the system pressure is 120±10 psi, the signal line pressure goes from 0 psi to system pressure.

TOOLS REQUIRED

FITTING	CNH NUMBER	PARKER HANNIFIN
Diagnostic Fitting	190177A1	PD34BTL
Tee Fitting		4-R6LO-S

2 SYSTEM EXHAUST PRESSURE SETTING

REGULATOR



2.	Exhaust Port

2 SYSTEM EXHAUST PRESSURE SETTING

This test is used to determine the maximum pressure the system can build, when the relief valve opens, and exhausting of the air takes place. The relief valve should open to exhaust at approximately 150±10 (10±1 bar). The following test will verify the relief spring setting.

TEST PROCEDURE

1. Attach a 20 bar (300 psi) gauge to one of the service outlet couplers so that the system pressure can be monitored.
2. Start the engine and let the pressure in the system build up.

TEST RESULTS

- At 150±10 (10±1 bar) the relief should open, exhausting air through port (2).

ADJUSTMENT

There is NO adjustment available, if the maximum system pressure is low or high, a new regulator valve should be installed.

CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 - 9120 SERIES AXIAL-FLOW COMBINE



SECTION 25 TRANSMISSION & FINAL DRIVES

Form 5175 1/2010

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Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember.



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

GENERAL INFORMATION

The AFX series combine utilizes a constant mesh four speed transmission that is electrical shifted and incorporates individual service brakes, axle differential lock and parking brake. A hydrostatic motor that provides infinite forward and reverse speed within each transmission speed drives the transmission.

The electrical shifting provides several advantages:

- With no mechanical linkages, noise entering the operator's environment is reduced.
- The transmission will always be IN or OUT of gear, not in-between.
- The clashing of gears when shifting is eliminated.
- Operator's efforts are reduced

The propulsion system is available in three configurations:

7120 Standard Propulsion
Iincorporates a 125 cc hydrostatic pump (electrically limited to 117 cc) and 107 cc motor, transmission with proper reduction and a bull gear final drive.

8120 - 9120 Standard Heavy Duty Propulsion (Optional on 7120)
Incorporates a 125 cc hydrostatic pump and 125 cc motor, transmission with proper reduction and planetary final drives.

Tracks
Tracks are available for the 8120-9120 machines as a dealer install unit. The tracks system requires different final drives and system configurations.

REMEMBER The heavy duty system must be used on the 7120 when installing the dual wheel attachment, 12 row corn header, working on hill sides, or cutting rice.

SPECIFICATIONS

Ground speed will vary with different tire and Power Guide Axle combinations. Following is the transmission ratios and examples for the ground speed.

Transmission Speed	Ratio
1st.	9.83
2nd.	5.40
3rd.	4.13
4th.	2.13
Differential	
Planetary & Tracks	20/61
Bull Gear	16/71
Final Drive Ratio	
Planetary	1/13.09
Bull Gear	11/111
Bull Gear (Tracks)	16/107

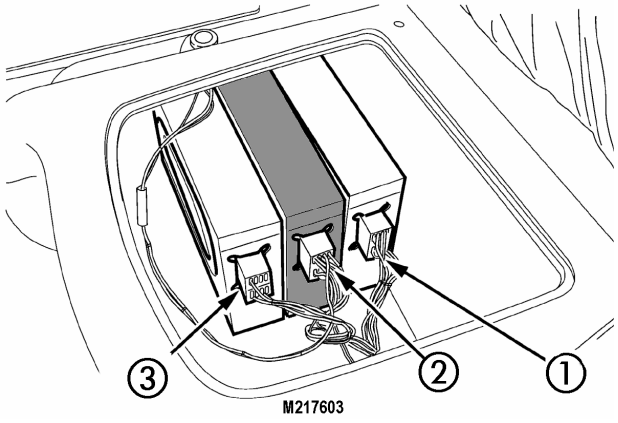
Ground speed when equipped with 900/60R32 tires, speeds are approximate for examples only. Note power guide axle operating position.

Gear	PGA OFF	PGA Optional Low Torque Setting	PGA Standard or High Torque Setting
1st.	4.4	3.7	3.3
2nd.	7.9	6.1	5.0
3rd.	10.4	7.5	5.9
4th.	20.1	N/A	N/A

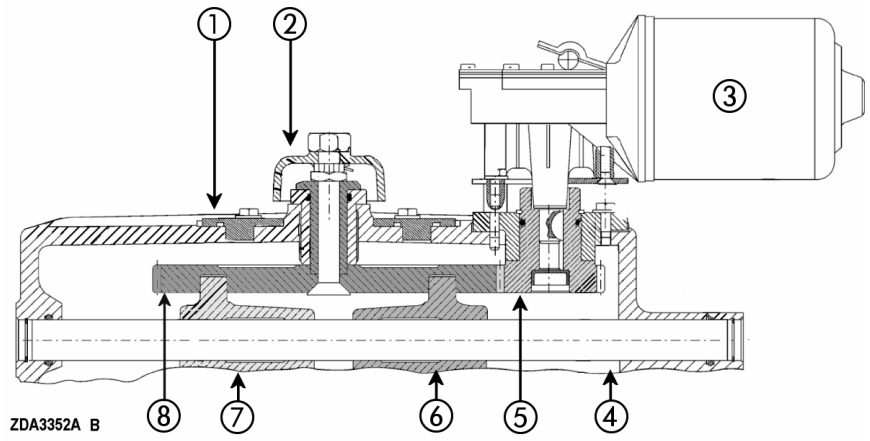
TRANSMISSION CONTROLS



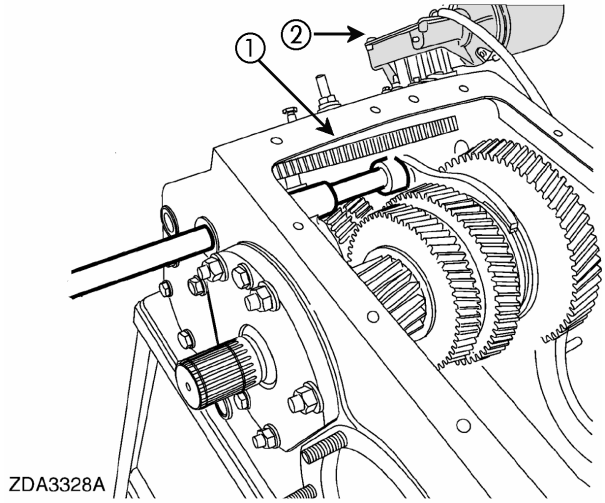
1. Propulsion Lever, NEUTRAL Switch
2. Gearshift Selector Control



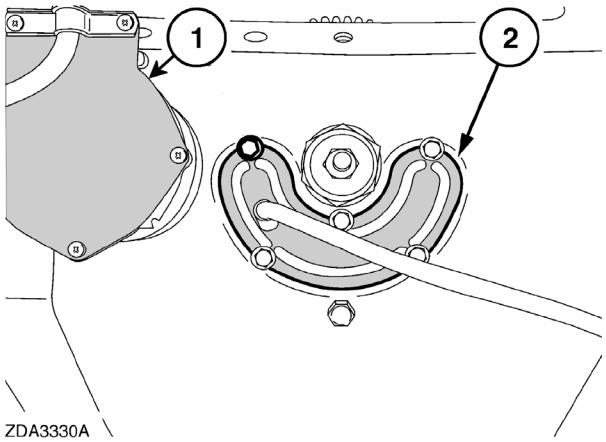
CCMs



1	Transmission Shift Position Sensor
2	Indicator Plate
3	Shift Motor
4	Shift Rail
5	Drive Pinion
6	1st /2nd Shift Fork
7	3rd /4th Shift Fork
8	Shift Disc



1. Shift Disc
2. Shift Motor



1. Shift Motor
2. Transmission Shift Position Sensor

TRANSMISSION CONTROLS

GEARSHIFT SELECTOR SWITCH, S-24

The gearshift selector switch gives the operator the ability to create a shift signal. The switch has five position, NEUTRAL, FIRST, SECOND, THIRD and FOURTH speeds. The switch directs a voltage signal to the RHM (right hand module).

Located: Right Hand Console

NEUTRAL SWITCH S-22, (PROPULSION LEVER (MFH))

The propulsion lever provides a signal to the CCM2 to verify the lever is in the NEUTRAL position.

Located: Right Hand Console

RIGHT HAND MODULE (RHM)

The RHM converts the operator input from the gearshift selection control and sends it out on the data buss.

Location: Right Hand Console

TRANSMISSION SHIFT POSITION SENSOR, B-37

The transmission position sensor is a group of five sensors molded into a common base that monitors the position of the shifting disc, providing a position signal to the CCM 2 module. There is one sensor for each transmission speed and one for NEUTRAL.

Location: Top rear of the transmission

CCM 2 (CHASSIS CONTROL MODULE)

CCM 2 evaluates the signals from the RHM and transmission position sensor and controls the electrical power supply to the transmission shift motor and park brake.

Location: Under the instructor's seat

GROUND SPEED SENSOR, B-17

The ground speed sensor is continually providing a transmission output speed to the CCM2. The CCM2 determines the theoretical ground speed and places a message on the data bus for all combine systems to use. The speed is continually displayed on the display in the upper left hand cell.

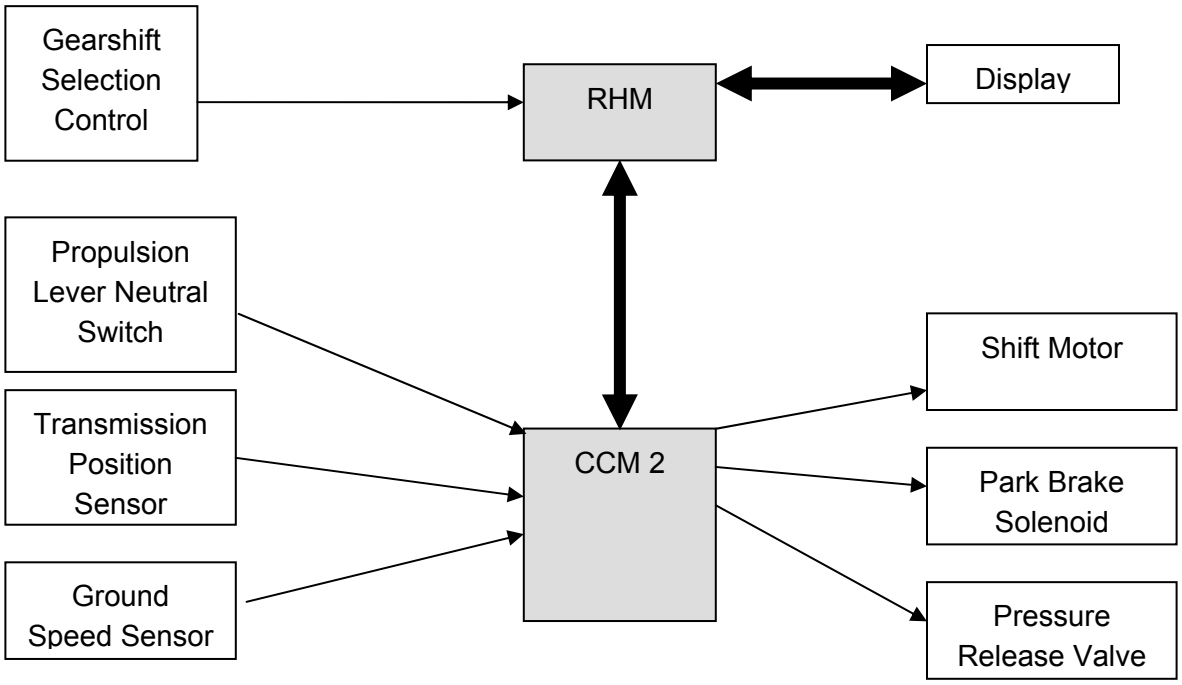
Location: Top transmission cover

PRESSURE RELEASE SOLENOID, L-05

The pressure release solenoid is used to connect the hydrostat "A" & "B" port together to release any transmission lockup during a shift.

Location: In the ground drive motor

TRANSMISSION INFORMATION



TRANSMISSION INFORMATION

The transmission is shifted as follows:

MACHINE STANDING STILL

Sequence of Events

1. The operator will rotate the gearshift selector switch to a desired speed.
2. The CCM2 will monitor the position of the NEUTRAL switch, to verify the propulsion lever is in the NEUTRAL position.
3. The CCM2 monitors and continually is placing a ground speed signal on the data bus. If the ground speed is at ZERO the CCM2 will activate the park brake and places a message on the data bus for the display to illuminate the park brake lamp.
4. The CCM2 will activate the ground drive motor Pressure Release solenoid, connecting the two work ports of the motor together, (ports A and B). This permits the transmission-input shaft to rotate freely.
5. The CCM2 monitors the current position of the transmission shift cam through the Transmission Position sensor. Using this information the CCM2 determines which direction to rotate the shift motor. CCM2 directs power to the shift motor.
6. Transmission cam rotation is monitored by the CCM 2 using the transmission position sensor located on the transmission housing.
7. The CCM2 places a message on the data bus as to the current position of the transmission shift cam. The display will show the shift cam's position in the upper left corner.
8. When the CCM 2 senses that the transmission has changed to the requested range the electrical power to the shift motor is discontinued.
9. The CCM2 will release the ground drive motor's pressure release solenoid.
10. The CCM2 will activate the park brake release solenoid and sends a message to de-activate the Park Brake indicator

TRANSMISSION INFORMATION

MACHINE IS NOT STANDING STILL

Propulsion Lever NOT In Neutral

When the propulsion lever is in the FORWARD or REVERSE position and the operator rotates the gearshift selector switch a signal is directed from the RHM to the CCM 2 requesting that the transmission be shifted to the requested speed. The CCM 2 will verify that the propulsion lever is in the NEUTRAL position, when it is found that the propulsion lever is NOT in the NEUTRAL position it will NOT direct electrical power to the transmission shift motor. The system will wait till the operator places the propulsion lever into the NEUTRAL position and ground speed is at ZERO, at which time the above mentioned shifting process will take place.

The CCM2 will place a message on the data bus for the display to display a message to the operator “To Move The Propulsion Handle to NEUTRAL”

TRANSMISSION ELECTRONICS

TRANSMISSION SHIFTING

REFERENCE MATERIAL:

Electrical schematic frame #7, 8, 9, 25, 27

KEY COMPONENTS:

Gearshift Selection Control S-24, Neutral Switch S-22, Transmission Position Sensor B-37, Shift Motor M-02, Park Brake Solenoid L-10, Park Pressure Sensor B-53, Pressure Release Solenoid L-5, Ground Speed Sensor B-17, RHM, and CCM2

OPERATION:

The **gear selector** switch S-24 is supplied 5V at pin 3 from the RHM connector X026 terminal 16 and a ground at pin 1 from connector X027 terminal 6. Pin 2 provides five different voltage levels to the RHM connector X027 terminal 11, depending on the position of the switch. When monitoring the switch on the display's diagnostic screens the voltage will vary from low in 1st speed to high in 4th speed. When the voltage level changes the RHM places a message on the data bus to perform a shift.

CCM2 monitors the **NEUTRAL** (S-22) switch position. The neutral switch contains two sets of contacts, in this operation the N/O set is used (pin 1 to pin 3). The neutral switch is supplied 12V from fuse F-48 at connector X059 terminal 3. When the MFH is in the NEUTRAL position the neutral switch is open, NO voltage signal to the CCM2.

CCM2 monitors the ground speed. The **ground speed** sensor B-17 is supplied with a signal wire from the CCM2 connector X017 terminal J3-14 and a ground from the connector X017 terminal J3-18.

The voltage from the CCM2 connector X016 terminal J2-15 to the **Park Brake** solenoid L-10 connector X457 terminal 1 is stopped. A message will also be placed on the data buss for the display to illuminate the PARK lamp.

The CCM2 will direct 12V out connector X017 terminal J3-15 to the Pressure Release Solenoid (L-05) connector X092 terminal A to power the solenoid to balance the ground drive motor work ports A and B. The solenoid is supplied a chassis ground from the terminal B to the ground point 2.

TRANSMISSION ELECTRONICS

TRANSMISSION SHIFTING, CON'T

The **transmission position sensor** incorporates five separate sensors. It is supplied 8V from the CCM2 connector X017 terminal J3-27, 28, 36, 37 and 38 for speed positions 4th, N, 1st, 2nd, and 3rd respectively. The sensor is supplied a common ground from connector X017 terminal J3-17. The sensors are bleeding its supply voltage off to the ground when it is not sensing metal on the shift cam. One sensor will always be sensing metal; its voltage will be high. Typical sensor readings would be ~6.8V or ~2.8V.

The **shift motor** (M-02) is supplied power from the CCM2 in one of two different pins, this is due to the motor requiring to be run in two directions, CW and CCW. The CCM2 may be directing power from connector X017 terminal J3-19 and 20 in one direction while supplying a ground at terminal J3-39 and 40. These pins will be reversed to reverse the motor direction. The motor incorporates a thermal circuit breaker to protect the motor from over heating.

REMEMBER: If the transmission position sensor fails, and the operator requests a gear change the CCM2 will rotate the shift motor fully CW or CCW until it finds a sensor or till the cam bottoms out. In most cases the operator will only be able to access 1ST or 4th speeds. In this case the motor would remain powered for 60 seconds or until a draw of 28 amps is reached.

REMEMBER: If the transmission position sensor loses a signal, the transmission may make a shift on it own the next time the MFH is placed in the NEUTRAL position.

REMEMBER: If the transmission position sensor signal is lost or is sending a signal that the transmission is in multiple gears the Power Guide Axle will be disengaged.

TRANSMISSION ELECTRONICS

GROUND SPEED SENSOR

REFERENCE MATERIAL:

Electrical schematic frame # 9

KEY COMPONENTS:

Ground Speed Sensor B-17, CCM2

OPERATION:

The **ground speed** sensor is supplied with a signal wire from the CCM2 connector X017 terminal J3-14 and a ground from the connector X017 terminal J3-18.

TESTING:

Using the display's diagnostic screen monitor the signal voltage as the combine begins to creep forward or reverse, the voltage should toggle between low and high voltage.

CALIBRATION:

Since the ground speed is used by many combine functions:

Yield Monitor
Ground Speed Display
Acre Counter
Reel To Ground Speed
Feeder To Ground Speed, etc.

the system must be calibrated for accuracy, follow the calibrating instructions that are provided at: MAIN>TOOLBOX>DRIVES>TIRE RADIUS.

When installing the sensor, turn it in until it makes contact with the gear teeth, back it out 1.5 turns, and tighten the locking nut.

DIAGNOSTICS

DIAGNOSTICS

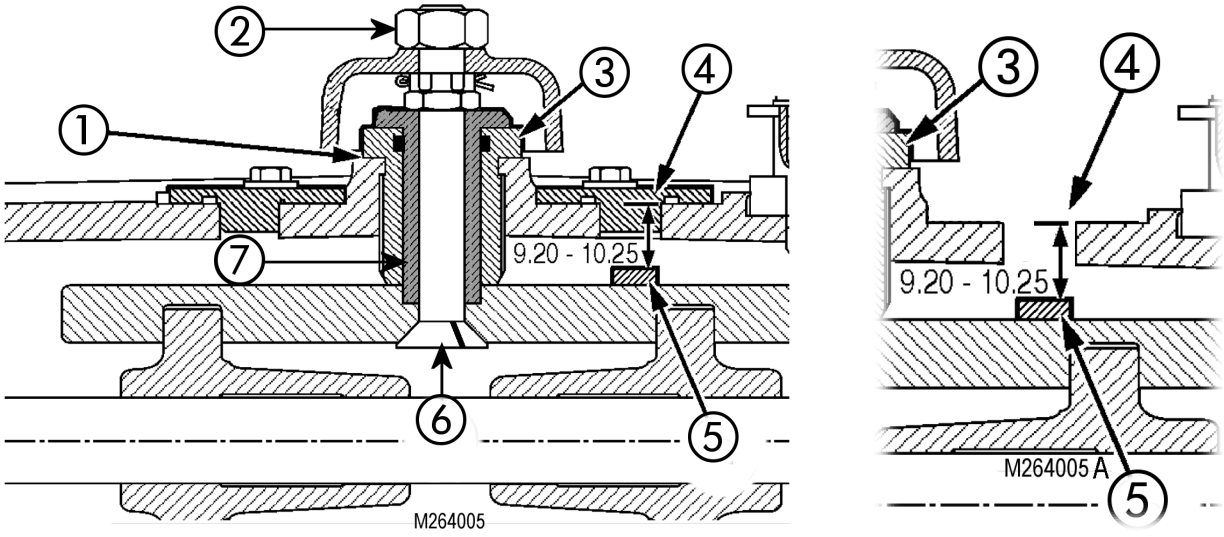
When diagnosing an operational problem proceed by:

- Monitoring the display screen for any “Messages” that may be presented
- Reviewing all error codes that may have been activated
- Perform required “Calibrations”
  - MFH Neutral
  - Ground Speed Sensor

Then proceed to the display’s diagnostic screen and monitor the controls and sensors as required. Refer to the sections 56 & 57 for basics on how to use the diagnostic screens.

TRANSMISSION SHIFT POSITION SENSOR ADJUSTMENT

The distance between the transmission position sensor and the shift cam must be adjusted and maintained for the position sensor to properly determine the cam position. The distance between the sensor mounting and the cam target must be approximately 9.2mm (0.362”) to 10.2mm (0.404”).

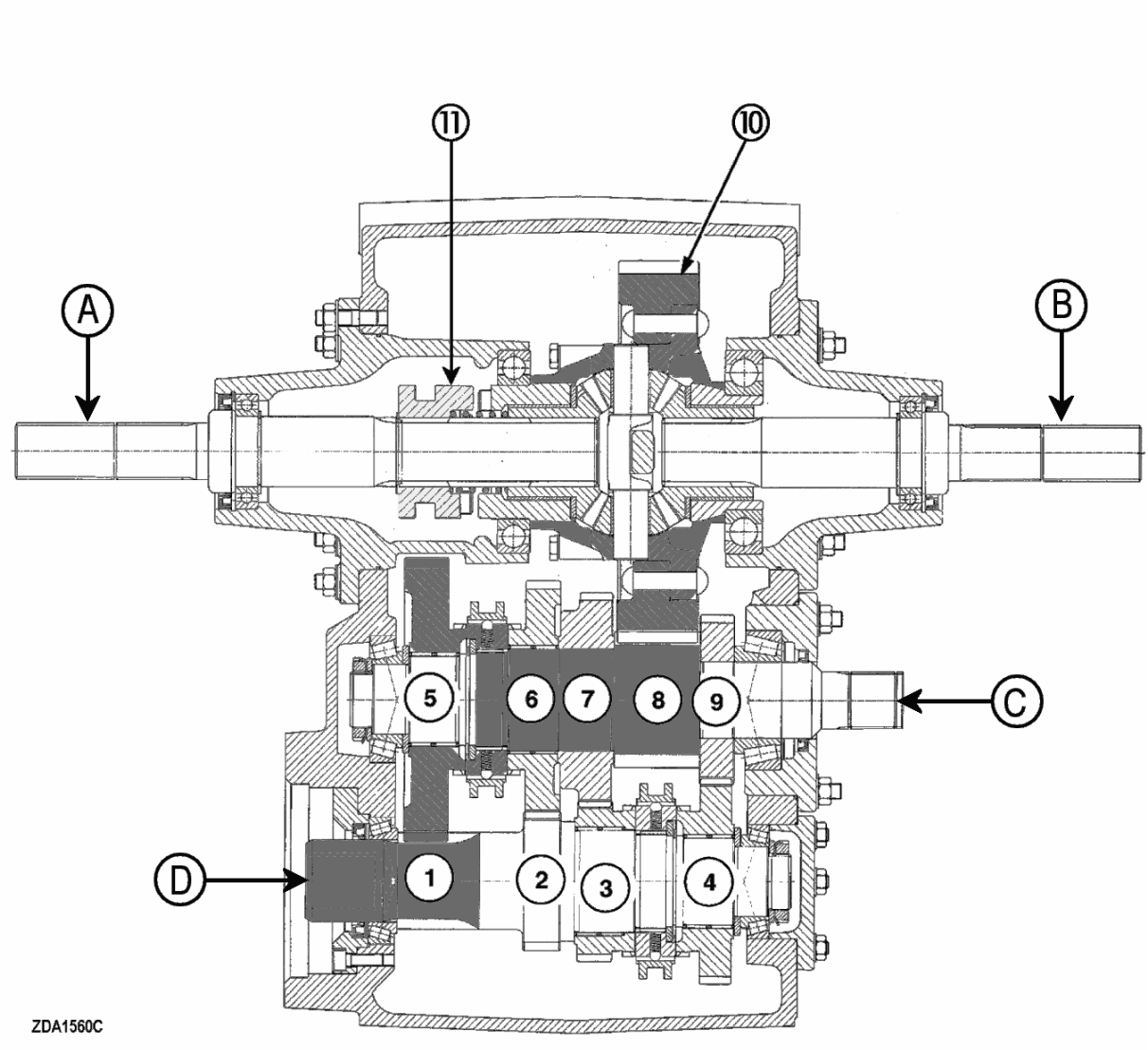


1.	Shim Position 937638	5.	Cam Target Pin
2.	Gear Indicator Nut	6.	Cam Retaining Bolt and Indexing Lug
3.	Adjustment Nut	7.	Pivot Bushing
4.	Sensor Seat		

1. Remove the sensor (4).
2. Using a depth micrometer or suitable measuring tool, measure the distance from the top of the sensor mounting pad (4) to the top of the target pin (5).
3. Add or remove shim (1) as required to the base of the adjusting nut (3) to position the target pin 9.2mm (0.362”) and 10.2mm (0.404”) from the sensor mounting pad.

IMPORTANT: When reassembling the adjusting nut (3) with shims and cam retaining bolt, MAKE SURE the pivot busing (7) is properly seated in the cam and the retaining bolt’s indexing lug (6) is properly seated into the cam.

TRANSMISSION COMPONENTS



The above example is in 1st gear speed.

1	Input 1st Gear	7	Countershaft 3rd	A	Left Axle Shaft
2	Input 2nd Gear	8	Countershaft Output Gear	B	Right Axle Shaft
3	Input 3rd Gear	9	Countershaft 4th	C	Countershaft
4	Input 4th Gear	10	Differential	D	Input Shaft
5	Countershaft 1st	11	Differential Lock		
6	Countershaft 2nd				

GEAR USAGE

1st Speed	1-5-8-10	2nd Speed	2-6-8-10
3rd Speed	3-7-8-10	4th Speed	4-9-8-10

TRANSMISSION COMPONENTS

There are two different transmission used, they are both identical with the exception of the differential ratio (standard 16/71 verses heavy duty 20/61). The heavy duty propulsion system uses planetary final drive that require a faster output speed from the transmission to provide the same ground speed as the standard final drives.

TRANSMISSION INPUT SHAFT

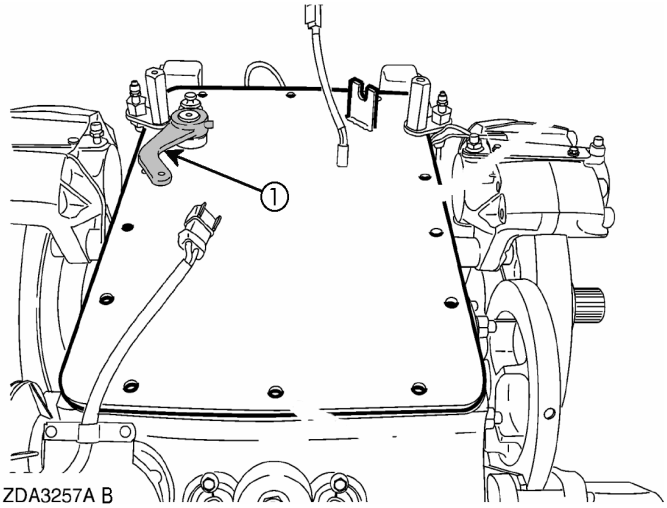
The input shaft has machined gears for 1st and 2nd drivers and a splined blocker ring and a detented shift collar for 3rd and 4th speeds. The shaft is carried on a pair of tapered bearings.

COUNTERSHAFT

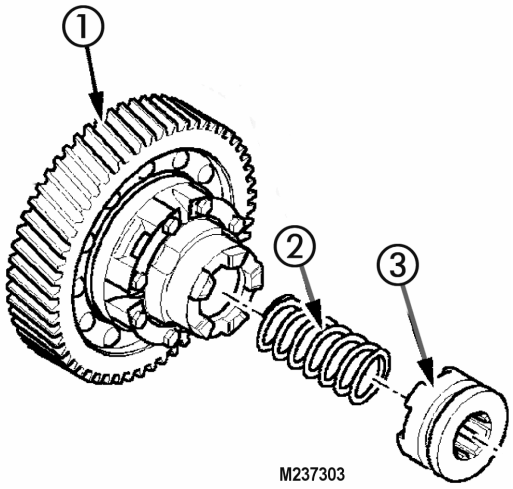
The counter shaft has a machined gear for the differential driver (8), a splined blocker ring and a detented shift collar for 1st and 2nd speeds. 3rd and 4th speeds use a splined gear to the shaft.

DIFFERENTIAL AND DIFFERENTIAL LOCK (OPTIONAL)

The differential is common type and may incorporating an optional spring dis-engaged dog type differential lock collar. The differential lock is engaged by the operator pressing on the differential lock pedal located on the left-hand side of the steering column.



1. Differential Lock Lever



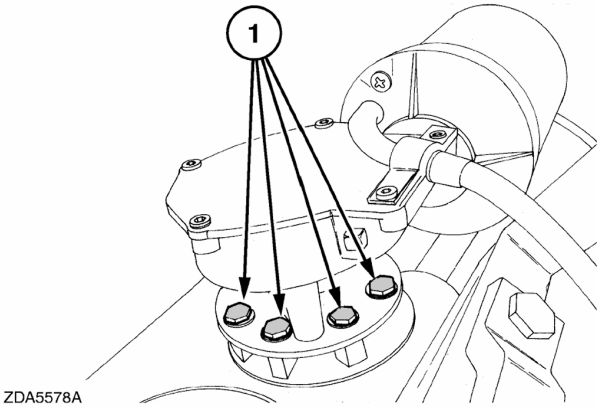
1. Differential Driven Gear
2. Differential Lock Release Spring
3. Differential Lock Engaged Clutch

IMPORTANT: The differential lock should be engaged before the wheels begin to spin. Once one of the main drive wheels begin to spin return the propulsion lever back to the NEUTRAL zone before engaging the differential lock.

TRANSMISSION OPERATION

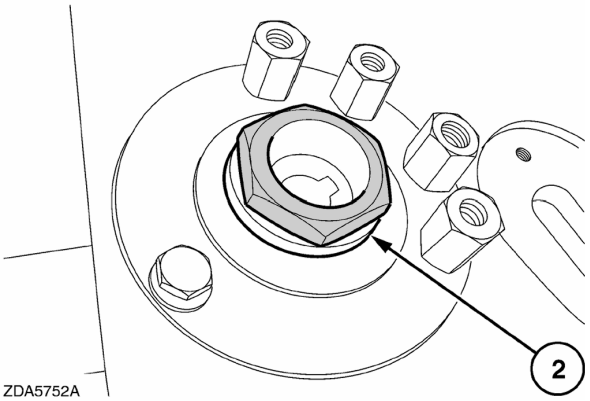
MANUAL SHIFT

If a problem should exists that prevents shifting the transmission electronically it may be shifted manually.



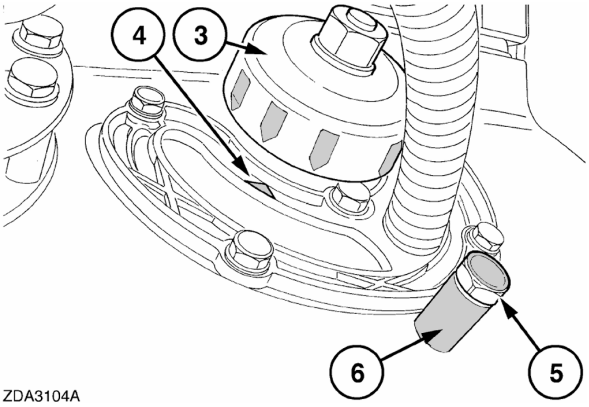
1. Park the combine on level surface (if possible).
2. Raise the header and engage the header safety latch. Stop the engine and **LEAVE** key switch in the **OFF** position.
3. Block the wheels adequately to prevent the combine from rolling.
4. Loosen four bolts (1) and remove the electric motor.

5. Use proper tools to turn nut (2) underneath the electric motor.



Wait a Minute... A special tool may be purchased through the parts system to manually shift the transmission with having to remove the shift motor. First unplug the motor and use tool number 84431038 in this step.

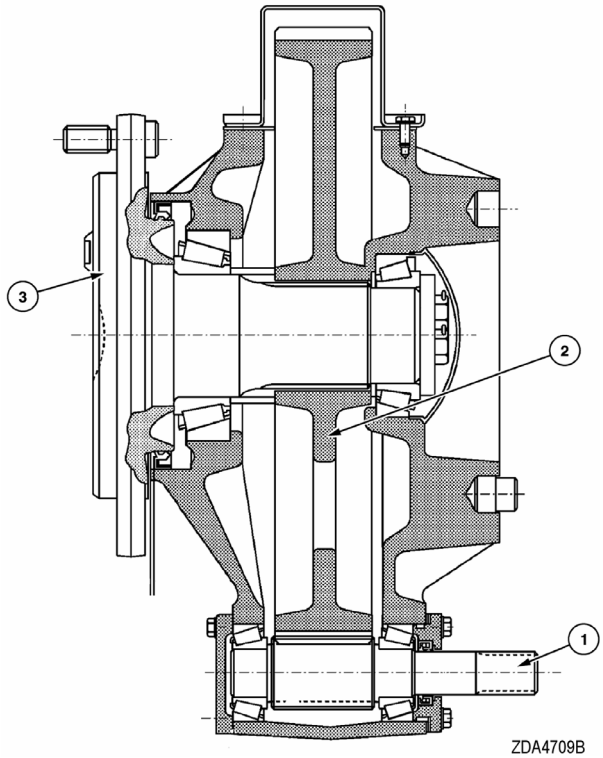
6. To check if a gear is selected, a gear number on indicator ring (3) should align with arrow (4) on the gearshift sensor.
7. To lock the manually selected gear, remove bolt (5) and remove bushing (6).
8. Install bolt (5) (without the bushing), to lock the selected gear (the bolt needs to align with a hole in the shift disc).



IMPORTANT: If the bolt (5) is not easy to turn in the gearbox, rotate nut 2 (step 5) until the bolt lines up with the shift disc.

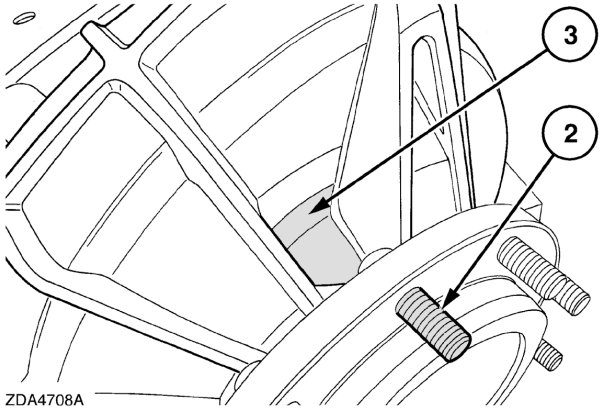
FINAL DRIVES

STANDARD FINAL DRIVE (BULL GEAR FINAL DRIVE)



Standard Final Drive
Ratio =
Wheel = 11:111
Track = 16:107

1	Input Shaft / Gear
2	Bull Gear
3	Output Shaft



Wheel Stud Replacement

2	Wheel Stud
3	Maintenance Pocket

The final drive is available in a Standard and Heavy duty version. The standard final drive is used on the 7120 combine as standard equipment. The heavy duty version (which is the planetary final drive which is standard on the 81-9120 machines) is recommended to be used when:

- Installing the dual wheel package
- Harvesting rice
- Working on hill sides
- Installing a 12 row corn head

IMPORTANT: Due to transmission ratios do not replace the standard final drives with heavy duty finial drive, ground speed will be reduced.

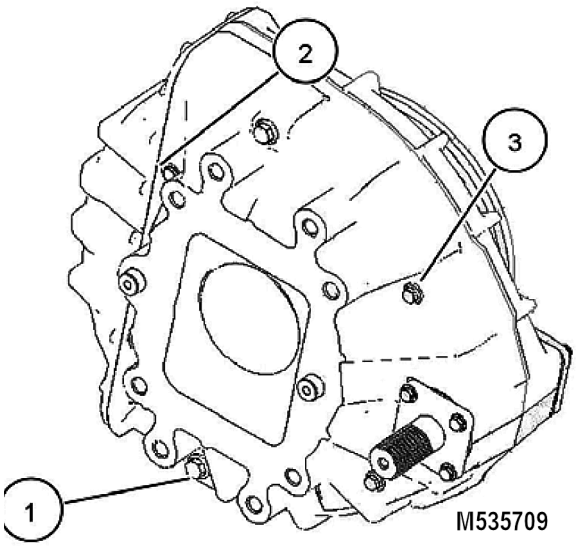
FINAL DRIVES

STANDARD FINAL DRIVE (BULL GEAR FINAL DRIVE)

When installing the final drives on a unit equipped with tracks, the finial drive case breather may require relocating to prevent fluid from blowing out. The final drive will be shipped with a standard open breather installed in a M24 port, this breather would be removed and the pressure breather 87282088 installed in the front M18 port (2). The M24 port would be plugged with plug 150006 and washer 220025 which may or may not be in the kit.

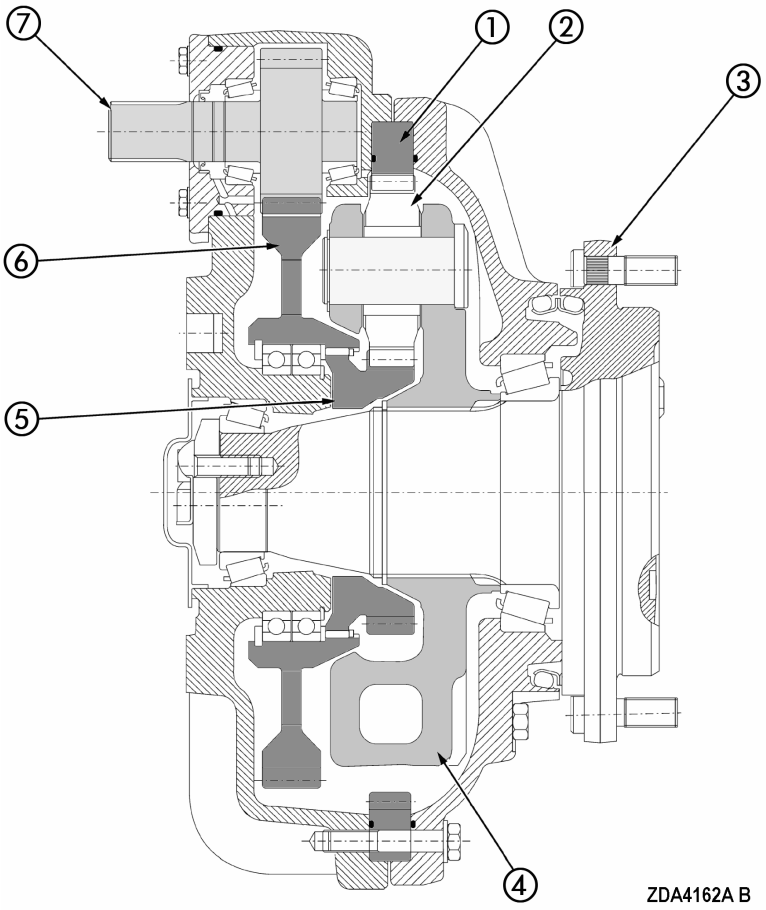
The rear M18 port (3) will be used for fluid level checking.

1.	Fluid Drain
2.	18 mm Port for Pressure Breather
3.	18 mm Fluid Fill Port



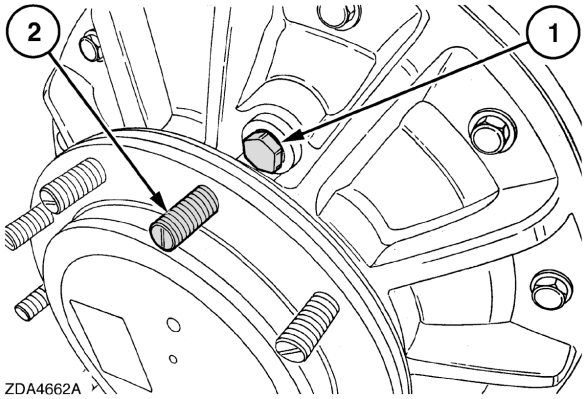
FINAL DRIVES

HEAVY DUTY FINAL DRIVE (PLANETARY FINAL DRIVE)



Ratio = 1:13

1	Fixed Ring Gear
2	Planet Gear
3	Output Shaft
4	Planetary Carrier
5	Sun Gear (Small Gear)
6	Sun Gear (Bull Gear)
7	Input Shaft / Gear



Wheel Stud Replacement

1.	Maintenance Plug, remove to replace stud
2	Wheel Stud

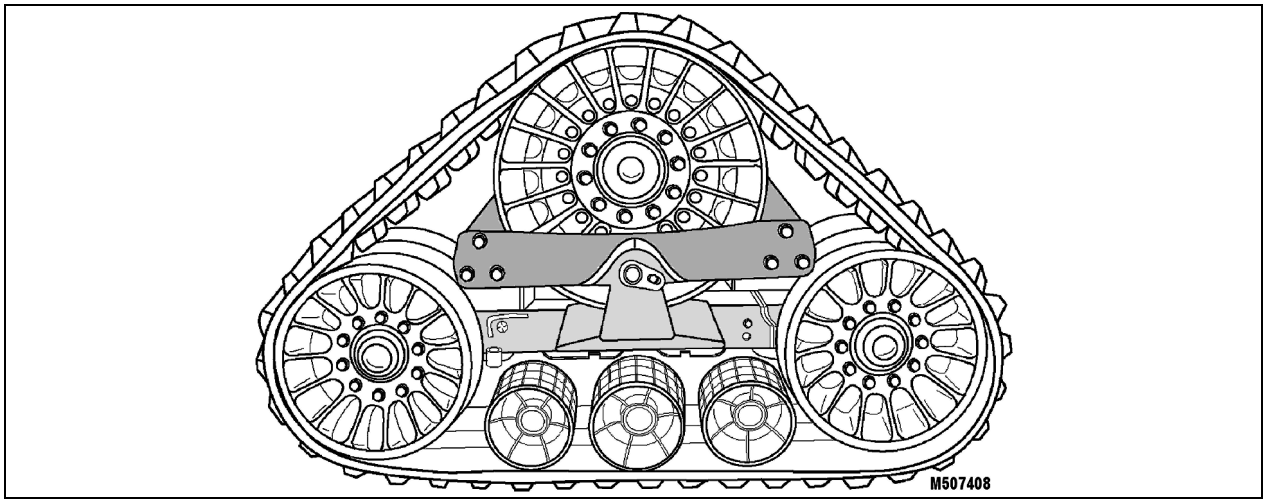
An axle extension may be placed between the axle and the final drive and/or a wheel spacer between the wheel and final drive to achieve the required wheel spacing.

IMPORTANT: The wheel bolts that are used in the 2500's and 7120 – 9120's are both 22mm bolts; BUT have a different thread type and must not be interchanged.

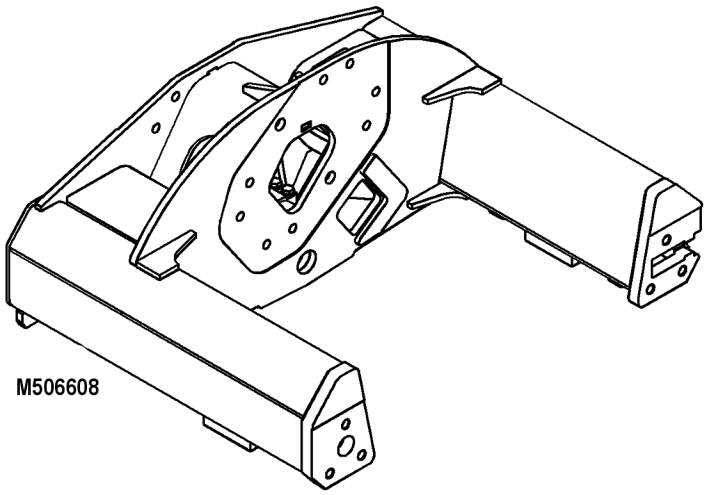
TRACKS

COMPONENTS

The undercarriage components are the same basic components as used on the STX tractors with the exception of the Main Mounting Frame, which is unique to the combine.



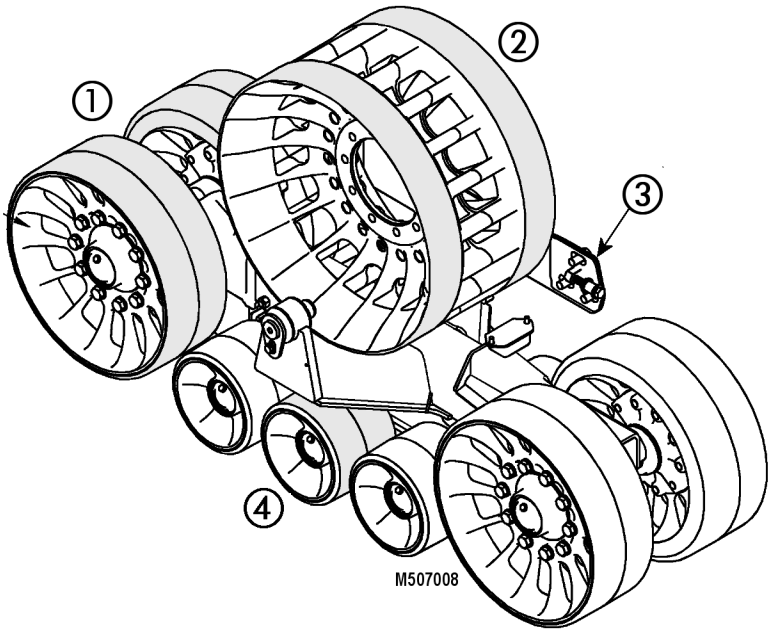
MAIN MOUNTING FRAME



TRACKS

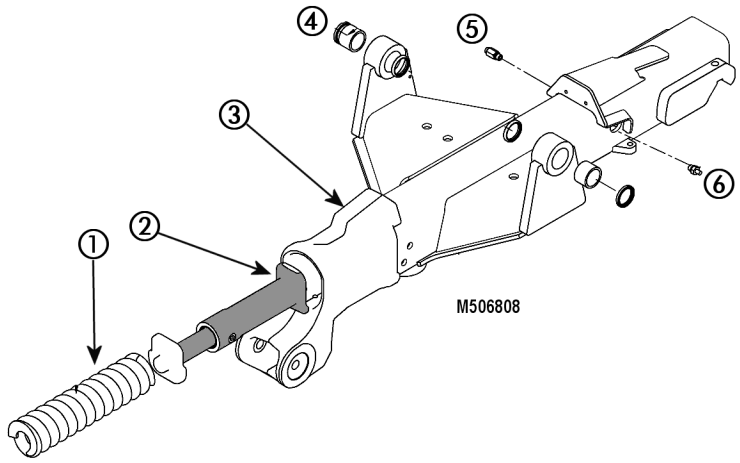
COMPONENTS

WHEEL COMPONENTS



1.	Idler Wheels
2.	Main Drive Wheel
3.	Track Alignment Adjustment
4.	Roller Wheels

LOWER MOUNTING FRAME & TENSIONING ASSEMBLY

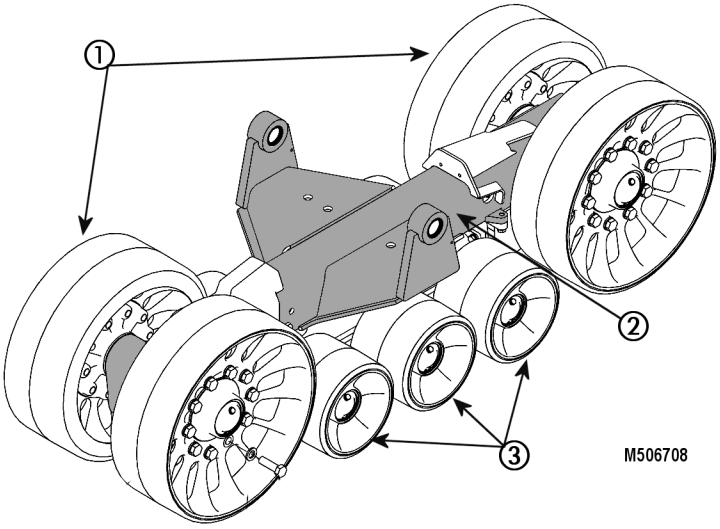


1.	Tensioning Damping Spring
2.	Tensioning Cylinder
3.	Mounting Frame
4.	Mounting Bushings
5.	Tension Pressure Check
6.	Tension Pressure Release

TRACKS

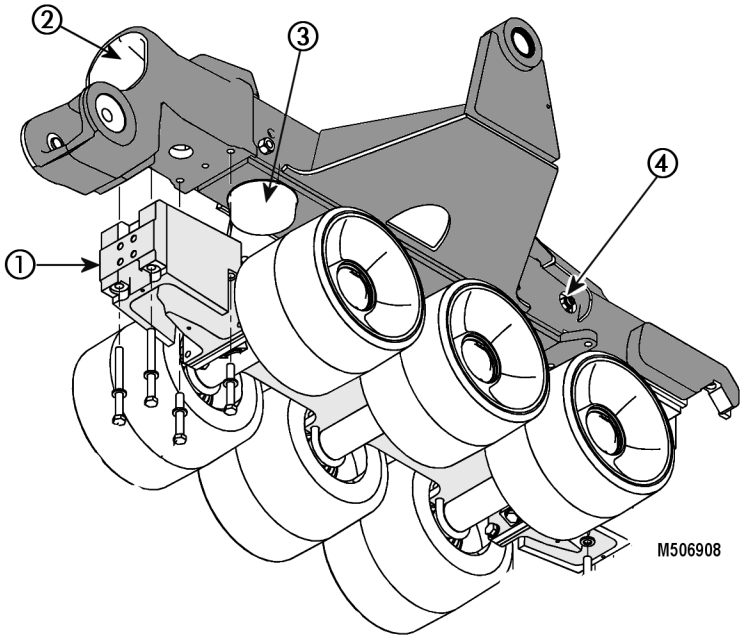
COMPONENTS

WHEEL ASSEMBLY



1.	Idler Wheel
2.	Mounting Frame
3.	Roller Wheels

ROLLER MOUNTING FRAME



1.	Roller Wheel Mounting Frame
2.	Tensioning Cylinder
3.	Bumper
4.	Tension Pressure Release

TRACKS

The track option is available on 8010-9120 machines as a dealer installation package. The tracks are the same 36" wide tracks that are used on the QuadTrac tractors. Tracks will provide additional flotation for less ground compaction and traction in adverse conditions. With a unit equipped with 620/70R42 duals and 2412/30 corn head there will be approximately 27 lb/sq. in, with tracks the same machine would be approximately 12 lb. Due to the size of the main drive wheel for the track system, the high speed transmission (used with the planetary final drives) and a higher speed bull gear final drive is used.

Due to the systems operation and machine configuration, there are a number of different combinations that may be seen in the field. Different set-ups:

- If tracks are installed on an 8010 or 8120-9120 factory equipped with tires (which uses the planetary final drives), ground speed will be greatly reduced. Most harvesting will be done in 3rd and 4th gear. The machine will require reconfiguring, which will permit the operation of the PGA in 4th gear. This would most likely be a different manufactures kit. The CNH kit will include final drives when available.
- If tracks are installed on a 8120-9120 track ready machine (which will have the high-speed bull gear final drives), ground speed will be as a normal wheeled machine.
- When a unit is ordered with tracks, it will be shipped with OUT wheels. The dealer will need to be ready to provide wheels for loading and unloading. Due to the size of standard drive tires, the machine will have a VERY fast and unsafe ground speed. The factory will be locking the transmission in 1st or 2nd gear and it will be the dealer's responsibility to reposition the transmission cam locking bolt during pre-delivery.



IMPORTANT: Do NOT operate a track ready machine in 3rd or 4th gear when equipped with standard drive wheels.

TRACKS

PREPARING TRACKS FOR USE

Once the tracks have been installed on a machine, the following will be required:

- tensioned properly
- they must be broken in properly
- they will require aligning
- the system will require configuration and calibration

TENSION TRACKS

The track is tensioned by a hydraulic cylinder that is teed straight into the PFC pump output circuit; providing the tensioning cylinder with pump high-pressure stand-by. If the machine is parked over night, the PFC pump should be placed on high-pressure stand-by before moving the machine. A track could be run off the idlers if not properly tensioned. The tensioning circuit incorporates a one way check to maintain the pressure in the cylinder when the pump returns to low-pressure stand-by. Manual tensioning should only be required once during start up, other circuit will cause the pump to turn on through out the day.

BREAKING IN TRACKS



IMPORTANT: **Never road a new machine with out properly preparing the tracks.**

The roller and idler wheels are covered with a rubber surface. When a new machine is driven, there will be some scuffing of the wheel against the track. This scuffing will create heat, heat may cause the rubber to pull or rip. The track and wheels will require conditioning (lubricating) for the initial break in.

In normal operation, dirt conditions the track and roller surfaces. In pre-delivery a bag of sand, floor dry or dirt should be placed inside the track and over the roller wheel. The machine should be driven at a slow speed, making sure that the total surface is being coated. Watch the temperature of the track during this operation. After initial conditioning, the combine should be operated in normal operations to further condition the tracks. The track conditioning process should be closely monitored for the first 150 hours of service

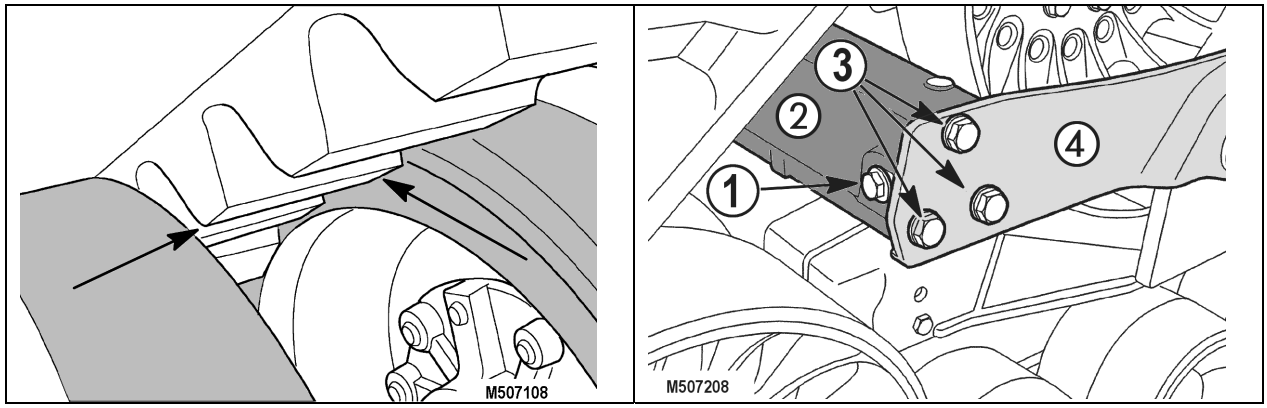
If the machine is driven for an extended period on a hard surface, conditioning may be required again.

TRACKS

PREPARING TRACKS FOR USE

TRACK ALIGNMENT

The track must be aligned so that it runs straight with the undercarriage. The track incorporates drive lugs that also function as track guides. These lugs should not touch the side of the idler wheels or heat will build up and possible fail the lugs.



Check Track Clearance Front and Rear

1.	Alignment Adjusting Bolt
2.	Main Mounting Frame
3.	Yoke Plate Bolts
4.	Yoke Plate

To adjust:

1. Drive the machine STAIGHT forward at 100 feet and stop. *IT VERY IMPORTANT THAT THE MACHINE IS DRIVE STRAIGHT*.
2. Check the running clearance, the track needs to be centered. If the machine has been operated on a hillside, the lugs may show scoffing even if there is running clearance.
3. Loosen the yoke clamping bolts and use the alignment bolt to push or pull the yoke plate. Push the plate rearward to move the track IN.
4. Tighten the yoke plate bolts and drive machine again.

TRACKS

PREPARING TRACKS FOR USE

CONFIGURATION

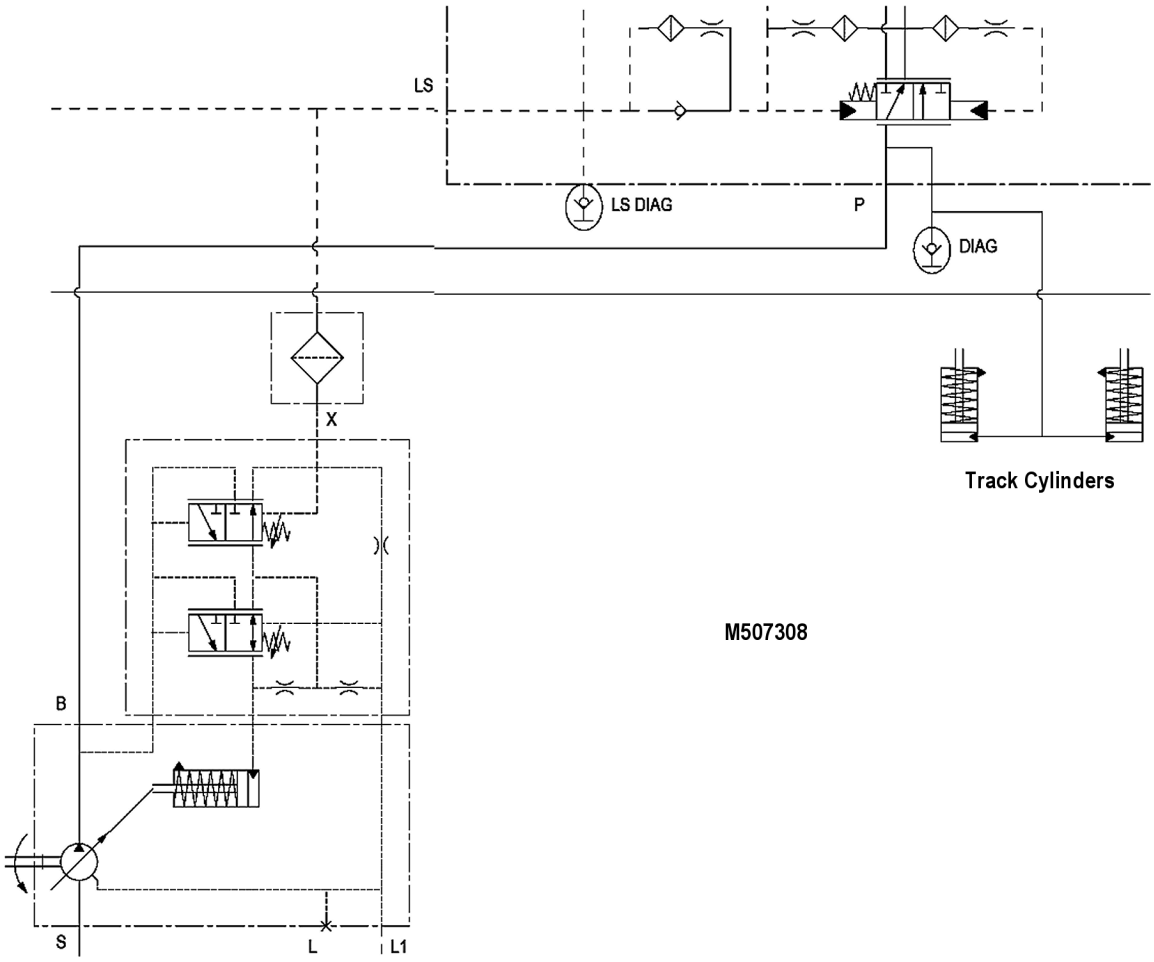
The machine must be configured for tracks. Depending on which software version install, either using the cab display unit or the service tool configure the machine for tracks installed.

CALIBRATION

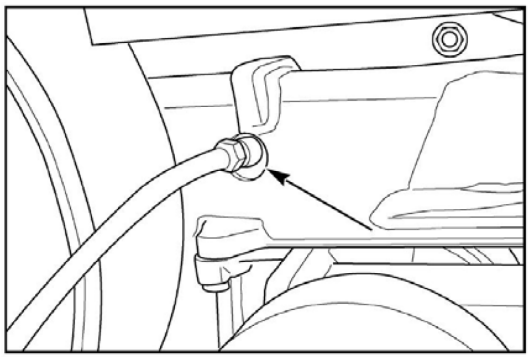
The system will require the ground speed calibration to insure that the MPH display and yield monitor is correct. This will take the normal 400 foot driving range and use the cab display to perform the operation.

TRACKS HYDRAULICS

TRACK SCHEMATICS



IMPORTANT: Before doing any work on the tensioning system, be sure to use the pressure release hose (Part Number 31-3183). The hose is attached to the pressure release fitting turned to open the release valve. Remember that the system will always be charged with high pressure. This is the same hose that is used on the QuadTrac tractors.



SERVICE BRAKES

The brakes consist of two service brakes, right and left, and a parking brake assembly. The service brakes use a single disc rotor for each side.

COMPONENTS

SERVICE BRAKES (2)

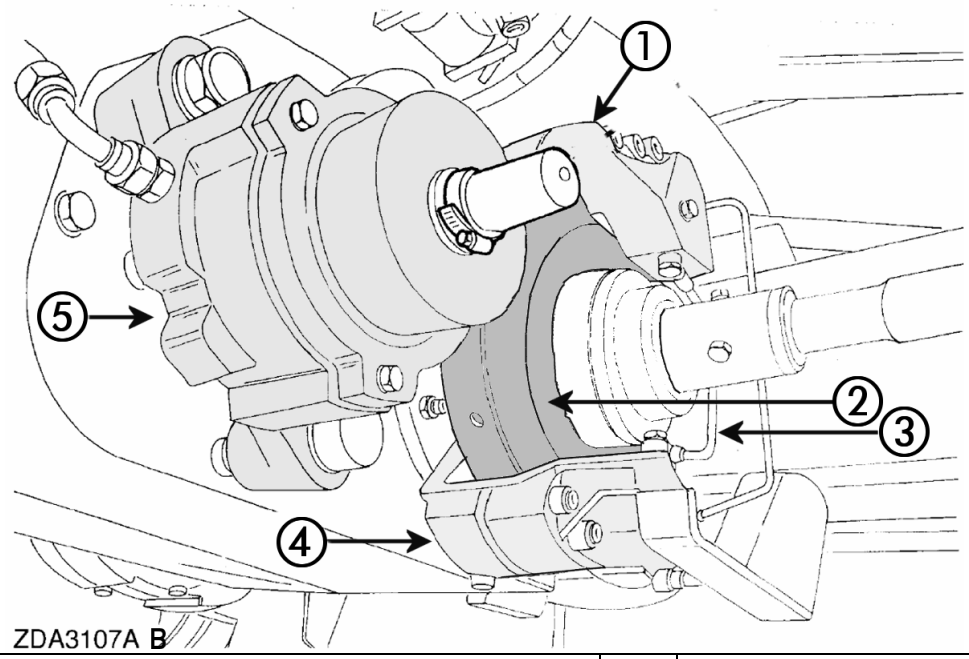
Right and left hand service brakes are incorporated into the transmission output shafts to provide individual wheel brakes. The brake is applied using upper and lower hydraulic calipers (four pistons), per brake assembly. This is not a power brake system, but foot operated hydraulic pressure. The assemblies are built so that the brake pads may be replaced with out disassembling or removing the calipers. The brakes are monitored electronically for wear.

WEAR INDICATORS, S-55 & S-56

Each upper brake pad incorporates a wear indicator wire that will ground out when the pad is worn excessively; this will activate a warning message.

BRAKE PRESSURE SWITCH, S-39

The brake pressure switch activates the rear brake lights when the right hand brake pedal is pressed.

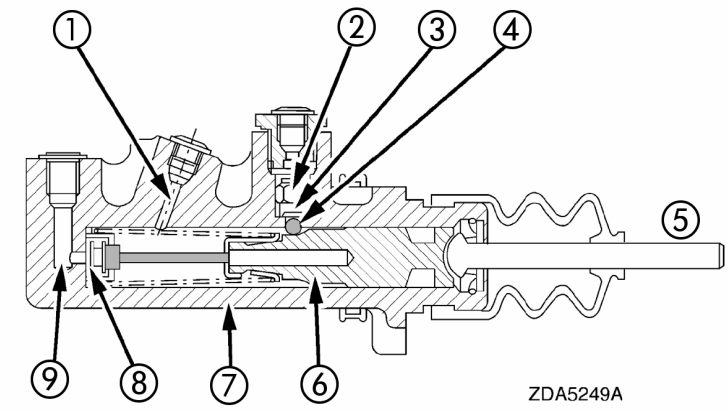


1.	Upper Right Hand Caliper and Wear Indicator	4.	Lower Right Hand Caliper
2.	Right Brake Disc	5.	Park Brake Assembly
3.	Connecting Pipe		

SERVICE BRAKES

BRAKE CYLINDERS

One foot operated brake cylinder is mounted under the cab for each wheel brake assembly. The master cylinders are connected with a common supply line and equalizing line. The equalizing line provides equal pressure to all calipers when both brake pedals are pressed at the same time. Inside the cab to the right of the operators seat is a brake reservoir that requires DOT 4 fluid.



1.	To Calipers	6.	Plunger
2.	Seat	7.	Main Cylinder Body
3.	Seal	8.	Seal
4.	Check Ball	9.	From Reservoir
5.	Actuating Rod		

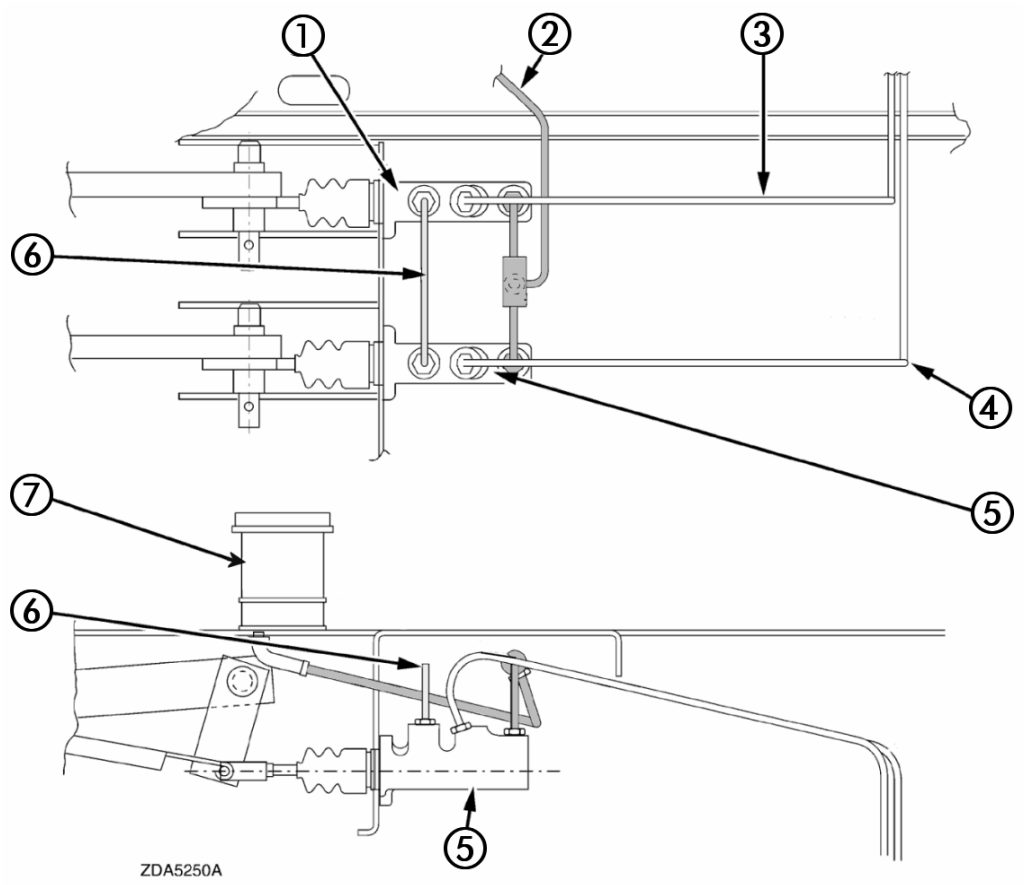
RESERVOIR FLUID LEVEL SENSOR, S-49

There is a fluid level sensor wired in parallel with the wear indicator message. The sensor is a N/O float type sensor the will alert the operator when the service brake fluid is low.

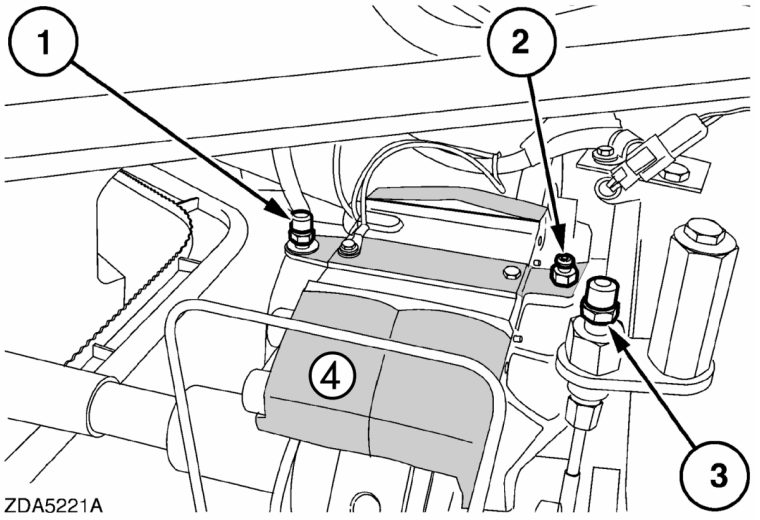




SERVICE BRAKES



1.	Right Master Cylinder	5.	Left Master Cylinder
2.	Brake Supply From Reservoir	6.	Cross Over Pipe
3.	Right Brake Line & Pressure Switch	7.	Reservoir
4.	Left Brake Line		



1.	Upper Outer Caliper Bleeder
2.	Upper Inner Caliper Bleeder
3.	Lower Caliper Bleeder

SERVICE BRAKE ELECTRONICS

WEAR INDICATORS & FLUID LEVEL SWITCH

REFERENCE MATERIAL:

Electrical schematic frame #8

KEY COMPONENTS:

Service Brake wear switches S-55 and S-56, CCM1, Ground point 2, Fluid Level switch M-49, Ground Point 2

OPERATION:

The brake wear indicators and fluid level switch are all N/O switches; and provide the operator with a warning message when maintenance is required. The three sensors are connected in a parallel circuit, meaning that any one of the switches may create the message. The brake wear switches are molded into the brake pads

The CCM1 connector X019 terminal J2-26 is directing a 8V out to the:

1. Right hand service brake caliber connector X085 terminal 1 and 3, which contains an INNER and OUTTER upper pad wires. When the pad thickness has worn sufficiently the wire rubs through, exposing it to the brake rotor and grounds out causing the voltage at the CCM2 terminal J2-25 to drop. The ground is supplied to the caliber at connector X295 terminal 1.
2. Left hand service brake caliber connector X084 terminal 1 and 3, which contains an INNER and OUTTER upper pad wires. When the pad thickness has worn sufficiently the wire rubs through, exposing it to the brake rotor and grounds out causing the voltage at the CCM2 terminal J2-25 to drop. The ground is supplied to the caliber at connector X294 terminal 1.
3. The fluid level switch connector X327 supplies voltage to the switch and connector X328 is connected to the chassis ground at point #2. The switch is a N/O. If the fluid level falls below a safe limit the switch will close, providing a ground, to cause the voltage at the CCM2 terminal J2-25 to drop.

SERVICE BRAKE ELECTRONICS

BRAKE LIGHT OPERATION

REFERENCE MATERIAL:

Electrical schematic frames # 09, 35, 38

KEY COMPONENTS:

Fuse F-52, Brake Light Relay K-33, Brake Pressure Switch S-39, Lights E-12 and E-11, and CCM2.

GENERAL INFORMATION

The brake lamps are activated anytime the combine speed is decreased to warn anyone that may be following the machine that it may be preparing to stop. The lights may be influenced by other machine operations:

- When the brake pedals are pressed, raising the brake pressure.
- When pulling the multi-function handle toward the **NEUTRAL** zone.
- When the engine is about to shut down due to an engine Auto-Shut-Down situation.

OPERATIONS:

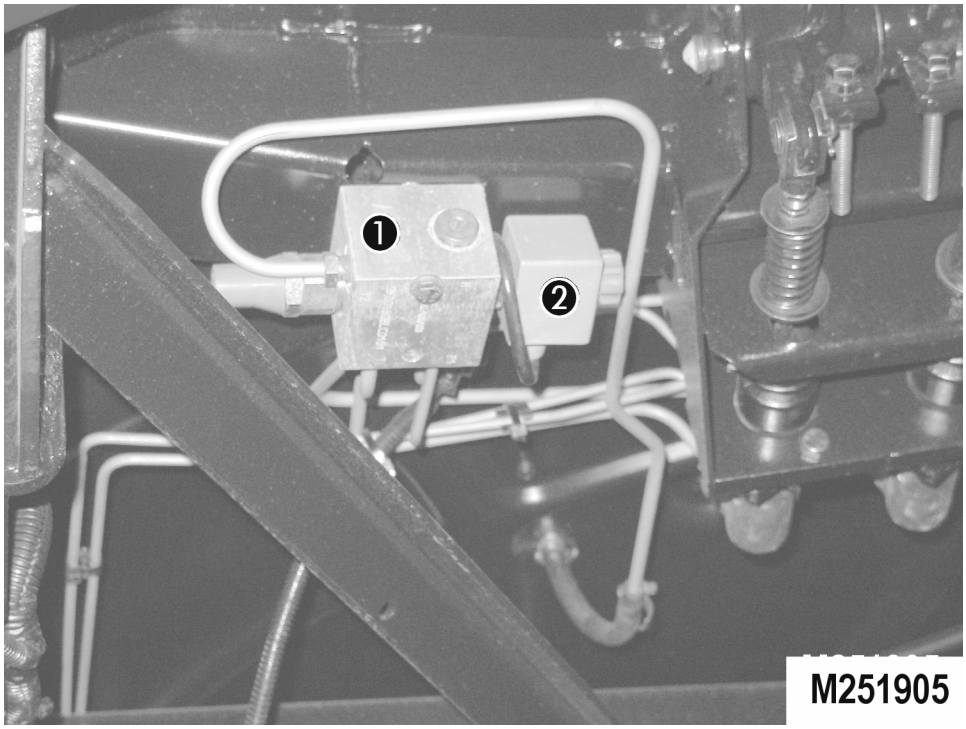
The brake pressure switch S-39 is an N/O switch. It is supplied 12V from the CCM2 connector X016 terminal J2-34 and a chassis ground at point 2. When the right brake pressure increase above 50 PSI the switch will close, bleeding off the supply voltage to the chassis ground.

The brake lamp relay K-33 is supplied B+ power at terminal 3 from fuse F-52. Once one of the above conditions is met the CCM2 will direct voltage out connector X015 terminal J1-18 to the brake relay K-33 terminal 1, activating the relay. The relay will direct 12V from terminal 3 out terminal 5 to the two rear brake lamps E-12 terminal 1, E-11 terminal 1 and terminal 54 of the trailer connector causing the brake lamps to illuminate.

BRAKE LIMITER VALVE

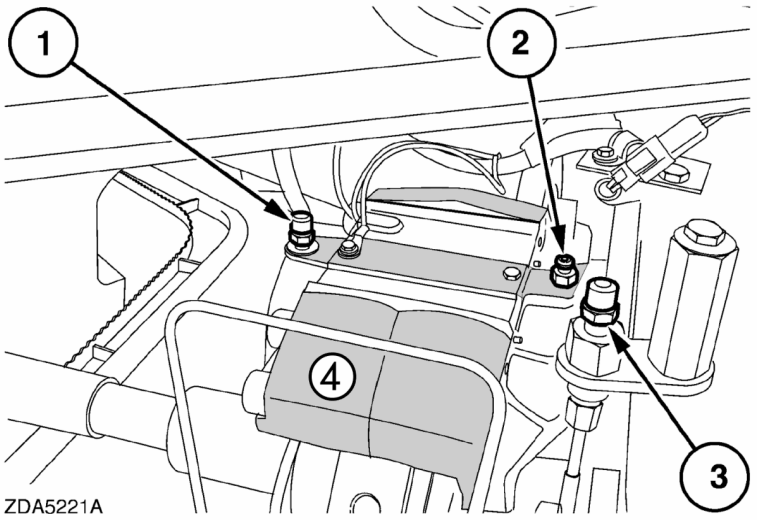
The European machines may be equipped with a pressure limiting valve to prevent the main drive wheels from locking up. The valve incorporates a solenoid L-32 that when activated will expose the brake pressure lines to a relief.

1.	Control Valve
2.	Solenoid



SERVICE BRAKE BLEEDING

BLEEDING THE SERVICE BRAKE



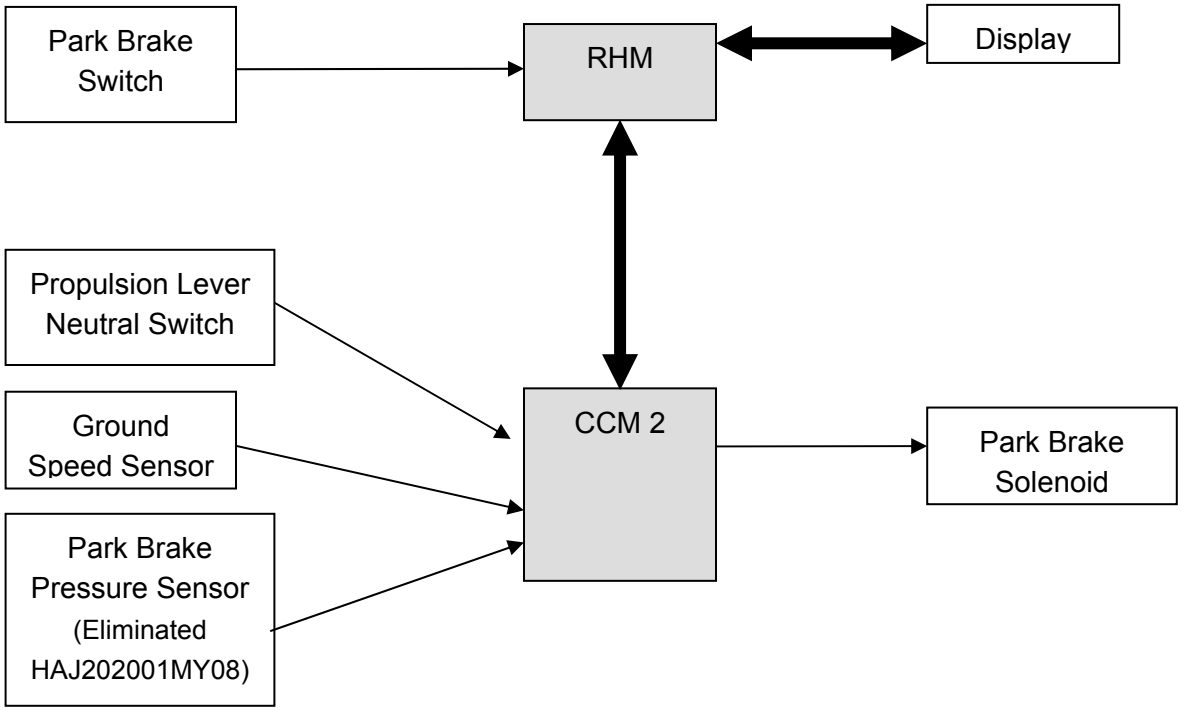
1.	Upper Outer Caliper Bleeder
2.	Upper Inner Caliper Bleeder

Any time the brake is disassembled or lines removed, the system will require bleeding. To bleed the system proceed as follows:

REMEMBER: As the brake pedal must be depressed several times while bleeding, this job has to be done with two persons.

1. Park the combine on level ground and block the wheels adequately to prevent the combine form rolling. The engine does NOT need to be running.
2. Raise the header and engage the header safety latch. Stop the engine.
3. Verify that the brake reservoir is filled.
4. Slide a transparent hose over the RH outside bleed screw to catch the oil when bleeding.
5. **Cab Operator** holds down the LH brake pedal and pumps RH brake pedal.
6. **Bleed Operator** loosens RH outside caliper bleed valve (#1 in photo) to allow the air to bleed out, and then retightens it when oil comes out of the port.
7. Operator then loosens RH inside caliper bleed valve (#2 in photo) to allow the air to bleed out, and then retightens it when oil comes out of the port.
8. Operator in cab then holds down RH brake pedal and pumps LH brake pedal.
9. Repeat steps 5-7 for the LH side.
10. Check for the reservoir for proper oil level.

PARK BRAKE ELECTRONICS



MACHINE STANDING STILL

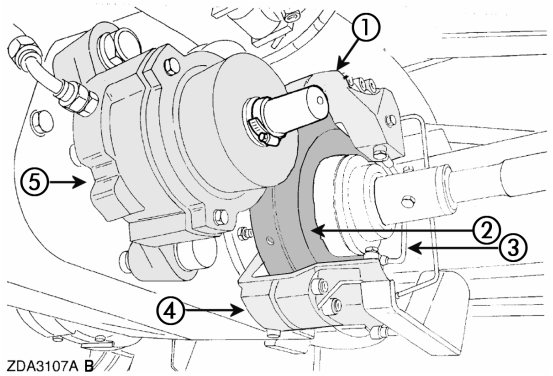
Sequence of Events

1. The operator will press the forward portion of the Park Switch; the RHM will place a message on the data bus.
2. The RHM will monitor the position of the MFH to determine if it is in the NEUTRAL zone, and place a message on the data bus when in NEUTRAL. If the MFH is NOT in NEUTRAL
3. The CCM2 will de-activate the park brake solenoid, engaging the brake and illuminating the park brake indicator.

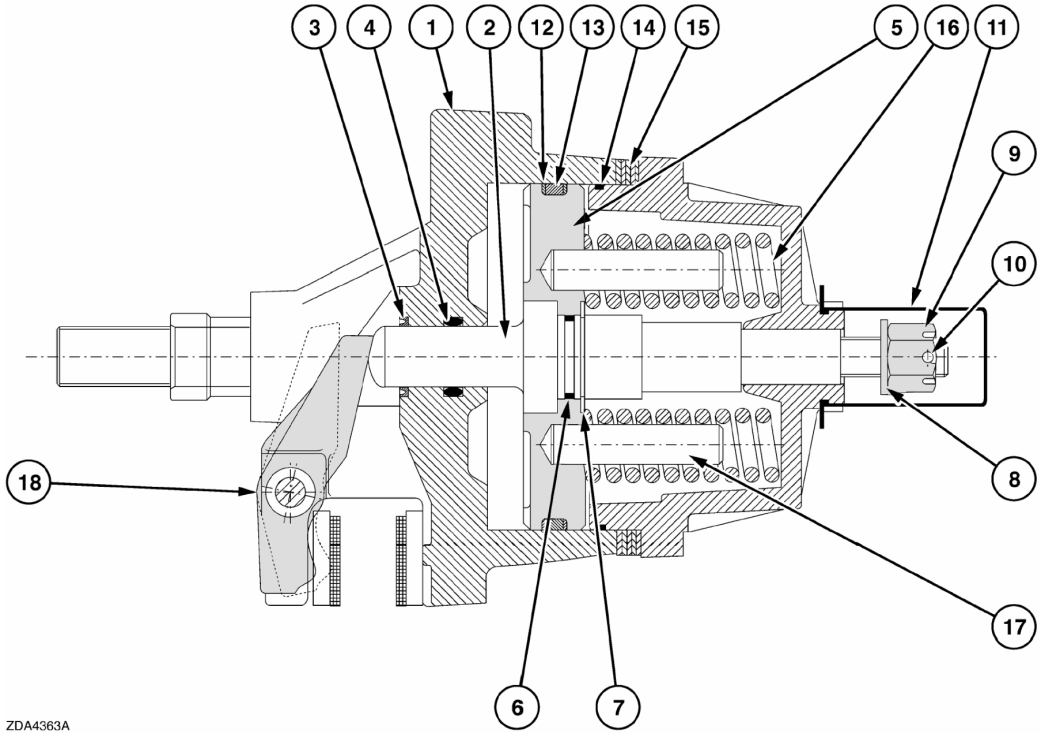


Park Brake Control Switch

PARK BRAKE ASSEMBLY



1.	Upper Right Hand Caliper and Wear Indicator
2.	Right Brake Disc
3.	Connecting Pipe
4.	Lower Right Hand Caliper
5.	Park Brake Assembly



1.	Piston Housing	7.	Circlip	13.	O'Ring
2.	Shaft	8.	Washer	14.	O'Ring
3.	Seal	9.	Nut	15.	Shims
4.	O'Ring	10.	Cotter Pin	16.	Spring
5.	Piston	11.	Rubber Cap	17.	Spring Guide
6.	O'Ring	12.	Seal Reinforcement	18.	Lever

PARK BRAKE

PARKING BRAKE (5)

The parking brake incorporates a spring-loaded piston to provide the clamping force on the brake disc. Regulated pressure is used to compress the springs in order to release the brake. The park brake is applied any time the unit is being shifted, the engine is not running or the park brake switch is placed into the engagement position. The assembly is built so that the brake pads may be replaced with out disassembling or removing the assembly. The brake requires periodic monitoring and shimming for wear.

The parking brake assembly is attached to the counter shaft of the transmission, which is geared directly to the differential ring gear. The brake assembly incorporates a set of coil springs (16) to engage the brake assembly and a hydraulically operated piston (5) to compress the springs to release the brake. The system also incorporates a process to manually release the brake assembly if needed.

The park brake system is designed to engage through three different conditions:

1. Shutting down the engine, loss of hydraulic pressure
2. Activating the parking brake switch, loss of electrical power to the hydraulic valve
3. Shifting the transmission, loss of electrical power to prevent the machine for rolling and to release any strain on the transmission during shifting

MAINTENANCE

Due to the limited travel of the piston (5), the spring housing must be properly shimmed from the piston housing. This adjustment will require routine checking and adjustments due to brake pad wear.

Whenever the system is disassembled it will require bleeding the air from the piston housing.

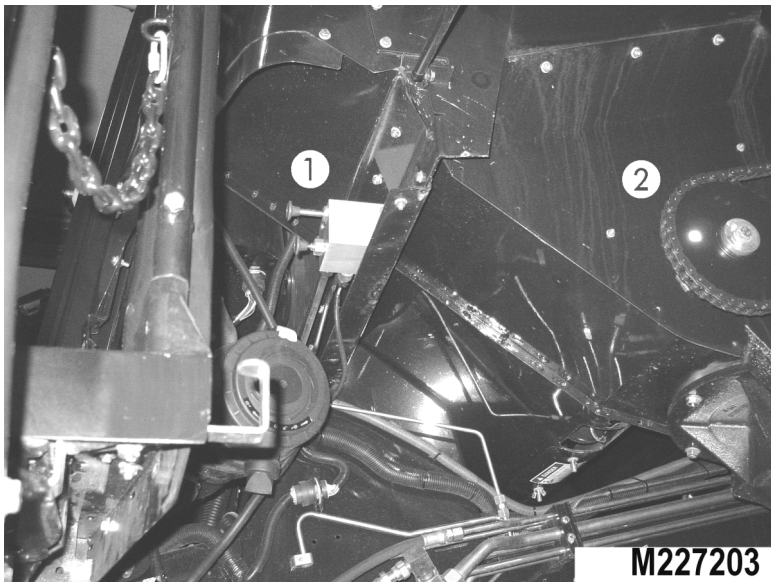
SPECIFICATIONS

Pad Wear:	Replace when less then 1 mm pad remains
Rotor Run-Out:	0.3 mm
Minimum Thickness	36.0 mm

The park brake valve receives regulated pressure oil from the PFC pump and Regulated/Park Brake/Tow Valve. Refer to the “General Hydraulic Section” to understand where and how regulated pressure is maintained.

PARK BRAKE HYDRAULIC

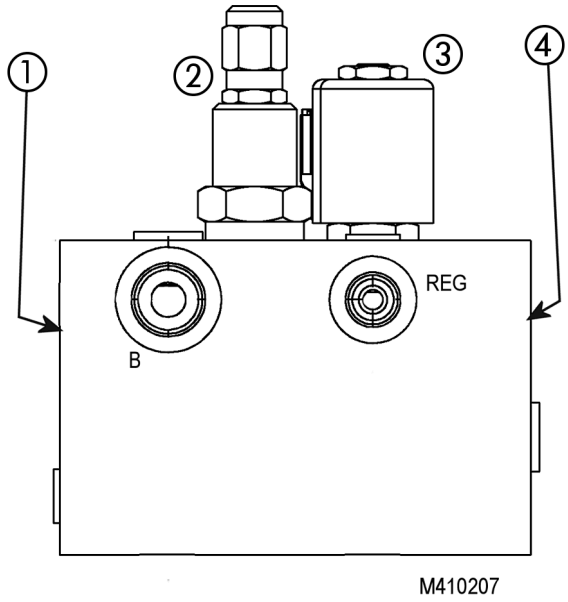
HYDRAULIC CIRCUITS

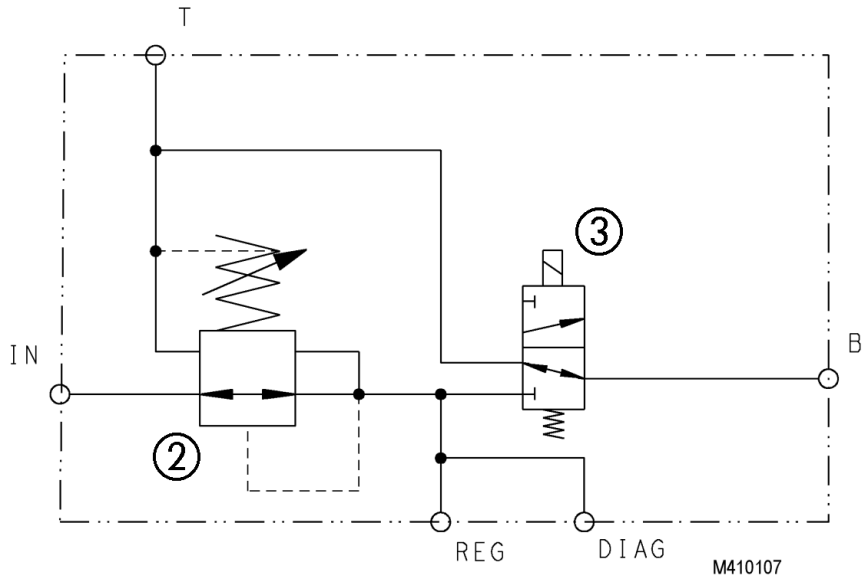


1.	Park Brake/Regulated Pressure Assembly
2.	Unloading Cross Auger Drive Chain

PARK BRAKE

COMPONENT LOCATION





1.	Supply From PFC Pump = “IN”	B	To Parking Brake
2.	Regulated Pressure Valve	REG	To Regulated Circuits
3.	Park Brake Valve	T	Tank
4.	Regulated Test Port = “DIAG”		

PARK BRAKE

PARK BRAKE VALVE OPERATION

REFERENCE MATERIAL:

Hydraulic Schematic
General Hydraulic Section for Oil Supply to the valve and Regulated Pressure.

KEY COMPONENTS:

Regulated/Park Brake/Tow Valve Assembly, Brake Assembly

Park Brake Engaged

The park brake valve also maintains the regulated pressure circuit and supply. Regulated pressure is supplied to the park brake solenoid (1) where it is deadheaded. When the solenoid is deactivated, models HAJ202001 and above, the Park Brake Indicator is illuminated. The brake piston cavity is free to flow back to the tank from port (T and B)

Park Brake Disengaged

When the park brake solenoid (3) is activated the controller will monitor the current draw, on models HAJ202001 and above, and turn **OFF** the park brake indicator. Regulated pressure is directed out port “B” to the park brake piston. The pressure is also exposed to the regulated pressure sensor (HAJ202000 and below) for the system to turn **OFF** the park brake lamp.

Manually Disengaged, (TOW)

For HAJ202001 and above the TOW function has been removed from the park brake valve assembly. There is no long a manual hydraulic park brake disengagement function.

PARK BRAKE

PARK BRAKE ELECTRICAL CIRCUITS

REFERENCE MATERIAL:

Electrical schematic frames #7, #9, #27

KEY COMPONENTS:

Park Brake Pressure Sensor S-53, Park Brake Solenoid L-10, Park Brake Switch S-09, CCM2

ELECTRICAL CIRCUIT

The park brake is controlled manually by the operator, or automatically when changing transmission speeds. The park brake switch is supplied 12V power from the RHM and is a double throw momentary switch.

OPERATOR RELEASING THE BRAKE

When the operator presses on the REAR portion a set of contacts will close. The park brake switch S-09 will direct a momentary 12V signal to the RHM connector X029 terminal 9. The RHM will place a message on the data bus to disengage the park brake.

The CCM2 will pick up the message and direct a 12V power supply out terminal J2-15 to the park brake solenoid L-10 terminal 1. The solenoid's terminal 2 is chassis ground at the main ground point (2). When the controller see a current draw from the solenoid it will place a message on the CAN to turn OFF the park brake indicator.

(HAJ202000 and below) A pressure sensor is used to monitor the parking brake release pressure, in turn monitoring the regulated pressure. The sensor provides a constant voltage reading to the CCM2, and the CCM2 places a message on the data bus for the display. If the pressure falls below specification the park brake indicator lamp will illuminate, warning the operator. The sensor is a variable resistance sensor.

A 5V power is supplied to the sensor from the CCM2 connector X017 terminal J3-26 to the sensor terminal A. The sensor terminal B is directed back to the CCM2 connector X0016 terminal J2-14. The sensor terminal C is providing a variable signal voltage to the CCM2 connector X017 terminal J3-34.

PARK BRAKE

PARK BRAKE ELECTRICAL CIRCUITS, CON'T

OPERATOR ENGAGING THE BRAKE

When the operator presses on the FRONT portion a set of contacts will close. The park brake switch S-09 will direct a momentary 12V signal to the RHM connector X029 terminal 1. The RHM will place a message on the data bus to disengage the park brake.

The CCM2 will pick up the message and discontinue the 12V power supply out connector X0016 terminal J2-15 to the park brake solenoid L-10 terminal 1.

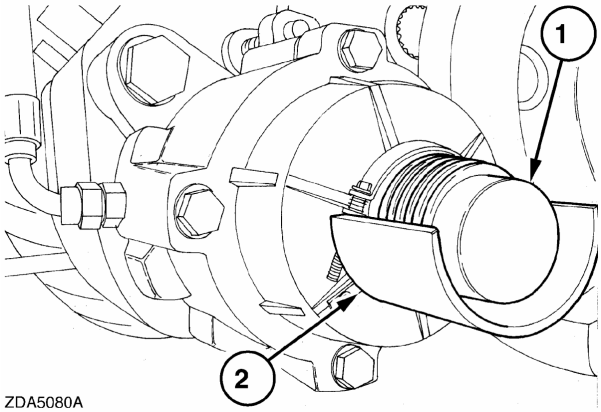
SHIFTING OPERATION

The park brake is activated when changing speed ranges in the mechanical transmission gearbox to prevent the machine from rolling and to free up the transmission. See the transmission portion of this section.

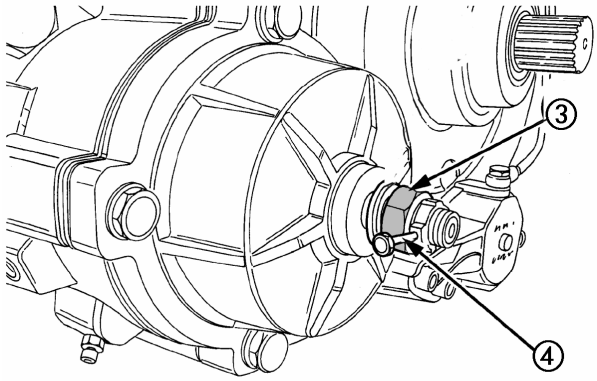
PARK BRAKE

MANUALLY RELEASING PARK BRAKE

REMEMBER: Remember to use the “Tow Valve” before resorting to using the “Manually Releasing” process.



ZDA5080A



ZDA4707B

1.	Protective Cap	3.	Release Nut
2.	Guard	4.	Retainer Pin

IMPORTANT: Remember that the parking brake can not be engaged using the operator’s controls once manually released.

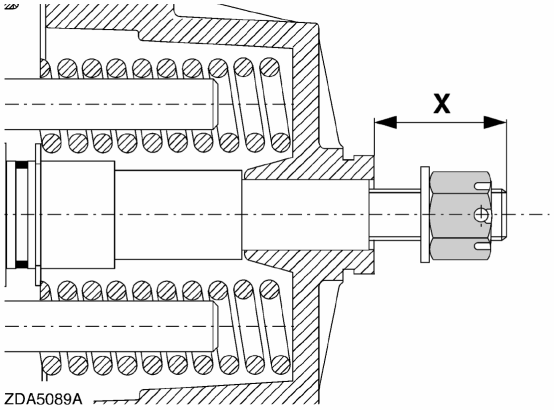
If it is not possible to release the parking brake electrically, it can be released manually. To release the parking brake manually, proceed as follows:

1. Raise the header and engage the header safety latch. Stop the engine.
2. Block the wheels adequately to prevent the combine from rolling.
3. Remove guard, (2) and protective cap (1).
4. Remove the retaining pin (4).
5. Thread the release nut (3) ON, (pulling the shaft out of the housing) until the piston is bottomed.

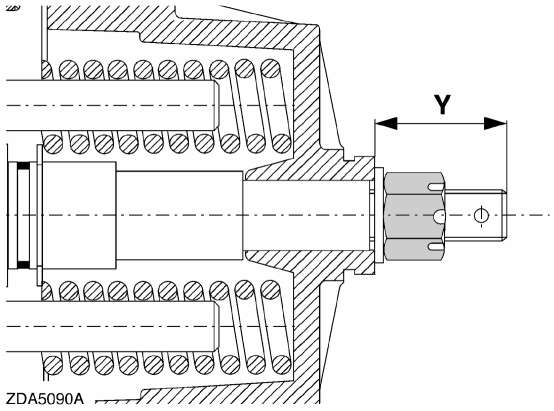
PARK BRAKE

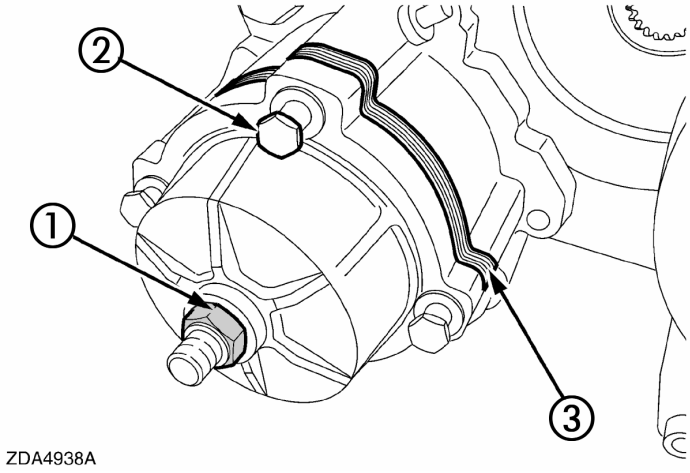
PARK BRAKE PISTON TRAVEL AND ADJUSTMENT

BRAKE SPRING ENGAGED



BRAKE MANUALLY RELEASED





X	Shaft Protrusion Brake Engaged
Y	Shaft Protrusion Brake Released
1	Brake Releasing Nut
2	Housing Bolts
3	Shim Pack

PARK BRAKE

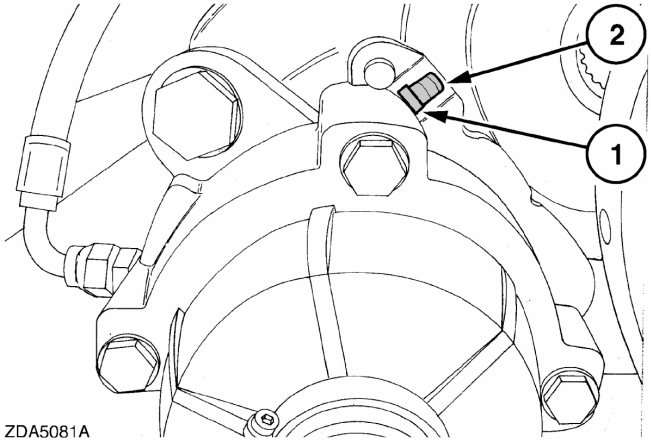
PARK BRAKE PISTON TRAVEL AND ADJUSTMENT

To obtain a correct and constant braking force, a clearance check and possible adjustment of the parking brake has to be carried out every 500 hours.

1. Park the combine on level ground and block the wheels adequately to prevent the combine from moving.
2. Raise the header and engage the header safety latch. Stop the engine.
3. Remove the guard from the end of the parking brake shaft.
4. Measure and record the shaft protrusion distance.
5. Manually release the parking brake, refer to “Manually Releasing Parking Brake” in this section.
6. Measure and record the shaft protrusion distance.
7. The difference between the measurements from step 4 and 6 is the piston travel. The piston travel must fall between 1/8” – 3/16”. If the travel is less brake drag may occur, if travel is to great reaction time will be excessive.
8. Loosen bolts (2) and adjust the quantity of shims as required. One shim will provide about 5/64”. Place the removed shim under bolts (2) for future use.
9. Recheck the piston travel by performing steps 4 through 6.

PARK BRAKE

BLEEDING THE PARK BRAKE



Any time the parking brake is disassembled or lines removed, the system will require bleeding. To bleed the system proceed as follows:

REMEMBER: As the brake switch must be depressed several times while bleeding, this job has to be done with two persons.

1. Park the combine on level ground and block the wheels adequately to prevent the combine form rolling.
2. Raise the header and engage the header safety latch. Stop the engine.
3. Remove the rubber cap (2) from the bleed screw (1).
4. Slide a transparent hose over the bleed screw to catch the oil when bleeding.
5. Start the combine engine.
6. Disengage and engage the parking brake a few times.
7. At the same time open the bleed screw until air free oil escapes through the bleed screw.
8. Engage the parking brake and stop the engine.
9. Remove the transparent hose and reinstall the rubber cap, (2).
10. Check the proper hydraulic reservoir for proper oil level.

CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 -9120 SERIES AXIAL-FLOW COMBINE



SECTION 29 HYDROSTATIC (GROUND) DRIVE

Form 5175 1/2010

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700 STATE STREET
RACINE, WI 53404
U.S.A.

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OBJECTIVES

After completion of this section of the text, the student should be able to perform the following:

- Be able to discuss the types of ground drive systems used and be able to identify and locate the components that transmit power from the engine to the separator.
- Be able to properly pressure test the drive circuit
- Know the proper clean-up procedures to be used after repairing a major failure.

Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER:



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

INTRODUCTION

Basic hydrostatic drive systems are made up of the following elements:

- Pump - This is a variable displacement axial piston unit that is driven by the engine.
- Propulsion lever - in the cab activates the ground drive control valve by electronics.
- Motor - this unit is located on the left-hand side of the transmission, which it drives via a splined coupler. The fixed displacement motor, its speed and direction are determined by the pump output.
- High Pressure Hydrostatic Lines - These are used to transfer fluid power from the pump to the motor.

Hydrostatic drive gives three distinct advantages over conventional type of drive systems.

1 The first of these is ease of control. The entire system works by controlling the following three elements:

   A. Flow rate of the fluid

   B. Direction of flow

   C. Fluid pressure

2 Through the control of these three elements, infinite variability of speed is possible within the range of the selected gear. By changing any one of the above elements alone or in any combination, it is possible to change ground speed. This is very important as it allows the machine to be operated at its optimum level of efficiency.

3 The third advantage is flexibility of component location. This system allows the motor to be remotely located from the pump. This gives a flexibility of design not found in mechanical systems.

GENERAL INFORMATION

The 20 series combines are equipped with a hydrostatic system to provide for driving the mechanical ground drive transmission. The hydrostatic system differs from previous models as it is controlled completely by electronics rather than by a control cable; solenoids are used to control the position of the pump swash plate. This provides for specific operations to take place:

- If the park brake is NOT released, the signals sent by the MFH will be disregarded. This prevents over powering the parking brake.
- If the NETURAL switch is NOT activated the signals sent by the MFH will be disregarded.
- If the MFH is placed into the REVERSE slot the Back Up Alarm is activated.
- If the MFH is placed into the REVERSE slot, and the field lights are ON the rear work lights will be activated.
- If the MFH is pulled from the FORWARD slot to the NETURAL position quickly, the Brake Lights will be activated.

SYSTEM OPERATION

Starting

The operator will be required to place the Multi-Function Hand (MFH) in the NEUTRAL position before the engine will crank.

Shifting the Transmission

The ground drive transmission may be shifted to any speed at anytime, but the requested action will NOT take place until the operator has placed the MFH in the NEUTRAL position.

GENERAL INFORMATION

Forward/Reverse Operation

When the MFH is moved out of the NEUTRAL zone the machine will move in the direction of and proportional to the movement of the MFH. As with any hydrostatic drive while running the transmission in a lower gear will reduce the drive pressure, but causes the pump flow to increase and the motor to operate at a higher RPM speed. There are times when it may be advisable to shift the transmission to a higher gear, this will reduce the motor RPM and may reduce the heat build up.

If the machine is equipped with the optional Power Guide Axle (PGA) it MAY not be advisable to operate in a lower gear. The PGA efficiency is determined by the system's drive pressure, if the systems drive pressure is low due to running the transmission in a lower gear, the PGA will not be as efficient. In many cases it is advisable to shift the transmission up to a higher gear in order to increase the drive pressure. If the PGA tires slip (spinning), too much power for the traction condition, shift to a lower gear to reduce the drive pressure.

POWER GUIDE AXLE

The PGA is an optional feature that may be installed on all units. The unit is an extension of the main hydrostatic drive system to provide additional traction in adverse condition. Since the PGA is an extension of the main system, the hydrostatic pump flow is split between the main transmission motor and the PGA motors, which will cause a reduction of ground speed. The PGA is not intended to be operated on the road; if the PGA and the ROAD mode or fourth gear is selected an operator's warning message is presented informing the operator the operation is not permitted.

GENERAL INFORMATION

TWO SPEED PGA OPTION

All PGA motors are capable of having a two speed valve added (dealer or factory installed option) to provide a **LO**/**HI** torque settings. The **LO** torque setting is very beneficial when operating in very marginal traction condition to prevent the wheels from spinning, which would prevent the main drive from receiving oil. Once equipped with the valve the operator may save time and the bother of shifting to a higher gear by switching the PGA over to the **LO** torque setting or turning the PGA **OFF**. As an Example:

Ground speed when equipped with 900/60R32 tires, speeds are approximate.

Gear	PGA OFF	PGA LO Setting	PGA HI Setting
1st.	4.4	3.7	3.3
2nd.	7.9	6.1	5.0
3rd.	10.4	7.5	5.9
4th.	20.1	N/A	N/A

FLOW LIMITERS, (87283385 & 87283482, BULLETIN AFX SB 004 09)

When operating in very marginal traction conditions, flow limiters may be installed to prevent the wheel motors from taking excessive fluid away from the main drive motor. These should be installed only after the PGA has been converted to a two speed system due to additional heat that may be created. Normally the two speed system will take care of the problem.

GROUND SPEED LIMITATION

The maximum ground speed is pre-set at the plant for the country of destination and tire size that the machine is ordered for, and may not be changed. When the unit is built, the information is placed into the non-volatile memory of the CCM's. This limits the pump's swash plate travel when in reverse third and reverse or forward fourth gear. Since the tire size makes little difference there is not a way to reconfigure the system. Machines built for the U.S. market are not limited on ground speed.

For Europe software is available to reprogram due to different country limitation.



Wait a Minute... Look in section 42 for a listing of the country codes.

Ground speed limitation is a function of the ROAD mode switch. When the unit is placed into forth gear and the road mode switch is in the ROAD mode position, ground speed is only limited for specific countries. If the road mode switch is left in the HARVEST position, ground speed will be reduced by approximately 15%. This is to get the operators to use the ROAD mode when traveling on the road.

COMPONENT SPECS.

7120 WITH "STANDARD DRIVE"

Specification	
Total System Capacity (PTO Gearbox and Hydrostatic)	Approximately 28 L (30 qts.) on oil change, Hytran fluid
Hydrostatic Pump	
Manufacturer	Bosch-Rexroth
Type	Series 32 Variable Displacement
Control	Electronic Control Directional Control Valve
Frame Size	125
Direction Of Rotation	Counterclockwise
Displacement	125 cc/rev (7.63 in^3/rev) Limited to 117 electronically
Charge Pressure	500±20 PSI (34±1.4 bar) at the test port
System Pressure - Maximum	450 bar (6525 psi) Pressure Cut-Off 480±6.9 bar (6960±145 psi) Relief setting
PTO Lube Pump (Charge Pump Displacement)	39 cc/rev (2.38 in^3/rev)
PTO Lube filter & Cooler Relief (Charge Pump Pressure)	20 Bar (290 psi)

Hydrostatic Motor	
Manufacturer	Bosch-Rexroth
Type	Series 6 Fixed Displacement
Frame Size	107
Direction Of Rotation	Bi- Directional
Displacement	107 cc/rev (6.51 in^3/rev)
Flushing Valve	16 bar (232 PSI), but due to case pressure a normal reading may be around 21 bar (305 psi)
Case Pressure - Continuous	3 bar (43.5 psi), (Normally approx. 15 PSI)
Case Pressure - Maximum	5 bar (72.5 psi)
Motor Flushing Valve (Shuttle Spool) Part # 87634753 Started Y9G206687 Part # 84168176	 21L/min (5.5 gpm) at 21 bar (305 psi) 40L/min (10.5 gpm) at 21 bar (305 psi)

Oil Cooler Bypass Valve	
Lube Pump Pressure (Lube filter & Cooler)	17.2 Bar (249 psi)

Power Guide Axle	
High Torque, (Low Speed)	2099 cc/rev. (128 in^3/rev)
Low Torque, (High Speed)	1049.5 cc/rev (64 in^3/rev)

COMPONENT SEPECS.

8120 & 9120 "STANDARD" OR 7120 W/ "OPTIONAL HEAVY DUTY DRIVE"

Specification	
Total System Capacity (PTO Gearbox and Hydrostatic)	Approximately 28 L (30 qts.) on oil change, Hytran Ultra
Hydrostatic Pump	
Manufacturer	Bosch-Rexroth
Type	Series 32 Variable Displacement
Control	Electronic Control Directional Control Valve
Frame Size	125
Direction Of Rotation	Counterclockwise
Displacement	125 cc/rev (7.3 in^3/rev)
Charge Pressure	500±20 PSI (34±1.4 bar) at the test port
System Pressure - Maximum	450 bar (6525 psi) Pressure Cut-Off 480±6.9 bar (6960±145 psi) Relief setting
PTO Lube Pump (Charge Pump Displacement)	39 cc/rev (2.07 in^3/rev)
PTO Lube filter & Cooler Relief (Charge Pump Pressure)	20 Bar (290 psi)

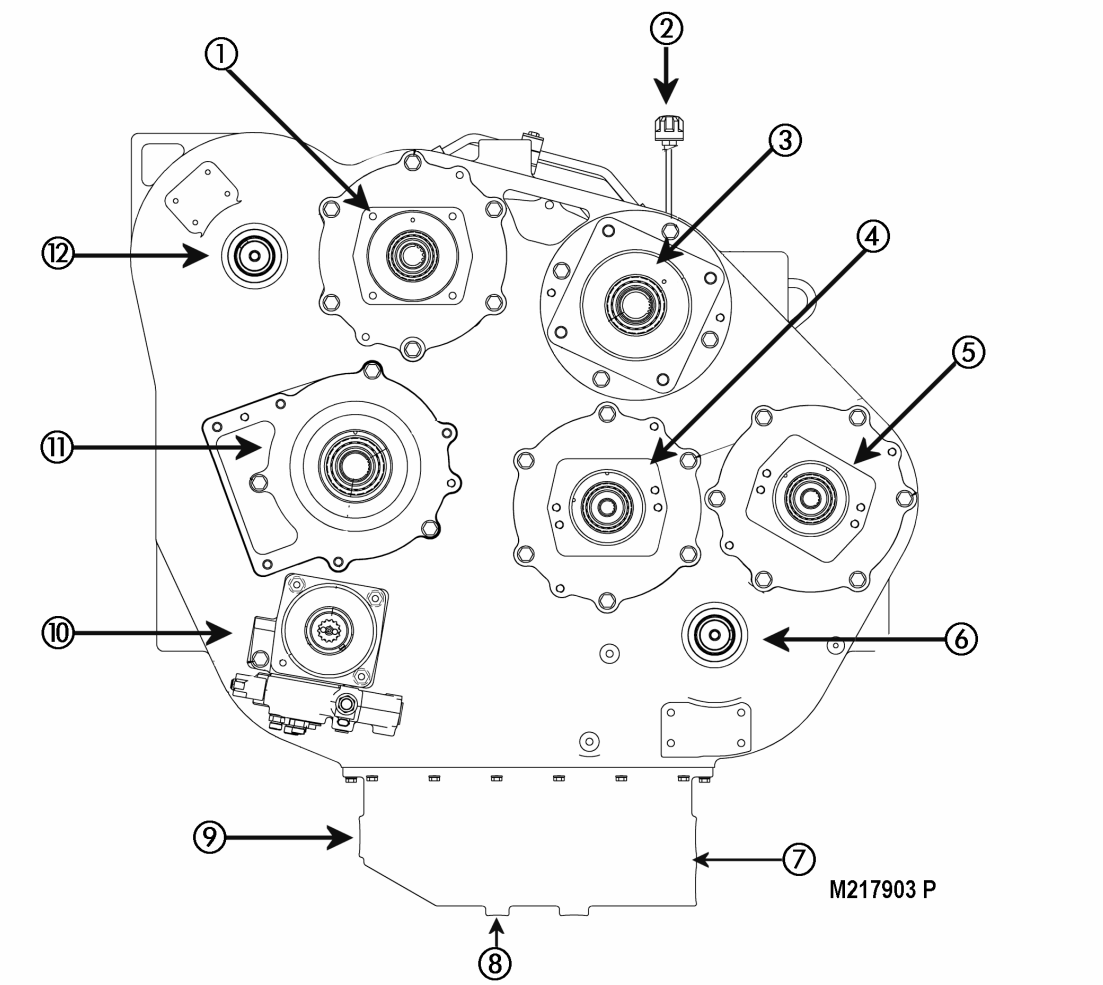
Hydrostatic Motor	
Manufacturer	Bosch-Rexroth
Type	Series 6 Fixed Displacement
Frame Size	130
Direction Of Rotation	Bi- Directional
Displacement	125 cc/rev (7.63 in^3/rev)
Flushing Valve	18 bar (260 PSI)@8gpm, but due to case pressure a higher reading may be observed
Case Pressure - Continuous	3 bar (43.5 psi), (Normally approx. 15 PSI)
Case Pressure - Maximum	5 bar (72.5 psi)
Motor Flushing Valve (Shuttle Spool) Part # 87634752 Started Y9G206762 Part # 84168175	 21L/min (5.5 gpm) at 21 bar (305 psi) 40L/min (10.5 gpm) at 21 bar (305 psi)

Oil Cooler Bypass Valve	
Lube Pump Pressure (Lube filter & Cooler)	17.2 Bar (249 psi)

Power Guide Axle	
High Torque, (Low Speed)	2099 cc/rev. (128 in^3/rev)
Low Torque, (High Speed)	1049.5 cc/rev (64 in^3/rev)

HYDROSTATIC DRIVE COMPONENTS

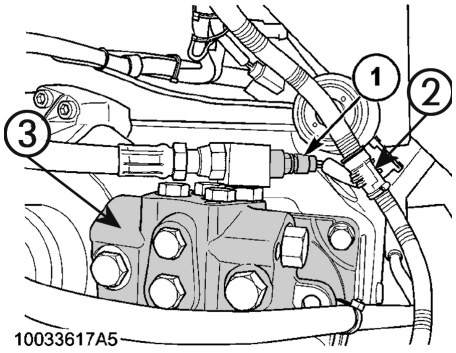
PTO GEARBOX



1.	Feeder/Rotor Pump Drive	7.	Supply/Return Port
2.	PTO Gearbox Breather	8.	PTO Gearbox Drain
3.	Hydrostatic Pump Drive	9.	Feeder Power Plus Drive Drain
4.	Gear Pump Drive	10.	Rotor Drive
5.	PFC Pump Drive	11.	Feeder Drive
6.	Beater/chopper Clutch Drive	12.	Unloader Clutch Drive

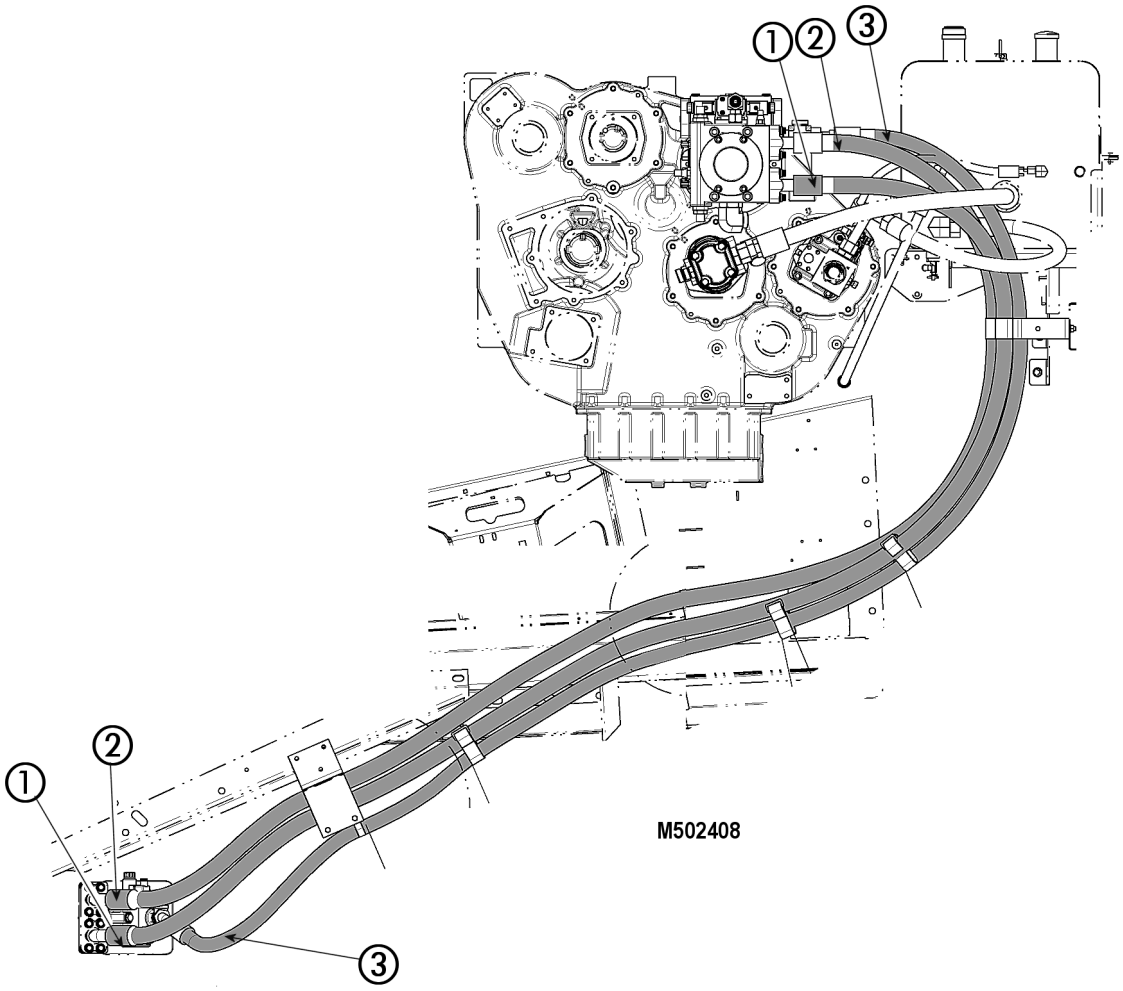
GROUND DRIVE MOTOR

1.	PTO Gearbox Temperature Sensor
2.	Two Speed PGA Connector
3.	Motor Assembly



HYDROSTATIC DRIVE COMPONENTS

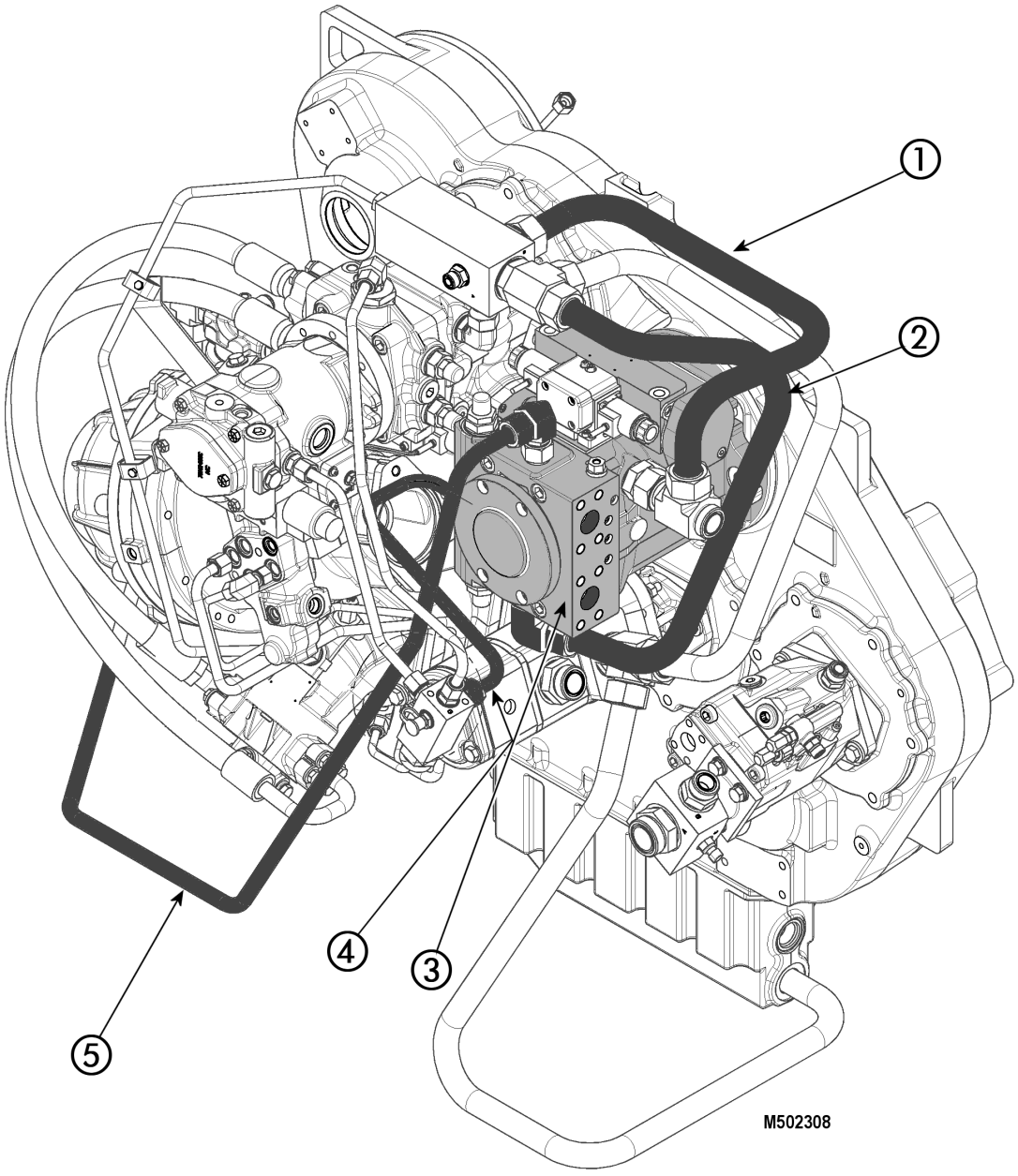
GROUND DRIVE HOSE CONNECTIONS



1.	Pump & Motor Port “A” Reverse
2.	Pump & Motor Port “B” Forward
3.	Pump & Motor Case Drain

HYDROSTATIC DRIVE COMPONENTS

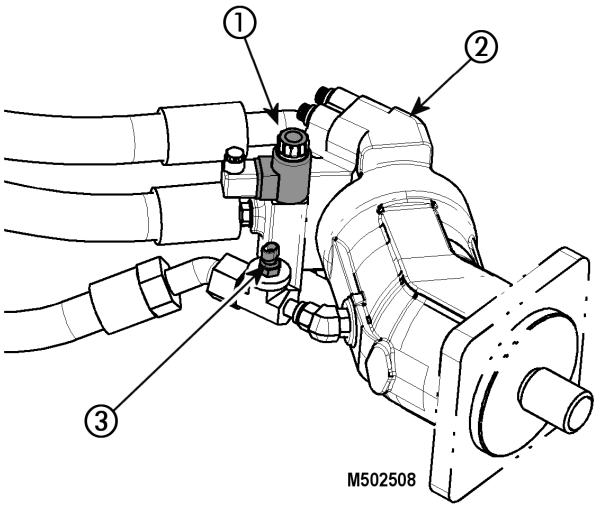
GROUND DRIVE HYDROSTATIC PUMP



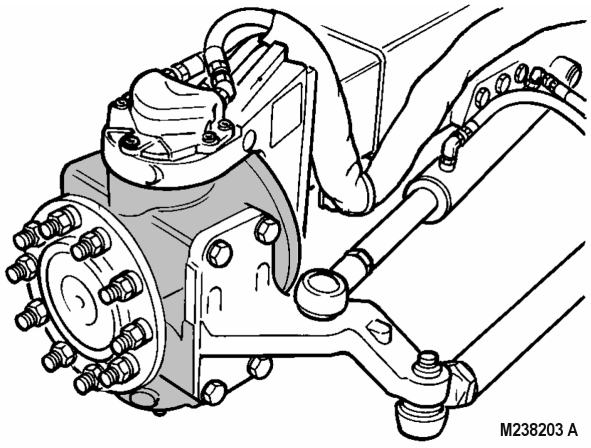
1.	Pump Case Drain	4.	Pump Charge Supply
2.	Lube Pump Supply	5.	Lube Pump Outlet
3.	Pump Assembly		

HYDROSTATIC DRIVE COMPONENTS

GROUND DRIVE HYDROSTATIC MOTORS



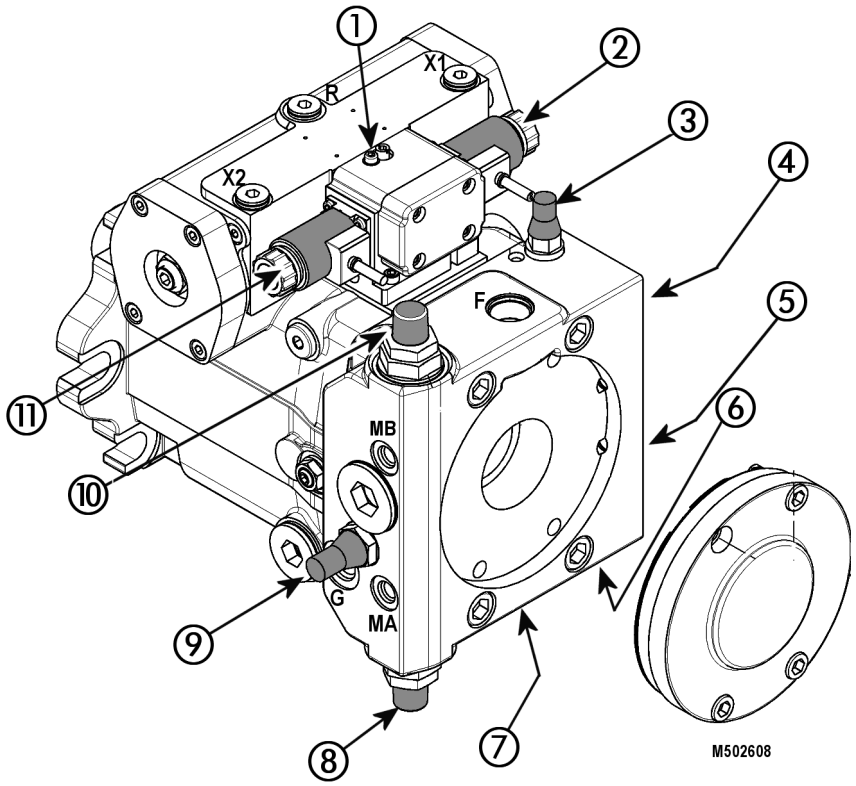
1.	Pressure Release Valve
2.	Ground Drive Motor
3.	PTO Temperature Switch



Power Guide Axle Motor

HYDROSTATIC DRIVE COMPONENTS

PUMP PORT LOCATIONS



1.	Control Valve Centering Screw	F	Lube Pump Outlet
2.	Solenoid	G	Pump Charge Supply Inlet
3.	Pressure Cut-Off Valve	MA	Reverse Drive Pressure Test
4.	Port “B” “Forward”	MB	Forward Drive Pressure Test
5.	Port “A” “Reverse”	MH	Not used (same as #6)
6.	Not used (MH)	R	Case Air Bleed (Case Pressure Test Port)
7.	Lube Pump Inlet (Port S)	X1	Servo Test Port
8.	Port “A” Main Relief “Reverse”	X2	Servo Test Port
9.	Charge Pressure Relief		
10.	Port “B” Main Relief “Forward”		
11.	Solenoid		

HYDROSTATIC PUMP COMPONENTS

PUMP COMPONENTS USAGE

Control Spool Centering Screw, (1)

The centering screw is used to mechanically center the control valve spool to prevent machine creepage. If the control valve solenoids are disconnected electrically the machine should not creep.

Control Solenoids, (2 & 11)

The solenoids are used to control the position of the directional control spool. Two solenoids are used, one for FORWARD and one for REVERSE, to direct signal pressure to each end of the servo piston.

Identification Plate, (next to item #1)

The units ID plate provides the units specification and PIN#.

Port "A" Test Port, (MA)

The test port is used to monitor the pressure in the Port "A". The port is also identified as "MA".

Port "A", (5)

Port "A" is used to connect one side of the pump's rotating assembly to the motor's rotating assembly. Port "A" will be the work port for the Reverse direction and the return port for the Forward direction.

Lubrication Pump Inlet, (7)

The gerotor pump that is incased in the pump housing is used to lubricate the PTO gearbox and components,, this is the supply port for the pump.

Port "B", (4)

Port "B" is used to connect one side of the pump's rotating assembly to the motor's rotating assembly. Port "B" will be the work port for the Forward direction and the return port for the Reverse direction.

HYDROSTATIC PUMP COMPONENTS

PUMP COMPONENTS USAGE

Port "B" Test Port, (MB)

The test port is used to monitor the pressure in the Port "B". The port is also identified as "MB".

Charge Relief Valve, (9)

The relief valve is used to regulate the charge pressure. The valve would relieve the pump flow into the pump case and out through the case drain. If the pump's case drain pressure was excessive and charge pressure was low this valve should be checked.

Port "B" Relief Valve, (10)

The high pressure relief valve will perform two distinctive functions that are covered in detail later in this section. The functions are, charge check and pressure relief.

Servo Test Port, (X1 and X2)

The servo test ports are used to check the pressure that is positioning the servo piston. When the unit is in NEUTRAL the pressures should be balanced on each end and should be very low if any.

Lubrication Pump Outlet, (F)

The pump outlet port directs the lubrication pump flow to the lube filter and onto the cooler. This is the flow that lubricates the PTO gearbox and components.

Charge Pressure Inlet, (G)

The machines charge pressure is used to charge the pump's rotating assembly, this is the inlet port from the charge pressure distribution manifold.

HYDROSTATIC PUMP COMPONENTS

PUMP COMPONENTS USAGE

Port "A" Relief Valve, (8)

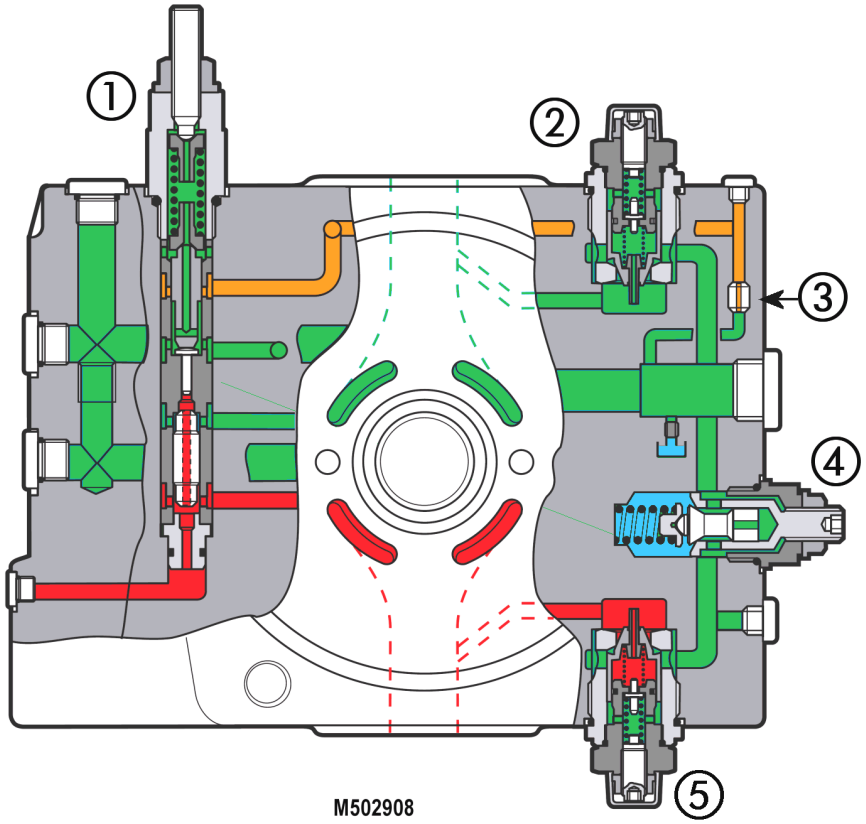
The high pressure relief valve will perform two distinctive functions that are covered in detail later in this section. The functions are, charge check and pressure relief.

Pressure Cut-Off Valve, (3)

The pressure cut-off valve is used to limit the drive pressure. If drive pressure increases about the spring load in the valve; the valve will shuttle, sending the directional control valve supply fluid to the reservoir.

HYDROSTATIC PUMP COMPONENTS

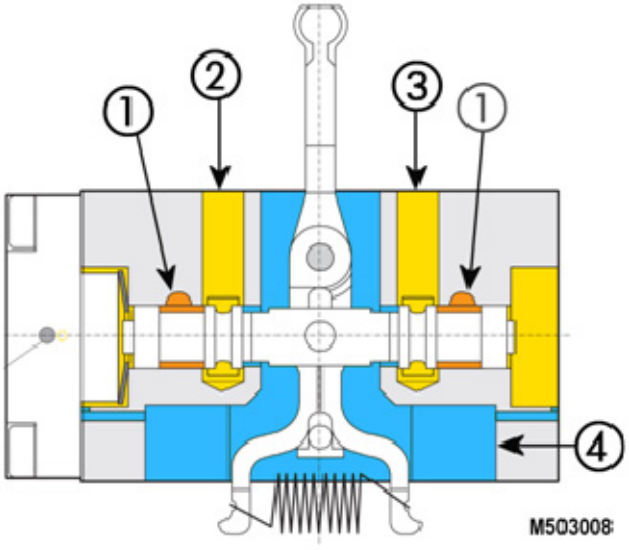
PUMP VALVES



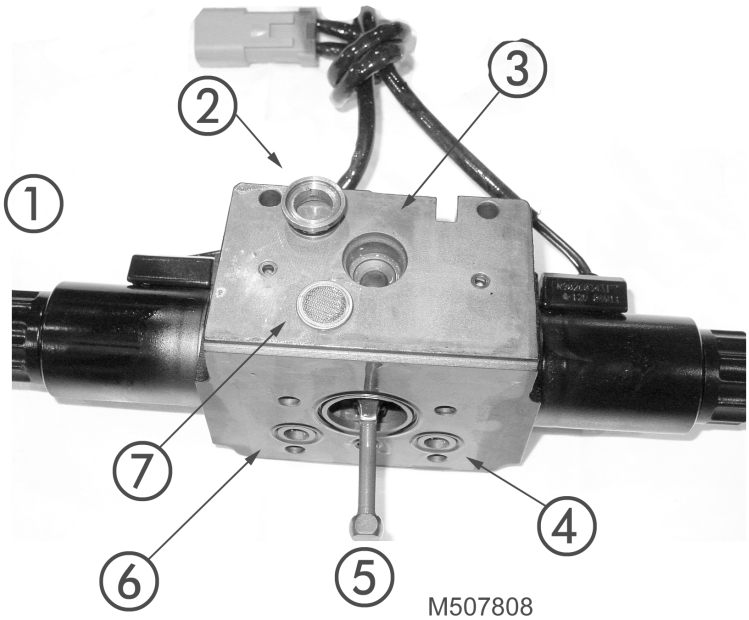
1	Pressure Cut-Off Valve	4	Charge Relief
2	Forward High Pressure Relief	5	Reverse High Pressure Relief
3	Directional Control Valve Supply Orifice		

HYDROSTATIC PUMP COMPONENTS

DIRECTIONAL CONTROL VALVE



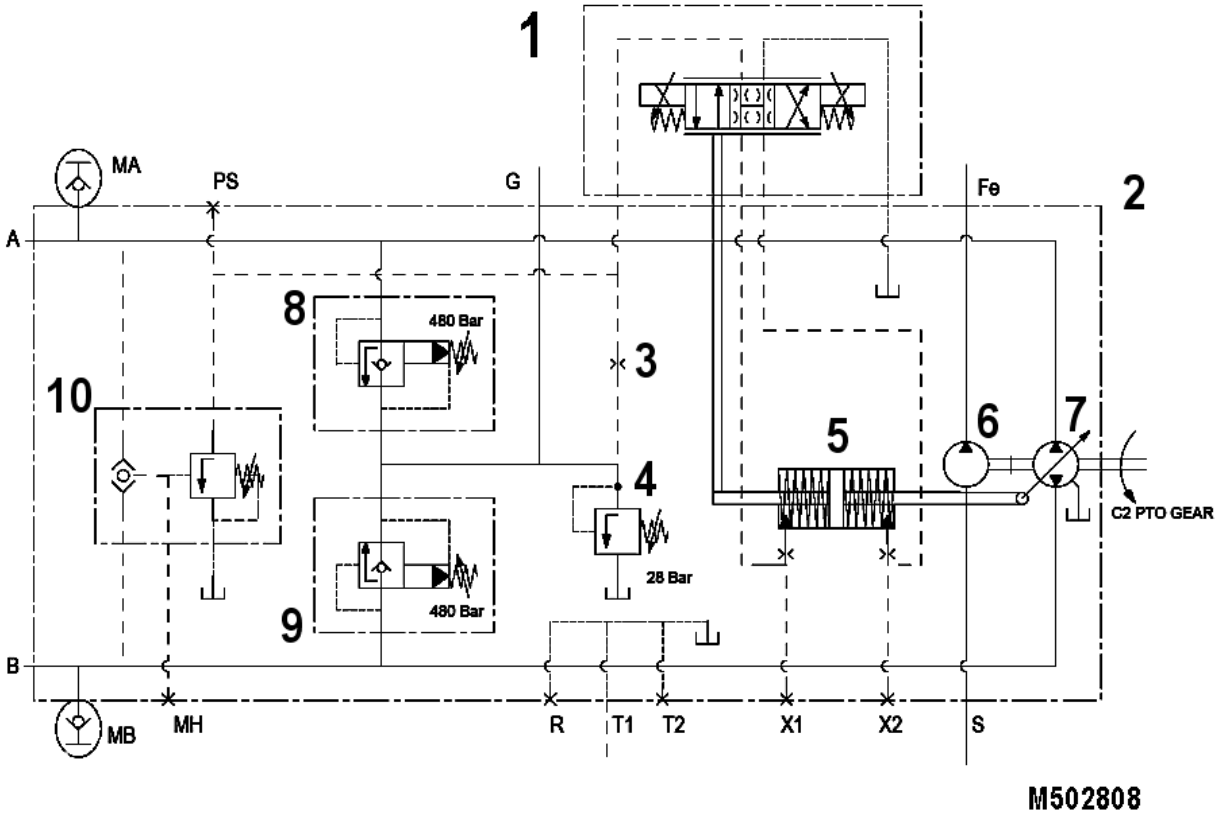
1	Charge Pressure (After Orifice)
2	Servo Port
3	Servo Port
4	Case Drain



1.	Control Solenoid	5.	Follow-up Link
2.	Screen Retainer	6.	Servo Port
3.	Inlet Port W/Screen	7.	Screen
4.	Servo Port		

HYDROSTATIC DRIVE CONTROL OPERATION

DIRECTIONAL CONTROL VALVE "NEUTRAL"



1	Directional Control Valve	F	Lube Pump Outlet
2	Pump Assembly	G	Charge Pressure Inlet
3	Control Valve Supply Orifice	MA	Reverse Test Port
4	Charge Relief Valve	MB	Forward Test Port
5	Servo Pistons	MH	Not Used
6	Lube Pump	R	Case Air Bleed
7	Pump Rotating Group	PS	Control Valve Supply Pressure
8	High Pressure Relief "Reverse"	S	Lube Pump Inlet
9	High Pressure Relief "Forward"	T1	Case Drain
10	Pressure Cut-Off Valve	X1	Servo Test Port
A	Reverse Work Port	X2	Servo Test Port
B	Forward Work Port		

HYDROSTATIC DRIVE CONTROL OPERATION

DIRECTIONAL CONTROL VALVE, NEUTRAL

The directional valve controls the position of the pump's swashplate by electrically controlling the primary spool.

Neutral Position

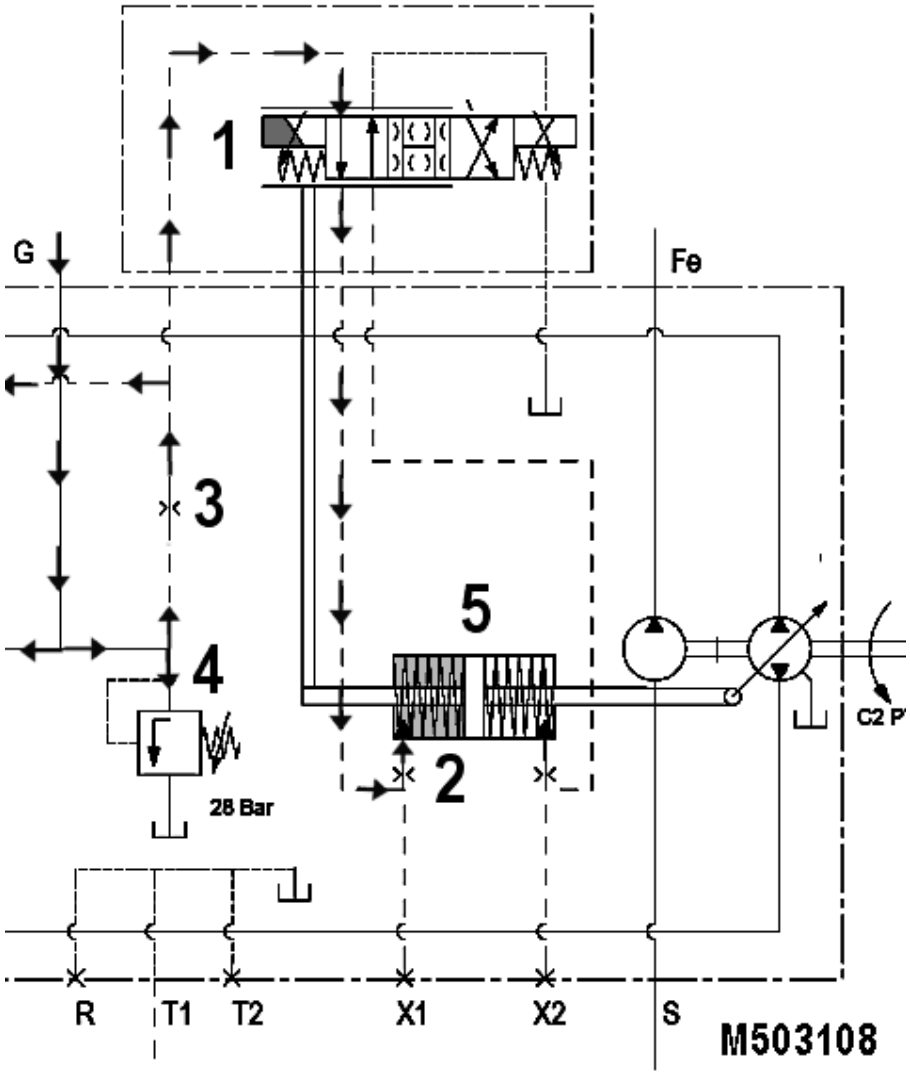
Charge pump flow comes into the pump assembly at port G, to the charge relief valve. The fluid is also free to flow through an orifice (3) to supply the directional control valve. This supply is also exposed to the pressure cut-off valve for future use.

In neutral, both directional control solenoids will be disabled, permitting the spool return spring to center the spool. By centering the spool both servo piston ports (5) will be drained to the case drain (T1). The servo springs will hold the swashplate in the neutral position, preventing any driving motion from the pump.

Ports X1 and X2 should have less than 10 PSID between them; if over 10 PSID the unit may creep and may require adjustment. The servo piston springs will hold the pump's swashplate centered to prevent any motion of the machine.

HYDROSTATIC DRIVE CONTROL OPERATION

DIRECTIONAL CONTROL VALVE "FORWARD"



1	Solenoid	G	Charge Pressure Inlet
2	Servo Damping Orifice	X1	Servo Test Port
3.	Directional Control Supply Orifice	X2	Servo Test Port
4	Charge Relief		
5	Servo Piston		

HYDROSTATIC DRIVE CONTROL OPERATION

DIRECTIONAL CONTROL VALVE, "FORWARD"

Out of Neutral Position

When the MFH is moved from the NEUTRAL position, the CCM2 controller will direct a PWM power supply to the directional control solenoids to activate it.

Example: Forward Travel

The solenoid on the directional valve (1) will shuttle to the right, pushing the primary spool. The fluid from the supply orifice (3) is directed through the directional control valve, through a damping orifice (2), to the forward servo piston. The servo piston will shuttle the swashplate to begin pumping fluid. The servo pressure can be checked at port X1. The pump will direct drive fluid flow out port "B" to the ground drive motor. Return flow will enter at port "A" to supply the pump.

The swashplate is mechanically connected to the primary spool through a follow up linkage, as the swashplate pivots the primary spool is press back toward the CENTERED position.

Normally a 100 PSID between ports X1 and X2 will provide maximum swashplate tilt.

HYDROSTATIC DRIVE CONTROL OPERATION

DIRECTIONAL CONTROL VALVE TROUBLESHOOTING

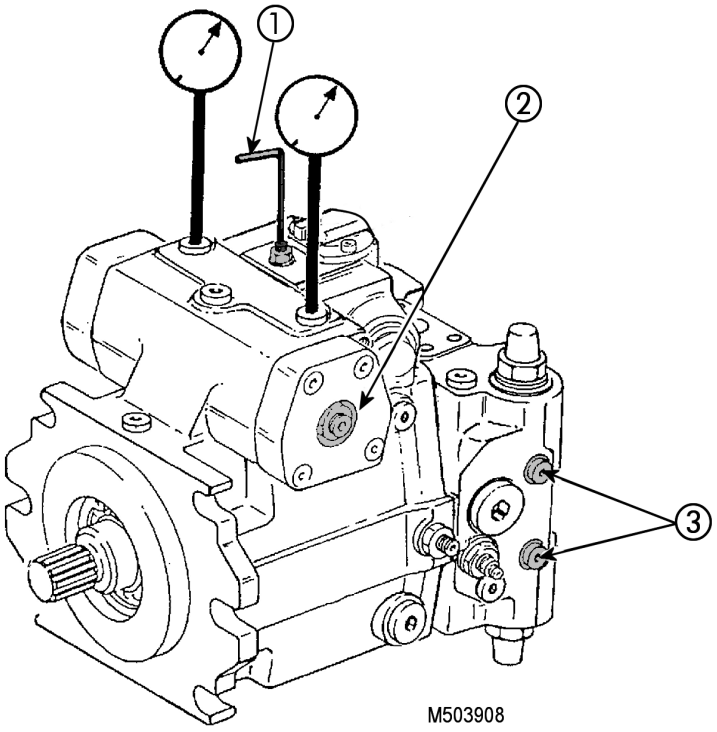
CREEPAGE

The main area for troubleshooting would be a unit that wants to creep. There are two areas that could cause a creep problem; it is NOT intended for the electronics to prevent creepage.

Possible Solutions:

1. Disconnect the electrical connection to the solenoids. Does the creeping stop? If so it would be an electrical problem.
2. If the machine still creeps, it may be that the servo piston is not centered. Using a hose, connect the two gauge ports X1 & X2 so that the servo piston is balanced hydraulically. Install two gauges at port MA & MB (3) to monitor the drive pressure, they should be equal. Using the servo centering adjustment (2), balance the pressures at port MA & MB.
3. Monitor the servo pressure at ports X1 and X2, they should be equal ±10 psi. If NOT, manually readjust the centering of the primary spool (1); there will be two screws at this location, one is used to lock the adjusting screw. The procedure would be to turn the screw until the machine creeps in one direction, then turn the screw until it creeps in the opposite direction (do not rotate more then 90°) and center the screw between the two extremes. If the pressure is not equal it would indicated that the servo piston and springs have not been adjusted correctly. As long as the system can be manually adjusted it should perform satisfactorily.

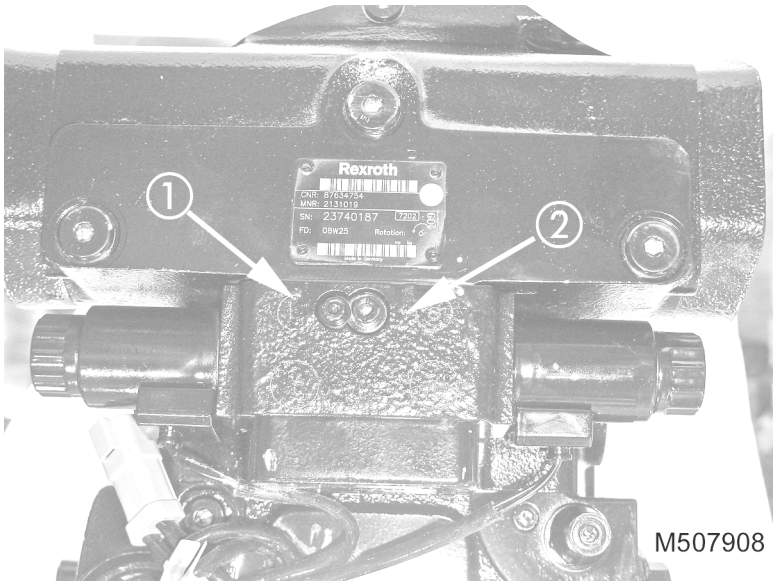
1.	Directional Valve Centering
2.	Servo Piston Centering
3.	MA & MB Test Ports



HYDROSTATIC DRIVE CONTROL OPERATION

DIRECTIONAL CONTROL VALVE TROUBLESHOOTING

CREEPAGE



1.	Adjustment Lock Screw
2.	Adjusting Screw

NO TRAVEL

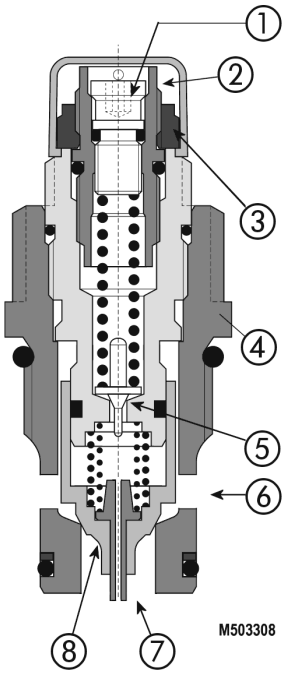
Possible Solutions:

1. Using the “TROUBLESHOOTING” screens monitor the current flow to the directional solenoids and for fault codes. If the current level does not change with MFH movement, it would be an electrical problem. Using an Ohm meter check the solenoid coils for an open circuit, there should be approximately 5.5 ohms of resistance in the coils.
2. Monitor the primary spool (1) operations by checking the pressures at port X1 and X2. The pressure should change with the position of the MFH.

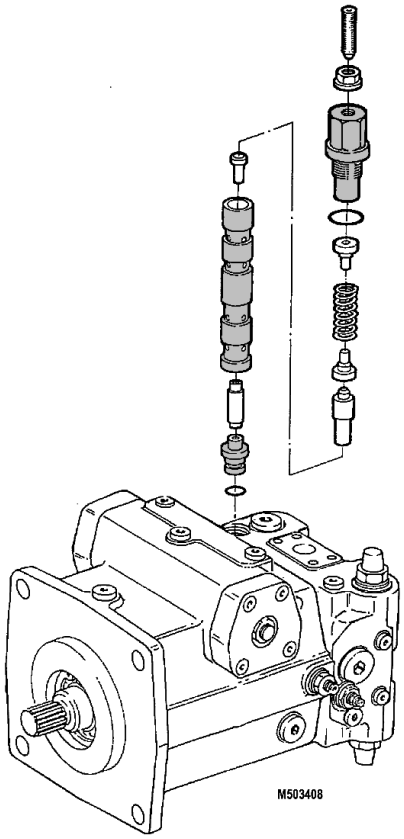
HYDROSTATIC DRIVE PROTECTION OPERATION

HIGH PRESSURE RELIEF VALVE

1	By-Pass Release (Tow Release)
2	Pressure Adjustment
3	Locking Nut
4	Housing
5	Pilot Poppet, (high pressure spring)
6	Charge Inlet Port
7	Drive Pressure Port
8	Secondary Poppet and Orifice, (low pressure spring)

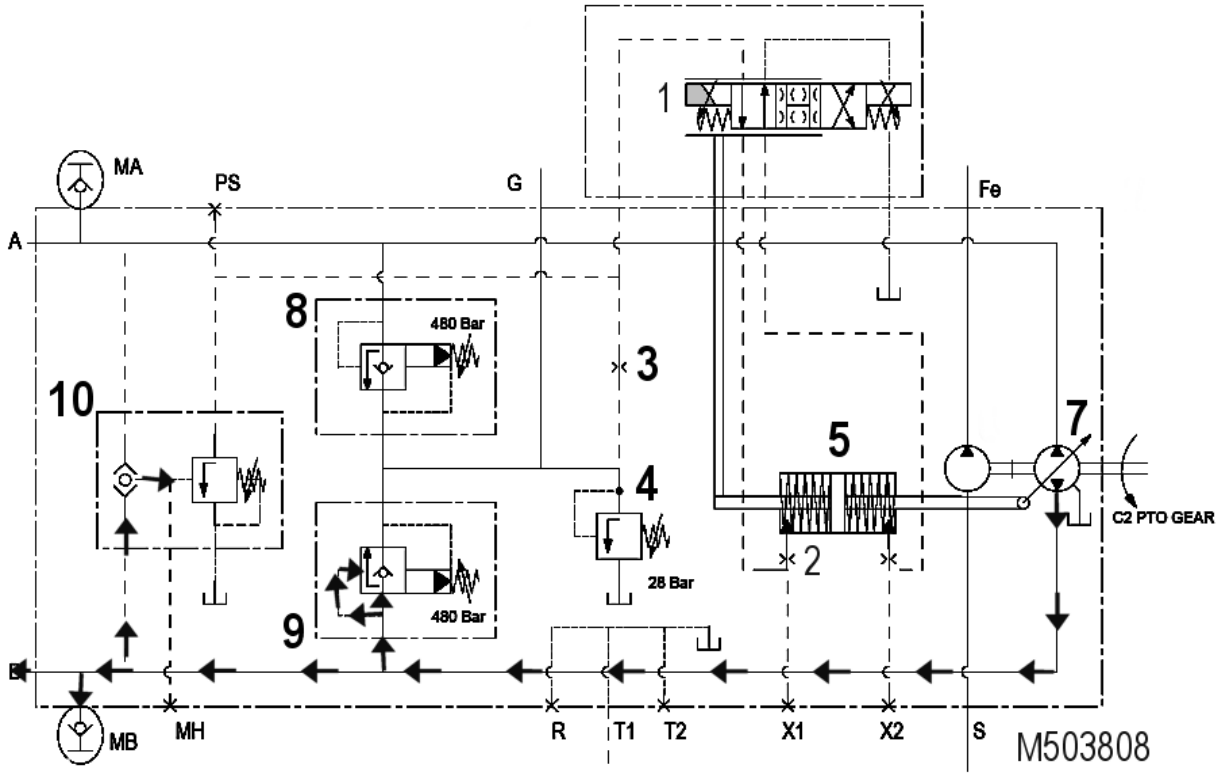


PRESSURE CUT-OFF VALVE



HYDROSTATIC DRIVE PROTECTION COMPONENTS

PRESSURE LIMITING SCHEMATIC



5	Servo Piston	10	Pressure Cut-Off
7	Pump	MB	Drive Pressure Test Port
9	High Pressure Relief	PS	Directional Control Valve Supply Pressure Test Port

HYDROSTATIC DRIVE PROTECTION COMPONENTS

DRIVE PRESSURE LIMITING

Forward Operation, (Gradual Load)

When driving in adverse conditions, the drive pressure will increase and must be limited to a safe operating level. The system may be limited in one of two ways; it is limit due to a gradual pressure increase and from a sudden pressure spike.

Example: Forward Travel, Gradual pressure build up
Once the swashplate is tilted and flow has started, the operating pressure is monitored by the Pressure Cut Off valve (10).

The valve includes a shuttle spool so the assembly may monitor the pressure from port A or B, whichever circuit is the higher pressure. Shuttle spool will be forced by the higher pressure circuit to close off the lower pressure circuit. If the spool was stuck mid way the machine may not move or if it was stuck fully in one direction the system would only have protection in one direction.

As fluid is forced out of the pump assembly (7) the pressure will increase. The pressure will be monitored on the non-spring end of the valve, and will shuttle the valve to the right against the spring. When the valve is shuttled, it will direct the directional control valve fluid supply from orifice (3) to the case drain. When this fluid is drained, the servo piston will lose its ability to hold the swashplate in position. The servo return spring will re-center the swashplate, limiting its output volume, reducing the pressure. The swashplate tilt will be reduced to a point that the pressure is reduced to a level below the setting of the pressure cut-off valve. This will normally take a couple of seconds to take place.

Normally a 100 PSID between ports X1 and X2 will provide maximum swashplate tilt.

Forward Operation, (Sudden Load)

Due to the reaction time between when the pressure cut-off valve opens and the swashplate reduced pump flow, the system must be protected from a sudden or rapid pressure increase. This protection comes from the high pressure relief valve. The drive pressure is also being monitored at the non-spring end of the high pressure relief (9). The high pressure relief is normally set approximately 10% higher then the pressure cut-off valve. If the high pressure relief is forced to the right, the total pump out put will be directed to the charge circuit.

If monitoring the operation with a gauge it will be normal to see the pressure spike to the relief valve setting, and once the pressure cut-off valve has had time to react the pressure will drop to the pressure cut-off valve setting.

HYDROSTATIC DRIVE PROTECTION COMPONENTS

PROTECTION SYSTEM TROUBLESHOOTING

LOW DRIVE FORCE

The machines drive force is controlled by the protection system. Within the protection system there are a number of areas that would need to be checked.

Possible Solutions:

1. Connect a gauge to the drive pressure test ports MA and MB. Place the transmission in a higher gear, hold the brakes and move the MFH forward. The pressure should increase slowing to the pressure cut-off setting. If the setting is not correct readjust the pressure cut-off valve.

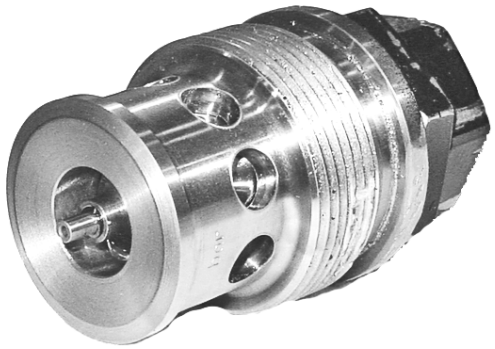
LOW DRIVE FORCE IN ONE DIRECTION ONLY

There are two areas that would permit low driving force in only one direction, one of the high pressure relief valves or the pressure cut-off shuttle check.

1 Swap the high pressure relief valve to see if the problem changes directions, if it does then one of the high pressure relief valves is the problem, if it does not change then look at the pressure cut-off valve.

2 There could also be a problem with the shuttle valve in the main drive motor.

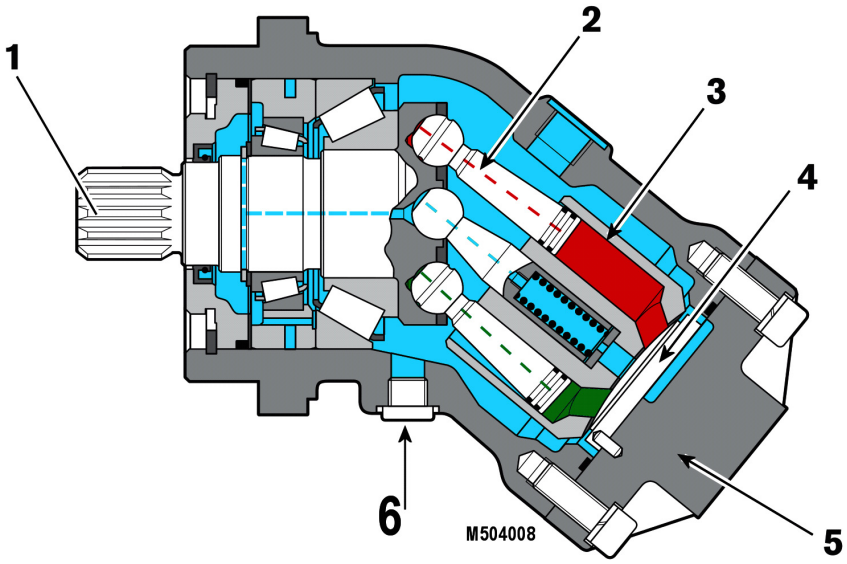
IMPORTANT: The high pressure relief utilizes a flat metal to metal face for sealing the high pressure. If the relief is reinstalled and torque with any foreign object between the housing seat and the relief valve, they could both be damaged beyond repair.



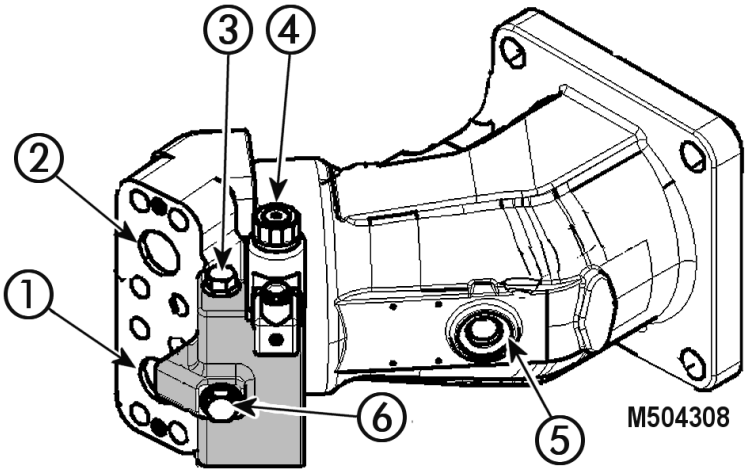
M508008

HYDROSTATIC MOTOR COMPONENTS

MOTOR PORT LOCATIONS



1.	Out Put Shaft
2.	Piston
3.	Barrel – Rotating Housing
4.	Valve Plate
5.	Port Cap



1	Port “A”
2	Port “B”
3	Shuttle Spool
4	Pressure Release Valve
5	Case Drain and Temperature Sensor
6	Flush (Shuttle) Relief Valve

HYDROSTATIC DRIVE COMPONENTS

MOTOR PORT LOCATIONS

Port "A" and "B", (1 & 2)

The work ports receive drive flow from and returns it back to the pump.

Case Drain Port and Temperature Sensor, (5)

The case drain is used to prevent the motor case from building pressure. The port also incorporates a hydraulic fluid temperature sensor.

Shuttle Valve, (3)

The shuttle spool is used to direct charge oil through the motor case for cooling and flushing debris from it. The spool is exposed to both FORWARD and REVERSE drive pressure, when drive pressure is present the spool will be forced over directing charge oil to the flush relief valve.

Pressure Release Solenoid, (4)

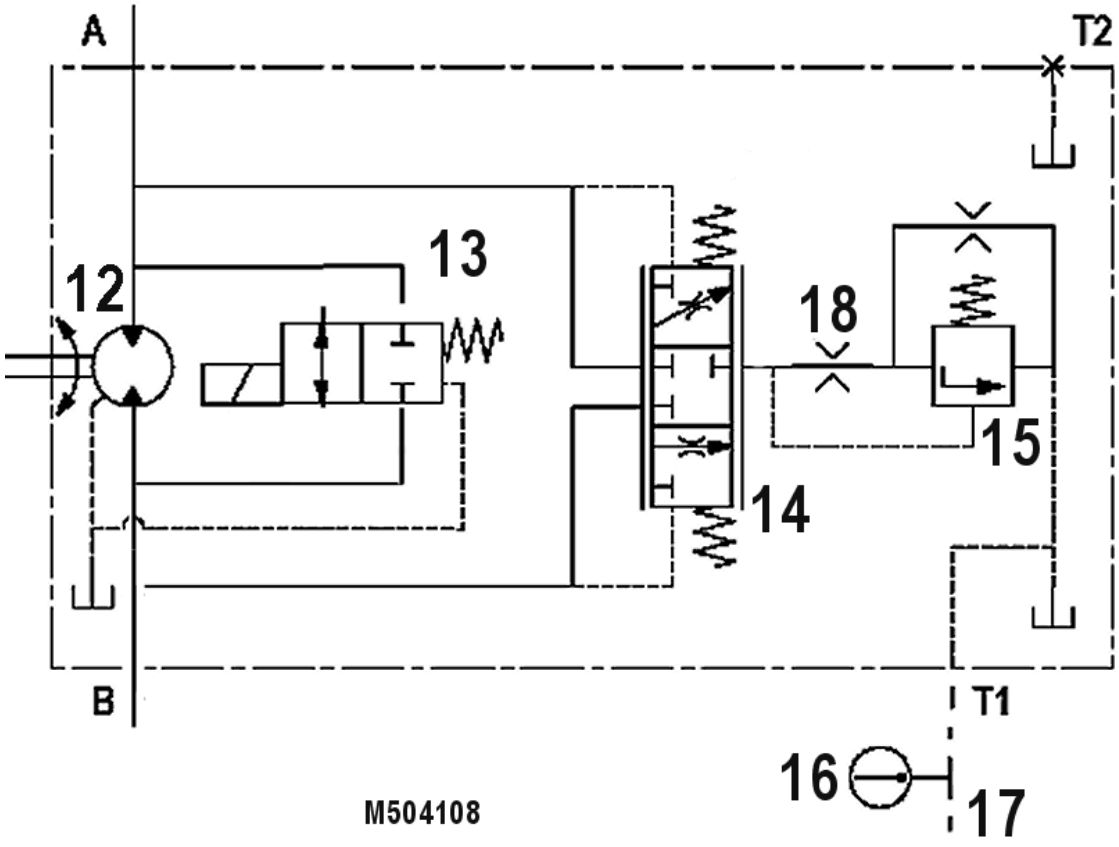
The pressure release solenoid is used to connect the two work ports (A and B) together during any transmission shifting operation.

Flushing (Shuttle Relief) Valve, (6)

The flushing relief is used to provide a flow of fluid through the motor case. Once the shuttle spool has been shuttled, charge oil is directed to the flush valve. The flushing valve is set to open below the charge pressure to assure a flushing acting.

HYDROSTATIC DRIVE MOTOR OPERATION

MOTOR SCHEMATIC "NEUTRAL"



12	Motor Rotating Group	A	Reverse Drive Port
13	Pressure Release Valve	B	Forward Drive Port
14	Shuttle Spool	T1	Case Drain
15	Flush Relief (Shuttle Relief)		
16	PTO Gearbox Temperature Sensor		
17	Case Drain		
18	Flushing Flow Orifice		

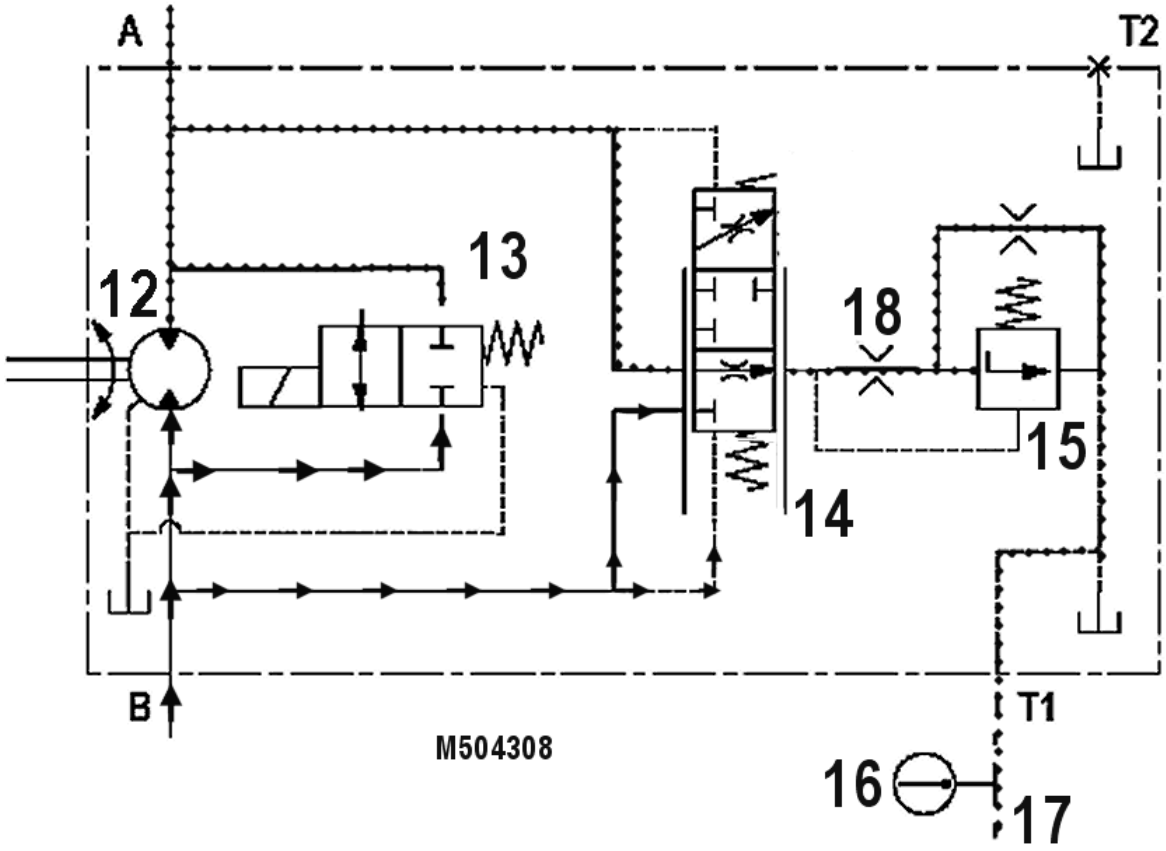
HYDROSTATIC DRIVE MOTOR OPERATION

MOTOR SCHEMATIC "NEUTRAL"

When the pump swashplate is in the NEUTRAL position, there will be no drive pressure and flow to the drive motor. Since the drive motor is not rotating, cooling and lube is not required so the shuttle spool is spring loaded to the center position. This block any charge fluid from flowing to the motor case. There will still be a very small amount of fluid leaking from the piston barrels and flowing into the motor case.

HYDROSTATIC DRIVE MOTOR OPERATION

MOTOR SCHEMATIC "FORWARD"



12	Motor Rotating Group	A	Reverse Drive Port
13	Pressure Release Valve	B	Forward Drive Port
14	Shuttle Spool	T1	Case Drain
15	Flush Relief (Shuttle Relief)		
16	PTO Gearbox Temperature Sensor		
17	Case Drain		
18	Flushing Flow Orifice		

HYDROSTATIC DRIVE MOTOR OPERATION

MOTOR SCHEMATIC "FORWARD"

When the pump creates flow, it is directed to the ground drive motor port "B" and on to the rotating group (12) of the motor causing the output shaft to rotate. At the same time the drive pressure is exposed to the LOWER side of the shuttle spool (14), causing it to shuttle UP. When the shuttle spool moves UP charge pressure fluid from the low pressure side of the closed loop is free to flow through a flow limiting orifice (18) and to the flushing relief valve (15) and the pressure release valve (13). The flushing valve is set lower then the charge pressure setting so it is forced off it seat and permits a continuous flow of fluid through the motor case for cooling, flushing and lubrication. For the shuttle spool to move the drive pressure must be higher then the charge pressure.

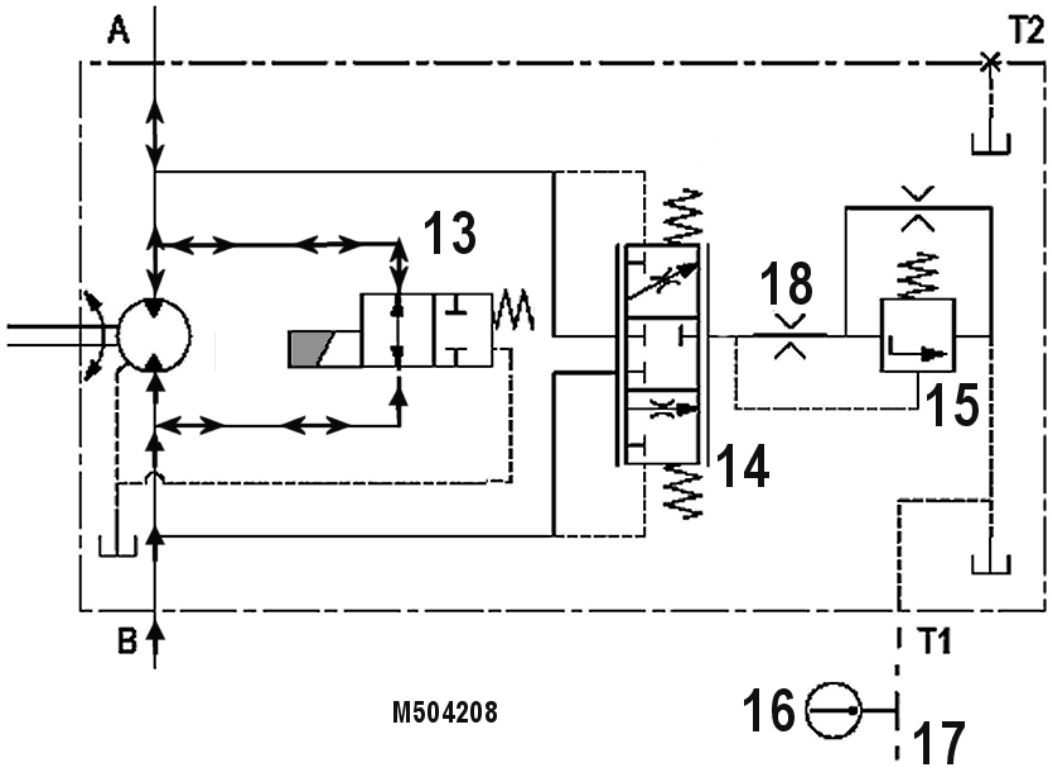
DECELERATION

If the machine starts down a slope or the MFH is pulled towards the NEUTRAL position there MUST be a positive braking action by the hydrostatic system to prevent coasting or free wheeling of the machine. When the transmission starts to turn the motor shaft faster than the pump is turning it, the return side "A" becomes charged with excess fluid causing a pressure increase on the return side of the motor's rotating group. This pressure is felt on the top side of the shuttle spool and forces the spool to the DOWN. This action prevents the drive pressure from leaking through the flushing valve. When deceleration has quit and the pump's output becomes pressurized again the shuttle spool will once again shuttle UP.

The motors parts numbers were change at pin number Y9G206770 to incorporate a high flow flushing system to help lower the operating temperature. The latter motors were 84168176 for the standard drive system and 84168175 for the heavy duty system.

HYDROSTATIC DRIVE MOTOR OPERATION

MOTOR SCHEMATIC "SHIFTING TRANSMISSION"



12	Motor Rotating Group	A	Reverse Drive Port
13	Pressure Release Valve	B	Forward Drive Port
14	Shuttle Spool	T1	Case Drain
15	Flush Relief (Shuttle Relief)		
16	PTO Gearbox Temperature Sensor		
17	Case Drain		
18	Flushing Flow Orifice		

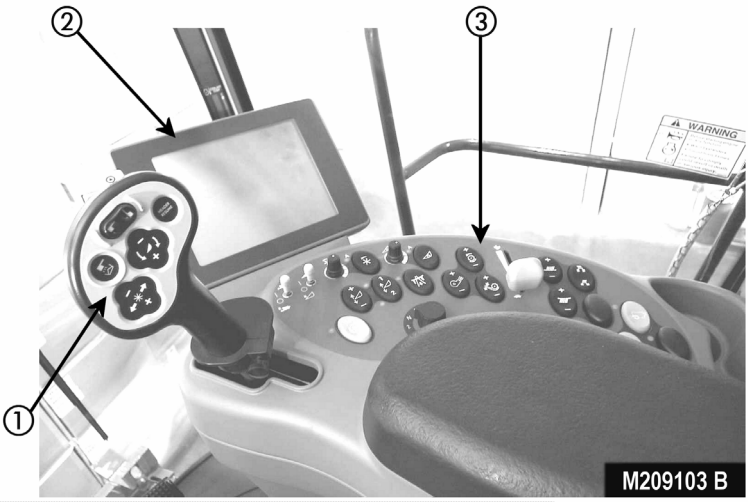
HYDROSTATIC DRIVE MOTOR OPERATION

MOTOR SCHEMATIC "SHIFTING TRANSMISSION"

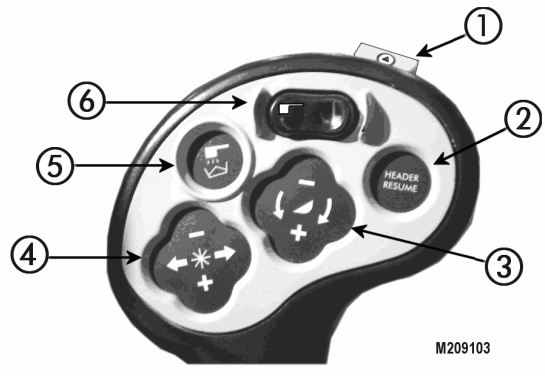
When the MFH is moved to the NEUTRAL position and the transmission shifting controls has requested a transmission shift, the electronics will activate the pressure release valve (13) to permit easier shifting.

With the pressure release solenoid activated, the pressure will be balanced on both sides of the drive motor. This will prevent the motor from creating any driving rotation, but will permit the motor to free wheel. In this mode the transmission will be free to shift.

OPERATOR'S CONTROLS

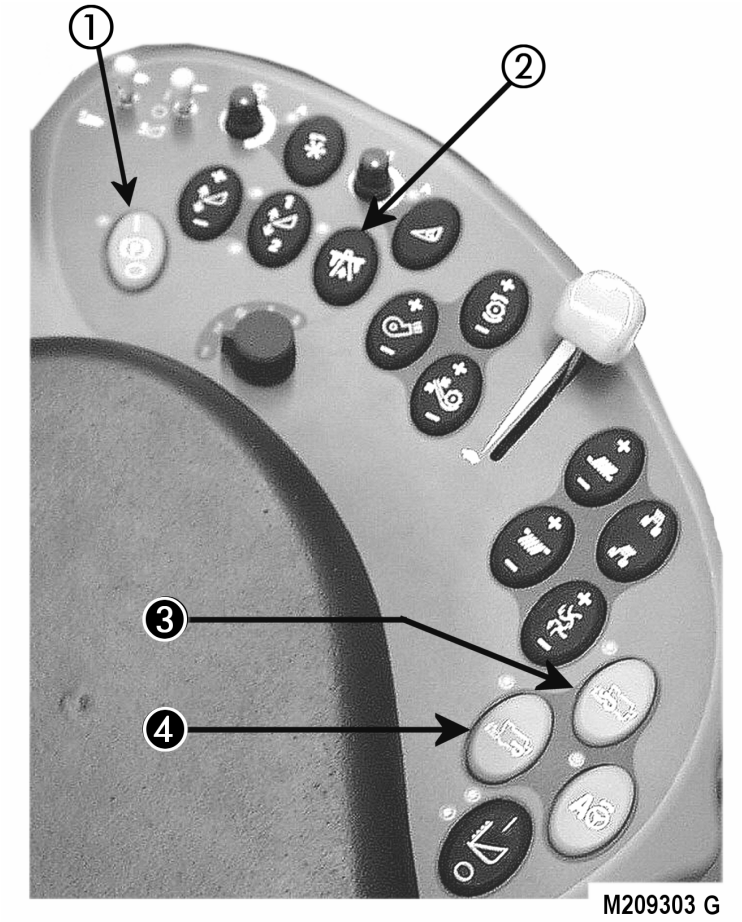


OPERATOR CONTROL CENTER	
1.	Mulit-Function Handle, MFH
2.	AFS Pro 600 Display
3.	Right Hand Console, RHC



MULTI-FUNCTION HANDLE

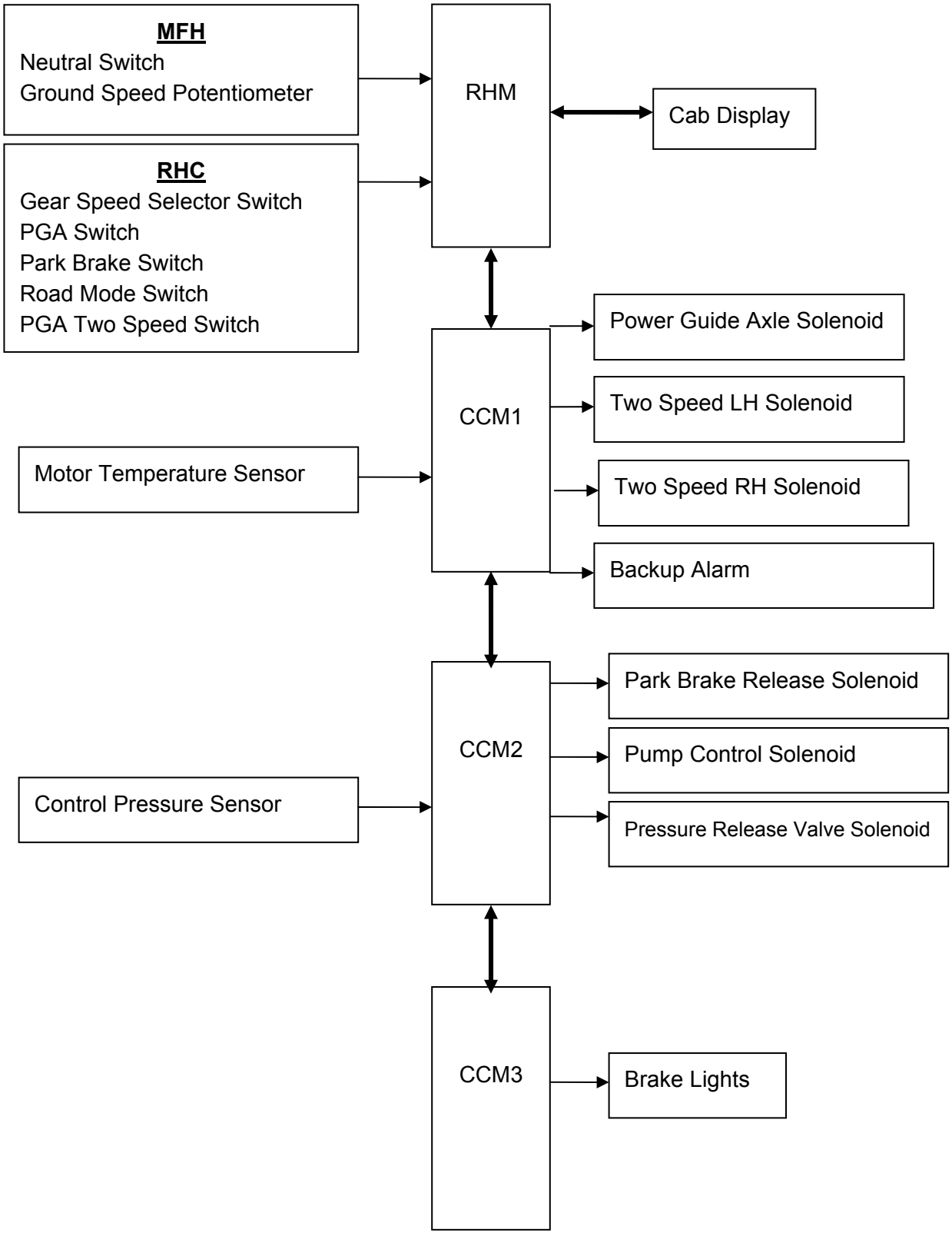
1.	Emergency Stop
2.	Resume
3.	Header Raise/Lower Tilt Right/Left
4.	Reel Raise/Lower, Fore/Aft
5.	Unloader Engagement
6.	Unloader Swing



RIGHT HAND CONSOLE (RHC)

1.	Park Brake Switch
2.	Field/Road Switch
3.	Two Speed Motor Switch (Function not available)
4.	PGA Switch

ELECTRICAL FLOW CHART



ELECTRICAL FLOW CHART

MACHINE STANDING STILL

Sequence of Events

1. When the operator moves the MFH out of the NEUTRAL zone the neutral switch will direct system voltage to the CCM2. This voltage will be used by the CCM2 to activate the pump's solenoids.
2. The RHM looks to see if the park brake has been released, and if so it will place a message on the data bus as to which direction and how far the MFH has been moved. If the park brake has not been released the RHM will placed a messaged on the data bus for the display to display a message to the operator. It does not matter whether or not the transmission is in gear.
3. The CCM2 will use the voltage supply from the neutral switch to provide a PWM to control the hydrostatic pump solenoids. The CCM2 will determine the amount of current required to position the pump's swash plate according to the data bus message.
4. The CCM2 will monitor the ground speed sensor to determine current travel speed and places a message on the data bus.
5. The CCM2 will monitor the drive motor's case drain temperature and if above a specific level will request that the solenoid current be reduced, reducing the ground speed.
6. The display will display the ground speed in the upper left cell.

ELECTRICAL COMPONENTS

RIGHT HAND CONSOLE

Ground Speed Control Potentiometer, R-04

The ground speed control potentiometer is used by the operator to provide input to the system as to the direction and speed of travel desired.

Location: At the base of the MFH

Neutral Position Switch, S-22

The neutral start switch incorporates two sets of contacts:

- The N/C set is used to senses when the MFH is in the NEUTRAL zone to permit the engine to start.
- The N/O set is used to signal the CCM2 OUT of the NEUTRAL zone to permit the hydro to operate. This is the power the CCM2 actually uses to power the hydrostatic pump's solenoids. If for some reason the ground speed control potentiometer failed the N/O portion of the neutral position switch will open when the MFH is returned to the NEUTRAL zone, stopping all travel.

Location: At the base of the MFH

Field/Road Switch, S-12

The field/road switch is used by the operator to provide input to the condition the unit will be used in. When operating the machine on the road, the road switch should be in the ON THE ROAD mode (with the LED illuminated). This mode prevents the engagement of the PGA. When in 4th gear and ROAD mode the ground speed is limited to 20 MPH or reduced by an additional 15% if left in the FIELD mode.

Location: On the RHC

Power Guide Axle, S-10

The PGA switch is used by the operator to engage and disengage the PGA drive system. The PGA is engaged when the LED is illuminated. Typically the PGA should be use at all times during harvesting, this will lower the operating pressure and temperature of the hydrostatic system. The PGA may not be engaged when the ROAD switch has been activated or in 4th gear.

Location: On the RHC

ELECTRICAL COMPONENTS

RIGHT HAND CONSOLE

Park Brake Switch, S-09

The operator will use the park brake switch to disengage the parking brake so that the machine may be moved. When ENGAGED the indicator will be illuminated. While the parking brake is ENGAGED, the ground drive hydro will NOT engage.

Location: On the RHC

Two Speed Motor Switch, S-11

The two speed motor option is a dealer installation kit only. It is used to control the torque level for the PGA. When switched to the LO torque setting, only half of the motor pistons are used. LO torque for faster ground speed and less slippage, HI for slower ground speed and higher drive torque.

Location: On the RHC

CCM1

Back Up Alarm, H-08

The back-up alarm is activated anytime the MFH is pulled to the REVERSE travel position to provide a warning for anyone outside the operators cab.

Location: Mounted on the rear of the engine maintenance platform.

Motor Temperature Sensor, B-46

The motor temperature sensor is used to monitor the ground drive motor's case drain oil temperature; this location will typically be the highest temperature on the machine. If the temperature should climb above acceptable levels, 221°F (105°C), the CCM1 will place a warning message on the data bus for the CCM2 to progressively de-stroke the pump to lower the operating load until the temperature has decreased and for the display to provide the operator with a message. Once the temperature has decreased within the operating range the pump will be permitted to return to the requested speed automatically.

Location: Mounted at the case drain line at the motor

Power Guide Axle Solenoid, L-26

The PGA solenoid is used to engage the PGA drive system by placing the wheel motors in a parallel circuit with the main ground drive motor. The flow of oil will be divided between the main motor and the two PGA motors, path of least resistance.

Location:

ELECTRICAL COMPONENTS

CCM1, CON'T

PGA Two Speed Solenoids, L-54 & L-55

The two speed solenoids are used to shift the wheel motors between LO/HI settings.

Location: One on each wheel motor.

CCM2

Park Brake Disengage Solenoid, L-10

The parking brake solenoid is used to disengage the parking brake by directing regulated oil pressure to the park brake piston.

Location: Mounted in the park brake valve assembly

Pump Control Solenoids, L-23

The pump control solenoids (-) (+) are used to control the position of the pump's swash plate, controlling the direction and speed of travel. The pump does incorporate a manually operated control that could be used for testing purposes only.

Location: Mounted on the hydro pump

Control Pressure Sensor, B-35

The control pressure sensor is used to monitor the supply pressure that is feeding the ground drive hydrostatic pump as well as the rotor and feeder drive hydrostatic pumps. If the pressure falls below 265 PSI a warning will be displayed on the display.

Location: Mounted in the control pressure manifold.

Pressure Release Valve, L-05

The pressure release valve is used to balance the drive pressure, FORWARD-REVERSE, while the transmission is being shifted into a different range. This reduces any mechanical drag that may be on the transmission.

Location: Mounted in the end cover of the motor

ELECTRICAL OPERATION

REFERENCE MATERIAL:

Electrical Frames: 7, 8, 9, 25, 26, 27

KEY COMPONENTS:

Neutral Switch S-22, Park Brake Switch S-09, PGA Switch S-10, PGA HI/LO Switch S-11, Road Switch S-12, Ground Speed Control Potentiometer R-04, Pump Control Solenoids L-23, MFH, RHM, CCM1, CCM2, Fuse F-48, Temperature Sensor B-46, Pressure release Valve Solenoid L-05, PGA Engage solenoid L-26, PGA HI/LO Solenoids L-54 & L-55,

NEUTRAL POSITION ELECTRICAL

When the operator places the MFH in the NEUTRAL zone the neutral switch will close providing an electrical signal to the CCM2 to place the hydrostatic pump in NEUTRAL.

The neutral switch S-22 is supplied 12V at terminal 1 any time the key switch is in the RUN or START position through fuse F-48. The neutral switch has an N/C and an N/O set of contacts and two very decisive jobs:

1. When IN the NEUTRAL zone the N/C set of contacts is closed, directing 12V out terminal 2 to the neutral start relay.
2. When NOT in the NEUTRAL zone the power source is directed out the N/O contacts to the CCM2 connector X015 terminal J1-17. The CCM2 will use this power to activate the hydrostatic pump solenoids. The lack of the supply power at the CCM2 connector X015 terminal J1-17 assures the deactivation of the pump's solenoids L-23.

The hydrostatic drive pump swash plate is held in the NEUTRAL position by a mechanical adjustment made by the manufacture.

FORWARD POSITION ELECTRICAL

The operator must release the parking brake before moving the MFH out of the NEUTRAL zone. The park brake switch S-09 is supplied 12V from the RHM and when the release portion of the switch is pressed a 12V signal is directed to the RHM connector X029 terminal 9. The RHM will place a message on the data bus to release the parking brake. The CCM2 connector X016 terminal J2-15 will direct 12V to the park brake release solenoid L-10 terminal 1, the solenoid is chassis grounded. Once the CCM2 has activated the L-10 solenoid, the park brake indicator will be turned OFF and the system will be permitted to operate.

ELECTRICAL OPERATION

FORWARD POSITION ELECTRICAL, CON'T

When the operator moves the MFH into the FORWARD slot the machine will move forward at a speed proportional to the distance that the MFH is moved.

The neutral switch S-22 will close the N/O set of contacts and open the N/C set. The 12V that is being supplied to the switch at terminal 1 is now directed out terminal 3 to the CCM2 connector X015 terminal J1-17, providing the power that will be used to power the hydro pump solenoids L-23. The CCM2 will direct a PWM voltage supply out J3-31 to the pump's (+) solenoid L-23 to cause the swash plate to tilt in the correct direction. The pump's flow will cause the machine to move in the correct directions.

Ground Speed, B-17

The machine's ground speed is monitored by the ground speed sensor B-17 that is located in the top cover of the transmission. The sensor, terminal 2, is supplied voltage from the CCM2 connector X017 terminal J3-14, and a return from terminal 1 to the CCM2 connector X017 terminal J3-18.

Temperature Control, B-46

If the combine is working in adverse conditions that cause the system to operate at high pressure, the system temperature may increase above safe levels. The ground speed will be reduced by 5% if the temperature exceeds the limit. If the temperature continues to exceed the limit it will be further reduced 5% at 10 second intervals. The reduction will not exceed 50% of the desired speed. Once the temperature has been lowered below the limit the ground speed will be increased by 5% at 60 seconds intervals until back to the operator's desired set point.

The ground drive motor case drain temperature sensor B-46 is used by the CCM1 to monitor the operating temperature. If the operating temperature increase above 212° F(100° C) the CCM1 will place a message on the data bus for the CCM2 to begin de-stroking the pump. The pump will be de-stroked proportional to the temperature until it has lowered back into the operating range. The temperature sensor B-46 is supplied a 5V supply at terminal B from the CCM1 connector X020 terminal J3-33 and is provided a return ground from terminal A back to the CCM1 connector X020 terminal J3-18. As the temperature increases the resistance in the sensor is reduced, and the supply voltage to the sensor is bled off to the ground, lowering the supply voltage creating the temperature signal.

ELECTRICAL OPERATION

FORWARD POSITION ELECTRICAL, CON'T

Power Guide Axle, S-10

When the operator presses the PGA switch the output flow from the hydrostatic pump will be split between the main drive motor and the two PGA motors. This splitting of the flow will cause the combines forward motion to be reduced, but the driving torque to be greatly increased. There is NO compensation by the electronic control system for the reduced ground speed.

The PGA switch S-10 is a momentary toggle switch; it is cycled to engage and disengage the PGA, is supplied 12V from RHM. Each time the switch is pressed a 12V signal is directed to the RHM connector X029 terminal 17. Every time the RHM receives this signal a message will be placed on the data bus alternating between ENGAGE and DISENGAGE the PGA. On the ENGAGED cycle the RHM will also provide a ground from terminal 18 to the PGA switch LED to illuminate it. The CCM1 will pick up the message and direct PWM voltage out connector X019 terminal J2-16 to the PGA solenoid terminal A. The solenoid is provided a chassis ground at the main ground point (1).

REMEMBER: If the transmission position sensor signal is lost, is sending a signal that the transmission is in multiple gears or the transmission is in 4th gear the Power Guide Axle will be disengaged.

Two Speed Power Guide Axle, S-11

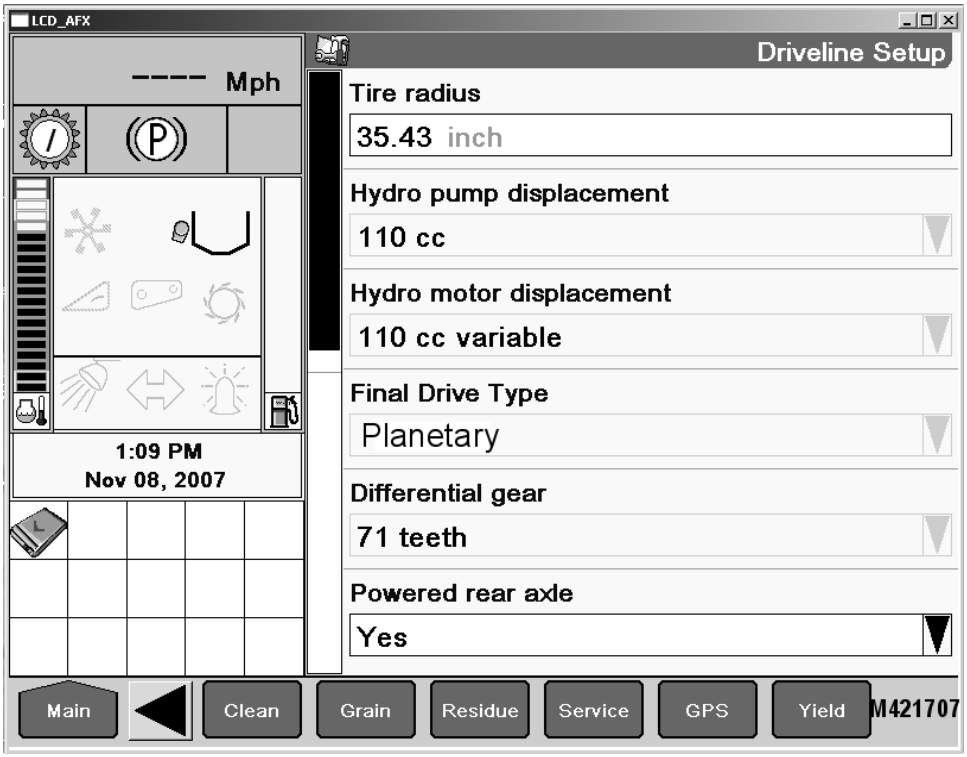
When the operator presses the PGA HI/LO switch S-11, the two motors will toggle from using all the pistons or half the pistons to reduce the torque limit and the amount of ground speed reduction.

The HI/LO switch S-11 is a momentary toggled between HI or LO, is supplied 12V from RHM. Each time the switch is pressed a 12V signal is directed to the RHM connector X029 terminal 6. Every time the RHM receives this signal a message will be placed on the data bus alternating between HI and LO torque. On the HI cycle the RHM will also provide a ground from terminal 18 to the HI switch LED to illuminate it. The CCM1 will pickup the message and direct PWM voltage out connector X020 terminal J3-3 to both motor solenoids L-54 & 55 terminal A. The solenoid is provided a chassis ground at the main ground point (2).

SYSTEM CONFIGURATION

The ground drive system must be correctly configured to operate correctly. The following screen provides a quick overview of some items that should be verified during pre-delivery and/or if a problem is encountered. Refer to section 42 “Configurations” for a list of the optional settings.

REMEMBER: If the box is grayed out it may only be changeable using the Electronic Service Tool.



TIRE RADIUS CONFIGURATION

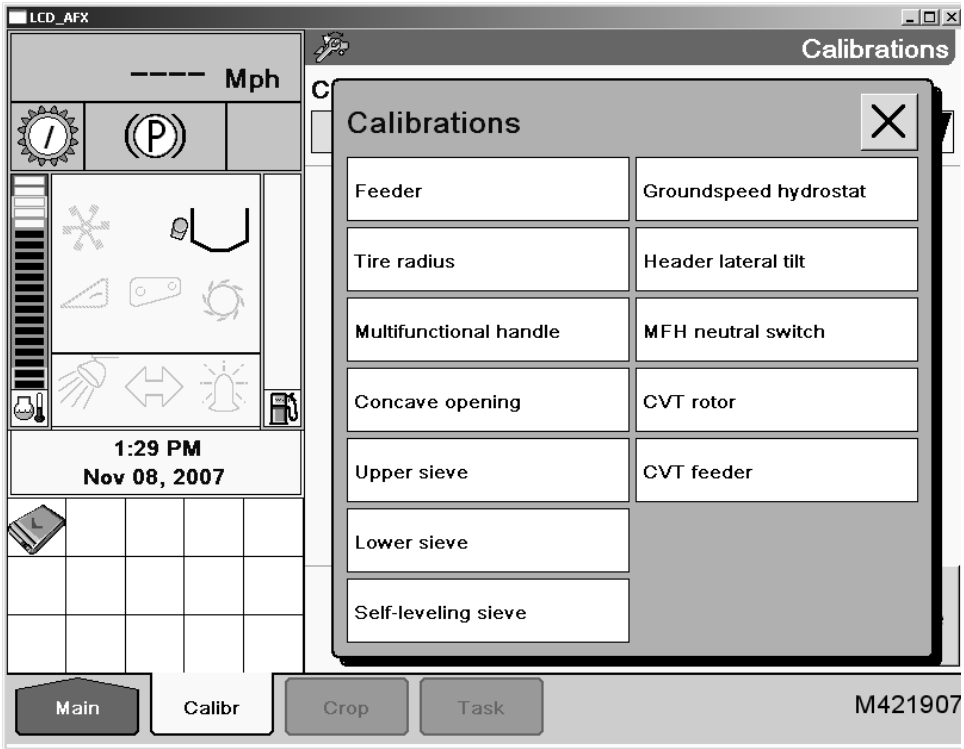
Using the display screen, the correct tire rolling radius should be entered or perform a dynamic distance calibration. This information is used to calculate ground speed and by the yield monitor.

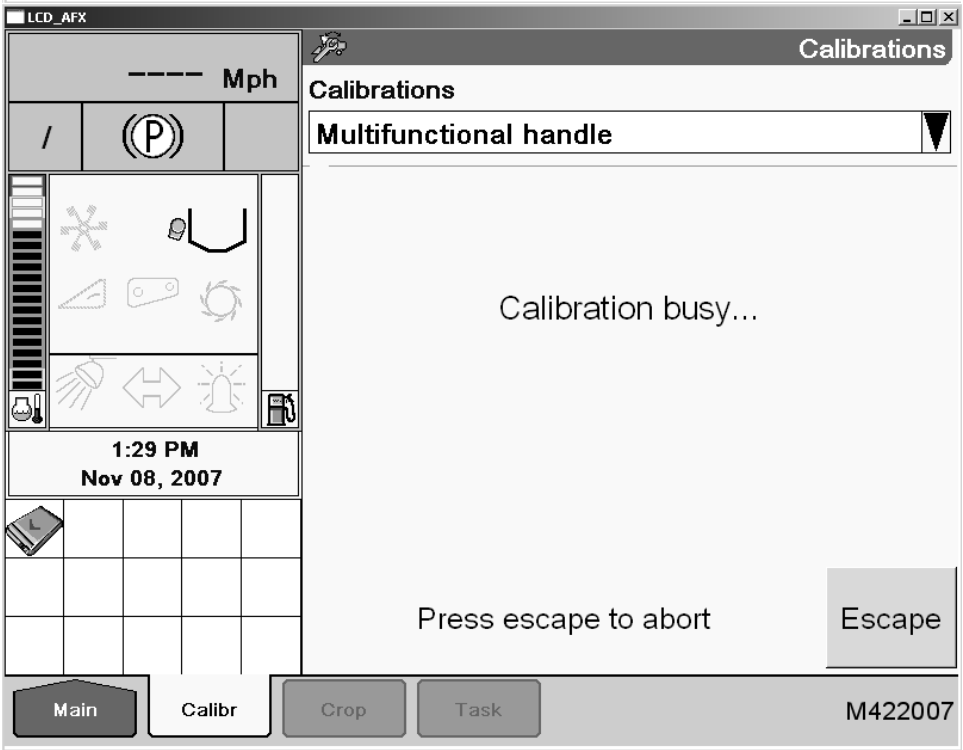
A dynamic calibration should always be used for best accuracy with the yield monitor. Navigate by MAIN>TOOLBOX>DRIVE>TIRE RADIUS

REMEMBER:

SYSTEM CALIBRATIONS

The ground drive system must be correctly calibrated to operate correctly. The following screen provides a quick overview of some items that should be calibrated during pre-delivery and/or if a problem is encountered.





SYSTEM CALIBRATIONS

There are four major calibrations that may be required when making system adjustment and/or replacing components. As rule they should not be required during pre-delivery.

TIRE RADIUS CALIBRATION

The ground speed sensor must be calibrated to provide for accurate speed information for the yield monitor and acre counter. For BEST accuracy, this should be done in field condition with a half full grain tank. Before performing the calibration be sure to "CONFIGURE" the tire-rolling radius. Before starting the calibration procedure, set out very accurate 400 ft (122 m) driving range, allowing for pre-stating and stop room for the machine. *Follow the on display screen instructions*.

REMEMBER: The 400 foot course must be measured accurately for the calibration to be accurate.

MULTI-FUNCTION HANDLE CALIBRATION

This calibration allows the controller to learn the voltage range of the MFH potentiometer. It learn four different positions:

- Full Forward
- Neutral on the forward side
- Neutral on the reverse side
- Full Reverse.

These values are stored in non-volatile memory and are used to determine the requested speed and direction of travel. These values are used to calculate the relative position seen on the diagnostic screen – MAIN>DIA>SETTING> Ground Drive> Propel Handle. The full forward value is +100%, forward neutral +0%, reverse neutral -0% and full reverse -100%. *Follow the on display screen instructions*.

MFH NEUTRAL POSITION CALIBRATION

The NEUTRAL calibration is used by the CCM2 to learn how much MFH movement is required (MFH potentiometer voltages) before the neutral switch changes position. The neutral switch MUST toggle before the hydro solenoids can be activated. *Follow the on display screen instructions*.

SYSTEM CALIBRATION

GROUND SPEED HYDROSTAT CALIBRATION

The propulsion handle position sensor must be calibrated so that the RHM can learn its position and is learning how much travel is required to produce initial ground speed.

If the system does not seem to retain this calibration, example: the combine has a reduced ground speed unless the calibration is performed on each key cycle, further investigation will be required.

When the MFH is moved out of the NEUTRAL zone, machine travel **MUST** begin before the hydrostatic pump's solenoid reaches 0.035 amps current flow. If the signal is above 0.035 amps, the calibration will not be retained after the key switch is turned **OFF**. To verify this condition use the display by going to: MAIN>DIAG>SETTINGS>GROUND DRIVE> ISENSE GROUND DRIVE HYDRO. If it take more then 0.035 amp (35m Amp) in either direction to start movement there are two **temporary** procedures to use:

1. Try to calibrate the system on a paved surface with the tire inflated to the maximum setting.
2. After determining which direction requires the highest reading to start movement try positioning the machine on a slight grade and perform a calibration.

REMEMBER: If replacing ANY hydrostatic pump components or swashplate adjustments made, contact TSG through the ASSIST program for additional instructions.

SYSTEM CALIBRATION

MAXIMUM FORWARD SPEED

The maximum forward ground speed is limited to approx. 20 MPH when the transmission is placed into 4th gear and the ROAD mode switch is placed into the ROAD mode. If the road mode switch is left in the HARVEST position, the ground speed will be reduced by an additional 15%. The maximum forward speed is limited by a setting that was programmed into the machine at the plant.

MAXIMUM REVERSE SPEED

The maximum reverse speed is limited by a setting that was programmed into the machine at the plant.

RESOLVING FORWARD OR REVERSE GROUND SPEED ISSUES

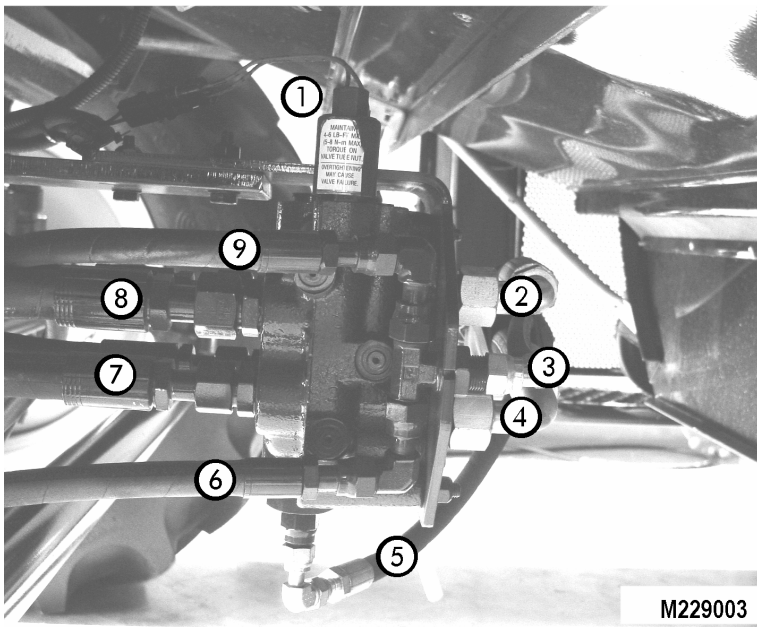
When components on the ground drive hydro pump or motor are changed, the ground speed may also be changed. In order to correct the ground speed issues a special EST tool (service tool that the CTM and TSS will need to source) is used to determine the saturation point of the control solenoids. Saturation is the point at which adding more current will not do any good, the solenoid has already moved the spool as far as it can go. If it would take 86% current to achieve maximum ground speed, it would do no good to give it 100%; it would just produce a dead band at the end of the MFH stroke.

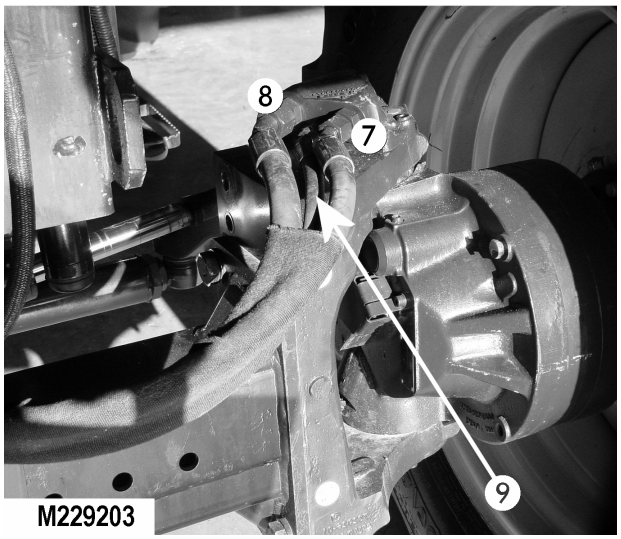
SAFE MODE

The loss of signal from either the MFH or the ground speed pot (R-04) will cause the ground drive to enter the SAFE MODE. This mode will de-energize the ground drive hydro solenoid, causing the machine to slow to a stop. This will produce an alarm message “A0098”. The MFH will need to be moved back into the NEUTRAL zone to reset it.

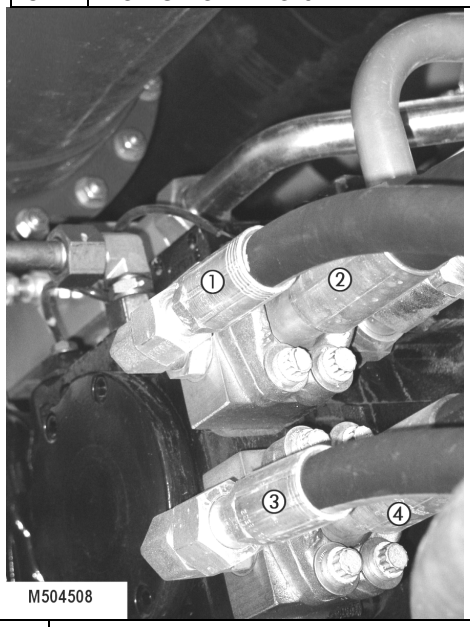
POWER GUIDE AXLE, PGA

OIL FLOW

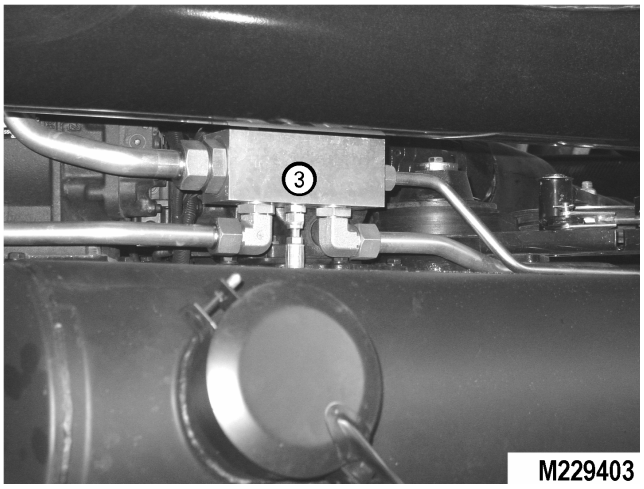




1.	PGA Solenoid	6.	Left Motor Drain
2.	Reverse Motor Ports	7.	Right Motor Reverser Supply
3.	Motor Case Drain	8.	Right Motor Forward Supply
4.	Forward Motor Ports	9.	Right Motor Drain
5.	Valve Tank Port		



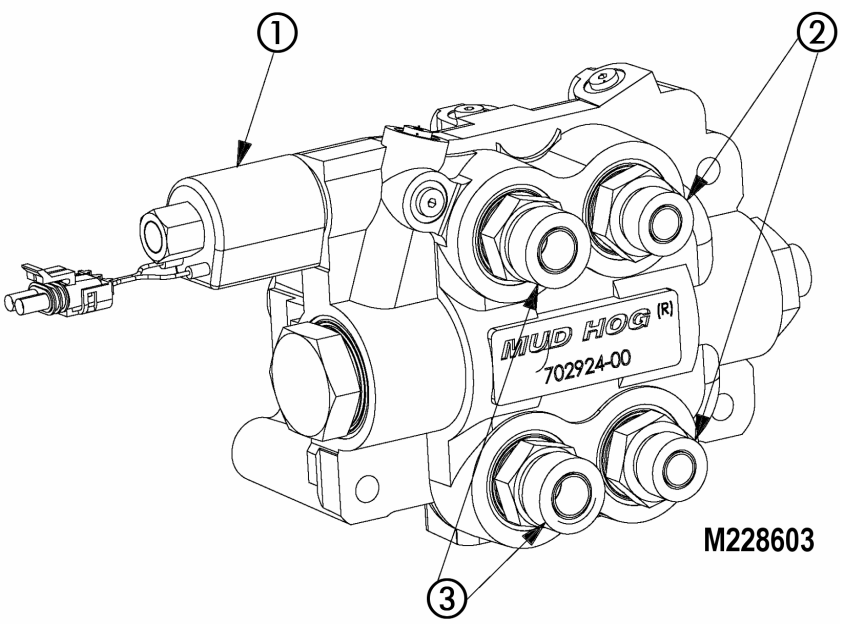
1	PGA Forward Hose
2	Main Motor Port “B” (Forward)
3	PGA Reverse Hose
4	Main Motor Port “A” (Reverse)

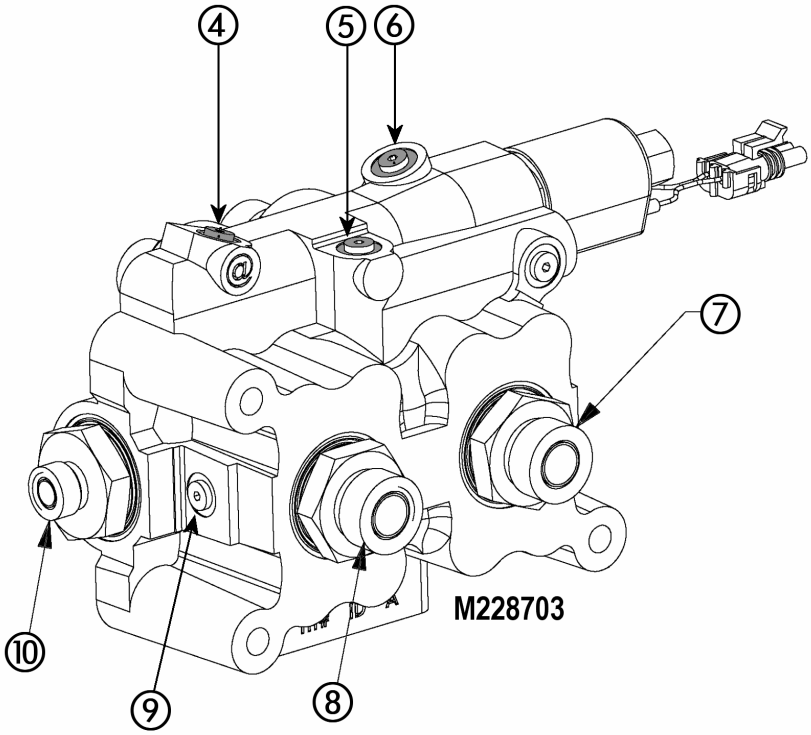


3	Return Manifold

POWER GUIDE AXLE, PGA

COMPONENTS

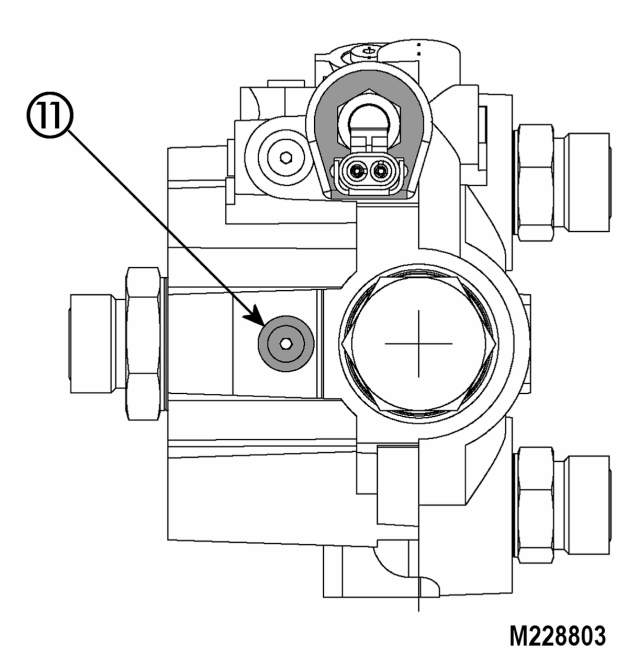




1.	PGA Solenoid	6.	
2.	Reverse Motor Ports	7.	Forward Supply Port
3.	Forward Motor Ports	8.	Reverse Supply Port
4.	Tank Port	9.	Reverse Test Port
5.	Control Pressure	10.	Valve Tank Port

POWER GUIDE AXLE, PGA

COMPONENTS

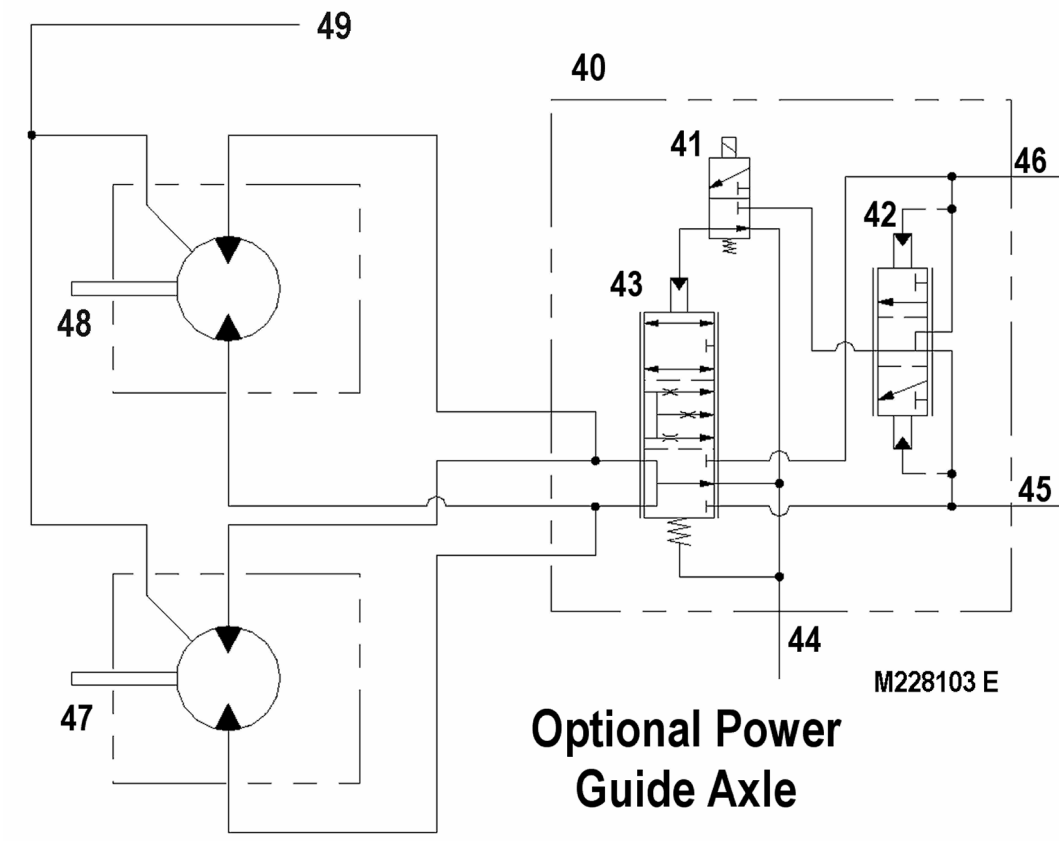


11.	Forward Test Port

IMPORTANT: When installing the test fitting for the Forward and Reverse Test ports the valve MUST be place vertical to prevent the internal shuttle valve parts from being mis-lodged.

POWER GUIDE AXLE, PGA

SCHEMATIC



40	PGA Valve	45	Drive Supply
41	Engagement Solenoid	46	Drive Supply
42	Shuttle Spool	47	Wheel Motor
43	Secondary Spool	48	Wheel Motor
44	Valve Return to PTO Gearbox	49	To Drain Manifold

POWER GUIDE AXLE, PGA

PGA VALVE OPERATION

IMPORTANT: Remember that the PGA valve is connected in parallel with the ground drive motor, meaning they both share the same fluid supply. That also means that the unit that turns the easiest can receive the greatest amount of fluid.

PGA "OFF"

The shuttle spool (42) is exposed at each end to both drive ports "A" (46) and "B" (45), whichever port has the highest drive pressure will cause the spool to move in the opposite directions. This permits control pressure flow to the PGA solenoid (41) for its operation.

When the PGA switch is in the **OFF** position the PGA solenoid (41) is NOT activated the ports "A" (46) and "B" (45) are blocked at the secondary spool (43) and total pump flow is directed to the ground drive motor.

There is NO motor flush lines connected to the motors at this time. The case drain (49) is for internal leakages.

PGA "ON"

Example:

Forward Travel

When the pump creates flow and directs it to the ground drive motor port "A" it is directed to the PGA port (46), shuttle spool (42) and secondary spool (43) where it is blocked.

The shuttle spool will be forced down, directing return (control pressure) fluid from port "B" (45) to the PGA control solenoid. The solenoid will be activated, causing it to shuttle down and directing the fluid to the non-spring end of the secondary spool (43). The secondary spool is set up with a modulating type spool, this permits a momentary middle position on the spool to allow for a soft engagement. The spool will finally end up in the full down position.

Drive pressure from port "A" (46) will be directed to the wheel motor. Whichever wheel turns the easiest will receive the most fluid.

The return from the two motors will flow back through the secondary spool and out port "B" (45) back to the pump.

The added drive pressure in the motors will cause additional leakage within them to create flush and cooling. The leakage is directed back to the return manifold.

PGA ELECTRICAL OPERATION

REFERENCE MATERIAL:

Electrical Frames: 7, 8, 9, 17, 25, 26, 27

KEY COMPONENTS:

RHM, CCM1, Road Mode Switch S-12, PGA Switch S-10, HI/LO Switch S-11

DISENGAGED POSITION ELECTRICAL

When the operator toggles the PGA switch S-10 so that the LED indicator lamp is NOT illuminated a signal is directed to the CCM1 to de-activated the PGA solenoid.

The PGA switch S-10 is supplied 12V from the RHM any time the key switch is in the RUN or START position. The PGA switch has a N/O set of contacts and an LED indicator lamp. When operator momentarily presses the switch a 12V signal is directed to the RHM connector X029 terminal 17. When the RHM sees this signal it places a message on the data bus to DISENGAGE the PGA.

The CCM1 picks up the message and does NOT supply power to the PGA solenoid L26.

ENGAGED POSITION ELECTRICAL

When the operator toggles the PGA switch S-10 so that the LED indicator lamp IS illuminated a signal is directed to the CCM1 to de activated the PGA solenoid.

The PGA switch has a N/O set of contacts and an LED indicator lamp. When operator momentarily presses (toggles) the switch a 12V signal is directed to the RHM connector X029 terminal 17. When the RHM sees this signal it places a message on the data bus to ENGAGE the PGA. The RHM also provides a ground for the LED indicator lamp at connector X027 terminal 18.

The CCM1 picks up the message and directs a 12V power out connector X019 terminal J2-16 to the PGA solenoid L26 terminal A. The solenoid is provided a chassis ground at ground point (1).

TWO SPEED POWER GUIDE AXLE, PGA

All 7010 /9120's are equipped with two speed PGA motors (if equipped with a PGA), but they are NOT equipped with the necessary control valves to use the feature. The controls are a Dealer Install kit or may be factory installed. The kit would require the installation of a two-speed valve manifold on EACH wheel motor and the necessary wiring to the rear of the machine.

The two speed will provide the operator with an additional PGA operating mode.

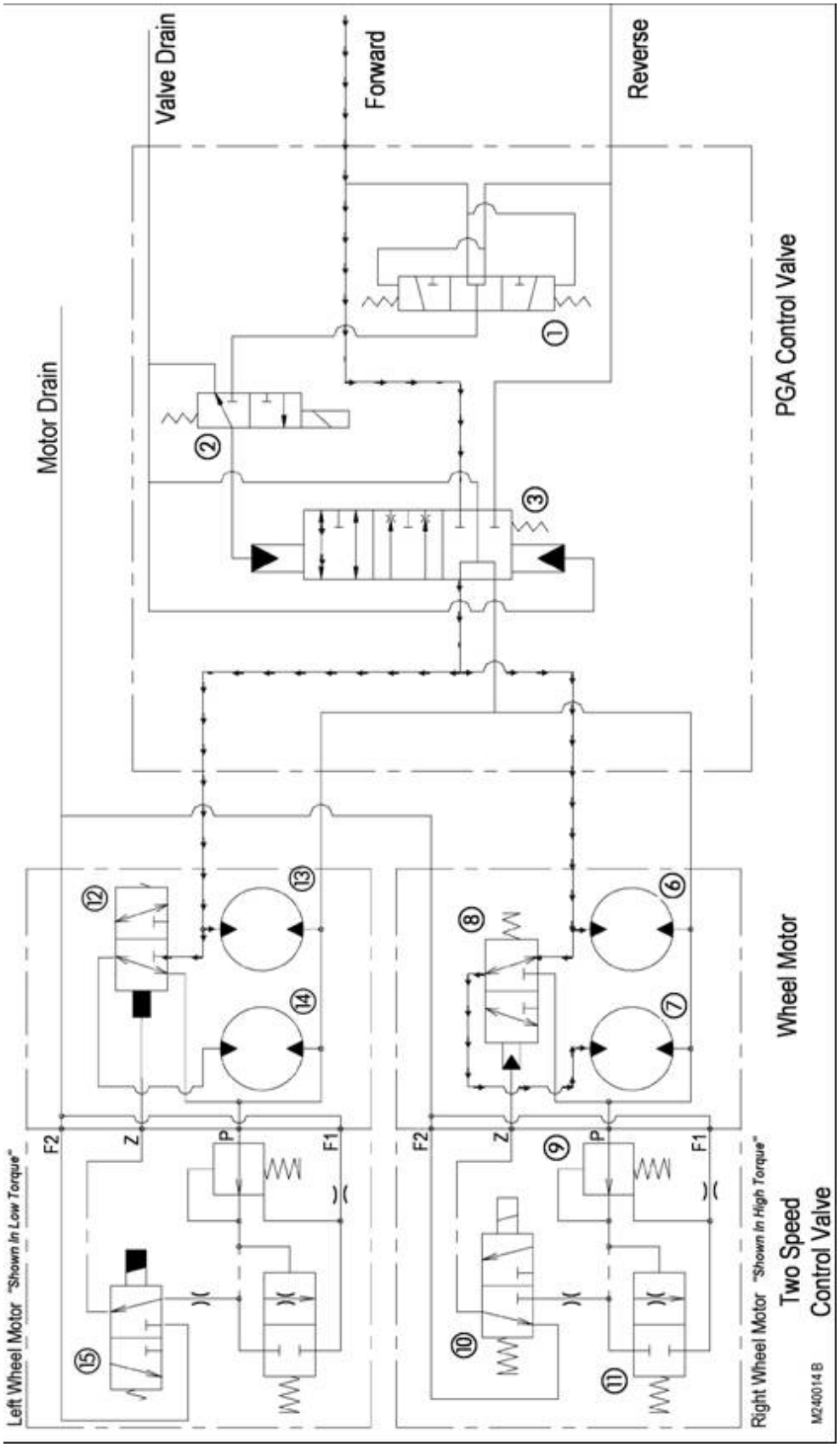
1. PGA OFF, the PGA valve is de-activated which provides all the hydrostatic pump's flow to the main drive motor. This setting provides for a faster ground speed but less pulling power for adverse conditions.
2. PGA LOW Torque, the PGA valve and the two speed valves are activated. This setting causes the two speed spool inside the wheel motors to shuttle, isolating half of the drive piston from receiving fluid. This setting provides limited driving torque to the rear wheel motors and also a reduced ground speed reduction. When working in very adverse condition this setting may help to prevent the rear wheels from spinning out, robbing fluid from the main drive motor.
3. PGA HIGH Torque, the PGA valve is activated. This setting provides maximum driving torque to the rear wheel motors, also the greatest ground speed reduction. When working in adverse condition, BUT where traction is available this setting may help to provide the pulling power needed.

REMEMBER: On all wheel motors there are normally four pistons being used on the drive cycle. When operating in the LOW torque mode only two pistons are used on the drive cycle.

REMEMBER: At this time it is not recommended to drive in reverse while in LOW torque mode for an extended period of time.

TWO SPEED PGA VALVE SCHEMATIC

1.	Shuttle Spool
2.	Engagement Sol.
3.	Secondary Spool
6.	Low Torque Pistons
7.	High Torque Pistons
8.	Two Speed Secondary Spool (HIGH Torque Position)
9.	Pressure Reducing Valve
10.	Two Speed Control Solenoid (HIGH Torque Position)
11.	Flushing Valve
12.	Two Speed Secondary Spool (LOW Torque Position)
13.	Low Torque Pistons
14.	High Torque Pistons
15.	Two Speed Control Solenoid (LOW Torque Position)



TWO SPEED PGA VALVE HYDRAULIC

TWO SPEED VALVE OPERATION

REFERENCE MATERIAL:

Hydraulic Schematic
PGA Valve Schematic

KEY COMPONENTS:

PGA Valve, Two Speed Valve, Two Speed Secondary Spool, Wheel Motor

IMPORTANT: Refer to the PGA Valve operation as list previously in this section.

PGA Engaged in "HIGH TORQUE" Drive (example FORWARD)

When the PGA function is engaged and the LOW/HIGH torque switch is toggled to the HIGH setting, the two speed control solenoid (10) is NOT activated. This is the normal operation position for units with or without the two-speed option.

Once the PGA is engaged, drive pressure is directed from the PGA secondary spool (3) to the LOW torque pistons (6 & 13) and also to the two-speed secondary spool (8). The secondary spool is spring loaded to the left. The drive pressure is directed around the secondary spool to the HIGH torque pistons, providing for additional driving torque.

Control pressure (the REVERSE loop) will be supplied through port (P) to the pressure reducing valve (9) to assure that the pressure that is being feed to the two speed valve block is not above approx. 400 psi. These valves do not require adjustments. This fluid is used to supply the flush valve (11) and the two speed control solenoid (10 & 15).

Flush Valve (11) will be forced to the left against its spring. Fluid will be directed around the valve, through a flow control orifice and out port (F1) to provide for flushing and cooling of the wheel motor assembly.

The two-speed solenoid (10) is de-activated and is spring loaded to the left, closing off the fluid supply to the two-speed secondary spool (8). The spool also provides for a tank return for the secondary spool through ports (Z) and (F2).

TWO SPEED PGA VALVE HYDRAULIC

TWO SPEED VALVE OPERATION, CON'T

PGA Engaged in "LOW TORQUE" Drive

When the PGA function is engaged and the LOW/HIGH torque switch is toggled to the LOW setting, the two-speed control solenoid (15) is activated. This provides for less driving torque, but faster ground speed.

Control pressure (the REVERSE loop) will be supplied to the pressure reducing valve (9) to assure that the pressure that is being feed to the two speed valve block is not above approx. 400 psi. These valves do not require adjustments. This fluid is used to supply the flush valve and the two speed control solenoid.

Flush Valve (11) will be forced to the left against its spring. Fluid will be directed around the valve, through a flow control orifice and out port (F1) to provide for flushing and cooling of the wheel motor assembly.

The two-speed solenoid (15) is activated, forcing it to the left. This will direct pressure through port (Z) to the secondary spool (12) forcing it to the right. When the secondary spool shuttles to the right, the drive supply for the HIGH torque pistons (14) will be closed off and the HIGH torque pistons will be supplied control pressure on both sides of the motor.

REVERSE Drive is the same as FORWARD.

TWO SPEED PGA VALVE ELECTRICAL

TWO SPEED ELECTRICAL CIRCUIT

REFERENCE MATERIAL:

Electrical schematic frames 8

KEY COMPONENTS:

Low Torque Solenoids L-54 & L-55, HIGH/LOW Torque Switch S-11, CCM1, RHM

ELECTRICAL HIGH TORQUE SETTING

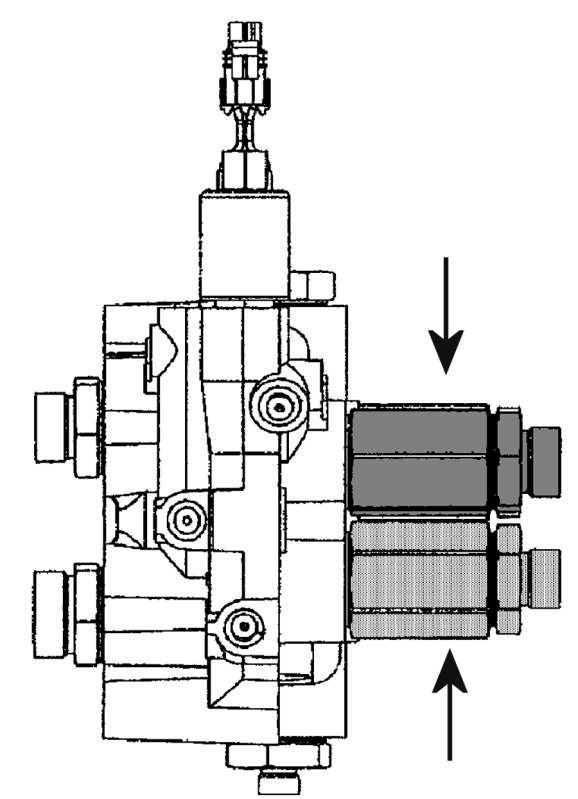
The HIGH/LOW switch (S-11) is supplied 12V from fuse F-48 and is a normally open (N/O) switch.

When the operator engages the PGA function and presses the HIGH/LOW switch (S-11), a voltage signal is directed out X387 terminal 16 to the RHM X029 terminal 6. The RHM will toggle the LOW torque setting **OFF**, place a message on the data bus for the CCM1 not to activate the two-speed solenoids (L-54 & L-55).

ELECTRICAL LOW TORQUE SETTING

When the operator presses the HIGH/LOW switch (S-11) a voltage signal is directed out X387 terminal 16 to the RHM X029 terminal 6. The RHM will toggle the LOW torque setting **ON**, place a message on the data buss for the CCM1 to activate the two-speed solenoids (L-54 & L-55). The RHM will also supply voltage out X027 terminal 13 to the HIGH/LOW switch indicator lamp at X387 terminal 19. The CCM1 will direct voltage out X020 terminal J3-3 to both solenoids. The solenoids are supplied a chassis ground at point (2).

FLOW LIMITERS POWER GUIDE AXLE, PGA



M203204

FLOW LIMITERS

When operating in conditions that permit the rear wheels to spin out,

Example: Heavy headers, snow cover, slippery mud

The operator should be running the PGA in the LO torque mode, but may still experience wheel spin out. The flow limiter kit may be installed to limit the amount of fluid the rear motors will receive. When installed there may be an increase in operating heat.

The flow limiters should only be installed after it has been proven that the two-speed kit does not provide enough control.

PGA ELECTRICAL OPERATION



Wait a Minute... Why won't my PGA always engage when requested?

- If the PGA is engaged while the ROAD switch is in the ROAD mode the operator will receive a message that the function is NOT allowed.
- If the ROAD switch is placed into the ROAD mode while the PGA is engaged, the operator will receive a message that the function is NOT allowed.

TROUBLE SHOOTING



Wait a minute, how can I trouble shoot a system that incorporates mechanical drives, electrical circuits and hydraulic circuits?

The most challenging part of repairing any operation is determining which part of the operation has failed as quickly as possible, but without overlooking any possibilities. Your first test must be able to verify whether the problem is in the electrical circuit, hydraulic circuit or the mechanical components.

First verify if a fault code is being displayed. If so, follow the explanation associated with the fault code. If not, make your first test with a voltmeter where electrical power converts to mechanical power, “The Solenoid”, to verify voltage is being supplied and a ground provided.

- ✓ If voltage and ground is supplied, the electrical circuit is not the main problem. Look at the hydraulic or mechanical circuit.
- ✓ If voltage and/or ground is not being supplied, then you must fix the electrical circuit first before moving on to the hydraulic and/or mechanical circuits.
- ✓ What other components are supplied the same hydraulic supply that is supplying the rotor drive circuits? Are they working? Check control pressure.
- ✓ Check for stuck control spools, plugged orifices, open relief valves, etc.

Section

8000

How to Read Symbols in a Hydraulic Schematic

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Rac 8-94372

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Printed in U.S.A.
July, 2000

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NOTE: Case Corporation reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.

HOW TO READ SYMBOLS IN A HYDRAULIC SCHEMATIC

Introduction

Accurate diagrams of hydraulic circuits are essential to the man who must repair them. The diagram shows how the components will interact. It shows the field technician how it works, what each component should be doing and where the oil should be going so that he can diagnose and repair the system.

The purpose of this section is to show you how to find your way around schematic circuit diagrams.

Circuit Diagrams

There are two types of circuit diagrams.

1. Cutaway Circuit Diagrams show the internal construction of the components as well as the flow paths. By using colors, shades or various patterns in the lines and passages, they are able to show many different conditions of flow and pressure. Cutaway diagrams take considerably longer to produce because of their complexity.

2. Schematic Circuit Diagrams the “shorthand” system of the industry, are usually preferred for troubleshooting. A schematic diagram is made up of simple geometric symbols for the components and their controls and connections.

Symbol Systems

There are several systems of symbols used when making schematic diagrams. They are as follows:

I. S. O. = International Standards Organization

A. N. S. I. = American National Standards Institute

A. S. A. = American Standards Association

J. I. C. = Joint Industry Conference

A combination of these symbols are shown in this section. There are differences between the symbols but there is enough similarity so that if you understand the symbols in this section you will be able to interpret other symbols as well.

Using Schematic Symbols

Reservoirs



VENTED RESERVOIR

710L8B



PRESSURIZED RESERVOIR

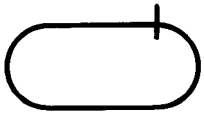
710L8D

A rectangle with the top removed represents a vented reservoir. A rectangle with the top in place represents a pressurized reservoir.



PRESSURIZED RESERVOIR

710L8C



PRESSURIZED RESERVOIR

710L8A

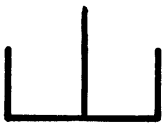
There are other schematic diagrams that show a slightly different version of a pressurized reservoir, but the symbols are similar and easily recognized. An oval with a short line on top or a rectangle with curved sides represents a reservoir that is pressurized.



RETURN LINE ABOVE THE OIL LEVEL

710L8E

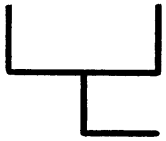
Lines connected to the reservoir usually are drawn from the top, regardless of where the actual connection is.



SUCTION LINE OR RETURN LINE BELOW THE OIL LEVEL

710L8F

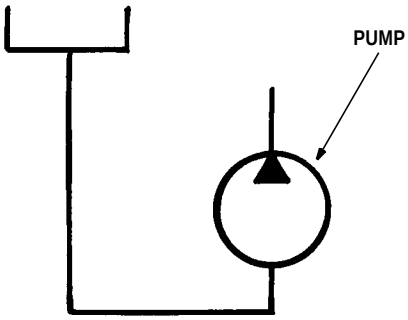
If the hydraulic line terminates below the fluid level, it is drawn all the way to the bottom of the symbol.



RESERVOIR WITH SUCTION LINE ATTACHED AT THE BOTTOM

7108G

A hydraulic line connected to the bottom of the reservoir may be drawn from the bottom of the symbol if the bottom connection is essential to the systems operation.



749L8B

If the pump inlet must be charged or flooded with a positive head of oil above the inlet port, we would position the reservoir symbol above the pump symbol, and draw the suction line out of the bottom of the reservoir symbol.

Every vehicle or system reservoir has at least two hydraulic lines connected to it, and some may have many more. Often the components that are connected to the reservoir are spread all over the schematic. Rather than having a lot of confusing lines all over the schematic, it is customary to draw individual reservoir symbols close to the components. The reservoir is usually the only component symbol pictured more than once.

Lines, Tubes and Hoses

A hydraulic line, tube, hose or any conductor that carries the fluid between components is shown as a line.

710L8H

A working line, such as an inlet pressure or return, is shown as a solid line.



OIL FLOWS ONE WAY ONLY

710L8J



710L8K

OIL CAN FLOW EITHER WAY

Working lines with arrows show direction of flow.

710L8K

Pilot or control lines are broken into long dashes.

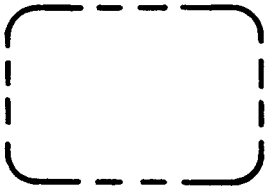
710L8B

Drain lines for leakage oil are broken into short dashes.



710L8C

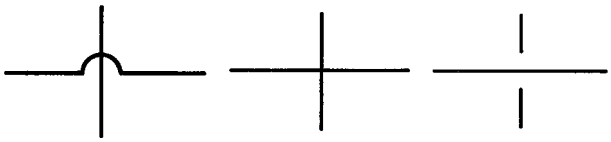
A flexible line is shown as an arc between two dots and is always represented by a solid line.



710L8D

Quite often you will see an enclosure outline that indicates that there are several symbols that make up a component assembly such as a valve or a valve stack. The enclosure outline appears like a box and is broken with dashes on all sides.

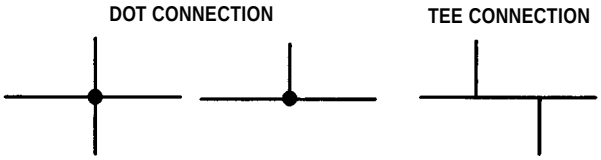
Crossing or Joining Lines



LINES THAT ARE NOT CONNECTED

711L8E 710L8L 710L8M

The shortest distance between two components that are connect is a straight line. There are lines that cross other lines but are not connected. There are several ways to show crossing lines.

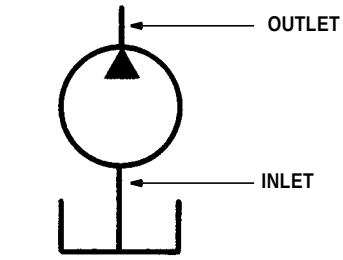


LINES THAT ARE CONNECTED

710L8N 710L8P 711L8H

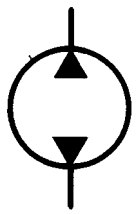
Lines that are connected are shown with a dot that represents the connection or shown as a tee connection. The dot connection is the most commonly used when drawing schematic diagrams.

Pump Symbols



FIXED DISPLACEMENT

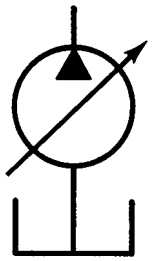
711L8J



FIXED DISPLACEMENT REVERSIBLE

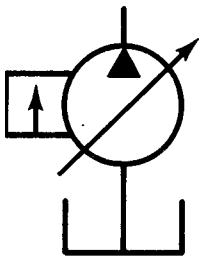
711L8K

There are many basic pump designs. A simple fixed displacement pump is shown as a circle with a black triangle that is pointing outwards. The black triangle is like an arrow head and points in the direction that the oil will flow. If the pump is reversible or designed to pump in either direction, it will have two black triangles in it and they will be opposite each other.



VARIABLE DISPLACEMENT

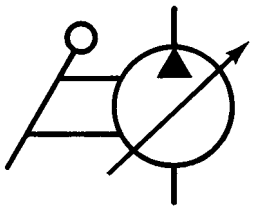
710L8s



VARIABLE DISPLACEMENT PRESSURE COMPENSATED

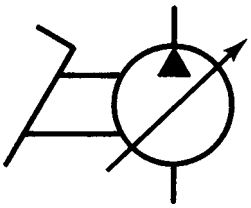
710L8T

A variable displacement pump is designated by drawing an arrow through the pump symbol at 45 degrees. To indicate a variable displacement pressure compensated pump, a small box with an arrow in it will be added to the side of the pump symbol.



LEVER CONTROLLED

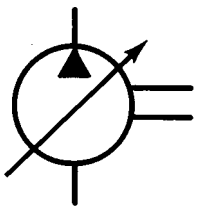
710L8V



PEDAL OR TREADLE CONTROLLED

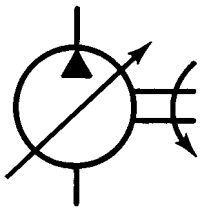
710L8U

If the pump is controlled by a lever or a pedal, it will be shown on the side of the pump.



PUMP WITH DRIVE SHAFT

710L8W

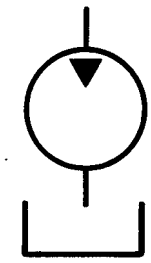


PUMP WITH DRIVE SHAFT AND DIRECTIONAL ARROW

711L8L

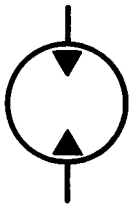
A drive shaft is shown as two short parallel lines extending from the side of the pump. If a curved arrow is shown on the drive shaft, it will indicate the direction of rotation.

Hydraulic Motor Symbols



NONREVERSIBLE MOTOR

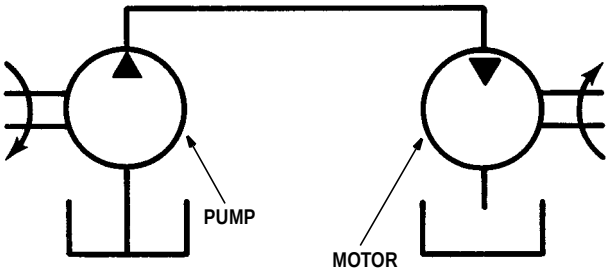
711L8M



REVERSIBLE MOTOR

711L8N

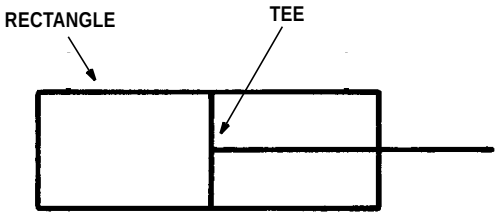
Hydraulic motor symbols are circles with black triangles, but opposite a pump the triangles point inward to show the motor is a receiver of oil. One triangle is used in a nonreversible motor and two triangles are used for a reversible motor.



711L8F

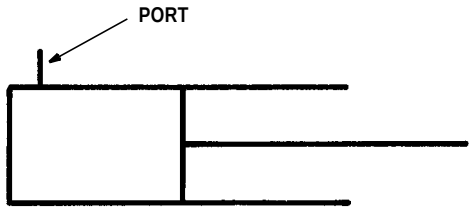
A simple schematic diagram is shown with a hydraulic motor connected to a hydraulic pump.

Cylinder Symbols



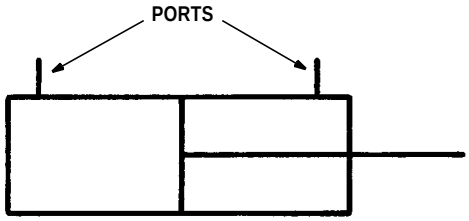
711L8Q

A cylinder symbol is a simple rectangle representing the barrel. The piston and rod are represented by a tee that is inserted into the rectangle. The symbol can be drawn in any position.



SINGLE ACTING CYLINDER

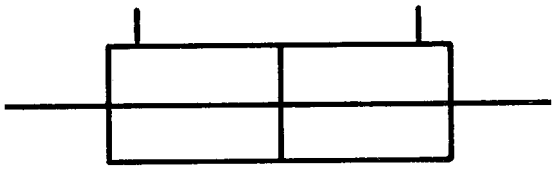
711L8P



DOUBLE ACTING CYLINDER

711L8Q

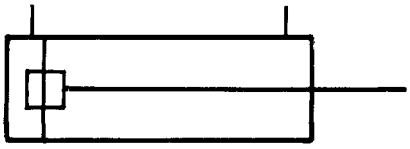
If the cylinder is single acting there is only one port shown on the symbol. The port is shown on the end of the cylinder that receives pressurized fluid and the opposite end of the cylinder is left open. A double acting cylinder symbol has both ends closed and has two ports on the symbol.



DOUBLE ROD END CYLINDER

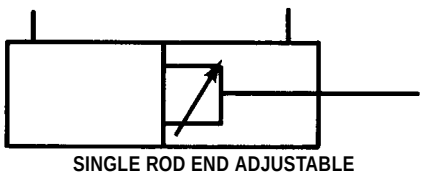
712L8A

A double rod end cylinder has a rod extending from each end of the rectangle.



SINGLE ROD END
FIXED CUSHION BOTH ENDS

749L8E



SINGLE ROD END ADJUSTABLE
CUSHION ROD END ONLY

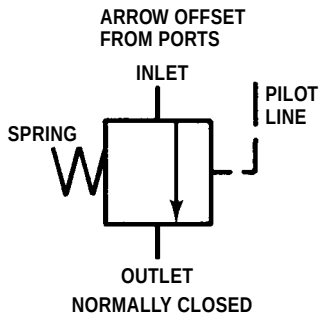
730L8E

Some cylinders have cushions built into them. The cushion slows down the movement of the piston as it nears the end of its stroke. Cylinder cushions are shown as a smaller rectangle on the piston. If the cushion has an adjustable orifice, a slanted arrow is drawn at 45 degrees across the symbol.

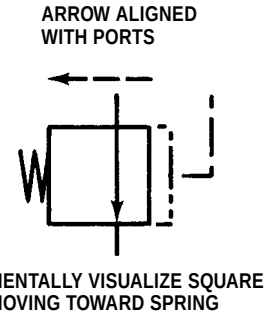
Pressure Control Symbols

The basic symbol is a square (which is called an envelope) with external port connections and an arrow inside to show the oil passage and direction of flow. Usually this type of valve operates by balancing the oil pressure against a spring, so a spring is shown on one side of the symbol and a pilot pressure line on the other side.

Normally Closed



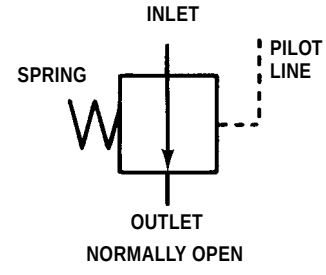
712L8B



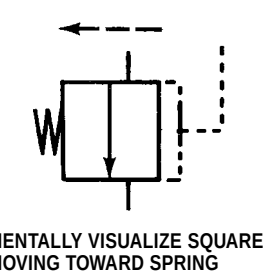
712L8C

A normally closed valve, such as a relief or sequence valve, is shown with the arrow offset from the ports and toward the pilot pressure line side of the square. The spring holds the valve closed until the pilot line oil pressure is greater than the spring pressure. Mentally visualize a build up of pressure in the pilot line and the square moving over, compressing the spring. The oil can now flow through the valve.

Normally Open



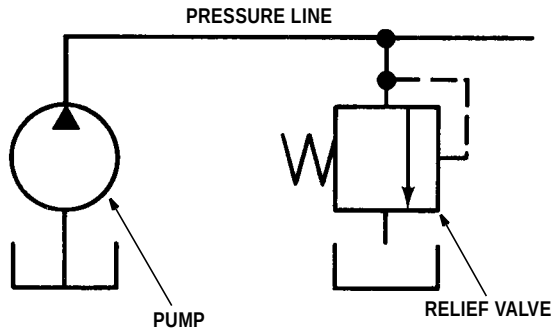
712L8D



712L8E

A normally open valve is shown with the arrow connecting the two ports. It closes when pressure overcomes spring force. Mentally visualize a build up of pressure in the pilot line and the square moving over, compressing the spring. The oil flow through the valve is now blocked.

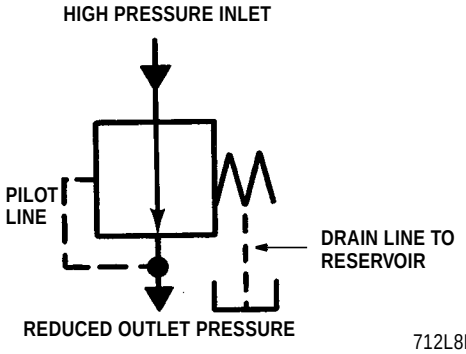
Relief Valve



712L8F

A relief valve is shown as a normally closed symbol connected between the pressure line and the reservoir. The flow direction arrow points away from the pressure line port and toward the reservoir. This shows very graphically how a relief valve operates. When pressure in the system overcomes the valve spring, flow is from the pressure line through the relief valve to the reservoir.

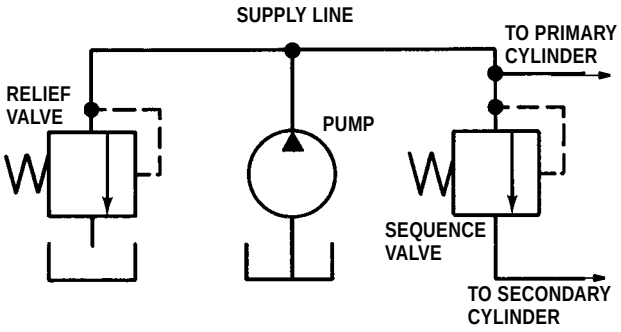
Pressure Reducing Valve



712L8H

A pressure reducing valve is shown as a normally open symbol in a pressure line. This valve works opposite of a relief valve, since it senses outlet pressure versus inlet pressure. As the outlet pressure builds, it works against a predetermined spring force. As the spring force is overcome, flow through the valve is modulated or shut off.

Sequence Valve

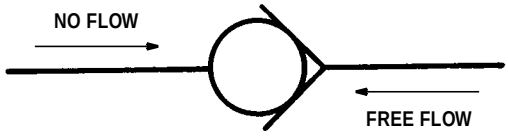


712L8G

The normally closed symbol is also used for a sequence valve. The inlet port is connected to a primary cylinder and the outlet port to the secondary cylinder line. When the piston in the primary cylinder reaches the end of its stroke, the pressure in the supply line increases. The sequence valve is also connected to the supply line and also feels the increase in pressure. As pressure increases, the square and directional flow arrow moves over, connecting the inlet and outlet ports allowing fluid to flow to the secondary cylinder.

Directional Control Symbols

Simplified Symbols
One Way Valve



712L8J

A simple ball check valve is shown. When oil pressure is exerted on the left side of the ball, the ball is forced into the V and no oil can flow past it. When oil pressure is applied to the right side of the ball, the ball moves away from the V and oil can flow past it.

By Pass Valve

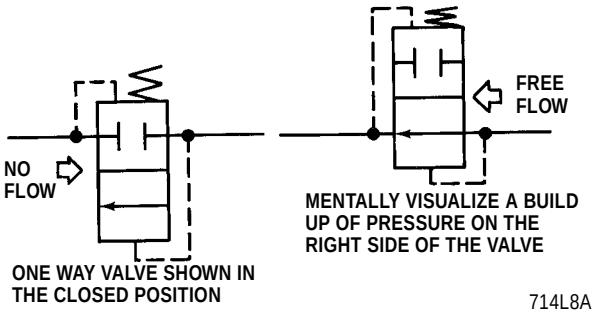


712L8K

A by pass valve is shown as a one way valve with a spring on the ball end of the symbol. This shows that a pressurized flow will be necessary to overcome the spring force and allow flow around the ball

Composite Symbols

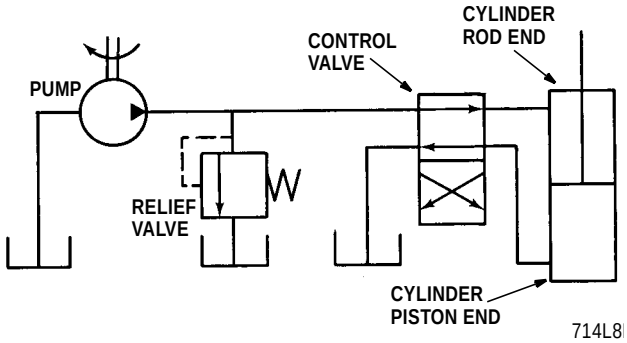
One Way Valves



714L8A

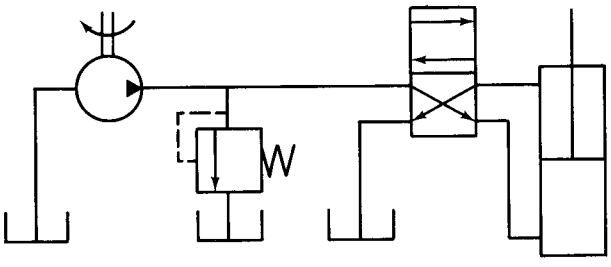
A more complex one way valve is now shown. This directional control symbol uses a multiple envelope (square) system that has a separate square for each position. Remember all of the port connections are made to the envelope that shows the neutral condition of the valve. Within each envelope are arrows showing the flow paths when the valve is shifted to that position.

Two Position Valves



714L8

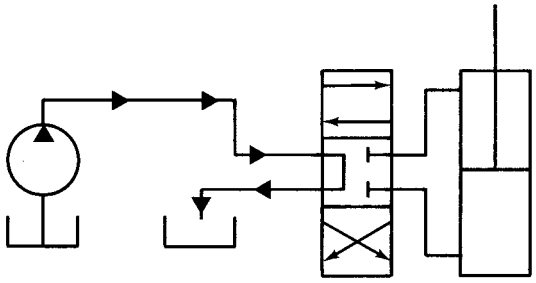
A simple control valve has two envelopes (representing the spool) if it is a two position valve. The envelopes show the flow conditions when they are in one position. The above schematic is showing that oil is being supplied to the rod end of the cylinder. If we mentally visualize the directional control valve moved to the other position, it would be as shown below.



714L8C

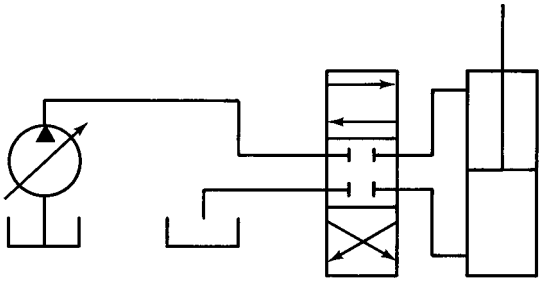
Here, pressurized oil is being supplied to the piston end of the cylinder and oil from the rod end of the cylinder is allowed to flow to the reservoir.

Three Position Valves



OPEN CENTER THREE POSITION VALVE

713L8A

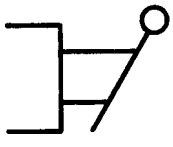


CLOSED CENTER THREE POSITION VALVE

713L8B

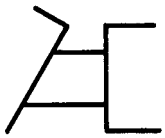
Three position valves will have a centered (neutral) position. The centered position can be either open or closed to flow. The open center is usually used with a fixed displacement pump and the closed center is usually used with a variable displacement pump.

Actuating Controls



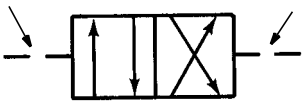
LEVER

713L8G



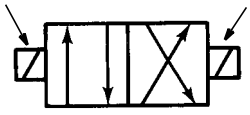
PEDAL

713L8F



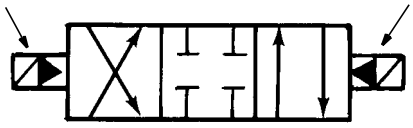
TWO POSITION, CONTROLLED BY EXTERNAL PILOT PRESSURE

713L8D



TWO POSITION, CONTROLLED BY SOLENOIDS

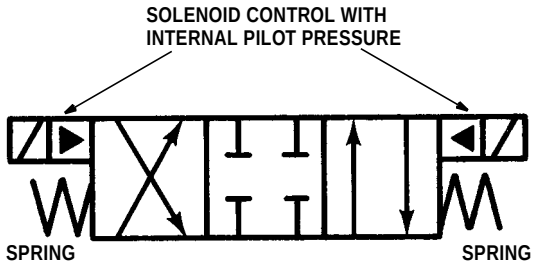
713L8E



THREE POSITION, SOLENOID CONTROLLED WITH INTERNAL PILOT ASSIST PRESSURE

713L8D

Valve spools are controlled by levers, pedals, pilot oil, electric solenoids, etc., which are called actuating controls. These actuating controls are shown by symbols placed on the ends of the envelopes.



THREE POSITION, SPRING CENTERED

713L8C

To show that a valve is spring centered, a spring symbol is placed at each end of the envelope. The above schematic shows that an electrical solenoid and pilot pressure assist are required to overcome spring force to move the valve spool.

Flow Control Symbols

Restrictors



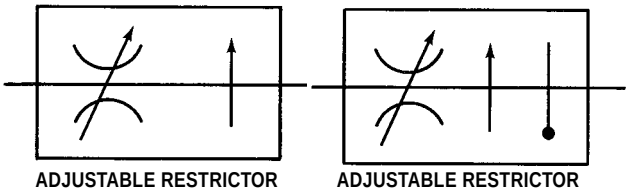
NON ADJUSTABLE RESTRICTOR

716L8A

ADJUSTABLE RESTRICTOR

716L8E

The basic flow control symbol is a representation of a restrictor. If the restrictor is adjustable, a slanted arrow is drawn across the symbol. The restrictor could be a special fitting with a small hole in it or a small drilled passageway within a valve. If it is an adjustable restriction, it could be thought of as a water faucet that can be controlled by turning the handle to regulate the flow. Restrictors can be applied to meter out, meter in and bleed off circuits.



ADJUSTABLE RESTRICTOR PRESSURE COMPENSATED

716L8C

ADJUSTABLE RESTRICTOR PRESSURE AND TEMPERATURE COMPENSATED

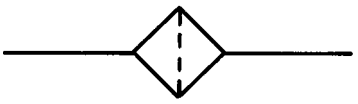
716L8D

There are adjustable restrictors that are pressure compensated. That means that the size of the opening in the restrictor will change with increases and decreases in pressure. A perpendicular arrow indicates pressure compensation. If the restrictor has both pressure and temperature compensation, the symbol for a thermometer will also be shown.

Accessories

Filters, strainers and heat exchangers are represented as squares that are turned 45 degrees and have the port connection at the corners.

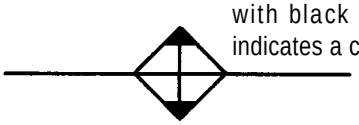
A dotted line perpendicular to the flow line indicates a filter or strainer.



FILTER OR STRAINER

716L8E

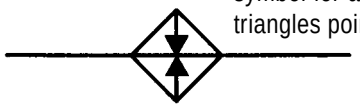
A solid line perpendicular to the flow with black triangles pointing out indicates a cooler.



COOLER

716L8F

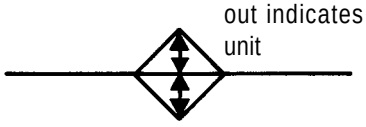
The symbol for a heater is like the symbol for a cooler, except the black triangles point in.



HEATER

731L8G

Two sets of triangles pointing in and out indicates a temperature control unit



TEMPERATURE CONTROL UNIT

731L8H

As you can see, the black triangles point in the direction that the heat is dissipated. Or in the case of the control unit, they show that the heat can be regulated.

An oval with details inside indicate an accumulator. The details inside will tell you what type of accumulator it is; spring loaded, gas charged, or other features.



The divider line indicates there is a separator between the charge and the oil. A hollow triangle indicates gas.

GAS CHARGED

716L8G



A spring shows that the accumulator is spring loaded.

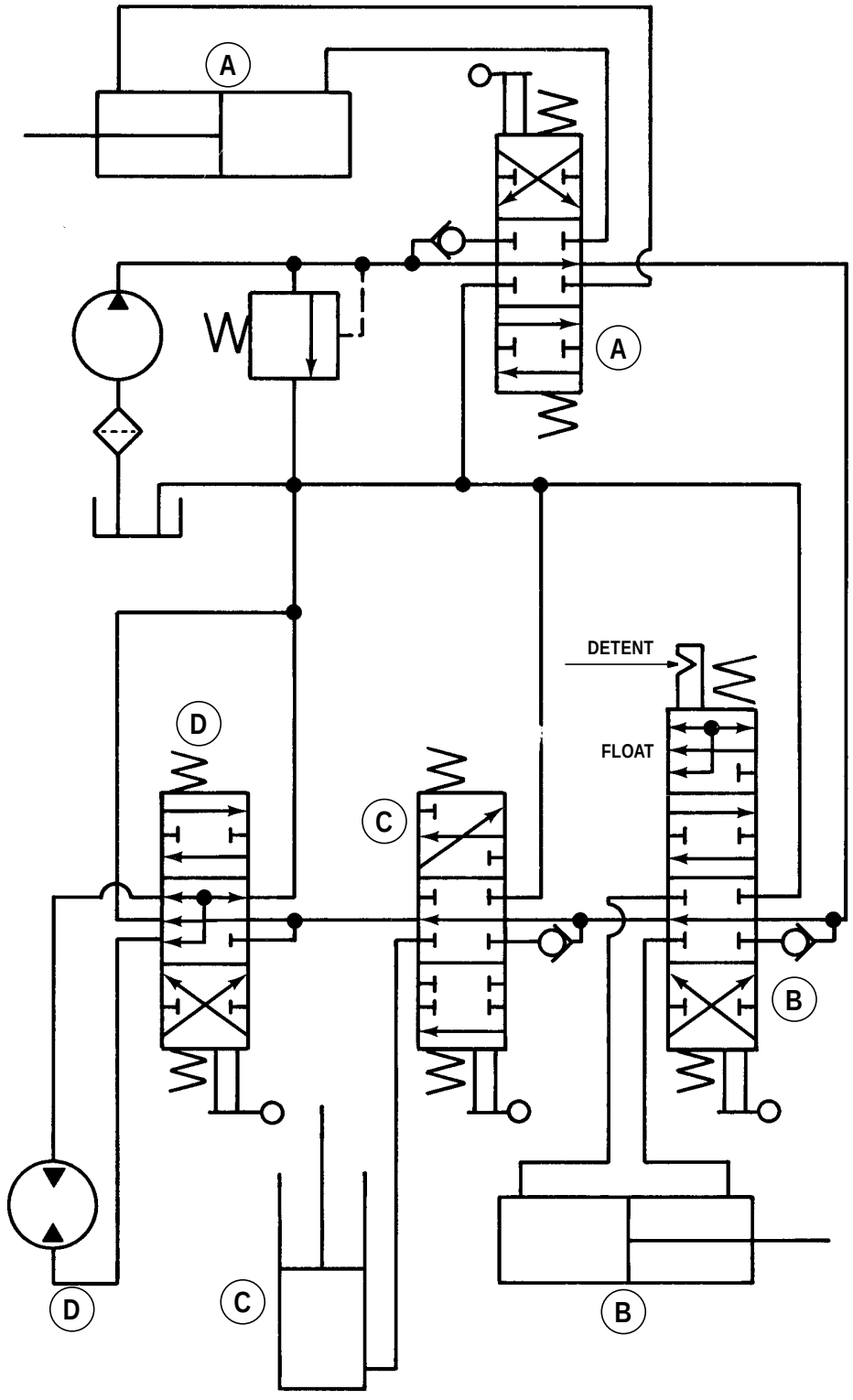
SPRING LOADED

716L8H

NOTES

SIMPLE SCHEMATIC

Now that you have completed hydraulic symbols, we have put some of the symbols together to form a simple hydraulic schematic. See if you can find your way around the schematic without reading the text for each valve. The text explains the function of each valve in the hydraulic system.



715L8

Valve A

This valve is a three position valve. The spool is lever operated and spring centered. It is an open center valve. Visually place the envelopes into the center position and you will see that the valve will direct oil into one end or the other of cylinder A. When the spool in valve A is moved out of the centered position, the valves downstream will receive no oil.

Valve B

Valve B is similar to valve A but it is a four position valve. The fourth position is a float position and is held into that position with a detent. With this valve the cylinder B can be extend, retracted, or placed in the float position. Visualizes the envelope for the float position in the inlet passageway.

You will see that oil can continue to flow to the next valve downstream and that the rod in cylinder B could be pushed back and forth. The oil could move from one end of the cylinder to the other via the valve. Both ends of the cylinder are also connected to the return line to the reservoir.

Valve C

This valve is also similar to valve A but is designed to control a single acting cylinder. When you visualize placing the upper envelope in the center position you will see that oil can drain back to the reservoir from cylinder C.

At the same time, oil from the pump can flow through valve C to the next valve.

Valve D

Valve D is a lever operated, spring centered valve and is designed to control a hydraulic motor. If a hydraulic motor was turning a flywheel and the oil supply and return were shut off abruptly, this would cause damage to the hydraulic lines, the motor, or whatever it was powering. Therefore when the valve supplying the motor is shut off, the motor should be able to slow down gradually. The center (neutral) position of valve D will allow that to happen by letting oil from the outlet of the motor return to the inlet side.

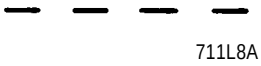
As you have seen, this brief information is all you need to read hydraulic schematics. The more you use it, the more you will be comfortable using hydraulic schematics as a troubleshooting guide.

COMMON SYMBOLS

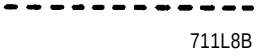
Lines and Line Functions


710L8H

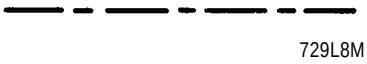
SOLID LINE
MAIN LINE


711L8A

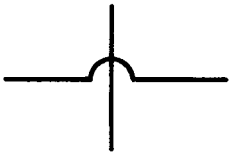
DASHED LINE
PILOT LINE


711L8B

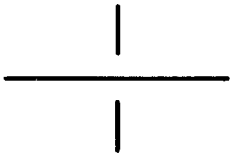
DOTTED LINE
EXHAUST OR DRAIN


729L8M

ENCLOSURE OUTLINE

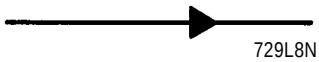

711L8E

LINES CROSSING


710L8M


710L8P

LINES JOINING


729L8N

LIQUID DIRECTION
OF FLOW

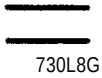

729L8P

GASEOUS DIRECTION
OF FLOW


711L8C

FLEXIBLE LINE

Mechanical Devices


730L8G

MECHANICAL CONNECTIONS
TWO PARALLEL LINES
(SHAFTS, LEVERS, ECT)

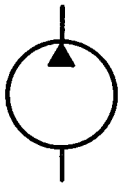

730L8H

VARIABLE COMPONENT (RUN ARROW
THROUGH SYMBOL AT 45 DEGREES

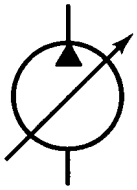

730L8J

SPRING

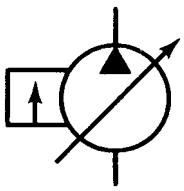
Pumps and Motors


729L8D

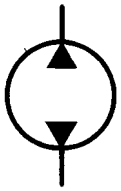
HYDRAULIC PUMP
FIXED DISPLACEMENT


729L8E

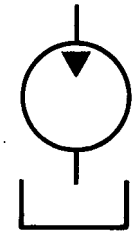
HYDRAULIC PUMP
VARIABLE DISPLACEMENT


729L8F

PRESSURE COMPENSATED
VARIABLE DISPLACEMENT PUMP

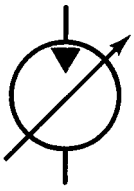

711L8K

FIXED DISPLACEMENT
HYDRAULIC PUMP
(TWO DIRECTIONAL FLOW)



711L8M

HYDRAULIC MOTOR
FIXED DISPLACEMENT



730L8B

HYDRAULIC MOTOR
VARIABLE DISPLACEMENT



730L8C

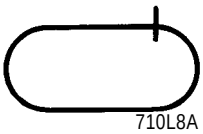
HYDRAULIC OSCILLATOR

Reservoirs



710L8B

RESERVOIR
OPEN TO ATMOSPERER



710L8A

PRESSURIZED RESERVOIR



710L8F

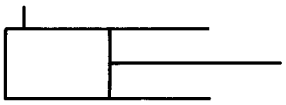
LINE TO RESERVOIR
BELOW FLUID LEVEL



710L8E

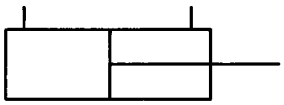
LINE TO RESERVOIR
ABOVE FLUID LEVEL

Cylinders



711L8P

SINGLE ACTING



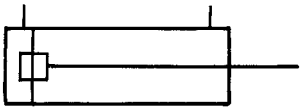
711L8P

DOUBLE ACTING
SINGLE ROD END



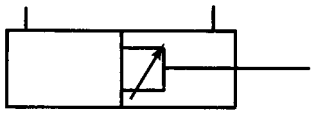
712L8A

DOUBLE ACTING
DOUBLE ROD END



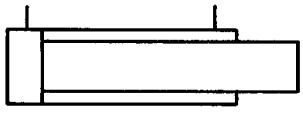
749L8EP

SINGLE ROD END
FIXED CUSHION BOTH ENDS



730L8E

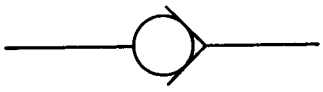
SINGLE ROD END
ADJUSTABLE CUSHION
ROD END ONLY



730L8F

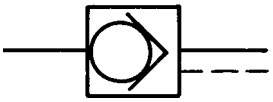
DIFFERENTIAL CYLINDER

Valves



712L8J

CHECK VALVE



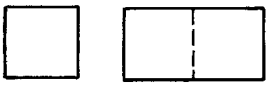
731L8A

PILOT OPERATED CHECK



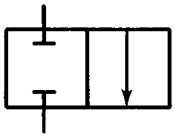
731L8B

ON - OFF
MANUAL SHUT OFF



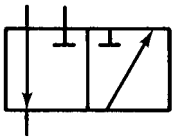
749L8A 749L8F

REGULATING OR SELECTOR VALVES



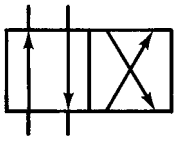
731L8C

2 POSITION - 2 WAY VALVE



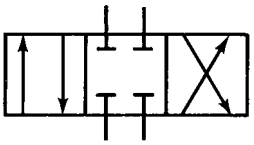
731L8D

2 POSITION - 3 WAY VALVE



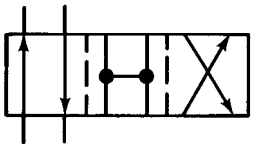
731L8E

2 POSITION - 4 WAY VALVE



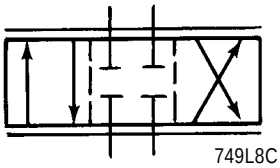
729L8K

3 POSITION - 4 WAY VALVE



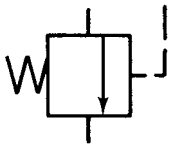
729L8L

2 POSITION - 4 WAY OPEN CENTER CROSS OVER



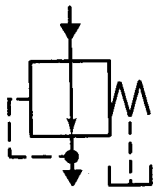
749L8C

VALVE CAPABLE OF INFINITE POSITIONING (INDICATED BY HORIZONTAL LINES DRAWN PARALLEL TO THE ENVELOPE)



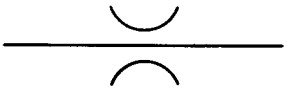
712L8B

PRESSURE RELIEF VALVE



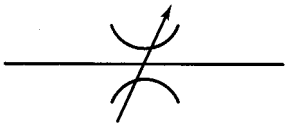
712L8H

PRESSURE REDUCING VALVE



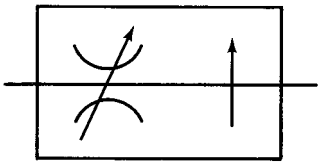
716L8H

NON - ADJUSTABLE RESTRICTOR



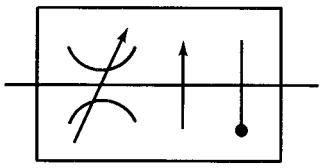
716L8B

ADJUSTABLE RESTRICTOR



716L8C

ADJUSTABLE RESTRICTOR PRESSURE COMPENSATED



716L8D

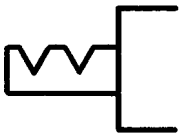
ADJUSTABLE RESTRICTOR (TEMPERATURE AND PRESSURE COMPENSATED)

Valve Actuators



G731L8L

SOLENOID



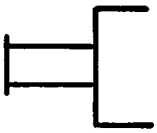
729L8

DETENT



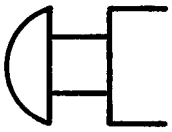
730L8J

SPRING



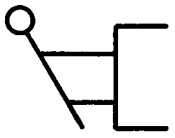
729L8A

MANUAL



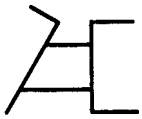
729L8B

PUSH BUTTON



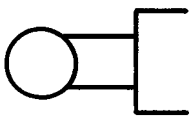
729L8C

PUSH PULL LEVER



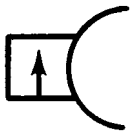
713L8F

PEDAL



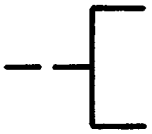
729L8G

MECHANICAL



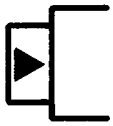
729L8H

PRESSURE COMPENSATED



731L8F

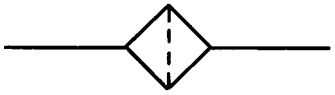
PILOT PRESSURE REMOTE SUPPLY



731L8M

LIQUID SUPPLY

Accessories



716L8E

FILTER



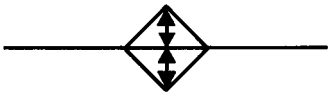
716L8F

COOLER



731L8G

HEATER



731L8H

TEMPERATURE CONTROLLER

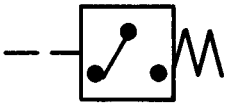


716L8G

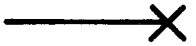
ACCUMULATOR HYDRO - PNEUMATIC


730L8K

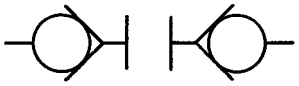
REVERSING MOTOR


730L8P

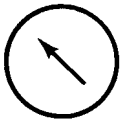
PRESSURE SWITCH


730L8L

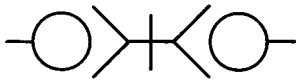
STATION OR TEST POINT


731L8J

QUICK DISCONNECTS (DISCONNECTED)


730L8M

PRESSURE INDICATOR


731L8K

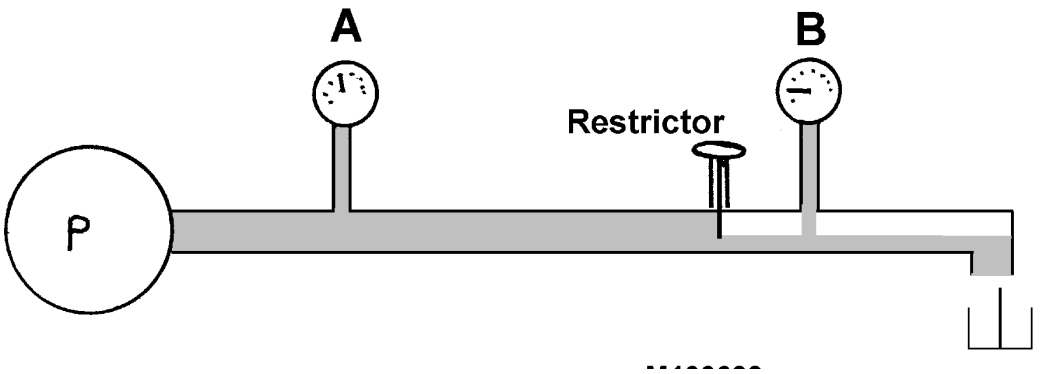
QUICK DISCONNECTS (CONNECTED)


730L8N

TEMPERATURE INDICATOR

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 - 9120 SERIES AXIAL-FLOW COMBINE



SECTION 35 GENERAL HYDRAULIC

Form 5175 1/2010

CNH America LLC
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RACINE, WI 53404 U.S.A.

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Printed in U.S.A.

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INTRODUCTION

PURPOSE OF THE TRAINING MANUAL

This manual is your guide to the 20 Series Combine Service Training Program.

You will also be able to use it when you are working on these combines in the workshop or in the field.

In writing this manual, we have assumed that you are familiar with the normal methods of servicing agricultural equipment and that detailed explanations in the use of tools and test equipment are not necessary. In the event of any difficulties, you should refer to the Service Manual and to your Service Manager.

USE OF THIS MANUAL

The information contained in this manual is supplementary to material to be found in other sources, it is not a replacement for them. You should always consult Service Manuals, Service Bulletins, Operator's Manuals and Parts Books when necessary.

This manual and the training program that it supports are both designed to help you know when and why you need to make repairs. It will also draw your attention to particular problems that you might encounter and the any special procedures that you must follow. There is plenty of space in this manual for you to add your own notes and observations.

Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember.



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

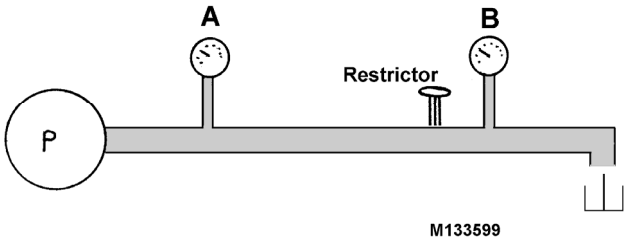
BASIC PRINCIPLES OF THE SYSTEM

Combines use a combination of PFC and open-center hydraulics. In a **PFC** system, oil flow is minimal unless there is a hydraulic demand. In an **open-center** system, oil is constantly pumped through the system regardless of hydraulic demand.

FLOW ACROSS A RESTRICTION

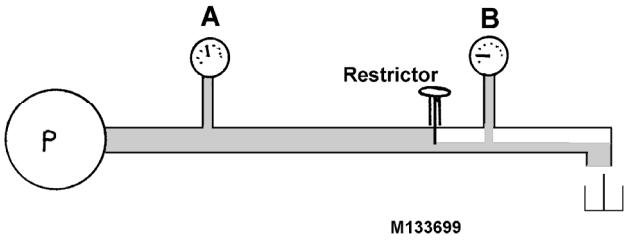
The hydraulic system of the combine uses the principle of flow across a restriction for some functions. It is important to understand this basic principle in order to understand how the system works, or more importantly, why the system may not be working.

1. When oil flows through an **unrestricted** passage, the pressure in this passage, if any, will remain constant as long as pump flow remains constant.



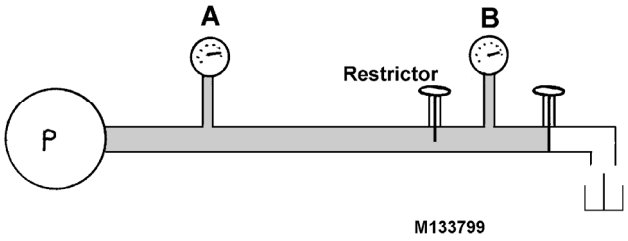
M133599

2. When oil in a passage **flows across a restriction**, the pressure after the restriction will be less than the pressure before that restriction**. Flow must exist for this to happen**. A restriction can occur by any component causing a resistance to flow.



M133699

3. When oil in a passage is **fully restricted** from flow (no-flow), the pressure in the passage will build until it reaches the relief valve setting. This relief pressure will be maintained as long as the flow is blocked and the pump is functioning normally. This is true regardless of what component is blocking flow. No flow will create constant pressure in the passage based on the relief valve setting.



M133799

BASIC PRINCIPLES OF THE SYSTEM

PILOT OPERATED HYDRAULIC SYSTEM

1. Pilot-operated hydraulic system has two basic parts or sections: A pilot (also called primary) section, and a main (also called secondary) section.

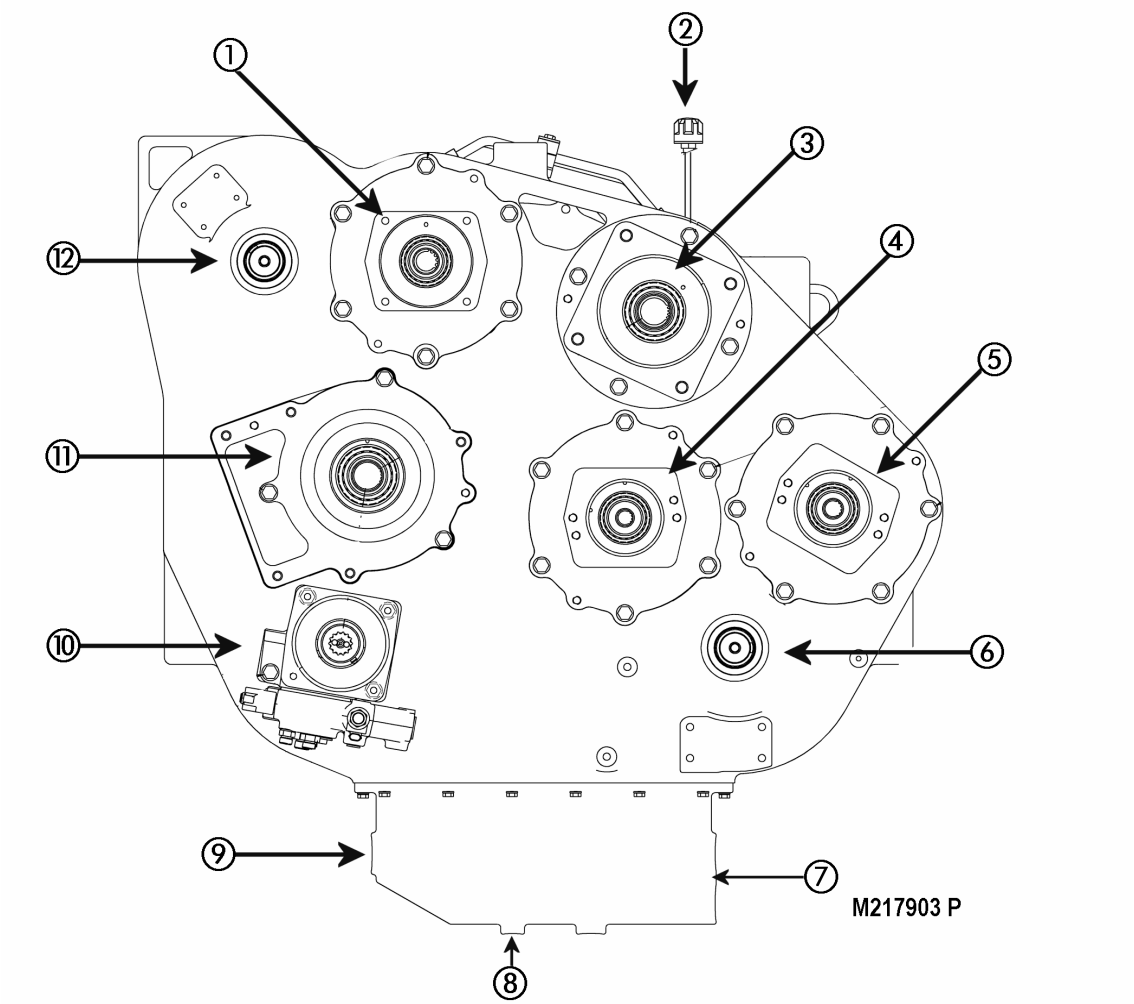
2. When a pilot-operated system is actuated, the pilot (primary) **always** moves first. Once the pilot has operated, the main (secondary) section **always** moves last. This is true whether the system is being activated or deactivated.

3. The movement of the pilot (primary) controls a very small amount of oil flow (pilot flow). The movement of the main (secondary) controls the majority of the oil flow (main flow) and is responsible for actuating a given system.

The header raise/header lower and reel drive valve are three examples of a pilot operated system used on the combine.

PTO GEARBOX LOCATIONS

PTO GEARBOX FACING OUT

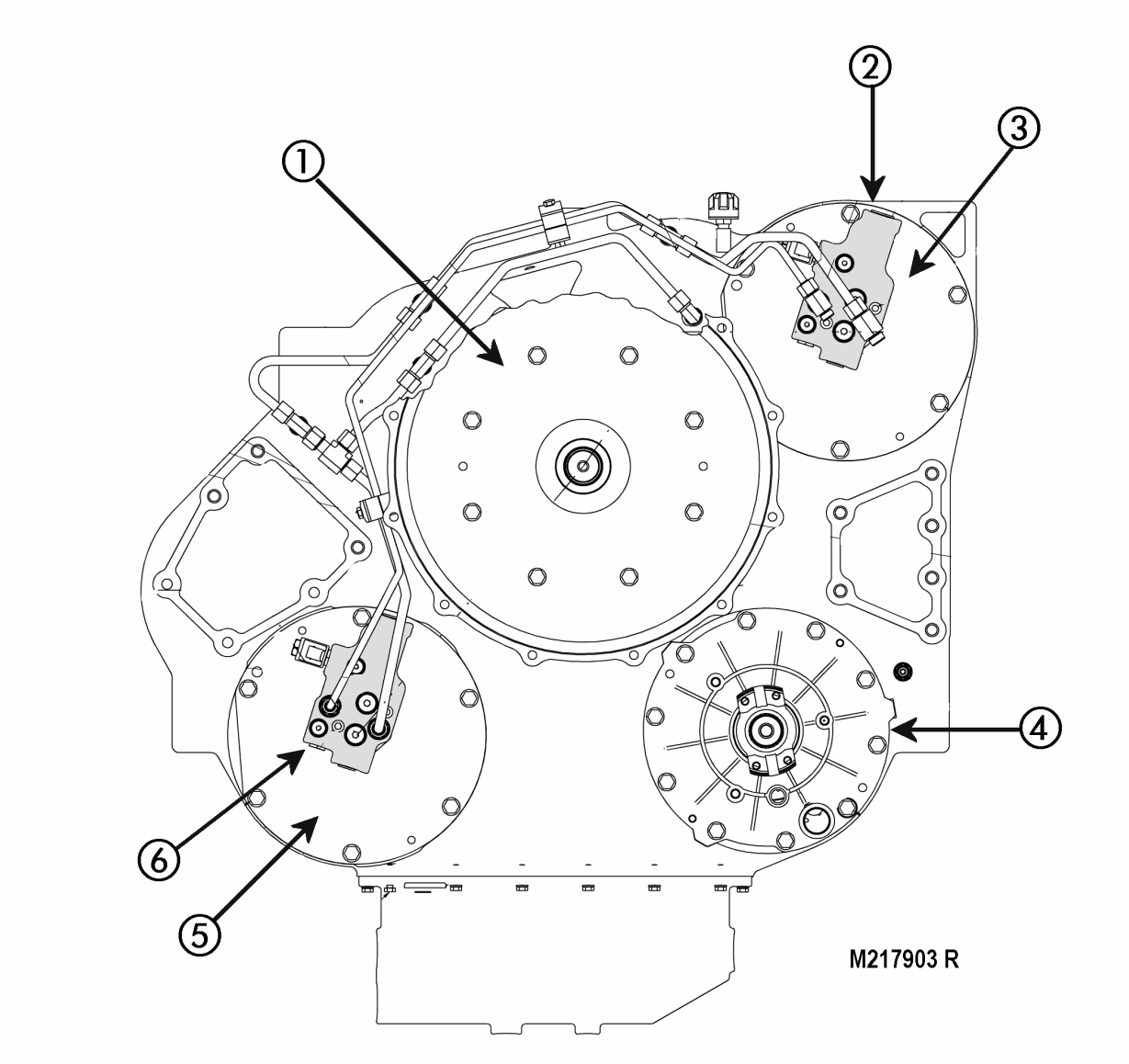


1.	Feeder/Rotor Pump Drive	7.	Supply/Return Port
2.	PTO Gearbox Breather	8.	PTO Gearbox Drain
3.	Ground Drive Hydro Pump	9.	Feeder Drive Drain
4.	Gear Pump Drive	10.	Rotor Drive
5.	PFC Pump Drive	11.	Feeder Drive
6.	Beater/chopper Clutch Drive	12.	Unloader Clutch Drive

Verify that the PTO gearbox dip stick is securely placed into the tube.

BEATER/CHOPPER CLUTCH

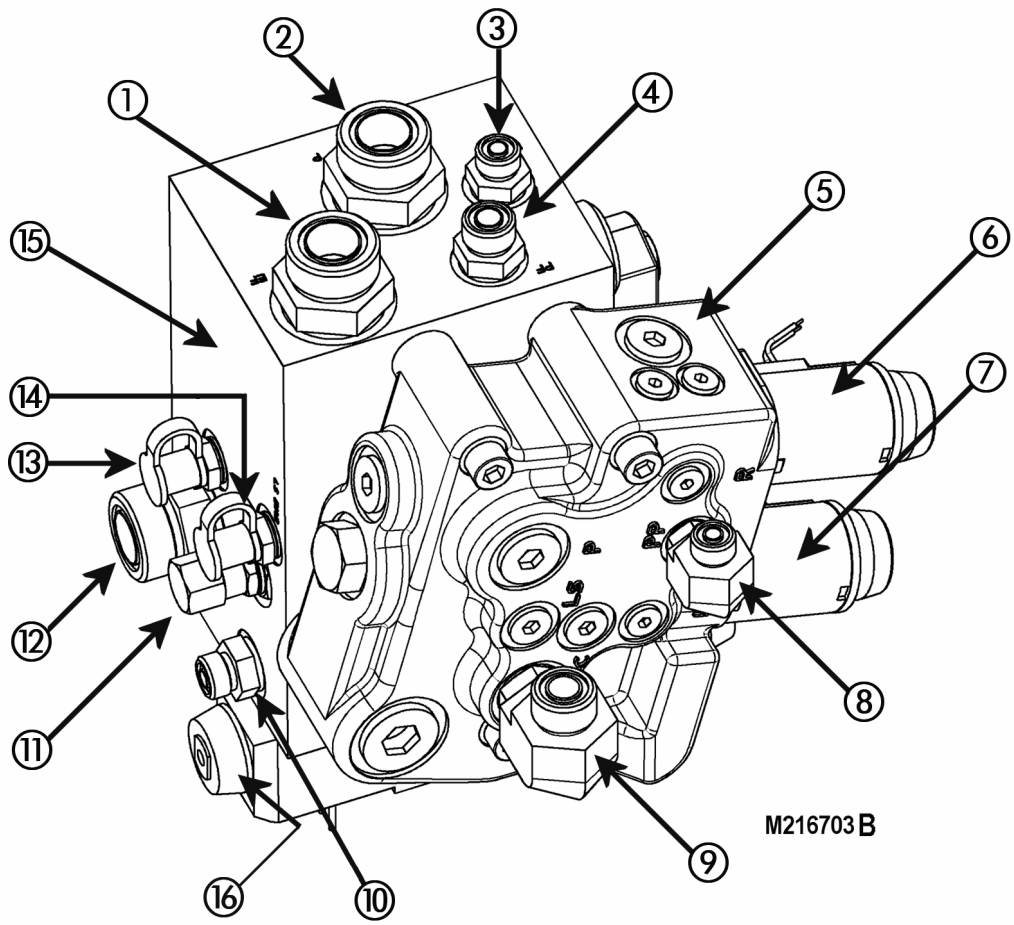
PTO GEARBOX ENGINE SIDE



1.	PTO Gearbox Input Shaft	4.	Rotor Drive Unit
2.	Unloading Auger Clutch Valve	5.	Beater/chopper Clutch
3.	Unloading Auger Clutch	6.	Beater/chopper Clutch Valve

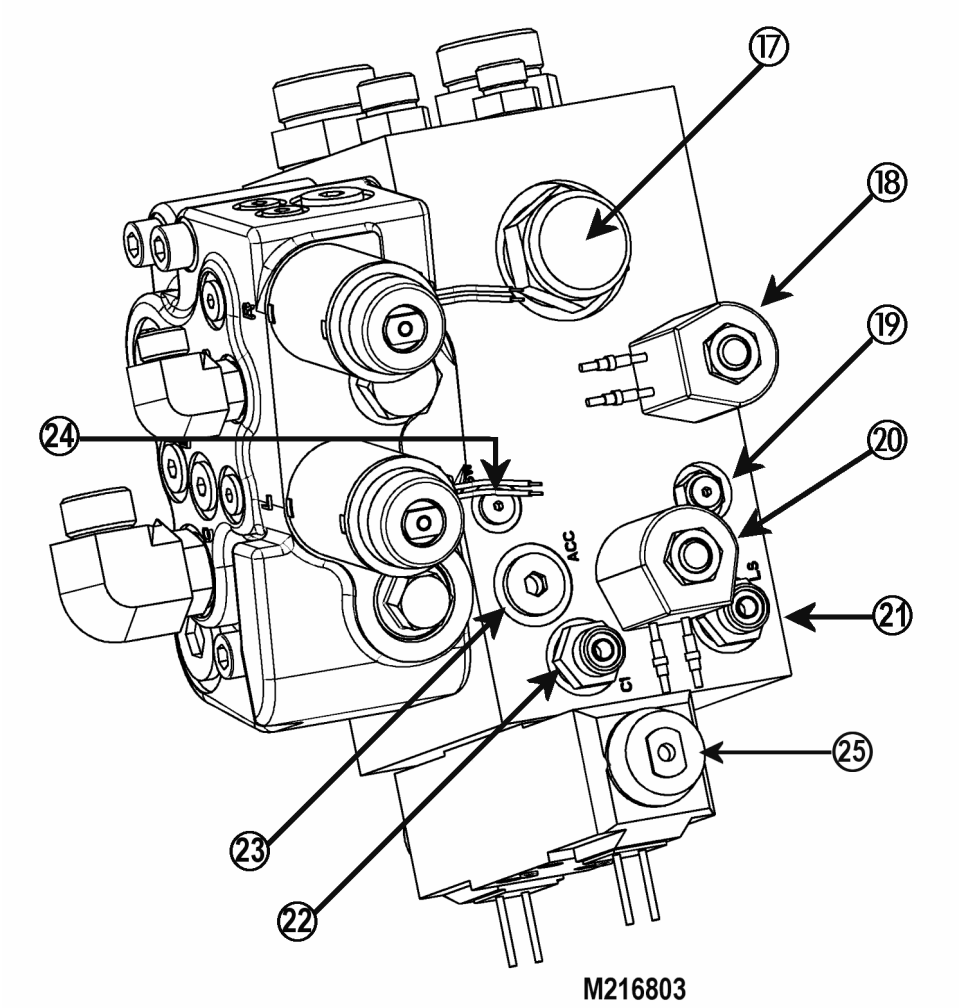
MAIN VALVE LOCATIONS

MAIN VALVE COMPONENT LOCATION



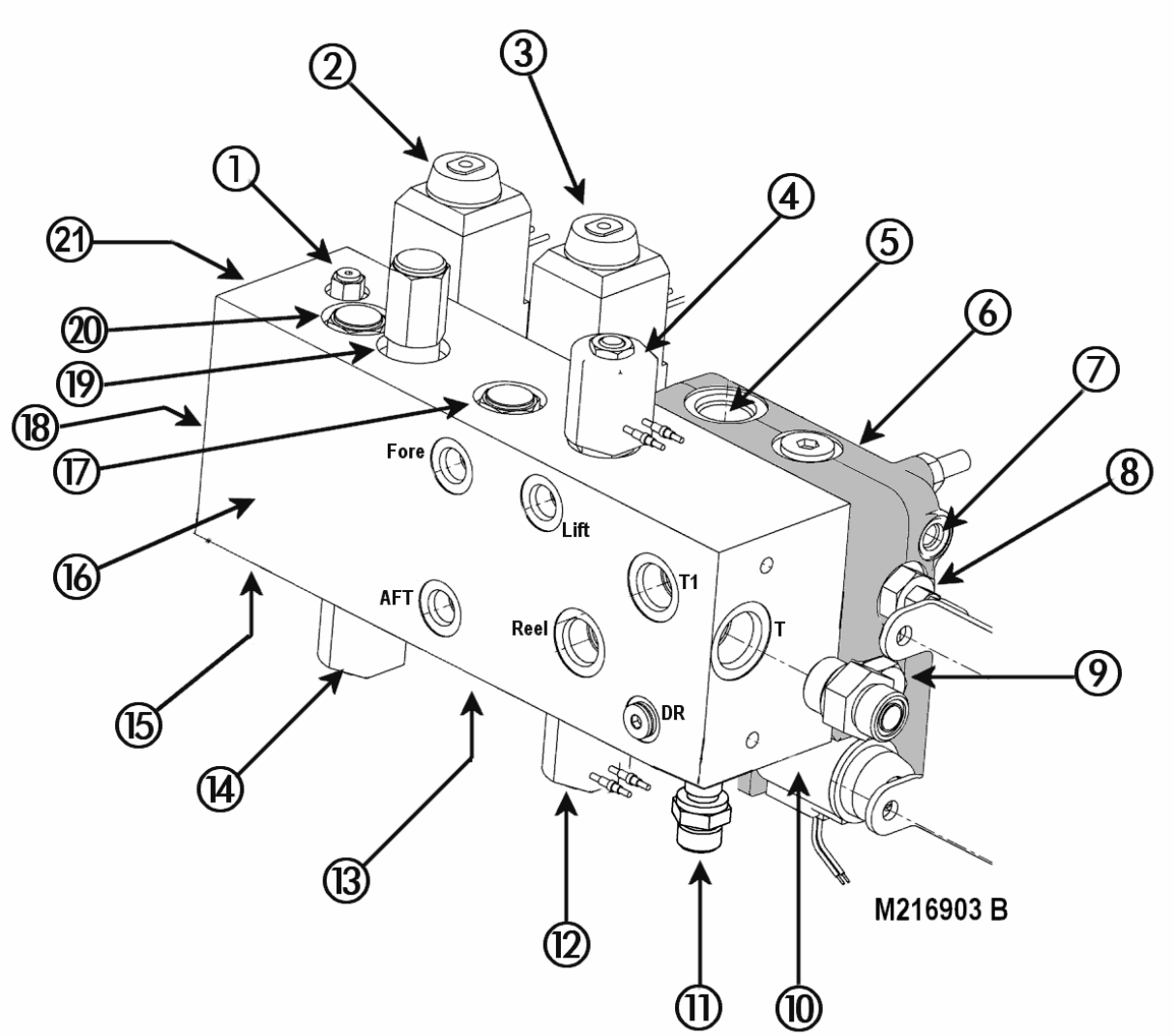
1.	To Feeder Valve Supply	9.	To Header Lift Cylinders
2.	From PFC Pump	10.	Unloading Auger Retract
3.	From Steering Hand Pump Signal	11.	Thermal Relief Valve
4.	To Steering Hand Pump Supply	12.	Tank Port
5.	Header Valve	13.	Pump Pressure Test Port
6.	Header Raise Solenoid	14.	Signal Line Test Port
7.	Header Lower Solenoid	15.	Main Stack Manifold
8.	From Regulated Pressure Supply	16.	Unloading Auger Extend Solenoid

MAIN VALVE COMPONENT LOCATION



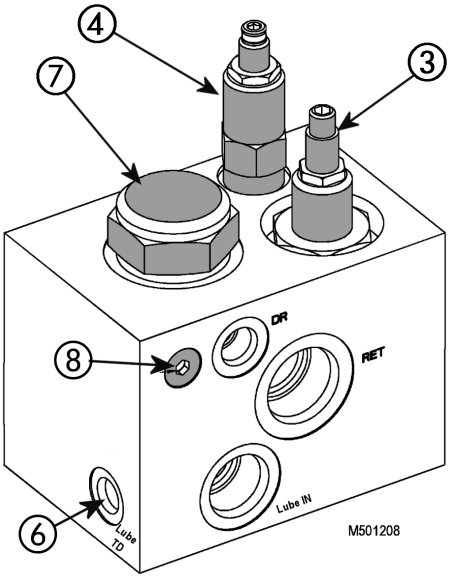
17.	Steering Priority Valve Cartridge	22.	Unloading Auger Extend
18.	Signal Valve	23.	To Accumulator
19.	Check Valve and Bleed Orifice	24.	Float Pressure Sensor
20.	Accumulator Solenoid	25.	Unloading Auger Retract Solenoid
21.	Signal To PFC Compensator		

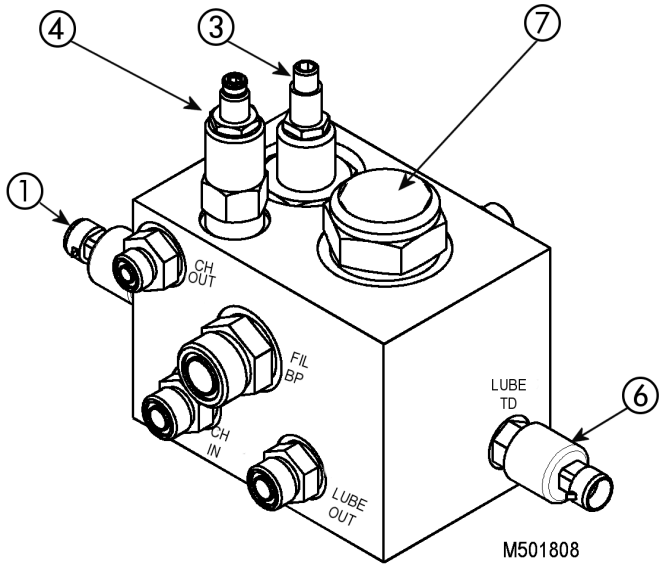
FEEDER VALVE COMPONENT LOCATION



1.	Tilt Signal Check Valve	15.	Pilot Checks, Tilt Base End
2.	Tilt Solenoid, CW	16.	Manifold Body
3.	Reel AFT Solenoid	17.	Pilot Checks, Fore
4.	Reel Lower Solenoid	18.	Tilt Port, CW
5.	Main Supply Port for Stack Valve	19.	Port Relief Valve, Tilt Rod End
6.	Reel Drive Valve	20.	Pilot Checks, Tilt Rod End
7.	Signal Port To PFC Pump	21.	Tilt Port, CCW
8.	Reel Drive Relief Valve	Fore	Reel Fore Port
9.	Reel Drive Secondary Spool	Aft	Reel Aft Port
10.	Reel Drive Solenoid	Lift	Reel Lift Port
11.	Regulated Pressure Supply	Reel	To Reel Drive Motor
12.	Reel Raise Solenoid	T1	From Reel Drive Motor
13.	Pilot Checks, Aft	T	To Return Filter
14.	Port Relief Valve, Tilt Base End	DR	Not Used

CONTROL / LUBE VALVE COMPONENT LOCATION





1.	Control Pressure Sensor "CLUTCH TD"
3.	PTO Cooler By-Pass Valve
4.	Control Pressure Regulating Valve
6.	Lubrication Pressure Sensor "LUBE TD"
7.	Lubrication Pressure Regulating Valve
8	Damping Orifice
CH IN	Charge Supply In
CL OUT	Control Pressure Out
DR	Internal Valve Drain
FIL BP	Charge Filter Base By-Pass IN Port
LUBE IN	Lube Supply IN
LUBE OUT	Lube Supply OUT
LUBE RV	Cooler By-Pass IN (on back side of valve)
RET	Return to Tank

GENERAL INFORMATION

The 20 series Axial-Flow combines use a very extensive hydraulic system to operate machine functions that are normally associated with belts and chains, along with the normal hydraulic functions. This section will cover the basics of the hydraulic supply system, each actual function will be included with that function's sections.

This section will cover the reservoirs, filtration, gear pumps, PFC pump and cooling. Since the machine incorporates two reservoirs, the hydraulic system is easily broken into two separate systems.

1. Hydraulics: Operator control functions
2. Charge / Control Pressure: Hydrostatic drives, associated valves and clutches

HYDRAULICS Hydraulic Reservoir	CHARGE / CONTROL PRESSURE PTO Gearbox Reservoir
Steering Header Raise / Lower Reel Fore / Aft, Raise, and Drive Lateral Tilt Unloading Auger Swing Fan Drive Spreader Drive Rotary Air Screen (8120 only) Parking Brake Regulated Pressure	Ground Drive Rotor Drive Feeder Drive (Fixed or Variable Speed) Beater/Chopper Clutch Unloader Clutch Lubrication

The two systems will incorporate several hydraulic pumps and motors to complete the required operations.

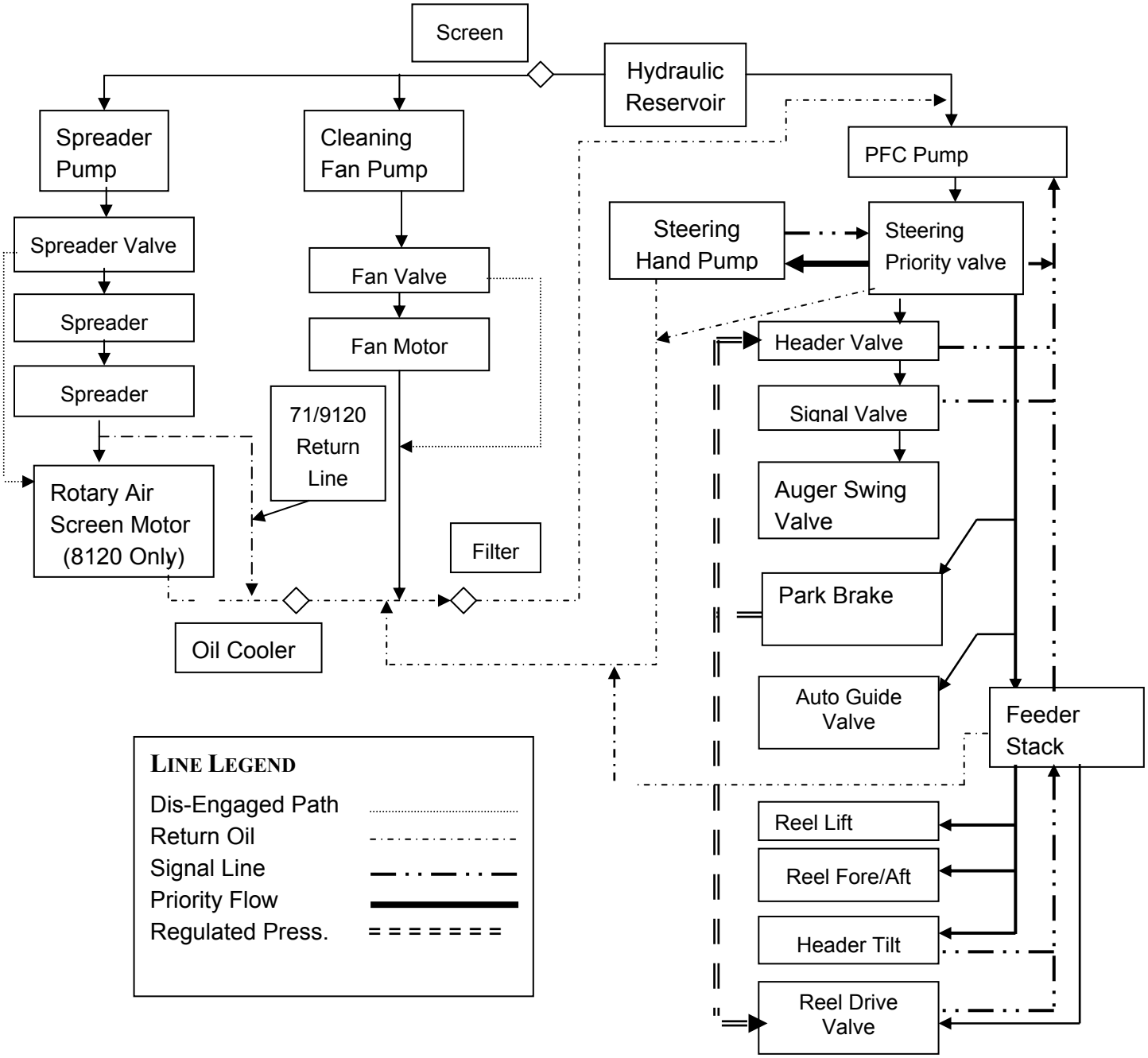
HYDRAULICS Hydraulic Reservoir		CHARGE / CONTROL PRESSURE PTO Gearbox Reservoir	
PFC Pump	Steering Header Raise / Lower Lateral Tilt Unloading Auger Swing Reel Fore / Aft and Raise Reel Drive Park Brake Regulated Pressure	**Charge Pump**	Ground Drive Rotor Drive Feeder Drive (Fixed or Variable Speed) **Control Pressure** Beater/Chopper Clutch Unloader Clutch Rotor Drive Clutches Feeder Drive Clutches
Fan Pump	Fan Drive Motor	**Lube Pump**	Lubrication
Spreader Pump	Spreader Drive Motors and 8120 Rotary Air Screen Motor		

SPECIFICATION

The following information should be used as a guide, refer to the service manual for updated information.

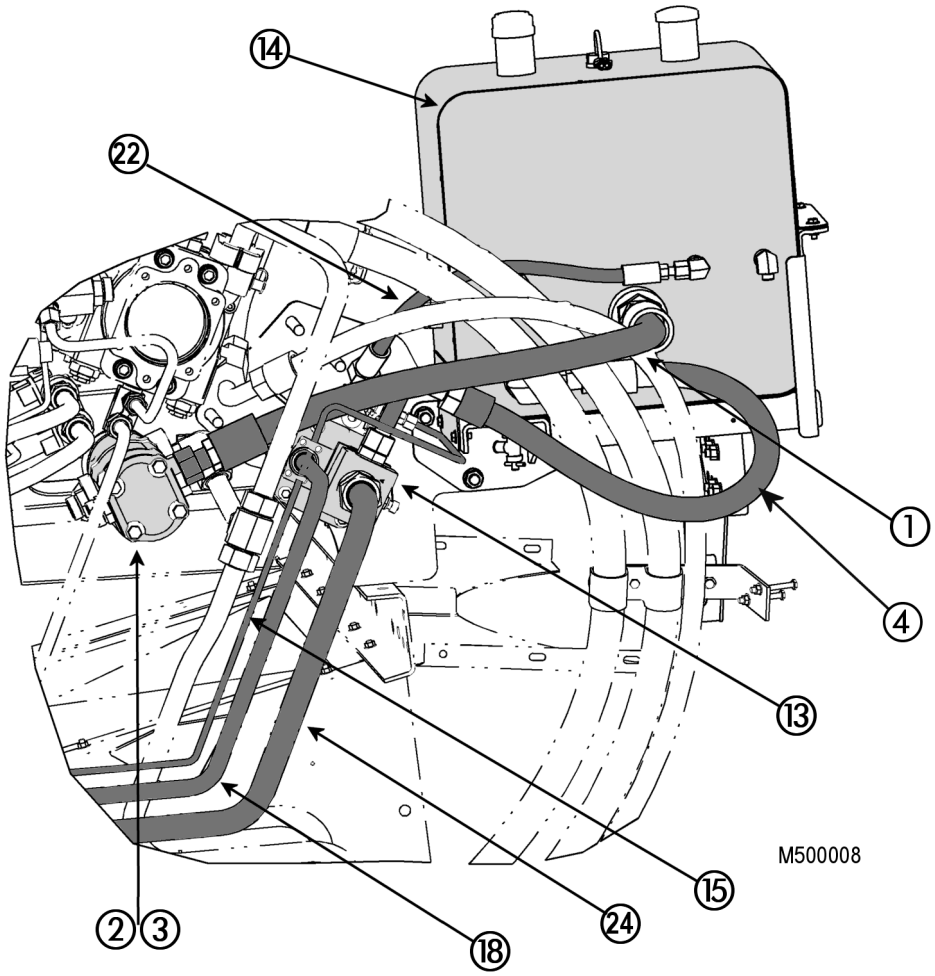
COMPONENT	SPECIFICATION
Electrical	
Control pressure sensor (0-500 psi) Lube Pressure sensors (0-100 psi)	0.0 PSI = 0.5V signal wire C Normal PSI = 3V signal wire C
Hydraulic & Charge filter restriction switches	N/O, Closes at 40 PSID
Hydraulic return oil temperature sensor Motor Temp. (Ground Drive) sensor	2500ohms @ room temperature 83 ohms @ 262°F (128°C)
Reservoir tank level switch	N/C, Closed with low oil 0.0 ohms
Hydraulic	
Hydraulic Reservoir Capacity	15 Gal (57L)
PTO Gearbox Reservoir Capacity	30 QT (28L)
Oil Type	CaseIH Hytran
	Synthetic Hytran (236610A2 may be used in some gearboxes for a heating problem, do **NOT** install in the PTO gearbox)
Spreader motor relief	2755 PSI (190 bar)
Rotary air screen motor relief (8010)	500±50 PSI (34±3.5 bar)
Fan motor relief	3500 PSI (241 bar)
Oil cooler by-pass (Hydraulic cooler)	110 PSI (7.6 bar)
Hydraulic filter by-pass	50 PSID (3.45 barD)
Regulated pressure	320-360 PSI (22-25 bar)
Charge pressure filter by-pass	50 PSID (3.45 barD)
Control pressure reducing valve	320±15 PSI (22±1 bar) Hot
Charge pressure relief	425±25 PSI (30±1.7 bar)
Lubrication pump / cooler relief	290±20 PSI (20±1 bar)
Lubrication system relief	50±5 PSI (3.5±.3 bar)
PFC pump low pressure stand-by	400±10 PSID (27±0.7 bar) Refer to test procedures for setting
PFC pump high pressure stand-by	3000-3100 PSI (207-214 bar)
Steering Signal Relief	2450±50 psi (169±3 bar)
Reel drive relief	2000 PSI (138 bar)
Header Tilt cushion relief	3000 PSI (207 bar)
Feeder lift cylinder thermal relief	4000 PSI (276 bar)
Spreader drive pump flow	16.5 GPM (63 l/m)
Fan drive pump flow	13.5 GPM (51 l/m)
PFC pump flow	44 GPM (166 l/m)
Charge pressure pump flow	39 GPM (147 l/m)
Lubrication pump flow	29 GPM (110 l/m)

HYDRAULIC SYSTEM



HYDRAULIC SYSTEM

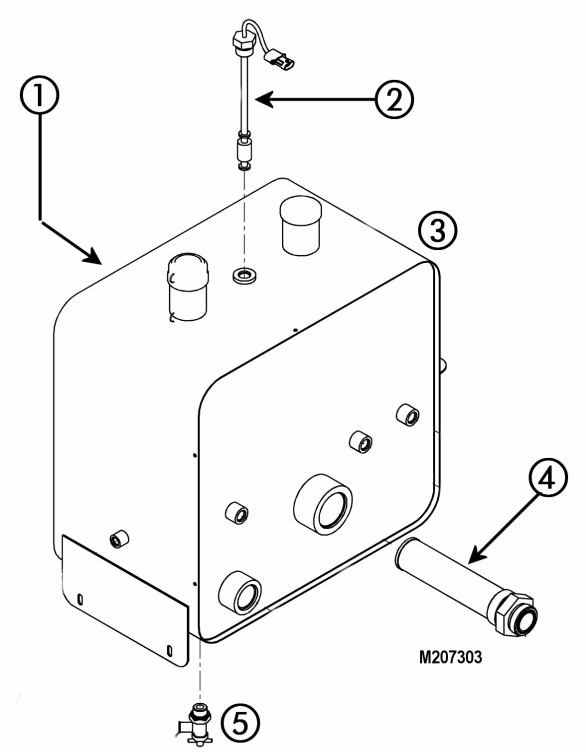
HYDRAULIC COMPONENT LOCATIONS



1.	Supply to Spreader and Fan Pumps	15.	Signal Line to Compensator
2&3.	Gear Pump Assembly, Spreader and Fan Drive	18.	PFC Pump Discharge Line
4.	Return to Reservoir	22.	PFC Pump Case Drain
13.	PFC Piston Pump	24.	PFC Pump Suctions
14.	Hydraulic Reservoir		

HYDRAULIC SYSTEM

OIL SUPPLY



1.	Oil Level Sight Glass
2.	Oil Level Sensor
3.	Reservoir Tank
4.	Outlet Strainer
5.	Tank Drain

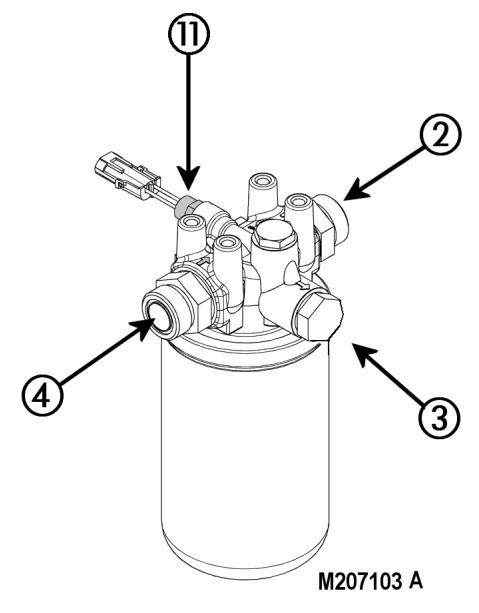
The hydraulic system is supplied with Hy-Tran Ultra from a central reservoir tank that is mounted behind the PTO gearbox. The tank contains approximately 15gal (57L) of oil and should be changed out every 1200 hours of operation.

A float type gauge that is mounted in the top of the tanks monitors the proper oil level. The float provides an Open/Closed signal to the display. The switch is OPEN when held in the operating position, CLOSED when oil is present. This sensor is ONLY for sudden fluid lost during operation. The operator should always monitor the sight glass in the reservoir tank for proper fluid level, which is above the sensor level.

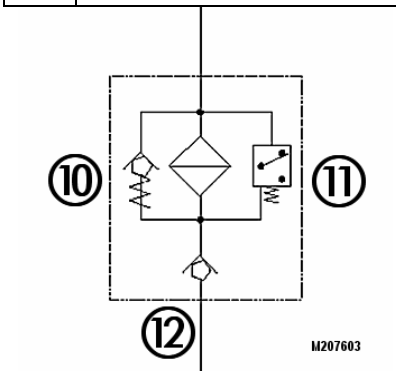
The tank incorporates a discharge port strainer and tank breather. A 100-micron strainer in the tank outlet is used to protect and supplies the Spreader and Fan gear pumps.

HYDRAULIC SYSTEM

FILTRATION



2.	Discharge Port
3.	Not used on the hydraulic filter
4.	Inlet Port
10.	Filter By-Pass
11.	Restrictions Indicator
12.	Back Flow Check Valve

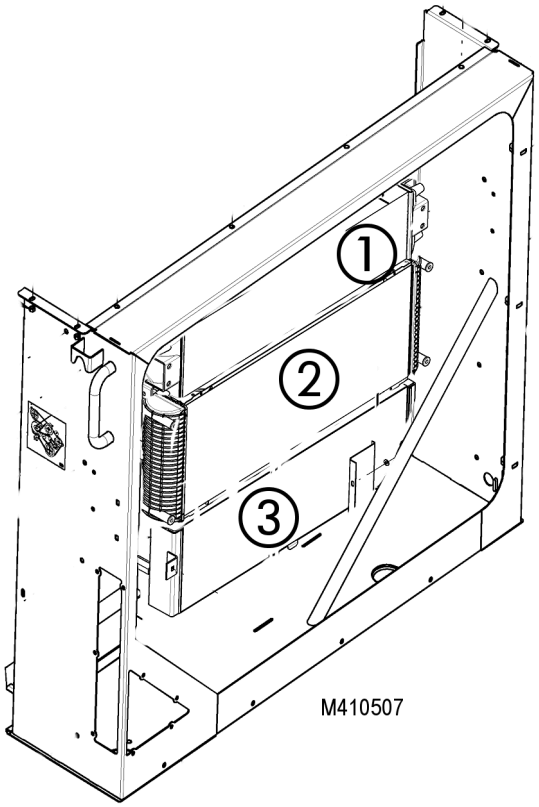


The hydraulic filter is on the return side of the hydraulic system, preventing trash from reaching the reservoir tank. It is imperative that only CLEAN Hy-Tran Ultra is placed in the tank. The filter base incorporates a filter restriction sensor (11) that monitors the condition of the filter element. If the restriction increases above 40 PSID differential pressure the sensor will CLOSE to create a signal to the display for operator warning. The filter base incorporates a filter by-pass valve that will open at 50 PSID differential pressure to prevent over pressuring the filter. The sensor is set to activate prior to the by-pass valve opening.

A back-flow valve (12) located in the base of the filter head should prevent a continuous flow of oil from the hydraulic reservoir tank while changing the filter.

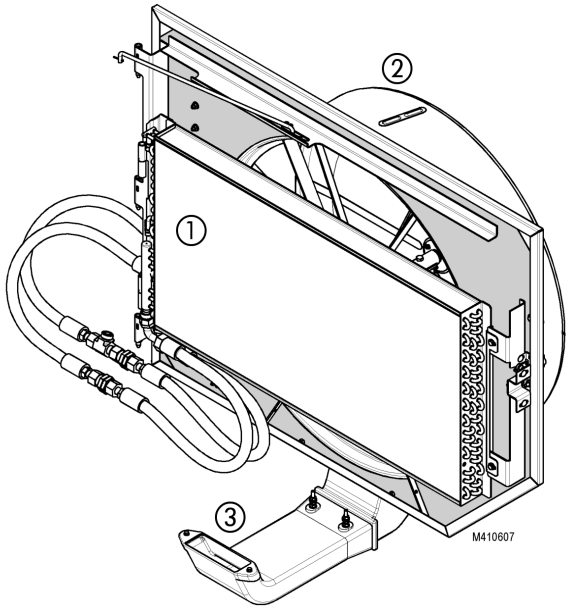
HYDRAULIC COOLING SYSTEM

COOLING, 8120



1.	Charge Air Cooler
2.	Radiator
3.	PTO Gearbox Cooler

RAS DOOR



1.	A/C Condenser (Upper portion) / Hydraulic Cooler (Lower portion)
2.	RAS Screen
3.	RAS Vacuum Tube

HYDRAULIC COOLING SYSTEM

COOLING, 8120, CON'T

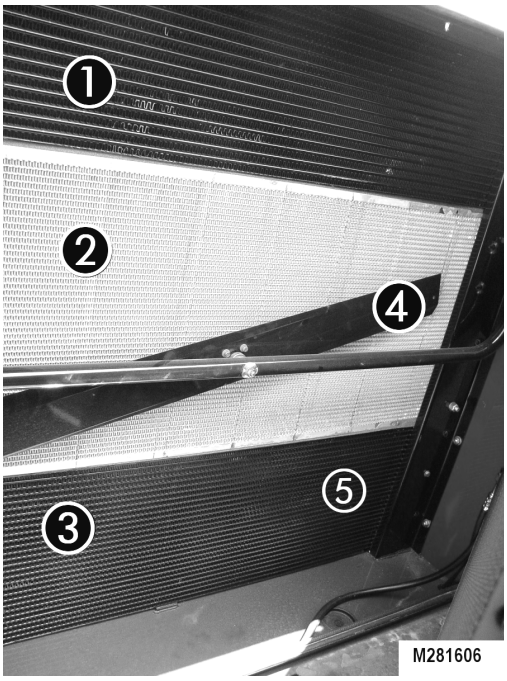
COOLING

The hydraulic cooler is mounted to the rotary air screen door and the PTO gearbox cooler is the lower portion of the cooler box.

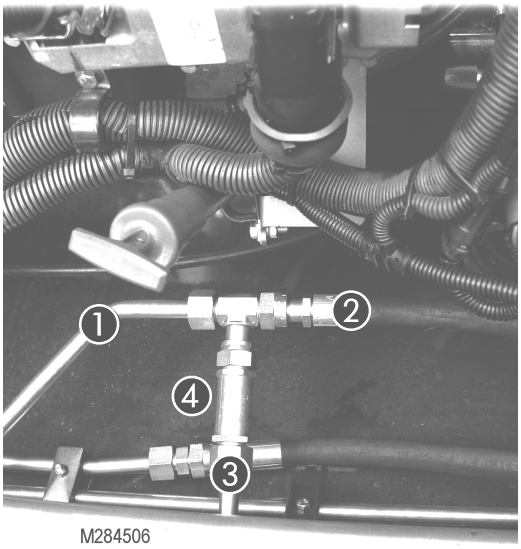
To protect the hydraulic cooler there is an inline 110 PSI (7.6 bar) oil cooler by-pass valve mounted in the outlet of the RAS motor.

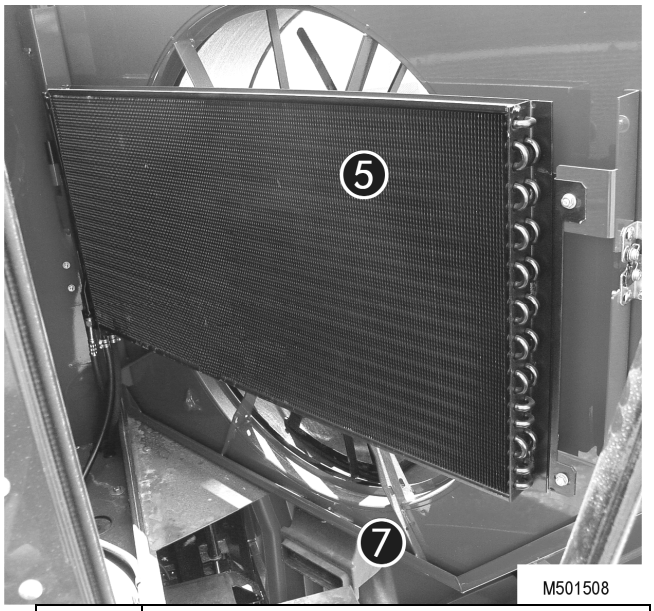
HYDRAULIC COOLING SYSTEM

COOLING, 7120 & 9120



1.	Air to Air Cooler
2.	Radiator
3.	Hydraulic Cooler
4.	Interrupter Blade
5.	PTO Gearbox Cooler





1.	From Spreader Valve
2.	To Hydraulic Cooler
3.	Cooler By-Pass to Fan return
4.	Cooler By-Pass Valve

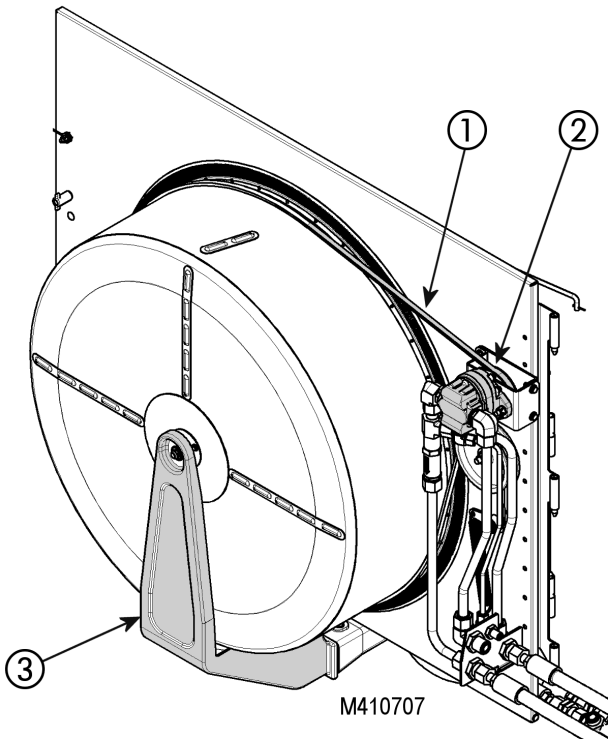
5.	HVAC Condenser
7.	RAS Vacuum Duct

COOLING

The hydraulic cooler (3) is mounted behind the rotary air screen and is a portion of the lower third of the cooler. There is a 110 PSI (7.6 bar) oil cooler by-pass valve (4) mounted below the engine oil dipstick.

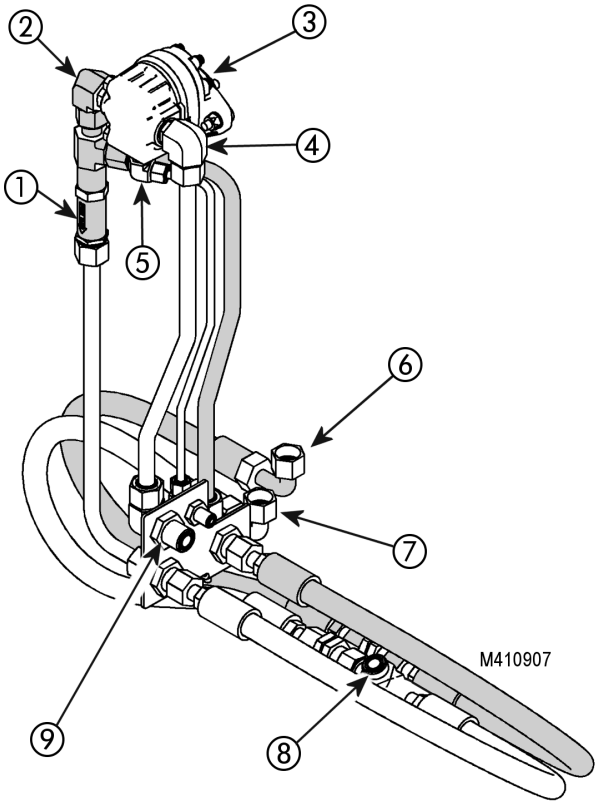
HYDRAULIC ROTARY AIR SCREEN SYSTEM

ROTARY AIR SCREEN, 8120 ONLY



1.	RAS Belt Drive
2.	RAS Drive Motor
3.	RAS Vacuum Tube

ROTARY AIR SCREEN FLOW



1.	Cooler Bypass Valve
2.	RAS Motor Return
3.	RAS Drive Motor
4.	RAS Supply from Spreader Valve
5.	Motor Case Drain
6.	To Cooler From RAS Motor
7.	From Cooler to Hydraulic Filter
8.	To Hydraulic Filter
9.	From Spreader Valve to RAS Motor

HYDRAULIC ROTARY AIR SCREEN SYSTEM

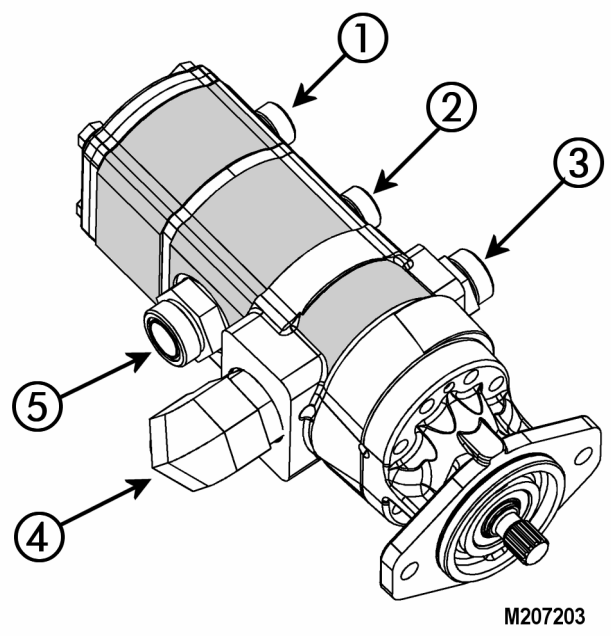
ROTARY AIR SCREEN, CON'T

The RAS system is supplied fluid flow from the spreader valve and then continues on to the hydraulic cooler.

From the spreader valve (9) the fluid is directed to the inlet side (4) of the RAS motor (3). The fluid then flows from the outlet side (2) of the motor to the hydraulic cooler (6). To protect the motor shaft seal, there is a case drain (5) which directs it back to the reservoir. If the cooler should become clogged, there is an inline bypass valve (1) that will open at approx. 110 PSI to protect it. Once the fluid has left the cooler (7) it is directed back to the main hydraulic return filter (8) before charging the PFC pump.

HYDRAULIC SYSTEM

GEAR PUMPS



1.	Fan Drive Output (rear pump)
2.	Spreader and Rotary Air Screen Output (center pump)
3.	Charge Pump Output (front pump)
4.	Supply From PTO Gearbox, (for pump 3)
5.	Supply From Hydraulic Reservoir, (for pumps 1 and 2)

The gear pump assembly is mounted in the PTO gearbox and incorporates three separate gear pumps.

The **Charge Pressure** pump, (pump 3, nearest to the drive shaft), is supplied oil from the **PTO gearbox and return manifold.** The pumps excess flow and system returns are used to supply the lube pump. See specification page.

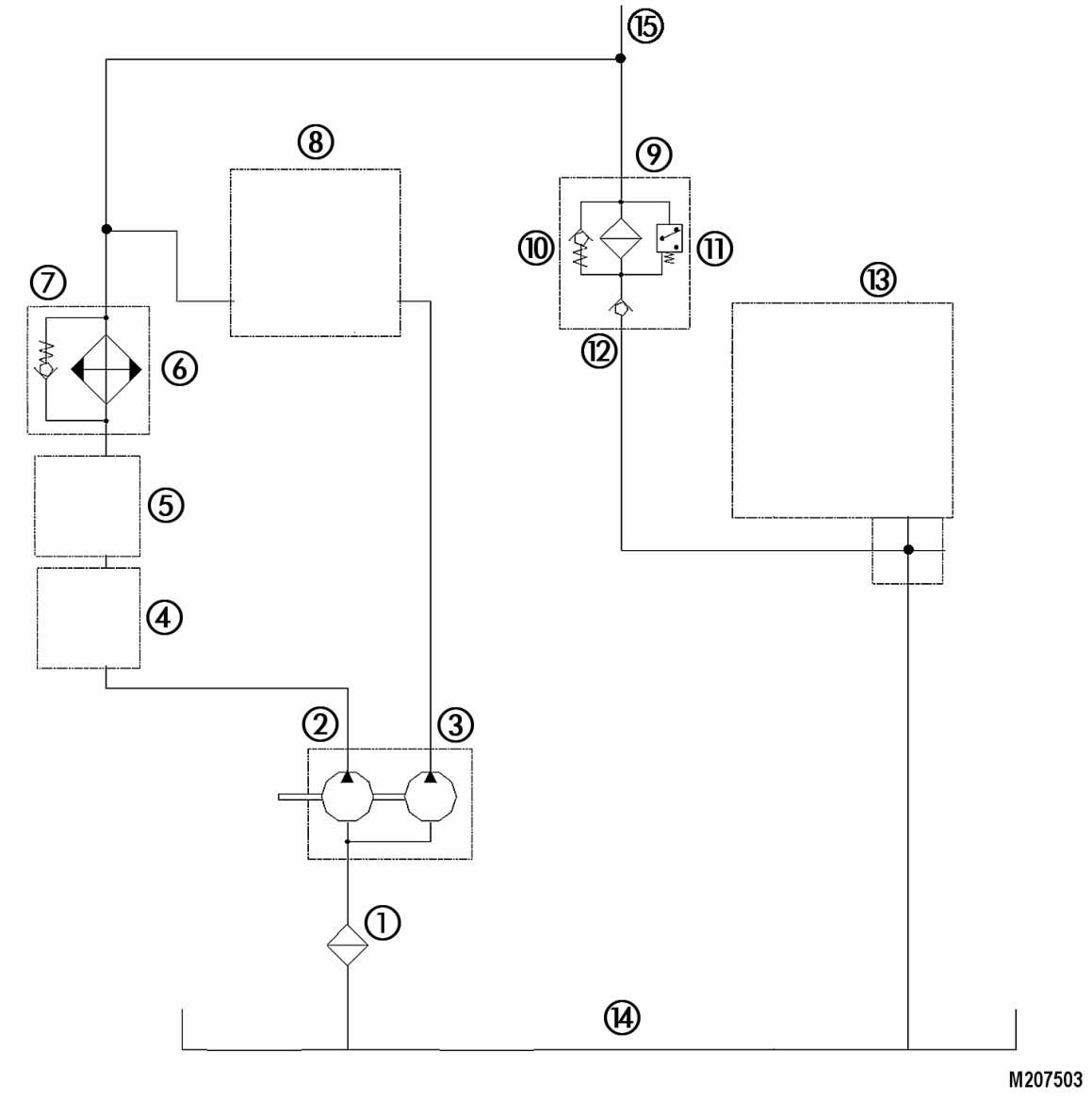
The **Spreader/Rotary Air Screen Drive** pump is supplied oil from the **hydraulic reservoir** and returns all of its flow back to the reservoir. See specification page.

The **Fan Drive** pump is supplied oil from the **hydraulic reservoir** and returns all of its flow back to the reservoir. See specification page.

REMEMBER: If the seal was to leak between the front and center pumps oil could transfer between reservoirs.

HYDRAULIC SYSTEM

HYDRAULIC SCHEMATIC



1.	Reservoir Strainer	9.	Return Filter Base
2.	Spreader/Rotary Air Screen Drive Pump	10.	Filter By-Pass Valve
3.	Fan Drive Pump	11.	Filter Restriction Indicator Switch
4.	Spreader Drive Valve	12.	Back Flow Check Valve
5.	Rotary Air Screen Valve (8120)	13.	PFC Piston Pump
6.	Oil Cooler	14.	Reservoir Tank
7.	Oil Cooler By-Pass Valve	15.	Return From All Hydraulic Functions
8.	Fan Drive Valve		

HYDRAULIC SYSTEM

HYDRAULIC SCHEMATIC

Spreader Pump

The spreader pump (2) will pull oil from the hydraulic reservoir (14) and direct it to the spreader valve (4). The spreader valve will direct the full flow from the pump on to the rotary air screen valve (5) once the spreader operation is completed. The rotary air screen valve will direct the full flow from the pump on to the oil cooler (6) once the air screen operation is completed. In cold weather the cooler may cause excessive restriction so the by-pass valve (7) can direct the oil flow around the cooler to the filter housing (9). The filter restriction is monitored by the filter sensor (11) and is protected by the by-pass valve (10). The filter directs the flow to the PFC pump inlet and the reservoir tank.

IMPORTANT: The spreader pump being a gear pump is associated with an open center system. In an open center system the pump flow is constant and MUST be routed back to the reservoir at all times. It can not be deadheaded or serious failures can occur.

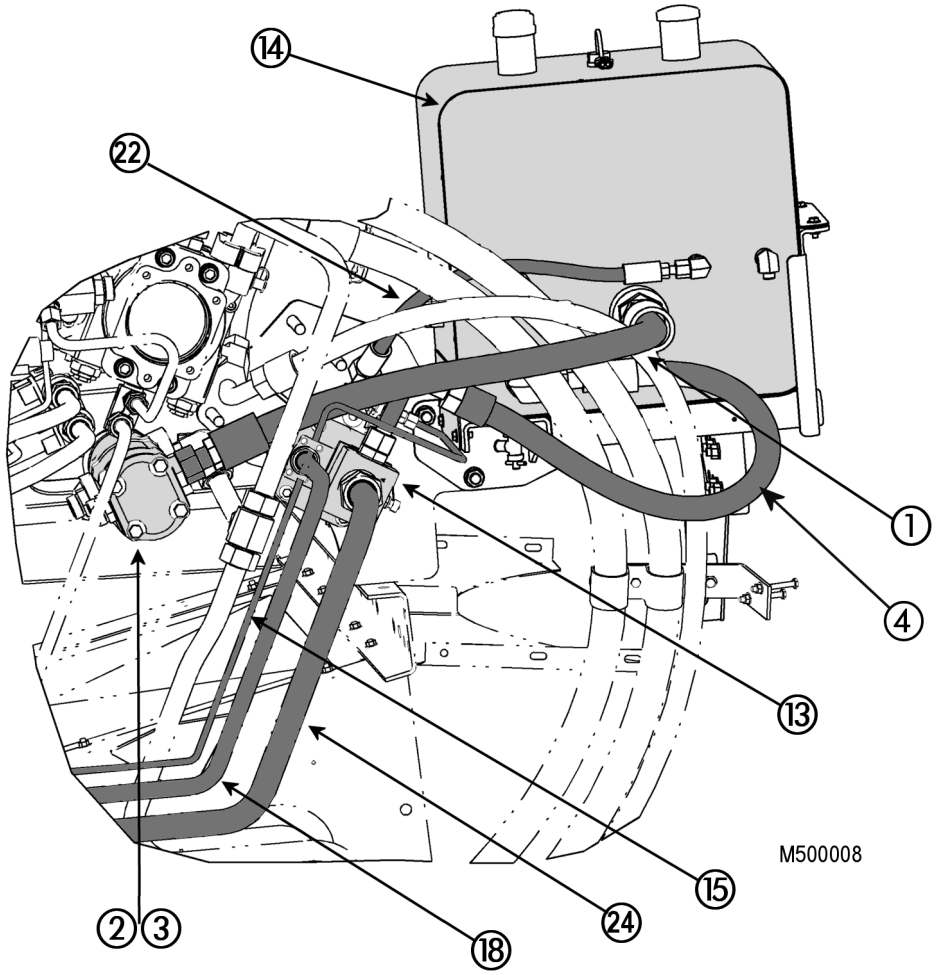
Fan Pump

The fan pump (3) will pull oil from the hydraulic reservoir (14) and direct it to the fan valve (8). The fan valve will direct the full flow of pump into the flow from the spreader pump headed to the filter base (9). The filter restriction is monitored by the filter sensor (11) and is protected by the by-pass valve (10). The filter directs the flow to the PFC pump inlet and the reservoir tank.

IMPORTANT: The fan pump being a gear pump is associated with an open center system. In an open center system the pump flow is constant and MUST be routed back to the reservoir at all times. It can not be deadheaded or serious failures can occur.

PFC PUMP HYDRAULIC SYSTEM

PFC COMPONENT LOCATIONS



1.	Supply to Spreader and Fan Pumps	15.	Signal Line to Compensator
2&3.	Gear Pump Assembly, Spreader and Fan Drive	18.	PFC Pump Discharge Line
4.	Return to Reservoir	22.	PFC Pump Case Drain
13.	PFC Piston Pump	24.	PFC Pump Suction
14.	Hydraulic Reservoir		

PFC PUMP HYDRAULIC SYSTEM

PFC PISTON PUMP

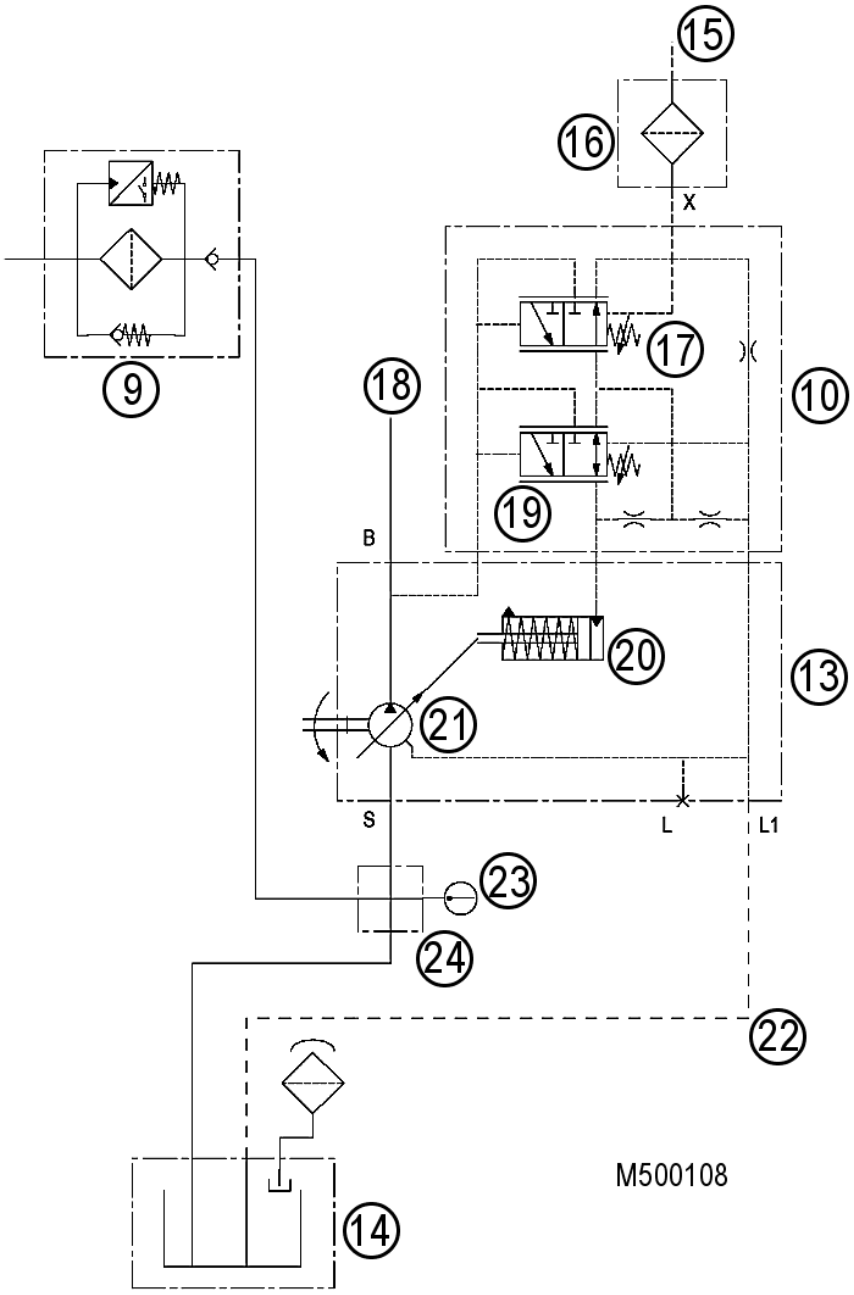
The PFC pump assembly is mounted to and driven by the PTO gearbox. The PFC pump will only produce the pressure and flow required meeting system demands when they occur. When discussing PFC hydraulics, it is important to realize that with the engine running the hydraulic system will always be in one of three modes:

- Low-pressure standby (could be thought of as neutral).
- Pressure and flow compensation (when the system is meeting the demand for oil).
- High-pressure standby (could be thought of as high-pressure relief).

The pump output is also directed to the parking brake valve where a regulated pressure is created and maintained for the pilot operated valve assembles.

PFC PUMP HYDRAULIC SYSTEM

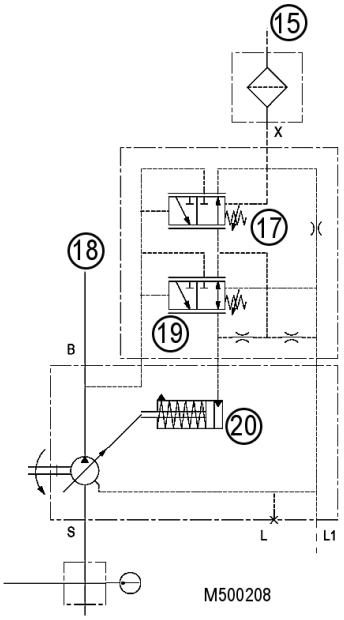
PFC PUMP SCHEMATIC



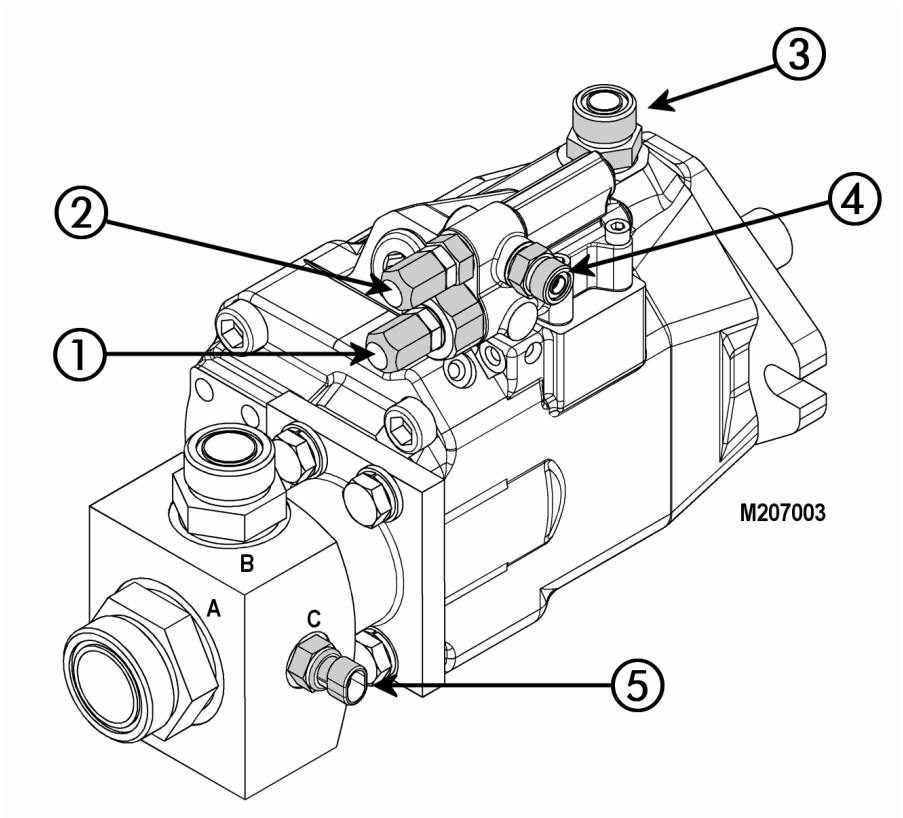
9.	Return Filter Base	18.	Pump Discharge Port
10.	PFC Pump Compensator	19.	High Pressure Spool
13.	PFC Pump Assembly	20.	Servo Piston (swashplate)
14.	Hydraulic Reservoir	21.	Rotating Assembly
15.	Signal Line to Compensator	22.	Case Drain
16.	Signal Line Screen	23.	Temperature Sensor
17.	Flow Control Spool	24.	Supply Manifold

PFC PUMP HYDRAULIC SYSTEM

PFC PISTON PUMP



15.	Signal Inlet
17.	Flow Control Spool
18.	Pump Outlet
19.	High Pressure Spool
20.	Servo Piston (swashplate)



1.	High Pressure Spool Adjustment	4.	Signal Line to Compensator
2.	Flow Control Spool Adjustment	5.	Temperature Sensor
3.	Case Drain to Tank		

HYDRAULIC SYSTEMS

PFC PUMP OPERATION

The PFC pump assembly is located directly in front of the reservoir. The PFC pump is an axial-piston type pump. When the drive shaft of the piston pump is rotated, the piston cylinder block, which is splined to the drive shaft, also turns. The piston block contains nine piston assemblies which have free swiveling slippers attached to the ball-end of the piston assembly. The slippers ride against the machined surface of the swash plate.

When the swash plate is tilted from neutral to its maximum angle by the swash plate control spring, the piston slippers follow the inclined surface of the swash plate and begin moving in and out of the piston block bore. Half of the piston assemblies are being pulled out of the piston block while the remaining half of the pistons are being pushed back into the piston block. As the pistons are pulled from the piston block, they draw oil into the piston block bores. This supply oil comes from the kidney shaped intake port. As the piston crosses over top dead center, the piston push the oil out of the piston block bores into a kidney shaped outlet pressure port. Each of the nine pistons completes this cycle for each revolution of the pump shaft. This causes a continuous even flow of oil from the pump.

The greater the swash plate angle, the greater the piston stroke. This increase in stroke causes more oil to be pulled into the pump and discharged out of the pressure port. When the engine is at high idle and the swash plate is at its maximum angle the pump output is approximately 44 GPM (166 l/m).

REMEMBER: The pump is always engaged by the swash plate spring to its maximum output. The compensator is always reducing the pumps output.

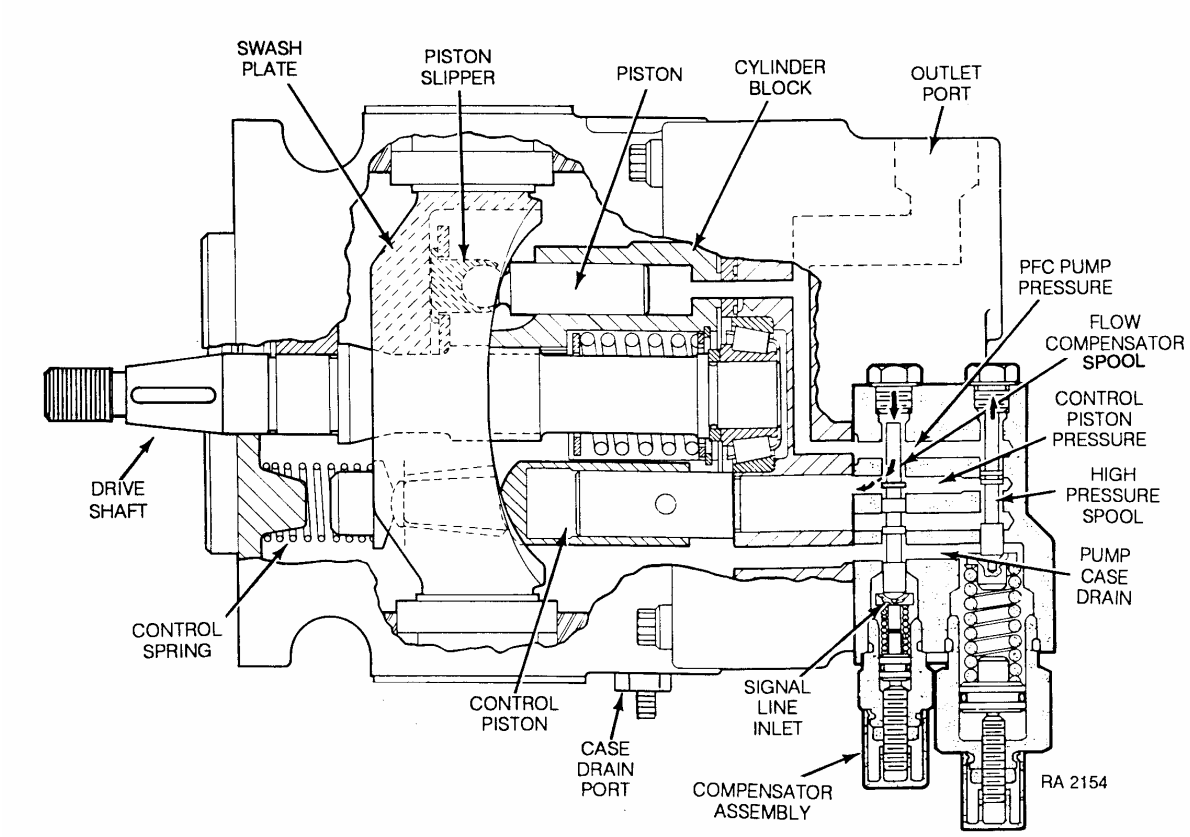
PUMP COMPENSATOR

The pump compensator assembly controls the angle of the swash plate by directing oil to the swash plate control piston. The swash plate control piston will over come the swash plate control spring, placing the swash plate at the proper angle.

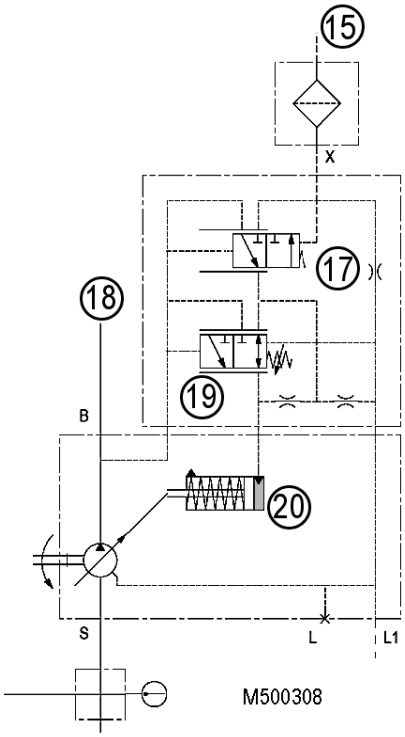
The main valve assembly, feeder valve assembly and steering hand pump each contain a signal port. The signal port and associated lines direct a signal pressure to the pump compensator. This signal pressure is equal to the system work pressure. The pump compensator will use this signal to place the piston pump swash plate at the proper angle to meet the system demand. The outlet pressure at the pump will be 27.6 bar (400±10 psi) higher than the signal line pressure due to the 27.6 bar (400±10 psi) spring in the compensator. The pump outlet pressure will continue to be 27.6 bar (400±10 psi) higher than signal line pressure until the high-pressure standby pressure is reached. After high pressure standby is reached, the pump outlet pressure and the signal line pressure will become equal.

HYDRAULIC SYSTEMS

LOW PRESSURE STANDBY



(Pump assembly is a representative drawing only.)



HYDRAULIC SYSTEMS

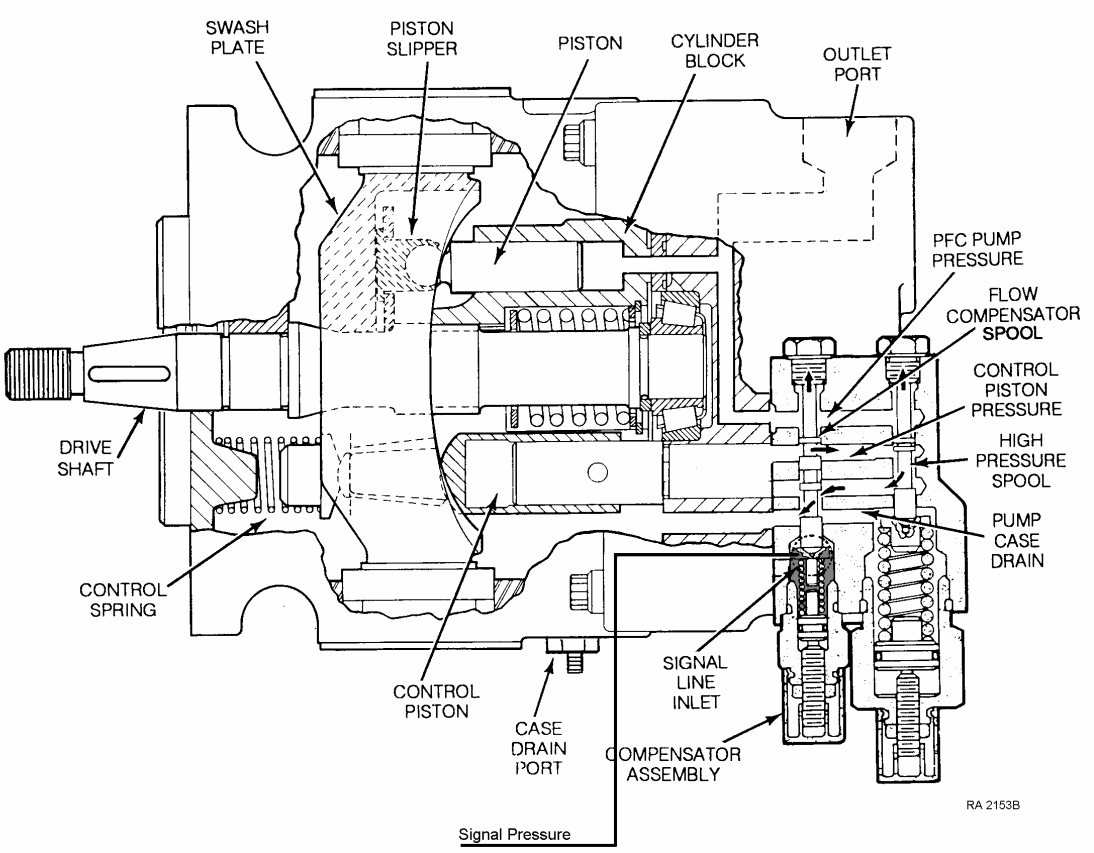
LOW PRESSURE STANDBY

When there is no demand for oil flow, the pump will go into the low-pressure standby mode. Low-pressure standby means low pressure and minimal flow in the system. When the engine is not running, no pressure exists in any circuit. In this state, the swash plate control spring is holding the piston pump at full stroke. When the engine is started and the pump begins to rotate, it will momentarily try to pump oil. This creates outlet pressure at the pump. This pressure is directed to the flow compensator spool and the high-pressure spool through passages in the piston pump back plate. The two spools in the pump compensator are both spring biased. The flow compensator spool has a 27.6 bar (400±10 psi) spring while the high-pressure spool has a 210 bar (3050±50 psi) spring. The pump pressure is directed to the non-spring side of these two spools. As pressure builds, it will cause the flow compensator spool to shift against its 27.6 bar (400±10 psi) spring. When the spool shifts it allows pump oil to pass to the pump control piston. This piston will extend and cause the swash plate to move against the control spring. The swash plate will move to a nearly zero degree angle, de-stroking the pump. In this condition, the pump will only move enough oil to make up for internal leakage within the system and maintain 31-41.5 bar (450-600 psi). The pump will remain in this position until there is a demand for oil. In low-pressure standby mode the pump produces less heat and uses less horsepower than an open-center system. Low pressure standby also makes starting the engine easier.

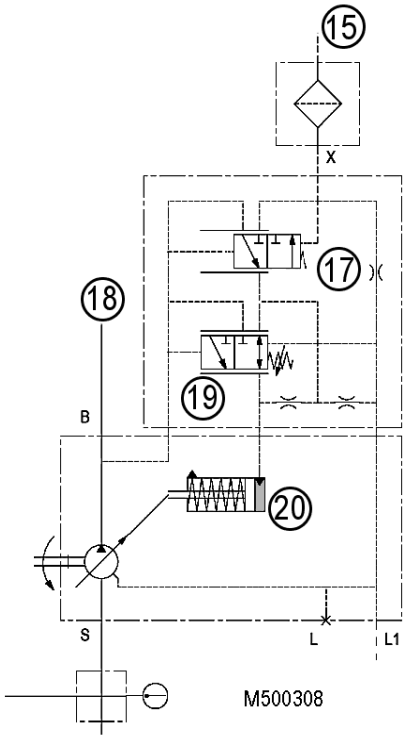
Minimum system pressure is 31-41.5 bar (450-600 psi) in the low-pressure standby mode. There is a 0.61 mm (0.024in) dynamic sensor orifice located in the steering priority spool. The dynamic sensor orifice connects the pump outlet port to the signal port of the pump compensator through the orifice check valve. If the oil in the signal line can flow through the steering hand pump too freely a 0.78 mm (0.031”) orifice in the steering hand pump signal passage provides back pressure in the signal line. This signal pressure of 3.45-10.3 bar (50-150 psi) is sent to the spring-end of the flow compensator spool. The spring pressure of 27.6 bar (400±10 psi) plus the signal line back pressure puts the pump into low pressure standby mode ranging from 31-41.5 bar (450-600 psi).

HYDRAULIC SYSTEMS

PRESSURE AND FLOW COMPENSATION



(Pump assembly is a representative drawing only.)



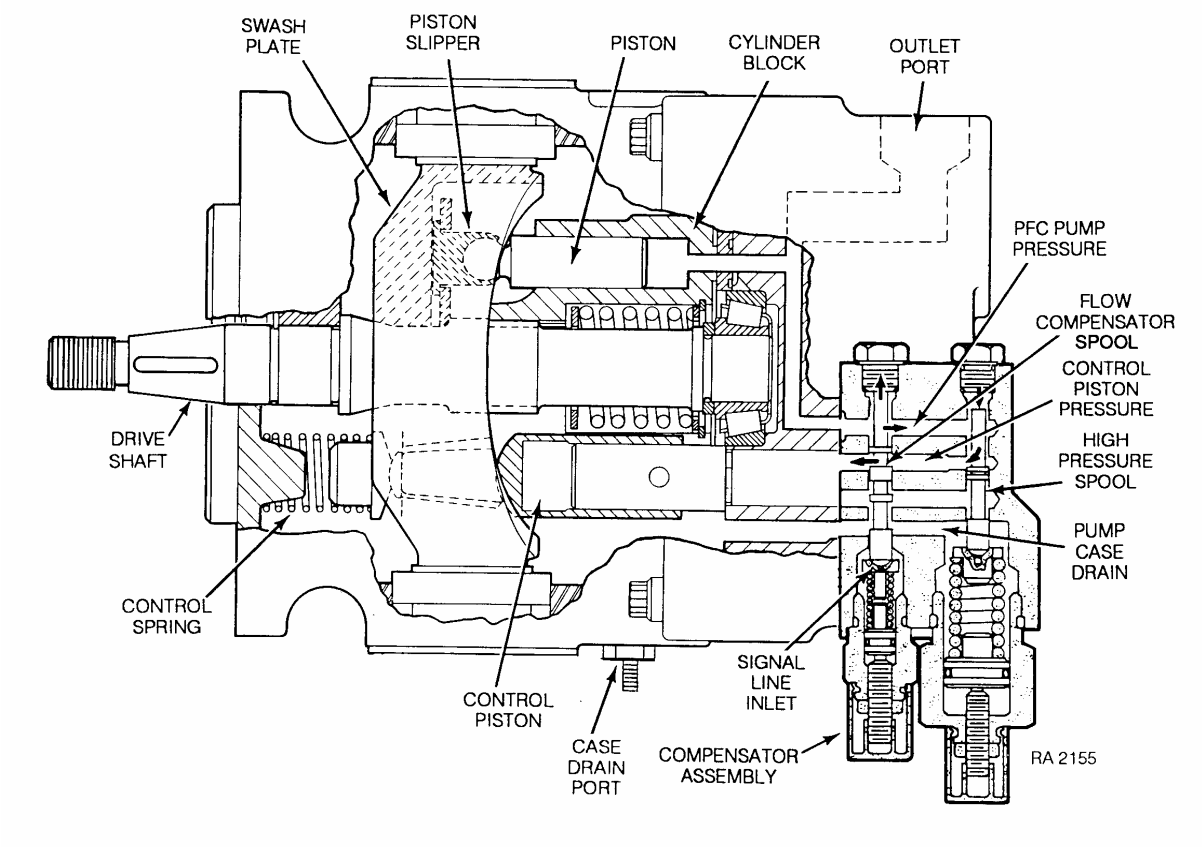
HYDRAULIC SYSTEMS

PRESSURE AND FLOW COMPENSATION

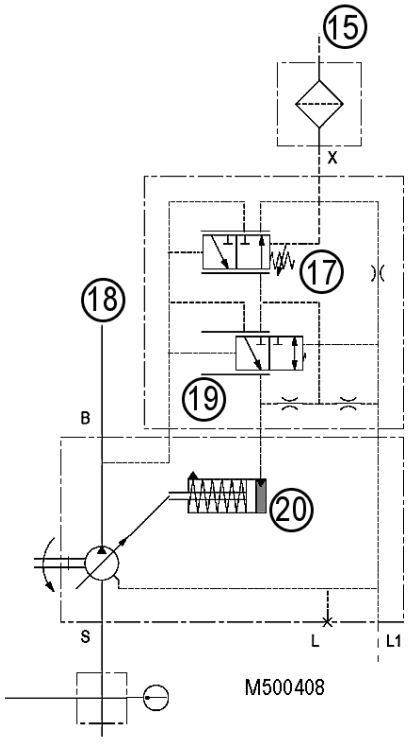
The flow of oil from the pump is controlled by the difference in pressure at opposite ends of the flow compensator spool. When a valve is opened to operate a function on the combine, the outlet pressure of the pump will drop. This drop in pressure is detected on the non-spring end of the flow compensator spool. The spring will now shift the spool and allow oil to drain from the pump control piston into the pump case. The swash plate control spring will tilt the swash plate, causing the pump to provide more oil flow. When the flow demand of the system is met, the swash plate will be tilted to provide only the flow required by the component(s) in use. The working pressure in the system is fed back to the spring-end of the flow compensator spool through the signal line. The pump must produce flow at a pressure equal to the working pressure desired, plus enough to overcome the 27.6 bar (400 psi) spring on the flow compensator spool. When the outlet pressure is high enough to overcome both the spring and work pressure, the flow compensator spool will shift allowing oil to flow to the control piston, causing the pump to destroke to match the demand.

HYDRAULIC SYSTEMS

HIGH PRESSURE STANDBY



(Pump assembly is a representative drawing only.)



HYDRAULIC SYSTEMS

HIGH PRESSURE STANDBY

Should the hydraulic system stall-out under a high load, or a cylinder reach the end of its stroke, the pump will go into high-pressure standby until the load is overcome or the valve is returned to neutral. When the system stalls-out, there will be no flow across the controlling valve. The pressure will then equalize on both ends of the flow compensator spool. The spring will then cause the flow compensator spool to shift. At the same time, the pressure will start to rise in the system until it is able to move the spring-loaded high-pressure spool. This spring is set at 182.85-189.75 bar (3050 psi). When the high-pressure compensator spool shifts, it directs oil to the swash plate control piston, de-stroking the pump.

The pump will remain in the high-pressure standby mode until the load is overcome or the valve is returned to neutral. When the valve is returned to neutral, pressure is no longer available to the signal line. The flow compensator spool will shift allowing oil to extend the control piston and destroke the pump. Signal line pressure is bled-off through a 0.5 mm (0.020”) signal orifice check valve threaded into the steering priory valve, a 0.89 mm (0.035”) dampening orifice located in the steering priority valve, a 0.78 mm (0.031”) orifice in the steering hand pump and then to the reservoir. When the signal pressure is bled-off, the flow compensator spool will return the system to low pressure standby.

SIGNAL CIRCUITS

The signal circuit pressure may be generated from the following sources:

- Steering Circuit
- Header Raise Circuit
- Signal Valve Circuit
- Lateral Tilt Valve
- Reel Drive Valve
- Auto Guide Circuit (if equipped)

The steering, header raise, terrain tracker and reel drive circuits react differently than the reel raise, reel fore/aft and unloading auger swing circuits. This is due to the location of the signal line. The steering, reel drive, terrain tracker and header raise rates are variable by the operator, unlike the other functions, which are not adjustable. For example, the steering speed can be affected by how fast the operator turns the steering wheel. The header raise rate can be increased or decreased by changing the raise rate setting on the display. However, the adjustments for speed of reel raise, reel fore/aft and unloading auger swing are set by the size of the orifices in each valve.

The signal line for the variable control systems (steering, terrain tracker, reel drive and header raise) is located after each control valve, (monitoring the circuit work pressure). In this location, the signal line will sense actual working pressure in the cylinder(s).

The reel raise, reel fore/aft and unloading auger swing can NOT create a signal. When any of these functions are activated the Signal valve is also activated. The signal valve is used to direct full pump pressure into the signal line, this causes the PFC pump to go to high pressure standby. A supply side orifice in each valve controls the speed at which these function operated.

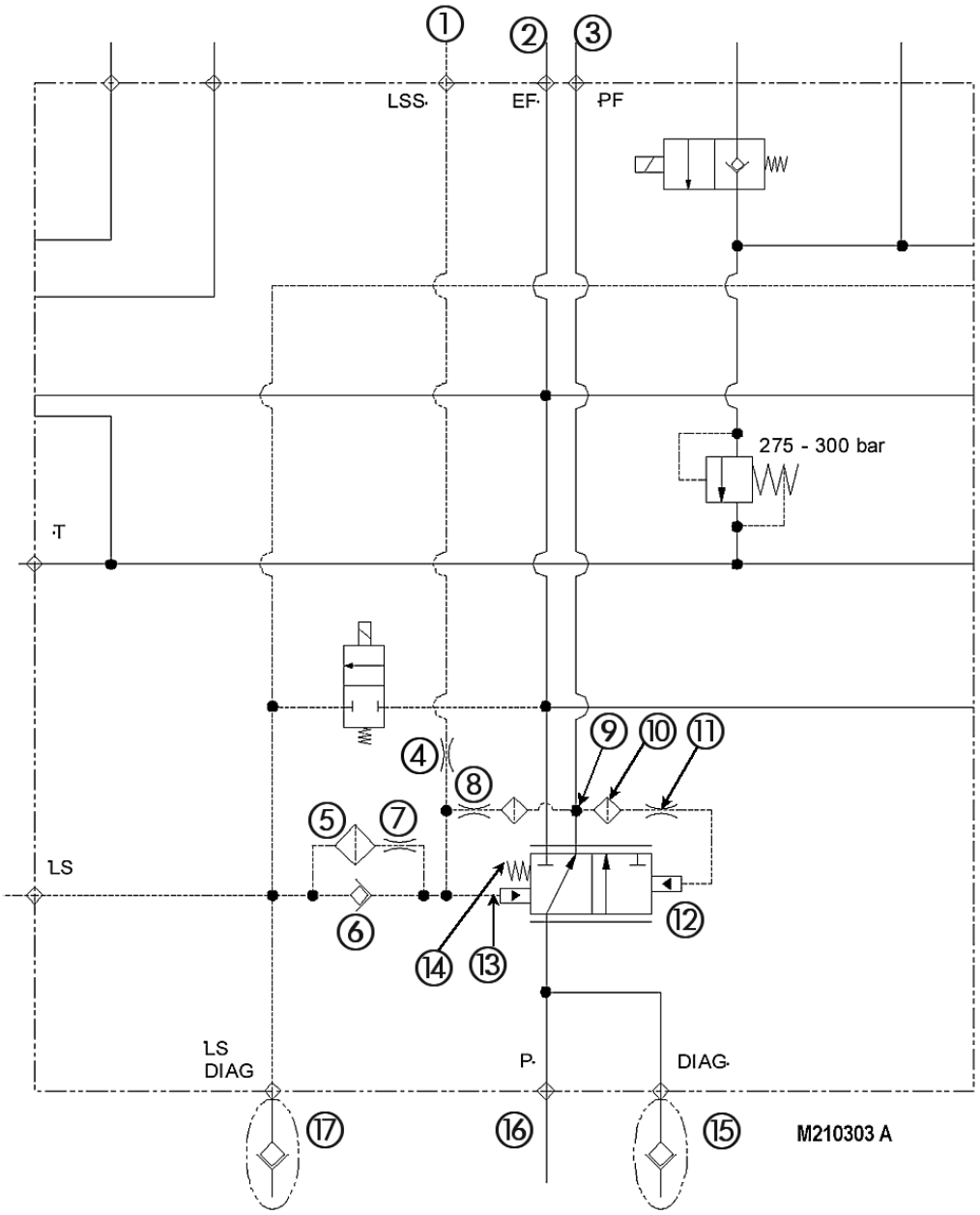
The signal valve is connected before the orifices that control the actuation speed. As a result, the signal pressure sensed is not the actual working pressure at the cylinder(s), but full system pressure. In this case, no pressure drop is detected and the oil pressure on either side of the flow compensator spool will remain equal. This situation will cause the system to go on high-pressure standby whenever reel raise, reel fore/aft and unloading auger swing are operated.

Within the PFC system there are five checks valves located in the signal lines. One at the header valve, one at the steering priority valve, one in the reel drive valve and two in the lateral tilt valve. The purpose of these checks is to allow the highest signal line pressure to get back to the compensator. This will make sure that the component with the highest-pressure demand is satisfied.

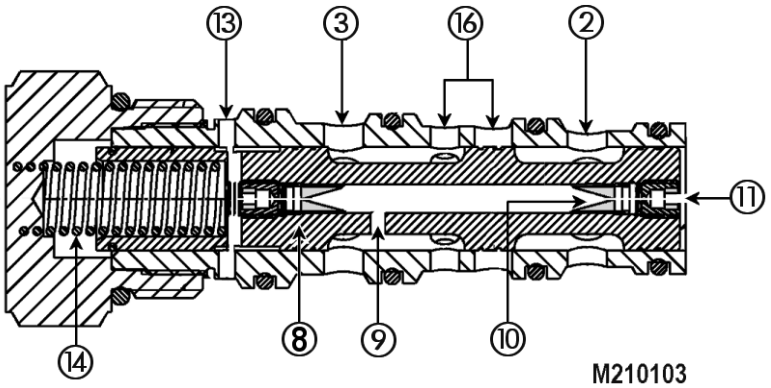
STEERING PRIORITY VALVE

MAIN MACHINE STACK VALVE

1	Signal from Steering
2	Supply to Feeder Valve
3	Supply to Steering Hand pump
4	Damping Orifice
5	Screen
6	Steering Signal Check Valve
7	Signal Bleed Off Orifice
8	Dynamic Orifice
9	Connection
10	Screen
11	Damping Orifice
12	Pump PSI
13	Signal PSI
14	Spring
15	DIAG Test Port
16	From PFC Pump
17	Signal Line Test Port



STEERING PRIORITY VALVE



STEERING CIRCUIT

STEERING PRIORITY VALVE

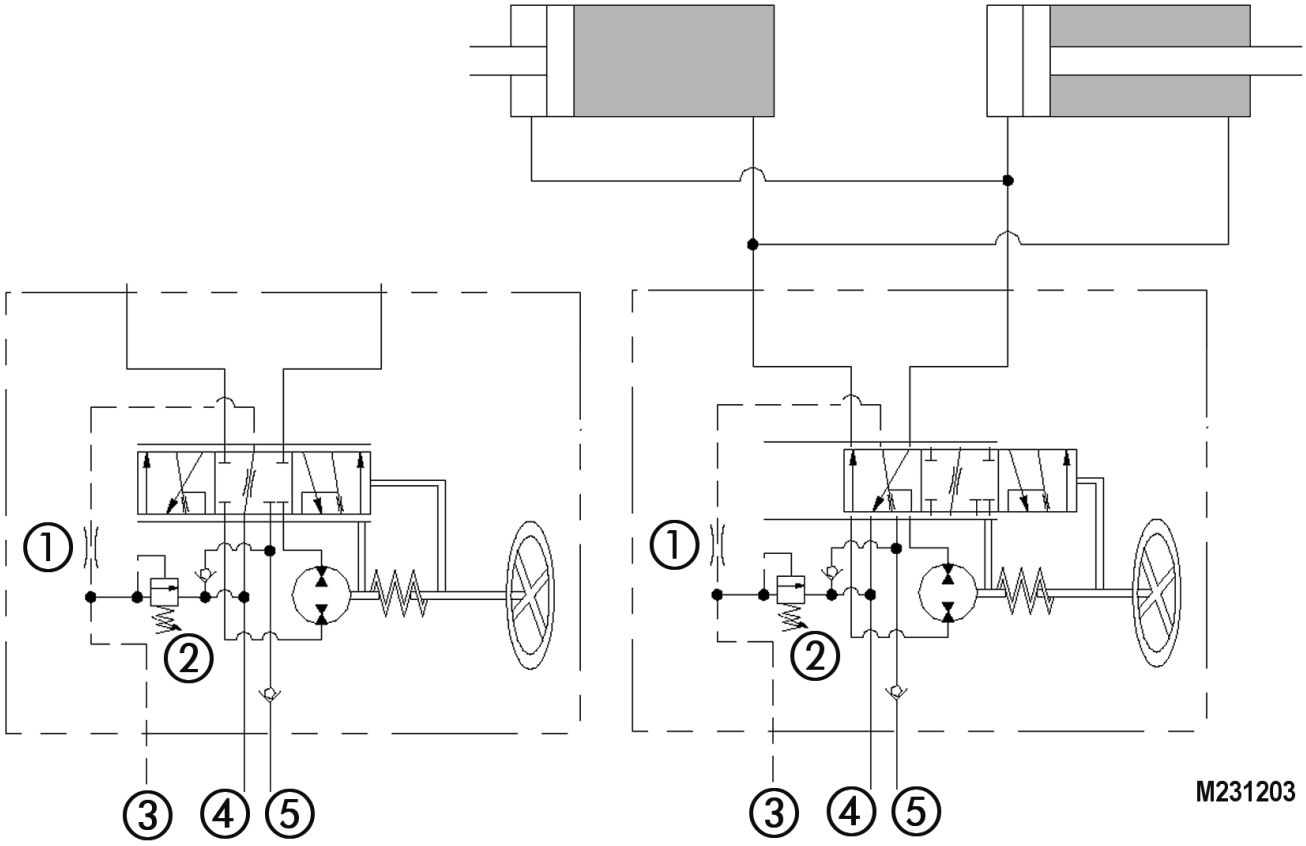
The steering priority valve is integral with the main stack valve on the left side of the combine. The primary function of the steering priority valve is to maintain a priority flow of oil to the steering system. Oil from the PFC pump is directed to the inlet of the steering priority valve. Inside the valve is the priority spool, which is spring biased. The spring will position the spool so incoming oil will to go to the steering hand pump first.

When steering is not being used, pressure will increase due to the closed-center steering hand pump. This build-up of pressure is directed to the non-spring end (12) of the priority spool through a screened 0.91 mm (0.035 in) damping orifice (11). At the same time, a screened 0.64 mm (0.025 in) dynamic sensor orifice (8) directs oil to the spring-end of the priority spool and to the signal line. The dynamic sensor orifice keeps the signal line filled with oil to keep the steering responsive. At the same time this oil is allowed to drain to the reservoir through the orifice in the steering hand pump spool. If the oil in the signal line can flow through the steering hand pump too freely, the 0.76 mm (0.031 in) orifice in the steering hand pump will create a back pressure of 10.3 bar (50-150 psi) in the signal line. This pressure in the signal line plus the 27.6 bar (400 psi) springs in the compensator act together to put the system at low pressure standby. With the oil on the spring-side (13) of the priority spool draining to the reservoir, and the increased pressure on the opposite end, the spool will shift against the spring. The priority spool will meter just enough oil to the steering circuit to make-up for the oil being bled-off through the 0.76 mm (0.031 in) orifice in the steering hand pump during low pressure standby. On the spring-end of the steering priority spool is an orifice (8) fitting that connects the steering hand pump signal line to the steering priority valve. This orifice fitting has a 0.64 mm (0.025 in) orifice in it, which serves as a dampening orifice to control priority spool movement.

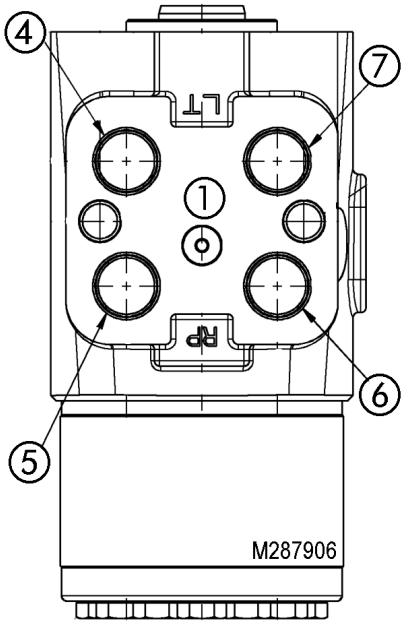
The steering hand pump circuit is opened when steering is required. This will cause a pressure drop on the non-spring end of the priority spool. The spring will shift the priority spool to direct oil out to the steering hand pump. The PFC pump will stroke to meet the steering demand. When steering demand is satisfied, pressure will start to build on the non-spring end of the priority spool. The pressure will overcome the spring, shifting the priority spool, thus allowing excess oil to be supplied to the main valve assembly if required.

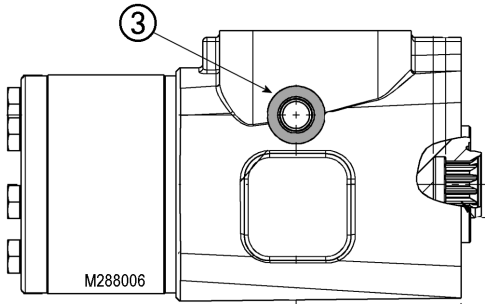
Threaded into the steering priority valve is a screened 0.51-mm (0.020in) orifice check. This orifice check allows oil pressure to get to the compensator when in low-pressure standby mode and when steering the combine. It also allows signal line pressure, once a function has been completed, to bleed from the compensator to reservoir through the steering hand pump, which de-strokes the pump.

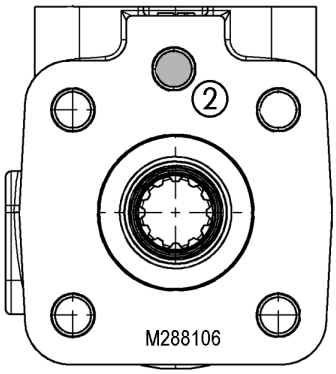
STEERING HAND PUMP



1.	Damping Orifice
2.	Relief Valve
3.	Signal Line Port
4.	Return Port
5.	Supply Port
6.	Right Work Ports
7.	Left Work Port







STEERING CIRCUIT

STEERING HAND PUMP

The steering system uses an Eaton steering hand pump. This hand pump is a closed-center, load-sensing design to minimize horsepower consumption and heat generation. The NA unit is 328 cc with 4.8 turns lock to lock and the EUR unit is 318 cc with 5 turns lock to lock. Two 2.25" X 13.4" cylinders are used to turn the wheels. The left hand cylinder may incorporate a position sensor for the AccuGuide system when installed.

STEERING NEUTRAL

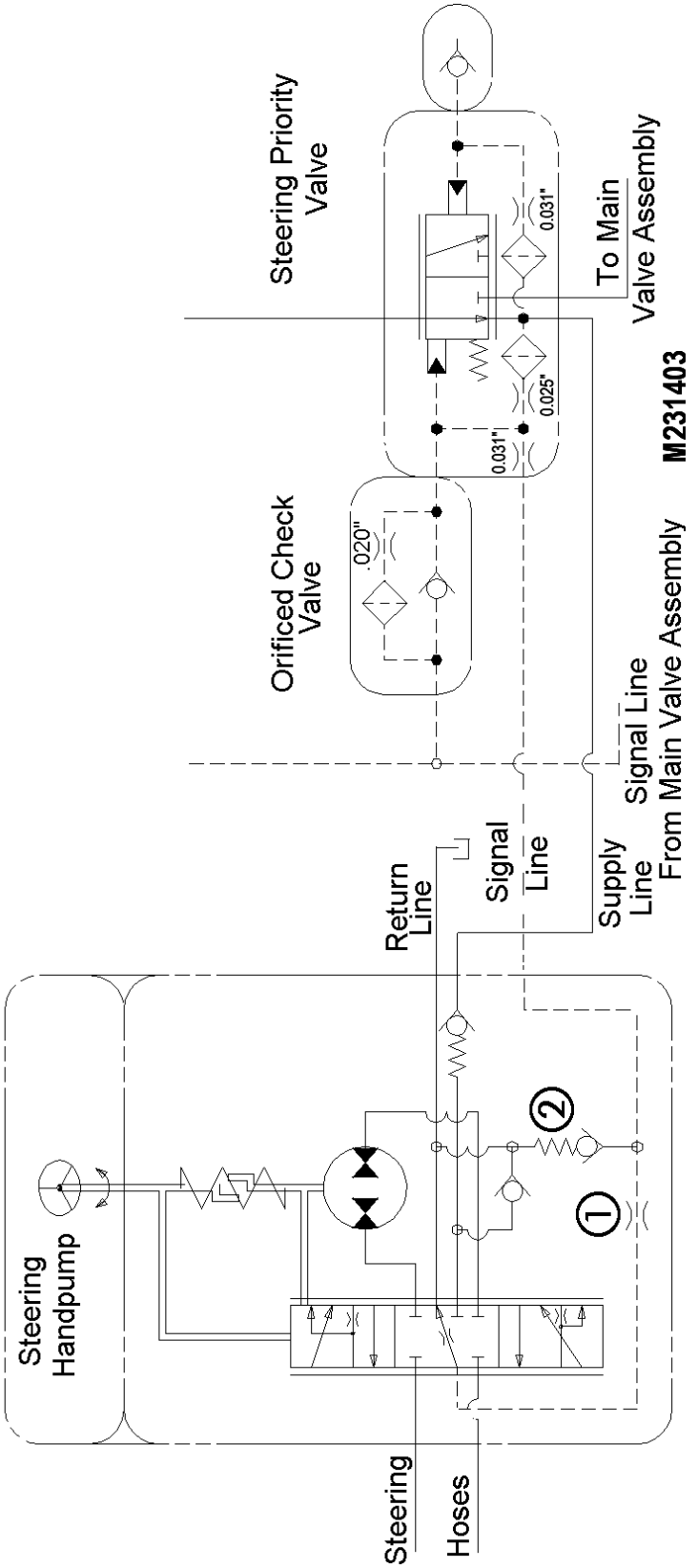
When there is no demand for steering, the spring-centered main spool and sleeve block the oil inlet port and the ports to the steering cylinder. At the same time the main spool and sleeve open a passage so the signal line can drain to the reservoir. The 0.64 mm (0.025 in) dynamic sensor orifice directs oil to the spring-end of the priority spool and to the signal line. The dynamic sensor orifice keeps the signal line filled with oil to keep the steering responsive. At the same time this oil is allowed to drain to the reservoir through the orifice (1) in the steering hand pump. The orifice in the steering hand pump will create a back pressure of 10.3 bar (50-150 psi) in the signal line. This pressure in the signal line plus the 27.6 bar (400 psi) spring in the compensator act together to put the system at low pressure standby. The internal check valve between the supply and return passages is closed at this time.

POWER TURN (LEFT OR RIGHT)

Oil from the PFC pump enters the steering hand pump at the supply port. This opens the spring-loaded check valve and seats the recirculation check. As the steering wheel is rotated (left or right), the main spool will move within the sleeve. This movement will direct oil to the metering section as well as to the signal line. The metering section begins to rotate with the rotation of the steering wheel. This moves oil from the PFC pump to the rod-end or the base end of the cylinder depending on the direction of rotation. At this point the oil pressure going to the cylinders is also transmitted back to the compensator by way of the signal line.

Oil returning from the cylinder is directed back to the main spool and sleeve, then out the return port of the steering hand pump to the oil filter. When rotation of the steering wheel is stopped, the spring-centered main spool and sleeve return to the neutral position. This stops oil flow to the metering section and traps oil in the cylinder.

STEERING RELIEF VALVE



1.	Damping Orifice	2.	Steering Relief

STEERING RELIEF VALVE

If the steering wheels are turned to their stops, or the wheels can no longer be turned, the steering system pressure increases until it goes on relief. When the signal pressure increases above 144-165 bar (2100-2400 psi), a simple relief valve (2) located in the steering hand pump signal line will open. An orifice (1) is located in the hand pump to limit the amount of oil that is being feed into the signal line, so that the relief valve can limit the pressure in the signal line. This will limit the signal pressure available to the steering priority valve and the compensator. The purpose of this relief valve is to limit the maximum pressure available to the spring-side of the priority spool, thus allowing oil to flow to the main valve assembly. If the steering relief pressure is set too close to the high-pressure stand-by pressure, the oil flow to the main valve assembly may be cut off when the steering relief valve opens. This relief valve is factory set to provide a signal supply pressure between 144-165 bar (2100-2400 psi), this will create a pump pressure of 172-190 bar (2500-2750 psi).

MANUAL STEERING

The steering circuit will permit manual steering control of the combine in the event of a dead engine; however, steering effort is more demanding. Manual steering uses the existing oil in the steering circuit for the oil supply, and the operator turning the steering wheel as input power. In manual steering operation, the metering section (turned by the operator) is used as the pump to supply oil to the steering cylinder.

MANUAL TURN (LEFT OR RIGHT)

As the operator rotates the steering wheel, the centering springs compress and the main spool changes relationship to the sleeve. Since there is no supply of hydraulic oil from the PFC pump, the inlet check valve will be held on its seat by the spring. At this point, the recirculation check ball will not be seated due to the fact there is no incoming oil. This allows oil from the return port to be drawn past the recirculation check, through the main spool and sleeve, to supply the metering section, which is now acting as the pump. The metering section controls the amount of oil being directed to the cylinder based on the rotation speed of the steering wheel. Oil flow from the metering section is then directed to the spool and sleeve, then out to the steering cylinder.

Oil returning from the steering cylinder is directed back to the main spool and sleeve, then to the return port. Since return port oil is now the supply to the metering section, and the recirculation ball is off its seat, the oil can again be directed to the metering section for a continuous supply.

When the rotation of the steering wheel is stopped, the centering springs return the main spool and sleeve to a neutral position.

HYDRAULIC SYSTEM

ELECTRICAL MONITORING CIRCUITS

The system uses a number of sensors to monitor the systems operations.

HYDRAULIC FILTER RESTRICTIONS SWITCH

Reference Material:

Electrical schematic frames: 10

Key Components:

Hydraulic Filter Restriction Switch S-32, CCM1, Ground (1)

The filter restriction switch is used to monitor the condition of the filter. The switch is a N/O switch. When the pressure differential on the filter exceeds the specifications the switch piston will shuttle over connecting the power wire to the filter base, providing a ground. The filter restriction indicator should illuminate prior to the filter by-pass opening, providing the operator time to replace the filter.

Power is supplied to the sensor from the CCM1 connector X019 terminal J2-34 to the sensor terminal B. The sensor terminal A is directed to the chassis ground (1).

HYDRAULIC OIL TEMPERATURE SENSOR

Reference Material:

Electrical schematic frames: 10

Key Components:

Hydraulic Oil Temperature Sensor B-18, CCM1

Located:

In the PFC pump inlet manifold

The reservoir tank temperature sensor monitors the oil temperature in the reservoir tank. If the temperature should climb above 194°F (90°C), the resistance of the sensor will be reduced to a point at which enough current will flow through it providing the CCM1 with a signal. AT room temperature the sensor reads approximately 2500 ohms and reduces as the temperature increases.

Power is supplied to the sensor from the CCM1 connector X019 terminal J2-24 to the sensor terminal B. The sensor terminal A is directed back to the CCM1 connector X019 terminal J2-14.

REMEMBER: The diagnostic screen on the display monitors the supply wire B.

HYDRAULIC SYSTEM

ELECTRICAL MONITORING CIRCUITS

RESERVOIR TANK LEVEL SWITCH

Reference Material:

Electrical schematic frames: 10

Key Components:

Hydraulic Oil Level Switch S-33, CCM2, ground (1)

The reservoir tank level switch monitors the oil level in the reservoir tank and is a normal open sensor. If the level fluid level is correct sensor will **CLOSE**, providing an complete circuit.

Power is supplied to the sensor from the CCM2 connector X016 terminal J2-39 to the sensor terminal B. The sensor terminal A is directed to the chassis ground (1).

PFC PUMP DISCHARGE PRESSURE SENSOR

Reference Material:

Electrical schematic frames: 22

Key Components:

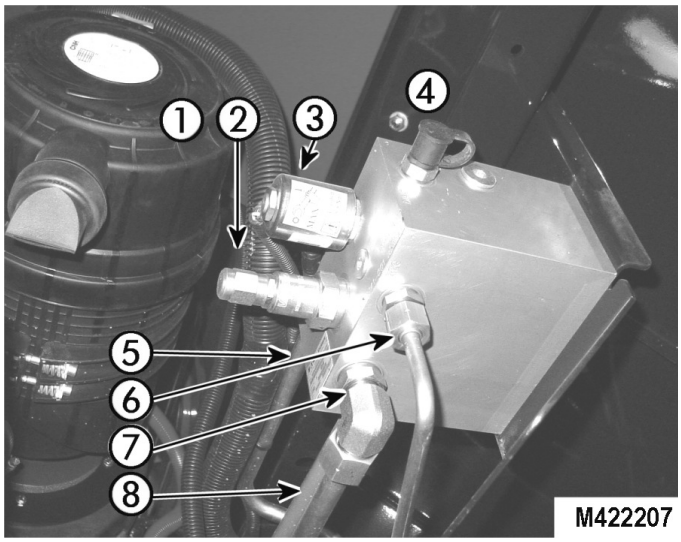
PFC Pump Pressure Sensor S-91

The PFC pump pressure sensor is used to monitor the pump's output pressure, mainly used while adjusting the grain tank cross auger covers. The sensor output (as PSI) may be monitored on the cab display by navigating BACK>COMBINE INFORMATION>HYDRAULIC.

The sensor is supplied 5V from the CCM2 connector X016 terminal J2-31 to the sensor terminal B. The sensor return terminal A is directed to the CCM 2 connector X017 terminal J3-18. The sensor's signal wire, terminal C, is directed to the CCM2 connector X016 terminal J2-29.

REGULATED PRESSURE

PARK BRAKE / REGULATED PRESSURE VALVE



1.	Cab Air Filter
4.	Park Brake/Regulated Pressure Assembly

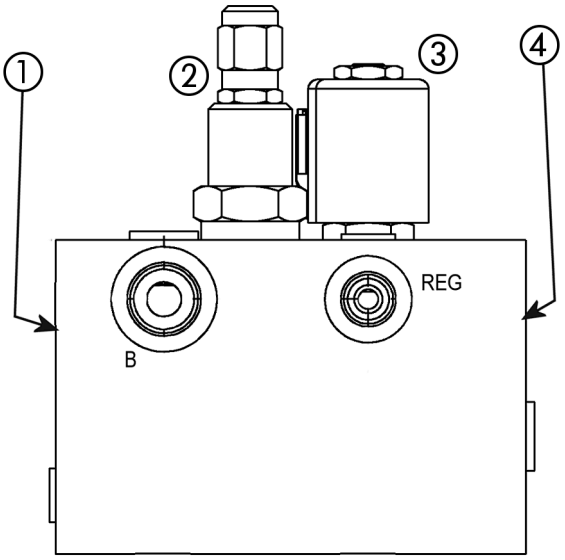
PARK BRAKE / REGULATED PRESSURE VALVE

The park brake / regulated pressure valve receives fluid from the PFC pump and creates regulated pressure. Regulated pressure is used for two functions:

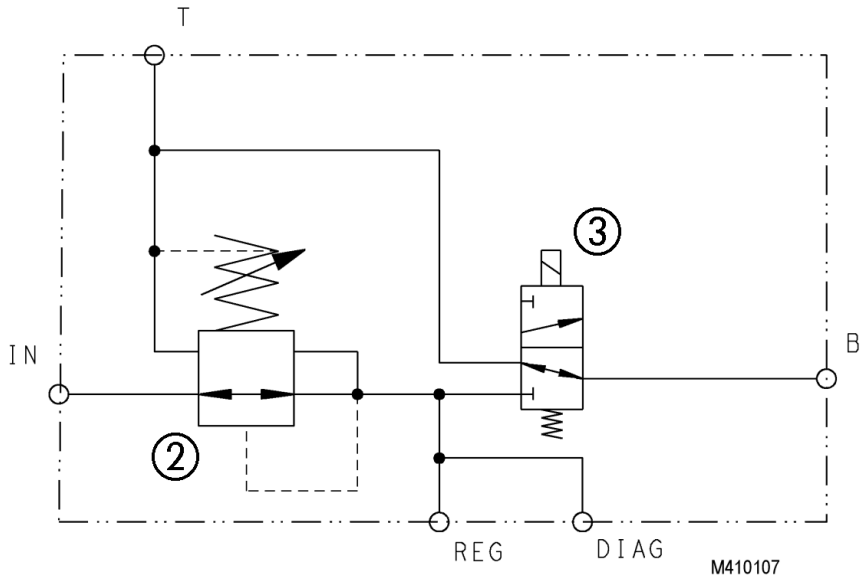
1. To control the secondary portion of pilot operated valve assembles, Header Raise / Lower and Reel Drive valve. The primary spool uses regulated pressure to control the position of the secondary spool, the secondary spools will be controlling the operating flow from the PFC pump.
2. To release the Parking Brake.

REGULATED PRESSURE

COMPONENT LOCATION



M410207



M410107

1.	Supply From PFC Pump = “IN”	B	To Parking Brake
2.	Regulated Pressure Valve	REG	To Regulated Circuits
3.	Park Brake Valve	T	Tank
4.	Regulated Test Port = “DIAG”		

PARK BRAKE

PARK BRAKE VALVE OPERATION

REFERENCE MATERIAL:

Hydraulic Schematic
General Hydraulic Section for Oil Supply to the valve and Regulated Pressure.

KEY COMPONENTS:

Regulated/Park Brake Valve Assembly

Regulated Pressure

The Regulating /Park Brake valve is teed into the hydraulic supply line from the PFC pump so when the PFC pump is operating, regardless of output pressure, the valve is receiving pump working pressure. PFC pump low pressure stand-by may vary between 450-600 PSI so it is the job of the regulated valve to maintain a regulated pressure of 320-360 PSI (22-25 bar) for the complete regulated circuit.

PFC is supplied at port (2) and is directed to the regulated valve assembly. All regulated functions are closed circuit operations, meaning they don't require large volumes of oil BUT demand constant pressure. Since there is no real flow of oil through the circuits the pressure will stabilize at the current PFC working pressure which is to high. The regulating valve, through the pilot line (5), is monitoring the regulated pressure AFTER the valve. As the regulated pressure increase the pressure is also directed to the non-spring end of the regulating valve and shuttles it against the spring, restricting the inflow of oil into the regulated circuit, maintaining the circuit pressure.

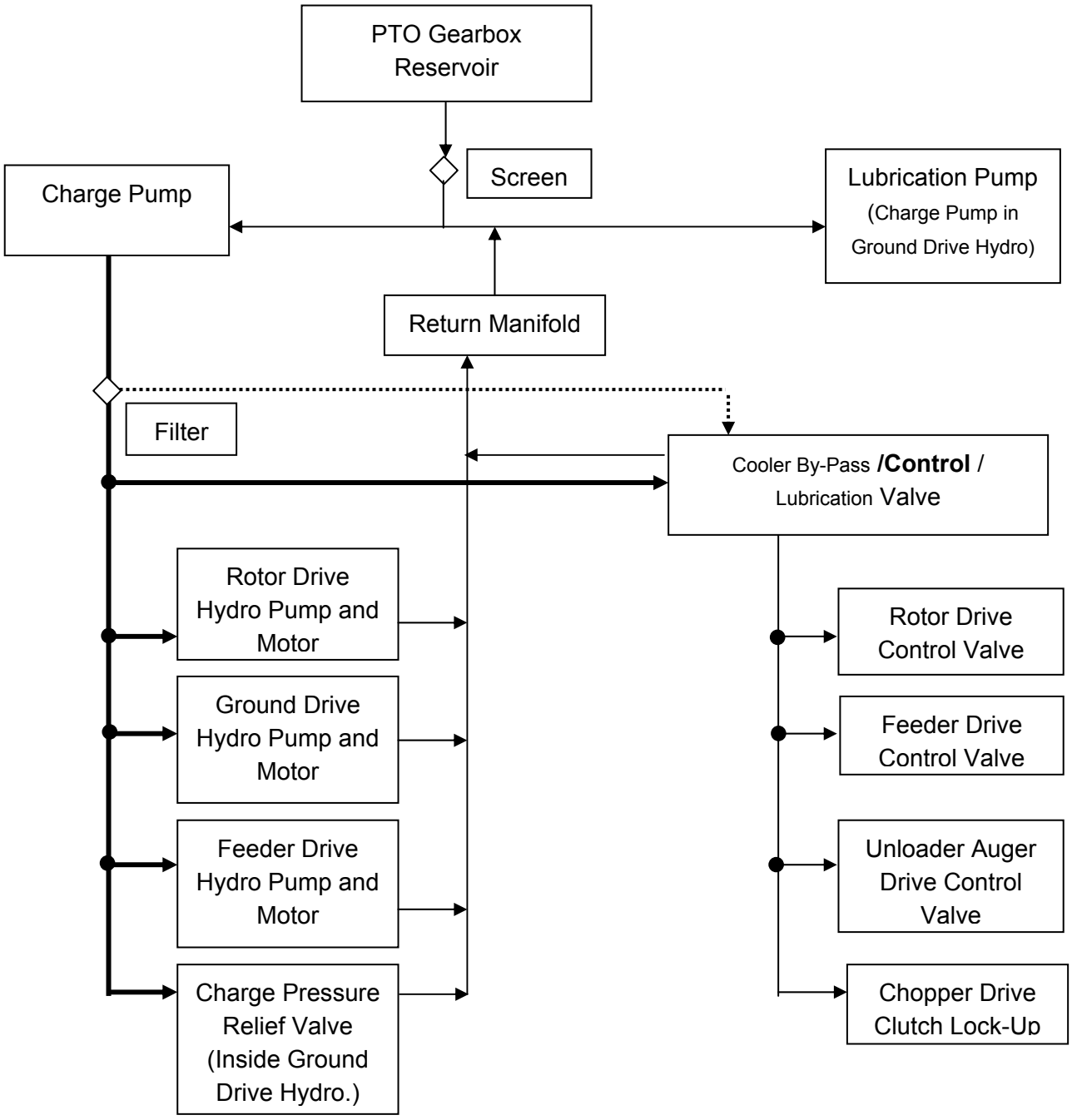
Regulated pressure may be tested at the test port (12).

REGULATED PRESSURE

ELECTRICAL MONITORING CIRCUITS

There is no monitoring system for the park brake or regulated circuit. When the brake release solenoid (L-10) is activated, to release the brake, the system will assume the brake did release and de-activate the Park Brake indicator on the cab display unit.

CHARGE PUMP



Most valves incorporated a case drain into the PTO gearbox also.

CHARGE PRESSURE SYSTEM

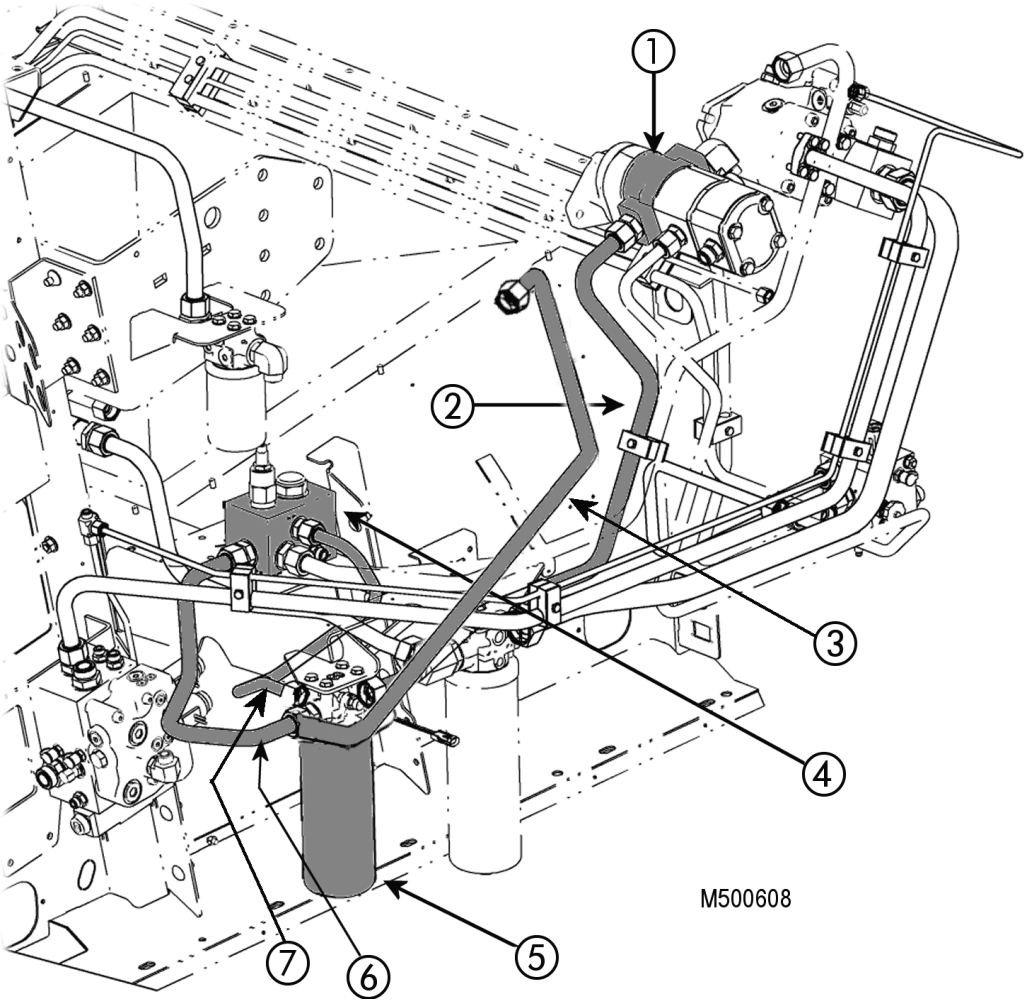
On the 7120-9120 combines the control pressure operation has taken a major change in operations. On the 7020-9010 combines, the hydrostats and drive clutches were supplied flow and the same pressure from the control pump. On the 7120-9120 combines the hydros are supplied flow and pressure from the charge pump and a reduced pressure level from the charge pump is supplied to the drive clutches. This means that there are now two different pressure settings; Charge pressure and Control pressure.

There are three individual hydrostatic drives, they all share common components. In the past we were accustomed to having a charge pump and filtering system for each hydrostatic drive, this system will use a common charge pump and filter for all drives. This pump and filter will be identified as the Charge Pump and Filter. The control pressure circuit, through a pressure reducing valve, will be supplied from the charge circuit

Normally the hydrostatic drive charge pump is mounted inside the hydrostatic pump end cover, not so on the 7120-9120 combine. Since the charge pump will be supplying all three hydrostatic drives a larger pump is required. The charge pump is the largest gear pump section of the gear pump assembly. The customary charge pump that is incorporated into the ground drive hydrostatic pump assembly will be used ONLY for PTO gearbox cooling and lubrication.

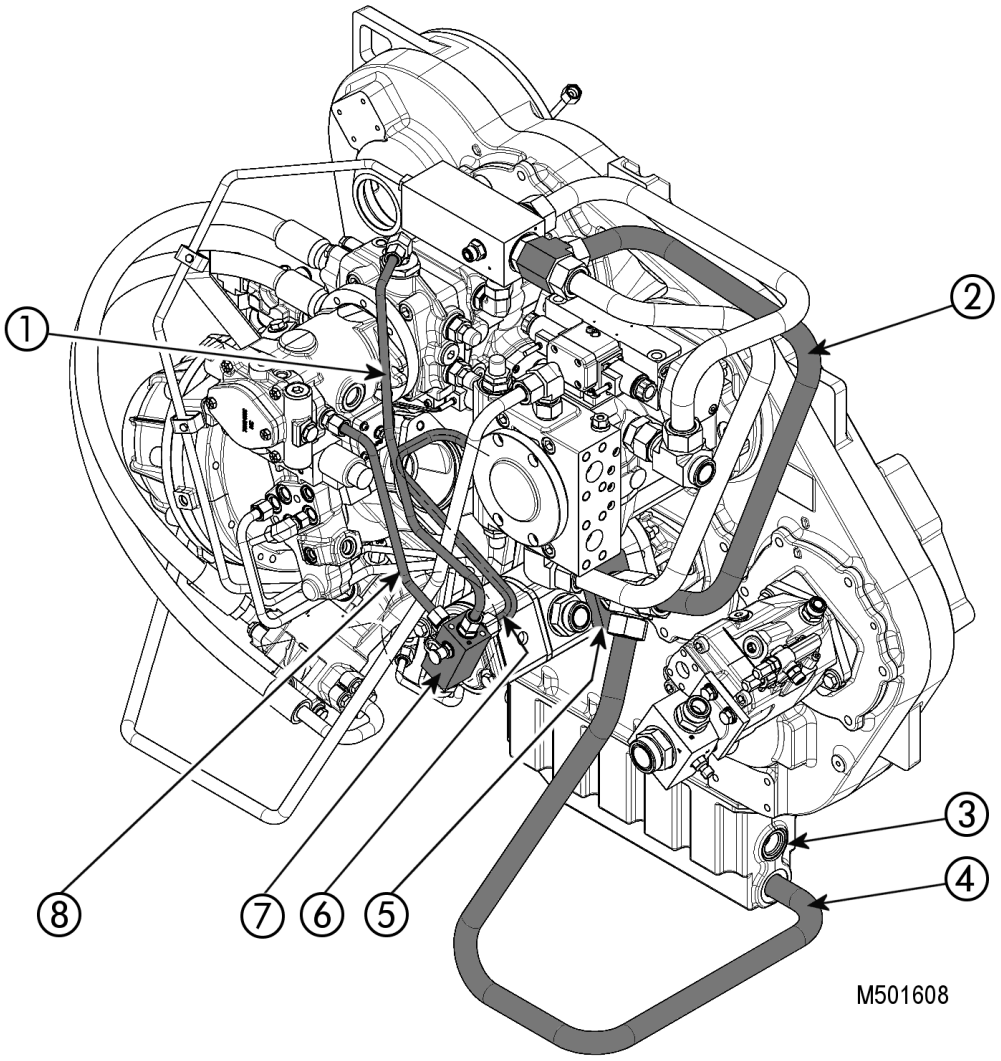
REMEMBER: The oil level in the PTO gear case should only be checked prior to engine startup in the morning OR after the unit has been shut down for a minimum of 15 minutes. Check the oil level twice to get an accurate reading.

CHARGE PRESSURE SYSTEM



1.	Gear Pump Assembly	5.	Charge Circuit Filter
2.	Pump to Filter Line	6.	Charge Supply to Control Pressure Valve
3.	Charge Supply Line	7.	Filter By-Pass Line
4.	Control / Lube Pressure Regulating Valve, with Control Pressure & Lube Pressure Sensors		

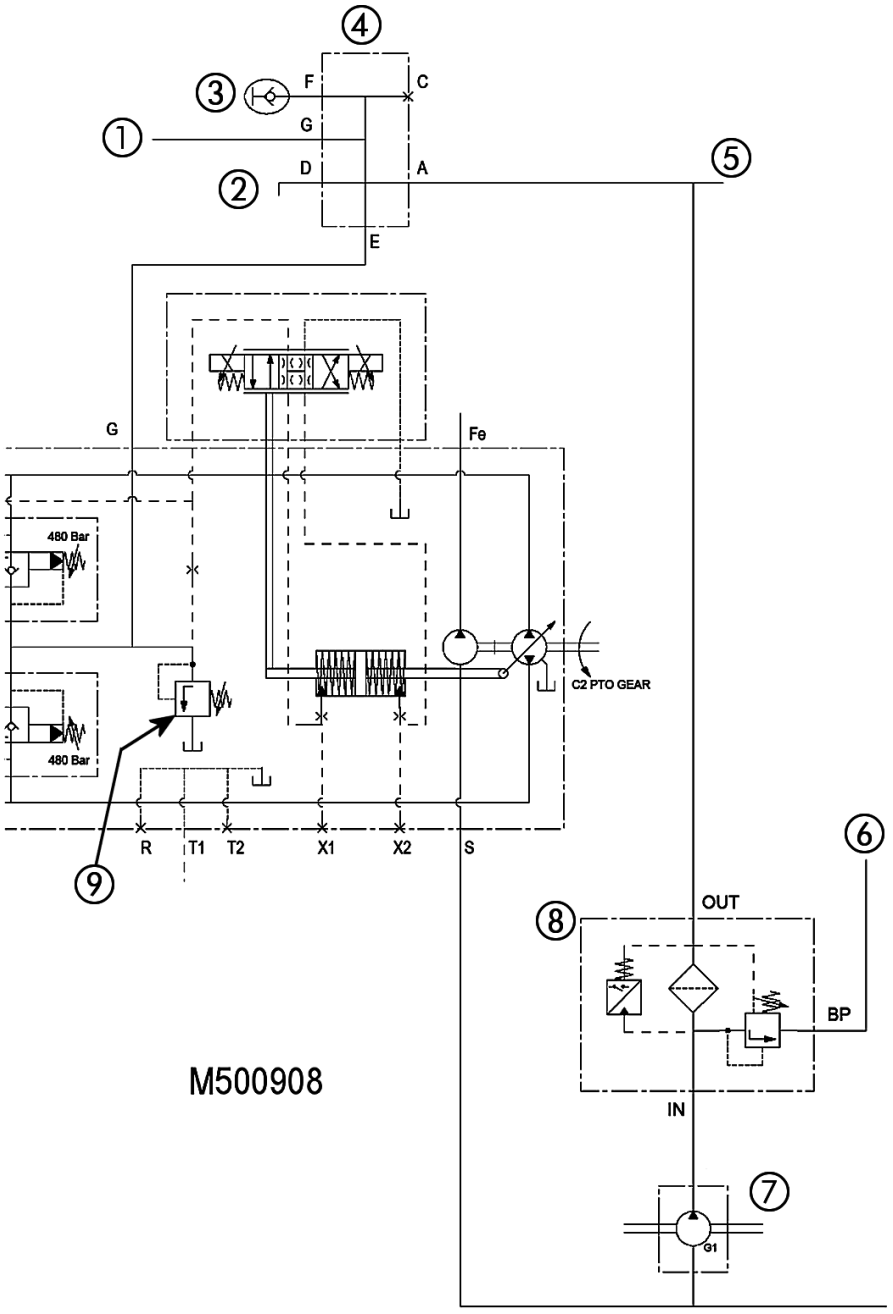
CHARGE PRESSURE SYSTEM



1.	Rotor Drive Supply	5.	Charge Pump
2.	From Return Manifold	6.	Ground Drive Supply
3.	Sump Strainers	7.	Charge Distribution Manifold W/Test Port
4.	Charge Pump Supply from PTO Gearbox	8.	Feeder Drive Supply

CHARGE PRESSURE SYSTEM

CHARGE CIRCUIT SCHEMATIC



1.	Charge Supply to Rotor Hydro	6.	Charge Filter By-Pass Port
2.	Charge Supply to Feeder Hydro	7.	Charge Pump
3.	Charge Test Port	8.	Charge Filter
4.	Charge Distribution Manifold	9.	Charge Relief Valve
5.	Charge Supply to Control Pressure Valve	E	Charge to Ground Drive Hydro

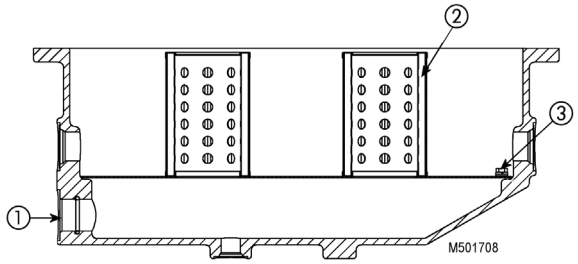
CHARGE PRESSURE SYSTEM

CHARGE CIRCUIT OPERATIONS

The charge circuit is used to supply fluid to the three hydrostatic drives and the control pressure circuit. The hydro circuit consumes a great deal of fluid, while the control pressure circuit consumes very little. The systems relief valve is in the ground drive hydro.

OPERATION

The charge pump (7) will pull fluid from the PTO gearbox, through a pair of replaceable 100 micron metal strainers, and directs it to the inline charge pressure filter (8).



1. Charge Pump Port
2. Strainers
3. Strainer retaining bolts

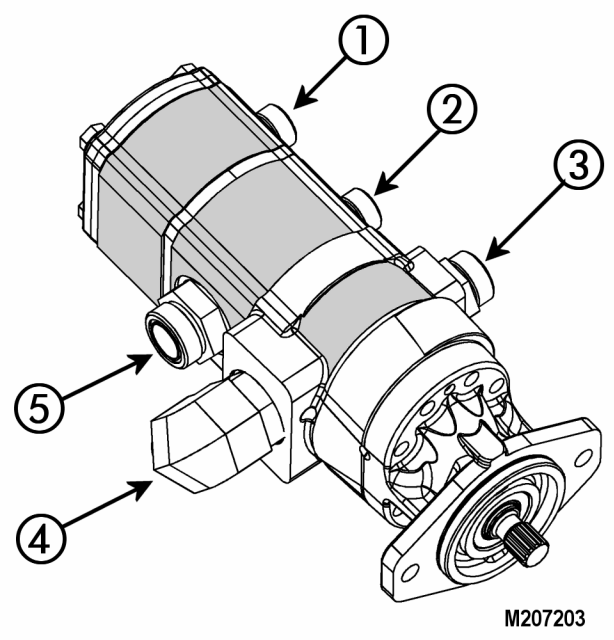
The filter contains a by-pass valve that directs the fluid to return (6) if the filter should become plugged, rather then permitting dirty fluid from going to the charge circuit.

From the charge filter, the fluid is directed to the distribution manifold (4). The distribution manifold directs the fluid to the rotor, feeder and ground drive hydros. Charge pressure is regulated by using a relief valve (9) which is mounted in the ground drive hydro, the pressure may be monitored at the distribution manifold port F (3).

Charge pressure is also directed at (5) to the control pressure valve to supply the control pressure circuits.

CHARGE PRESSURE SYSTEM

CHARGE PRESSURE PUMP



1.	Fan Drive Output (rear pump)
2.	Spreader and Rotary Air Screen Output (center pump)
3.	Charge Pressure Output (front pump)
4.	Supply From PTO Gearbox, (for pump 3)
5.	Supply From Hydraulic Reservoir, (for pumps 1 and 2)

The gear pump assembly is mounted in the PTO gearbox and incorporates three separate gear pumps.

The **Charge Pressure** pump, (pump 3, nearest to the drive shaft), is supplied oil from the **PTO gearbox and return manifold.** The pumps excess flow and system returns are used to supply the lube pump. See specification page.

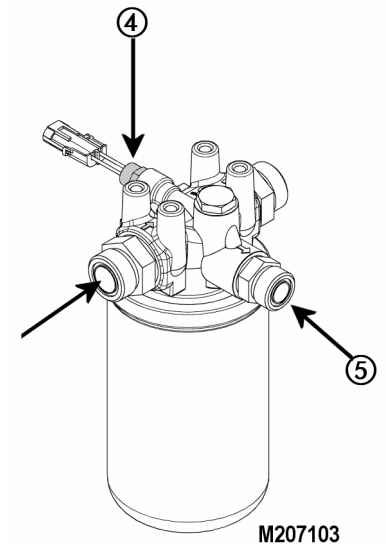
The **Spreader/Rotary Air Screen Drive** pump is supplied oil from the **hydraulic reservoir** and returns all of its flow back to the reservoir. See specification page.

The **Fan Drive** pump is supplied oil from the **hydraulic reservoir** and returns all of its flow back to the reservoir. See specification page.

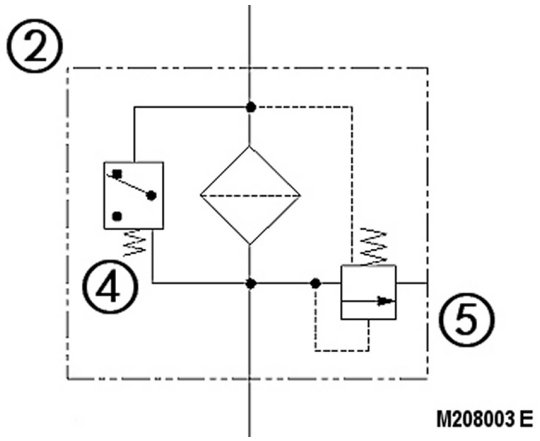
REMEMBER: If the seal was to leak between the front and center pumps, oil could transfer between reservoirs.

CHARGE PRESSURE SYSTEM

FILTRATION



2.	Filter Base
4.	Restrictions Indicator
5.	Filter By-Pass Port



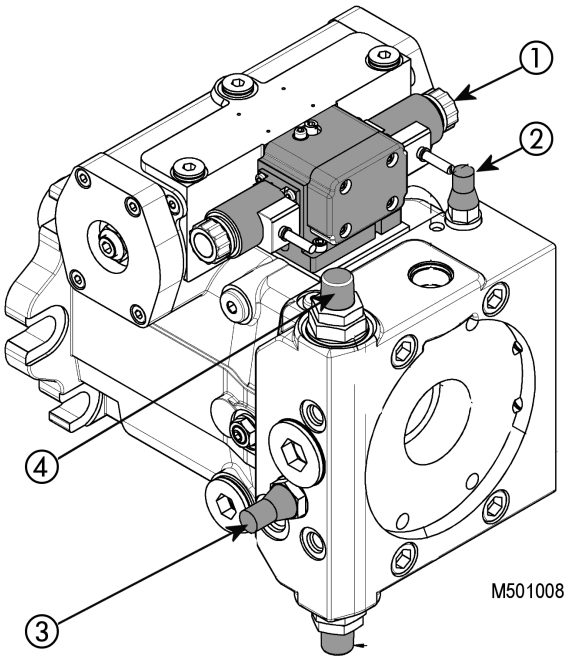
The charge pressure filter is on the supply side of the charge pressure circuits, the filter is a pressure filter. The filter base incorporates a filter restriction sensor (4) that monitors the condition of the filter element. If the restriction increases above 40 PSID differential pressure the sensor will CLOSE to create a signal to the display for operator warning.

The filter base incorporates a filter by-pass valve (5) that will open at 50 PSID differential pressure to prevent over pressuring the filter. Since the flow is supplying the hydrostatic pumps and motors, the filter by-pass does NOT permit dirty oil to flow through the filter base down stream. The filter base directs the by-pass out port (5) to the return manifold. The sensor is set to activate prior to the by-pass valve opening.

REMEMBER: It is common to have low charge pressure until the system warms up due to filter restriction. If the charge or control pressure is low in cold weather inspect the charge pressure filter for plugging and/or the filter bypass valve.

CHARGE PRESSURE SYSTEM

CHARGE REGULATOR VALVE



Ground Drive Pump

1.	Hyrdo Control Valve
2.	Shuttle Relief
3.	Charge Circuit Regulator
4.	Drive Pressure Relief

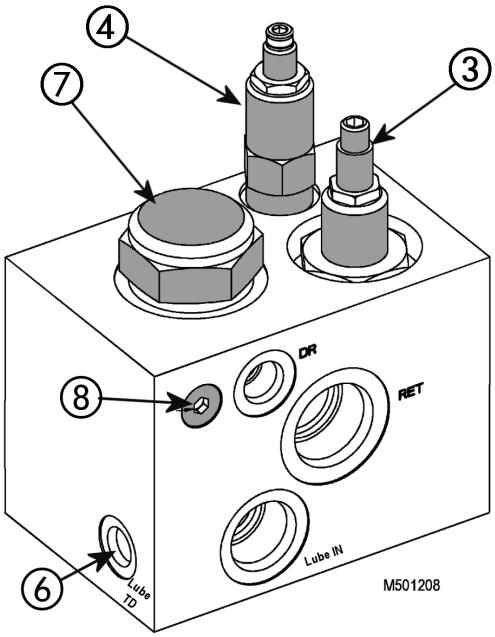
The charge regulator (3) is used to control the charge circuit pressure, directing the excess flow into the pumps case drain. The valve is set at 425±15 PSI (30±1.7 bar), and can be monitored by installing a test gauge at the charge circuit distribution manifold. This setting is not electronically monitor or displayed on the cab display unit.

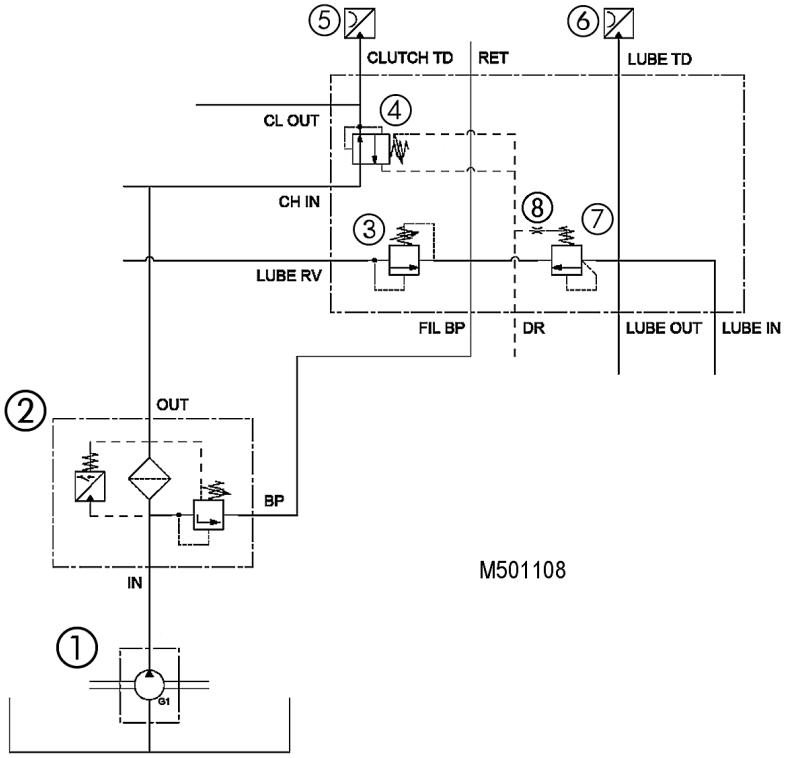
IMPORTANT: Since hydrostatic pumps and motor consume additional fluid when under load, the charge pressure MUST be verified while placing each drive system under load.

IMPORTANT: The charge pressure circuit MUST be checked before attempting to set or troubleshoot the control pressure circuit.

CONTROL PRESSURE SYSTEM

CONTROL / LUBRICATION PRESSURE VALVE





1.	Charge Pump	5.	Control Pressure Sensor
2.	Charge Filter Base	6.	Lubrication Pressure Sensor
3.	Lube System Filter/Cooler By-Pass Valve	7.	Lubrication Pressure Regulating Valve
4.	Control Pressure Reducing Valve	8	Damping Orifice

CONTROL PRESSURE SYSTEM

CONTROL / LUBRICATION PRESSURE VALVE

The Control/Lube pressure valve controls three separate circuits, regulates the control pressure, cooler by-pass and lube pressure; here we will only be looking at the control pressure portion of the valve's operation. The valve is supplied oil from the charge pump at port CH IN and is exposed to the control pressure reducing valve (4). This is a pressure reducing valve due to the fact that the valve monitors the system pressure after the valve rather then before the valve. The valve does not direct any fluid to the reservoir under normal operation, it will only reduce the flow into the control pressure circuit to a point that the correct pressure level is maintained. The reducing valve is adjustable to maintain a control pressure of 320±15 PSI (22±1.5 bar). If the pressure exceeds the spring setting, the valve will shuttle and shut OFF the inflow of fluid. The valve does use a drain port DR to prevent a hydraulic lockup behind the valve.

The valve body also receives the charge filter by-pass oil at port FIL BP and combines it with the oil from the cooler bypass and lube pressure regulators. The combined oil is directed out the return port RET to the return filter and back to the PTO reservoir or the lubrication pump.

The control and lubrication pressure can be checked on the cab display screen under MAIN>COMIBNE INFO>HYDRUALIC or be removing the sensors and installing a test gauge. The lubrication oil is supplied from the lubrication pump, which will be discussed later in this section.

CHARGE PRESSURE SYSTEM

ELECTRICAL MONITORING CIRCUITS

The system uses two components to monitor the systems operations.

CHARGE PRESSURE FILTER RESTRICTIONS SWITCH

Reference Material:

Electrical schematic frames: 10

Key Components:

Filter Restrictions Switch S-34, CCM1

The filter restriction switch is used to monitor the condition of the filter. The switch is a N/O switch. When the pressure differential exceeds the specifications, the switch piston will shuttle over connecting the power wire to the ground. This action will cause alarm message A0010 to be displayed. The alarm should not be active until the PTO gearbox temperature sensor registers 77°F.

Power is supplied from the CCM1 connector X019 terminal J2-35 to the B terminal on the switch. The A terminal is directed to chassis ground point (1).

CONTROL PRESSURE SENSOR

Reference Material:

Electrical schematic frames: 10, 27

Key Components:

Control Pressure Sensor B-35, CCM2

Location:

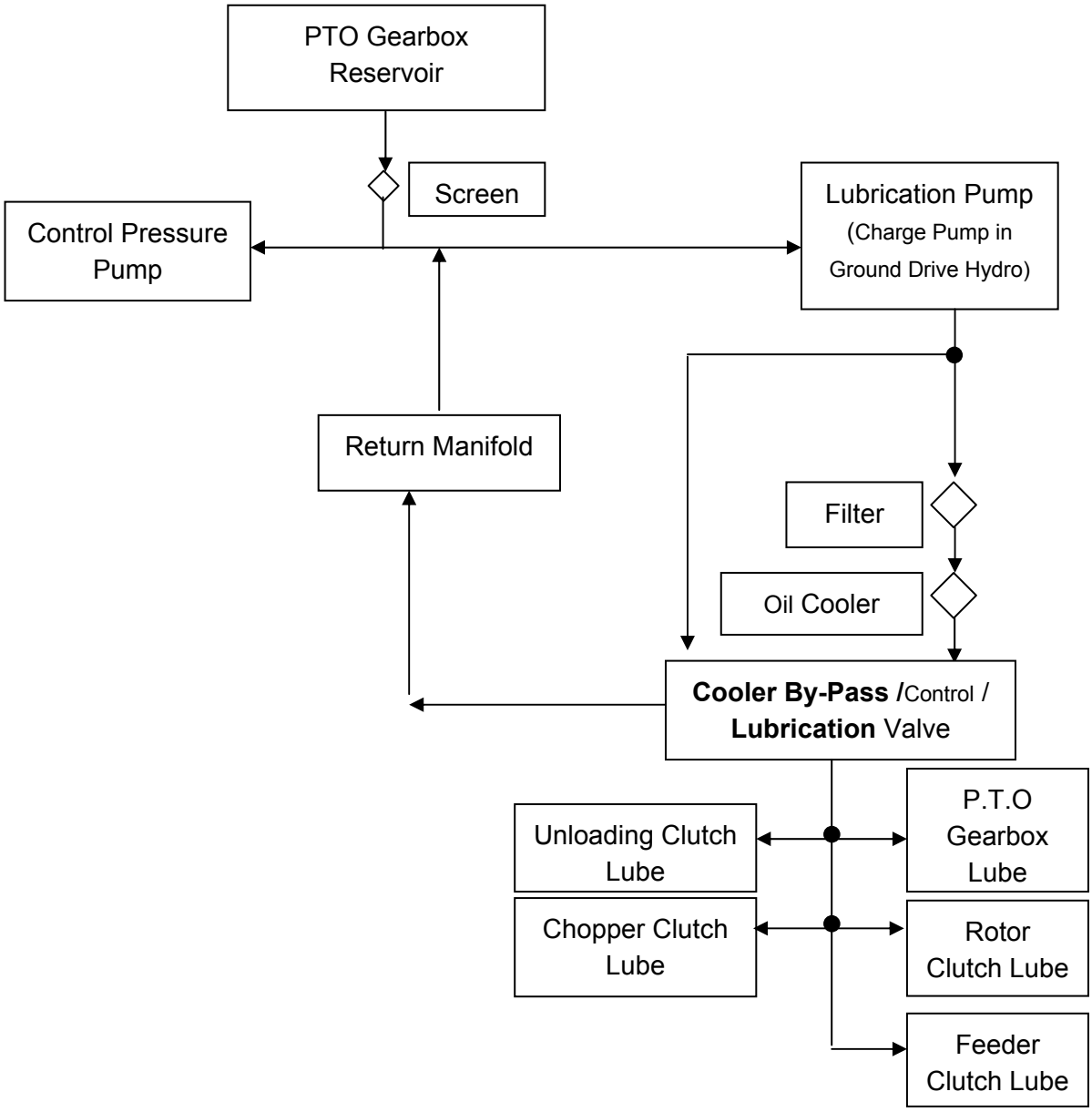
In the control pressure / Lube regulating valve.

The control pressure sensor is used to monitor the control pressure. The sensor provides a constant pressure reading to the CCM2. The CCM2 places a message on the data bus for the display to display and provides a warning if the pressure should drop, providing a warning to the operator. This operation may be monitored on the COMBINE INFO or DIAG screen.

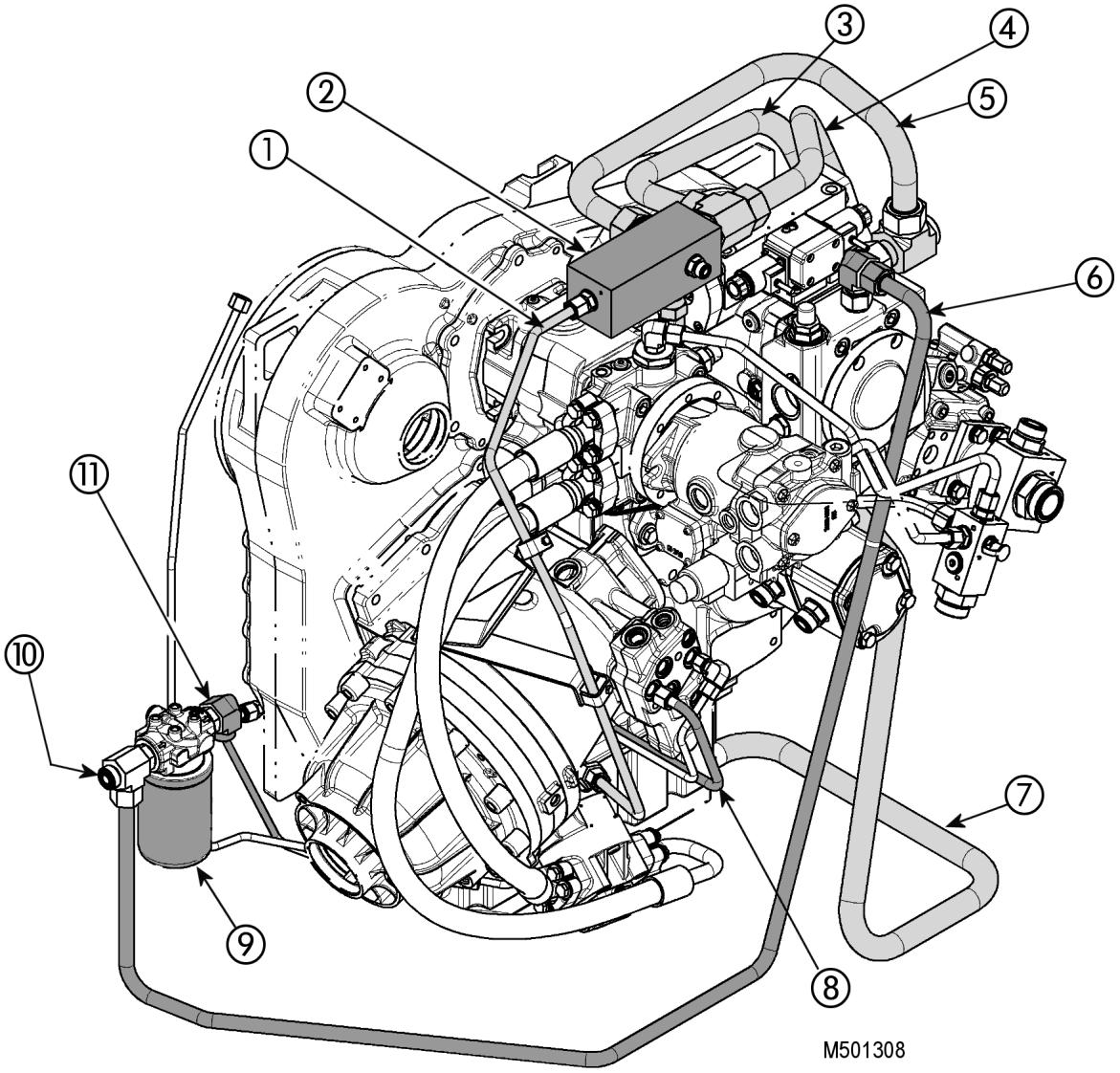
A 5V power supply from the CCM2 connector X016 terminal J2-31 is directed to the A terminal of the sensor and a return wire from the B terminal is directed back to the CCM2 connector X016 terminal J2-14. The sensors C wire provides the pressure signal to the CCM2 connector X016 terminal J2-19. When the pressure is normal, a signal voltage above 3V is normal. The reading may be monitor on the display RUN screen.

Working range = 0 psi = 0.5V 500 psi = 4.5V

PTO Gearbox Cooling and Lubrication System



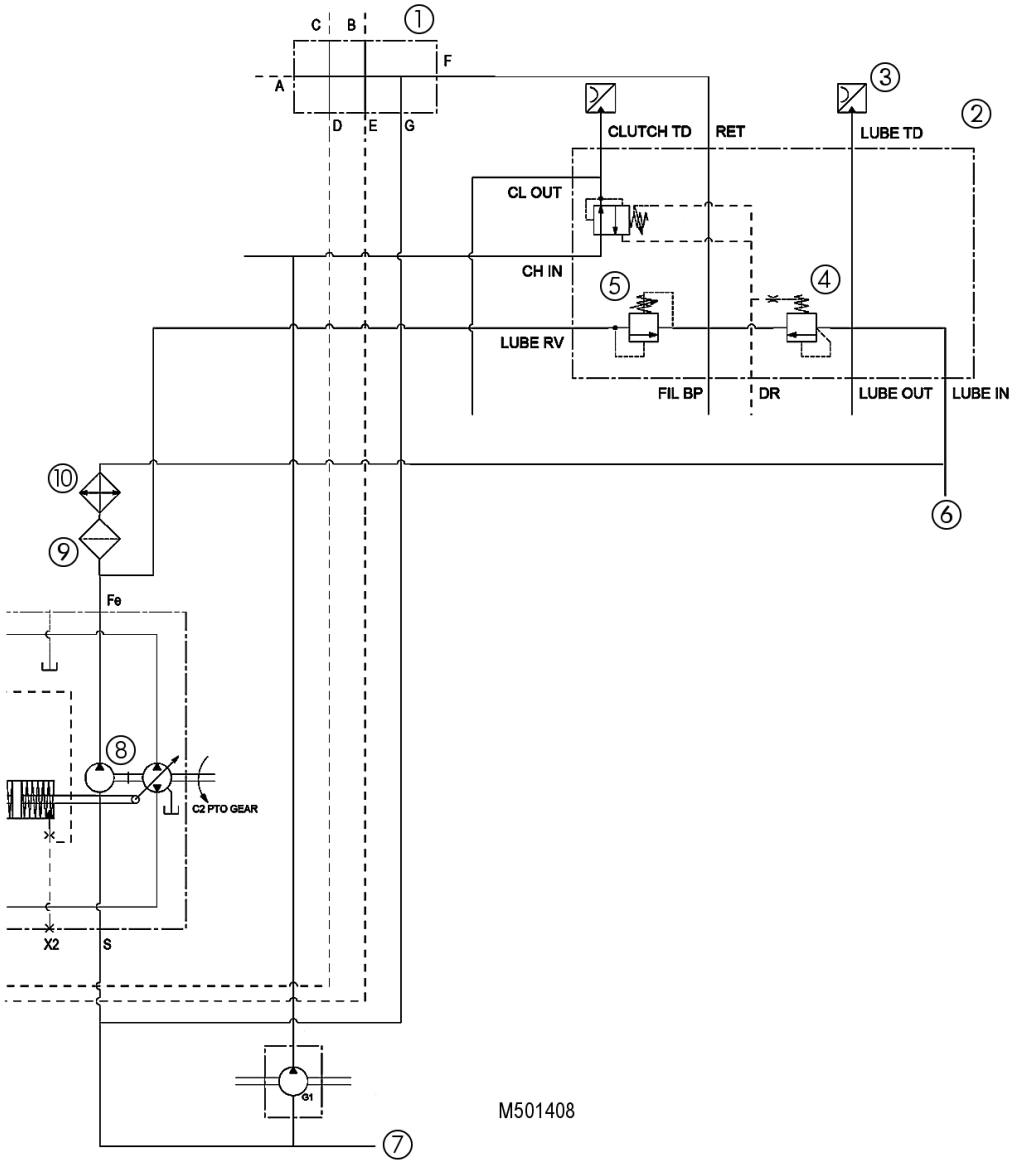
LUBRICATION SYSTEM



1.	Rotor Motor Case Drain	7.	From PTO Reservoir to Charge Pump
2.	Return Manifold	8.	Lube to Feeder Drive Valve
3.	To Charge Pump Inlet	9.	Lube Filter
4.	To Lube Pump Inlet	10.	To Cooler/Filter By-Pass Valve
5.	Ground Drive Case Drain	11.	To Oil Cooler
6.	Lube Pump OUT to Filter		

LUBRICATION SYSTEM

LUBE SCHEMATIC



1.	Return Manifold	CH IN	Charge Supply In
2.	Control / Filter By-Pass / Lube Va.	CL OUT	Control Pressure Out
3.	Lube Pressure Sensor “LUBE TD”	RET	Return to Tank
4.	Lube Relief Valve	LUBE IN	Lube Supply IN
5.	Filter/Cooler By-Pass Valve	LUBE OUT	Lube Supply OUT (rotor/feeder clutches
6.	To Control Valve Lube Ports	DR	Control Valve spring drain
7.	From PTO Reservoir	LUBE RV	Cooler By-Pass IN
8.	Lube Pump	FIL BP	Charge Filter Base By-Pass
9.	Lube Filter	CLUTCH TD	Control Pressure Sensor
10.	PTO Gearbox Cooler	LUBE TD	Lubrication Pressure Sensor

LUBRICATION SYSTEM

The lubrication system is used to provide cooling and lubrication to the PTO gearbox and all components housed within it. The system consist of a lube pump, filter/cooler by-pass, lube filter, oil cooler, lube relief and required pluming. The pump is enclosed in the ground drive hydrostatic pump, we would think of it as the hydro charge pump.

OPERATION

The lube pump (8) may pull fluid from the return manifold (1) or the PTO gearbox (7), whichever point will supply the fluid the easiest. Normally the fluid will be coming from the return manifold. The lube pump, housed inside the ground drive hydro, will direct its total output to the lube filter (9). This line contains a tee, which exposes the output to the filter/cooler by-pass valve (5).

NORMAL OPERATION

The fluid is directed through the filter (9) and cooler (10); and is teed off to provide lube to the system at (6) and to the lube relief valve (4). The lube relief monitors the lube pressure on the non-spring end of the valve, if the pressure increased above 50±5 PSI the spring may be compressed and the valve will shuttle UP to open a path to the return manifold (1). The lube relief is not adjustable. The system monitors the lube pressure through the lube pressure sensor (3). On the cab display navigate by: MAIN>COMBINE INFO>HYDRAULICS.

FILTER BLOCKAGE

The lube pump pressure is monitored at the cooler by-pass valve (5). If the filter or cooler should become blocked, the valve will direct the flow to the return manifold, limiting the system pressure to 290±20 PSI (20 bar).

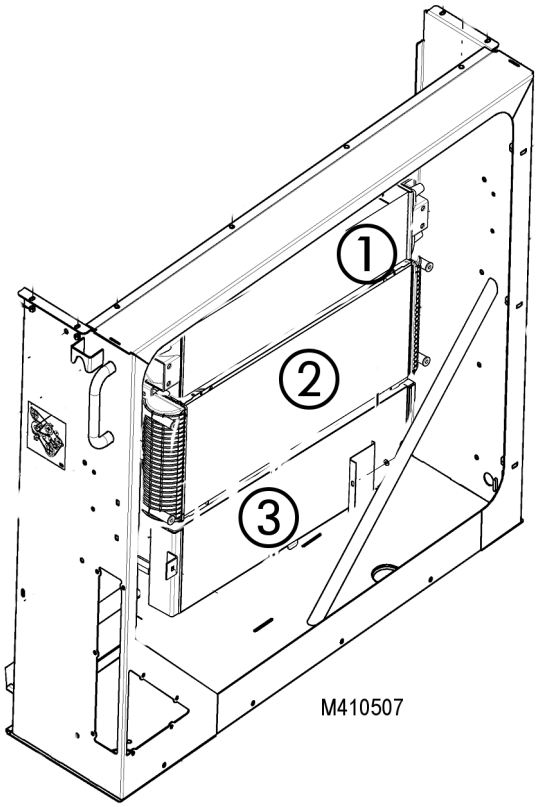
SYSTEM TEMPERATURE

The system monitors the ground drive motor's case drain before it enters the return manifold. The motor case drain should be the hottest return oil in the system.

PTO GEARBOX COOLING SYSTEM

COOLING, 8120

1.	Charge Air Cooler
2.	Radiator
3.	PTO Gearbox Cooler

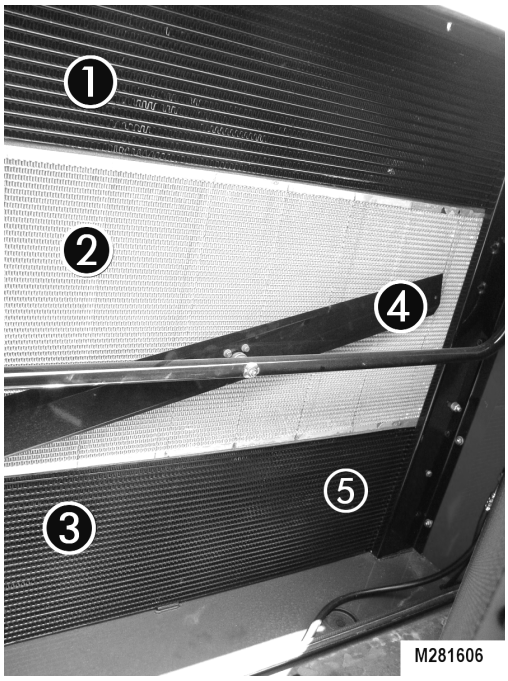


COOLING

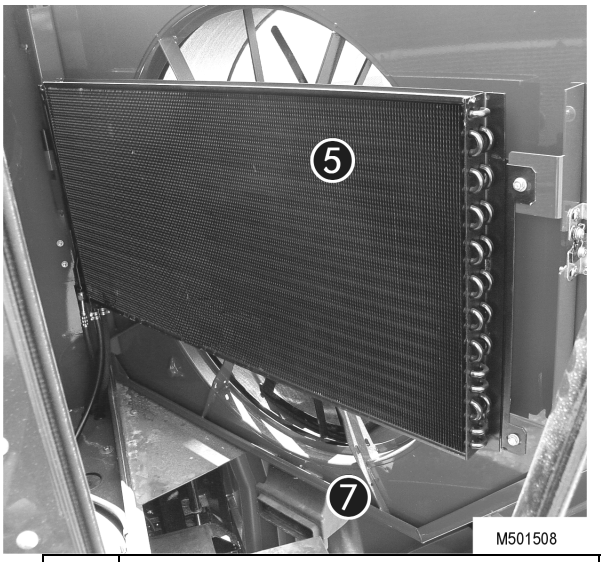
The PTO gearbox cooler (3) is mounted behind the rotary air screen and is the lower portion of the cooler assembly. The oil cooler by-pass valve is in the control / lube valve.

HYDRAULIC COOLING SYSTEM

COOLING, 7120 & 9120



1.	Air to Air Cooler
2.	Radiator
3.	Hydraulic Cooler
4.	Interrupter Blade
5.	PTO Gearbox Cooler



5.	HVAC Condenser
7.	RAS Vacuum Duct

COOLING

The PTO gearbox cooler (3) is mounted behind the rotary air screen and is a portion of the lower third of the cooler. The oil cooler by-pass valve is in the control / lube valve.

LUBRICATION SYSTEM

ELECTRICAL MONITORING CIRCUITS

The system uses two components to monitor the systems operations.

GROUND DRIVE MOTOR TEMPERATURE SENSOR, (CASE DRAIN)

Reference Material:

Electrical schematic frames: 8, 26

Key Components:

Hydrostatic Motor Temperature Sensor B-46, CCM1

The ground drive motor temperature sensor monitors the oil temperature from the case drain of the ground drive hydrostatic motor. At room temperature, the sensor reads approximately 2500 ohms and reduces as the temperature increases. If the temperature should climb above 221°F (105°C), the resistance of the sensor will be reduced to a point at which enough current will flow through it providing the CCM1 with a signal. The CCM1 then places a message on the data bus provide a warning to the operator. The temperature may be monitored on the display.

Power is supplied to the sensor from the CCM1 connector X020 terminal J3-33 to the B terminal and the sensors A terminal is directed back to the CCM1 connector #020 terminal J3-18. As the temperature increases the resistance of the sensor decreases, providing for a voltage drop on the supply wire. The signal voltage may be monitored on the display diagnostic screen.

LUBRICATION PRESSURE SENSOR, (PTO GEARBOX)

Reference Material:

Electrical schematic frames: 10 and 26

Key Components:

CCM1, Lubrication Pressure Sensor B-60

The lubrication pressure sensor is mounted in the cooler y-pass / control / lubrication valve and is used to monitor the lube pressure to the PTO gearbox components. The sensor provides a constant pressure reading to the CCM1, then places a message on the data bus. If the pressure goes outside of the normal limits the CCM1 will place a message on the data bus for the cab display. The pressure may be monitored on the display.

Power (5V) is supplied to the sensor from the CCM1 connector X019 terminal J2-31 to the A terminal and a sensor return (ground) from terminal B back to the CCM1 connector X019 terminal J2-14. The sensor provides a signal from terminal C to the CCM1 connector X019 terminal J2-29. The signal voltage may be monitored on the display diagnostic screen.

HYDRAULIC SYSTEM TESTING PROCEDURES

When diagnosing a hydraulic system problem, check the electrical circuits first by verifying that the proper solenoids are activated at the correct time. This will isolate hydraulic problems from electrical problems.

BEFORE STARTING ANY TESTS:

- Be sure all oil filters are clean and the reservoir is full of clean oil.
- Check the tension and condition of the drive belt.
- Verify the pump is being driven.
- Check the high and low idle settings of the engine.
- Inspect the hydraulic system for leaks and replace hoses and tubing that show damage or wear.
- All tests are to be conducted with an oil temperature of at least 50°C (120°F).

CAUTION!
Hydraulic oil escaping under pressure can have enough force to penetrate the skin. Hydraulic oil may also infect a minor cut or opening in the skin. **If injured by escaping oil, see a doctor at once.** Serious infection or reaction can result if medical treatment is not given immediately. Make sure all connections are tight and that hoses and lines are in good condition before applying pressure to the system. Relieve all pressure before disconnecting the lines or performing other work on the hydraulic system.

To find a leak under pressure, use a small piece of cardboard or wood, never use hands.

Clean all connecting points thoroughly before disconnecting any lines. Cap all disconnected lines that are not used to maintain system cleanliness.

DIAGNOSTIC TEST EQUIPMENT

Test Couplers and Hoses

Quick Couplers	Style	Case Part #	Parker Number	Aeroquip Number
Male Tips	1/8 NPT Female		PD322	FD90-1034-02-04
	1/8 NPT Male	H434164	PD323	FD90-1012-02-04
	1/4 NPT Female		PD342	FD90-1034-04-04
	1/4 NPT Male	S243718	PD343	FD90-1012-04-04
	3/8"-24 O'ring			FD90-1044-03-04
	7/16-20 O'Ring	R55912	PD341-6	FD90-1044-04-04
	1/2-20 O'Ring		PD351	FD90-1045-03-04
	9/16-18 O'Ring	1541849c1	PD361-6	FD90-1046-03-04
	M14X1.5 O'Ring	84320565	PD367A-6	
	M18X1.5 O'Ring	358968A1	PD3127-6	
	M18X1.5 O'Ring	325647A2	PD3127-743-6	
	7/16" - 20 JIC (1/4" tube)	R54805	PD34BTX	
	9/16" - 18JIC (3/8")		PD36BTX	
	3/4"-16JIC (1/2" Tube		PD38BTX	
	1-1/16" 12 JIC (3/4" Tube)	D137625	PD312BTX	FD90-1046-06-04
	1/2" Tube O-Ring Face Seal		PD38BTL	
Female Tips	1/8" NPT Female		PD222	FD90-1021-02-04
	1/4 NPT Female	1543171C1	PD242	FD90-1021-04-04
	1/4 NPT Male		PD243	
	7/16-20 Female O'Ring		PD240	
	9/16-18 Female O'Ring		PD260	
	9/16"-18 ORFS	190117A1	PD34BTL-6	
	11/16"-16 ORFS	190119A1	PD36BTL-6	
	13/16"-16 ORFS	190316A1	PD38BTL-6	
	1"-14 ORFS	377921A1	PD310BTL-6	
	M22X1.5 Metric		PD296	
Shut off Valve	14-99-7 1 per hose			
Test Hose	CAS-1281-2			
Hose Adapters	Converts hose to 1/4 Male pipe 211863 2 per hose			

1. Hose is rated for 8,500 psi working pressure and is 8 ft. long.

- M14X1.5 Male coupler from OTC includes a special steel washer around the O'Ring which is required on the "88" Series Excavators.

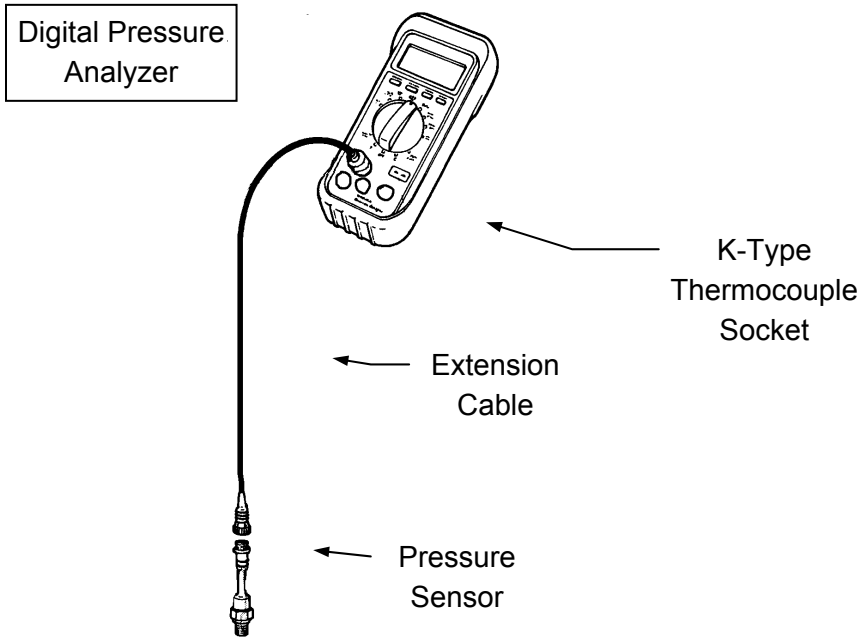
This is just a generic list of test fittings if required, see section 1 for required special fittings.

DIAGNOSTIC TEST EQUIPMENT

Digital Pressure & Temperature Analyzer

Reference: Tool Bulletin ST04-01, 2004

Test Tools	Adapters
Digital Pressure & Temperature Analyzer From OTC Tool Comp.	Kit 380040154 Inc. One each of the units listed below.
500 PSI Sensor	OEM1602
5,000 PSI Sensor	OEM1603
10,000 PSI Sensor	
20ft. Extension Cable	OEM1607; two cables
K-Type Thermocouple	231509
Additional Items	
10,000 PSI Sensor	OEM1604
Gauge Protector (500psi)	OEM1661
12ft. Cable Extension	OEM1606
6ft. Cable Extension	OEM 1605



HYDRAULIC SYSTEM TESTING PROCEDURES

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9 REGULATED PRESSURE TEST ---------- 98

#10 SPREADER PUMP FLOW TEST ---------- 100

11 FAN PUMP FLOW TEST ---------- 102

12 PFC PUMP FLOW ---------- 104

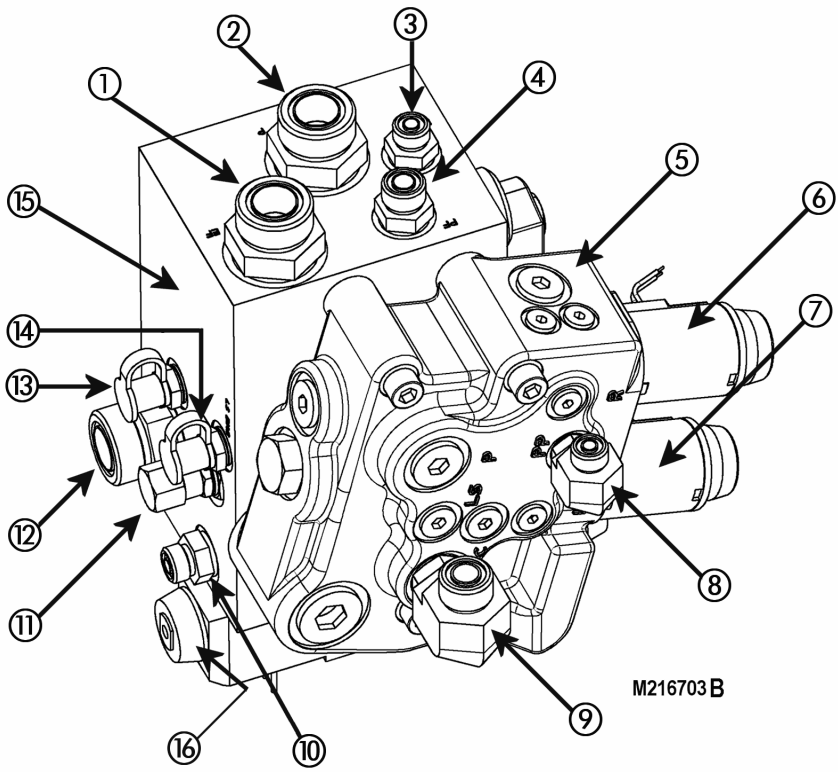
13 CHARGE PRESSURE PUMP FLOW TEST ---------- 106

#14 CHARGE CIRCUIT SUCTION LEAKS ---------- 108

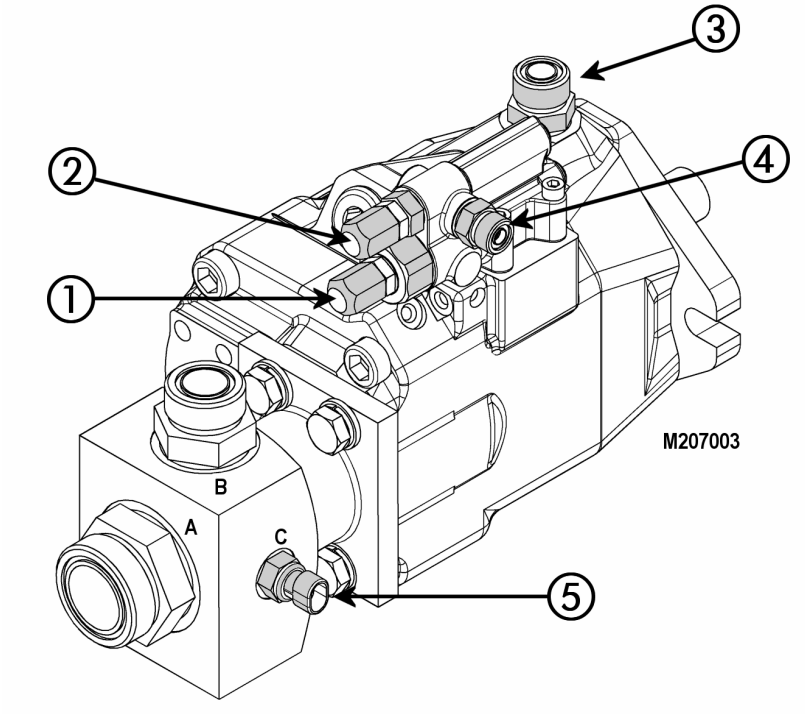
#15 CONTROL PRESSURE LEAKS ---------- 109

HYDRAULIC PRESSURE SHEET ---------- 13

1 LOW PRESSURE STANDBY



13	Pump Pressure Port
14	Signal Line Test Port



1.	High Pressure Compensator Spool
2.	Flow Compensator Spool

1 LOW PRESSURE STANDBY

This test is used to determine low-pressure standby. There are two items responsible for low-pressure standby, the 375-400 PSI (26-28 bar) spring on the flow compensator spool and the 0.078 mm (0.031 in) orifice in the steering hand pump – which creates back pressure in the signal line of **approximately** 50-150 psi. The 375-400 PSI (26-28 bar) spring plus the back pressure will equal low-pressure standby. The following test will show the spring setting of the flow compensator spool.

TEST PROCEDURE

1. Attach a 69 bar (1000 psi) gauge to the signal line pressure test port (14) on the main valve assembly. It is recommended to install a needle valve in the test hose to prevent damage to the gauge. With the needle valve closed, start the engine. At low idle, open the needle valve on the gauge. **Make sure that the steering wheel is not moved or that other hydraulic functions are not activated otherwise the gauge could be damaged.** The signal line pressure should be approximately 50-150 PSI (3.45-10.4 bar). Record this number for use later.

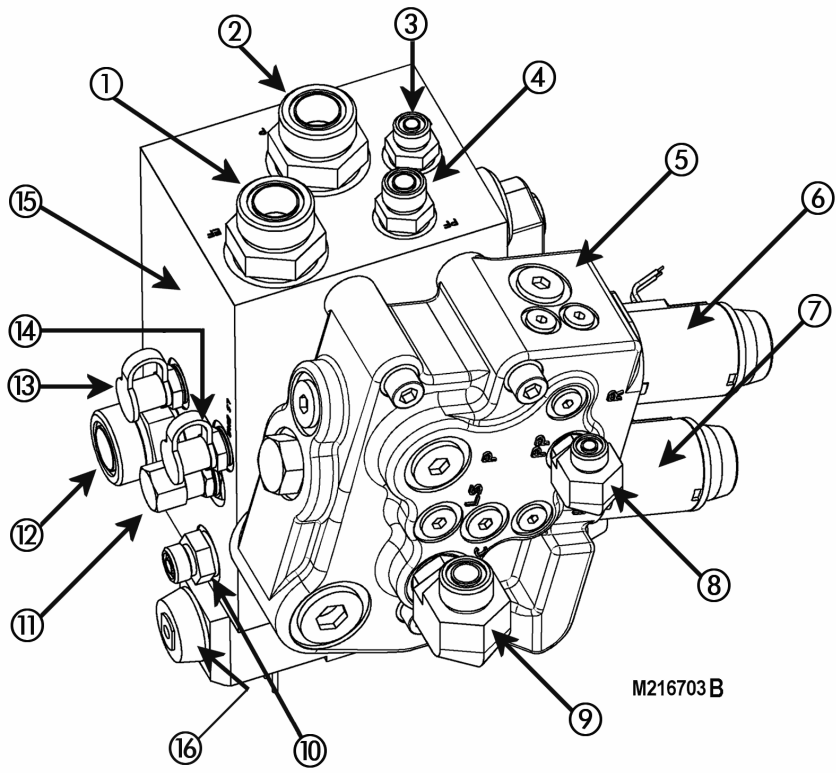
2. Then attach the SAME 69 bar (1000 psi) gauge to the PFC pump pressure test port (13) on the main valve assembly. With the needle valve closed, start the engine. At low idle open the needle valve on the gauge. **Make sure that the steering wheel is not moved or that other hydraulic functions are not activated otherwise the gauge could be damaged.** The PFC pump pressure port should read 375-400 PSI (26-28 bar) above the reading that was recorded from the signal line.

If the PFC pump pressure port does not read 375-400 PSI (26-28 bar) ABOVE the signal line, adjustment of the flow compensator spool spring is required. The adjustment procedure is as follows:

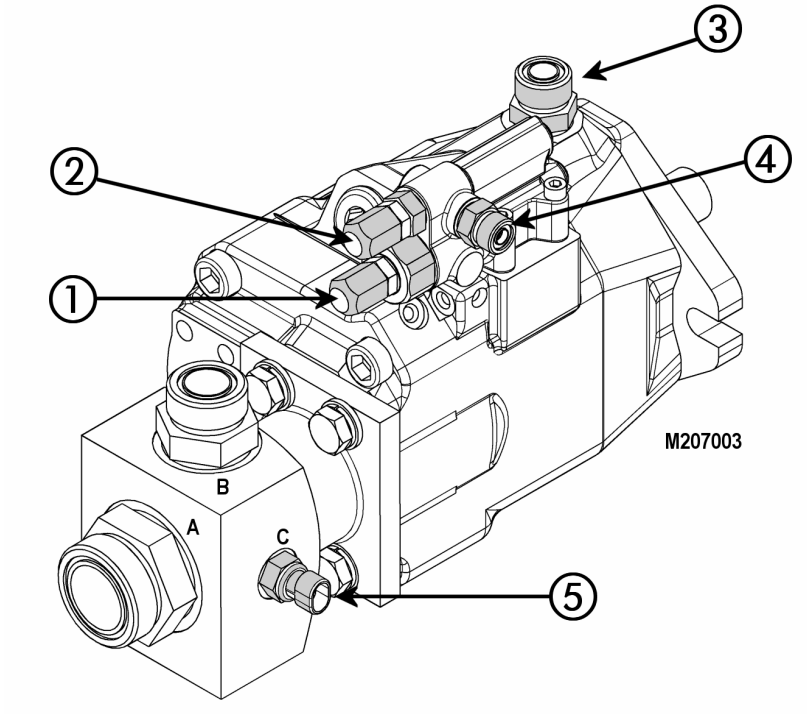
Example	Signal line pressure port reading	112 psi (7.7 bar)
	Flow compensator spool spring setting	+ 400±25 psi (27.5 bar
	PFC pump pressure port reading AFTER adjustment	512±25 psi (35.3 bar)

3. Remove the cap for the adjustment screw located on the compensator.
4. Loosen the jam nut.
5. Use an allen wrench to adjust the pressure to match the number calculated. (See example.)
6. Tighten the jam nut. Repeat test to verify the low-pressure standby setting.
7. If not correct, make adjustment again. If it is correct, replace the cap.

2 HIGH PRESSURE STANDBY



13	Pump Pressure Port
14	Signal Line Test Port



1.	High Pressure Compensator Spool
2.	Flow Compensator Spool

2 HIGH PRESSURE STANDBY

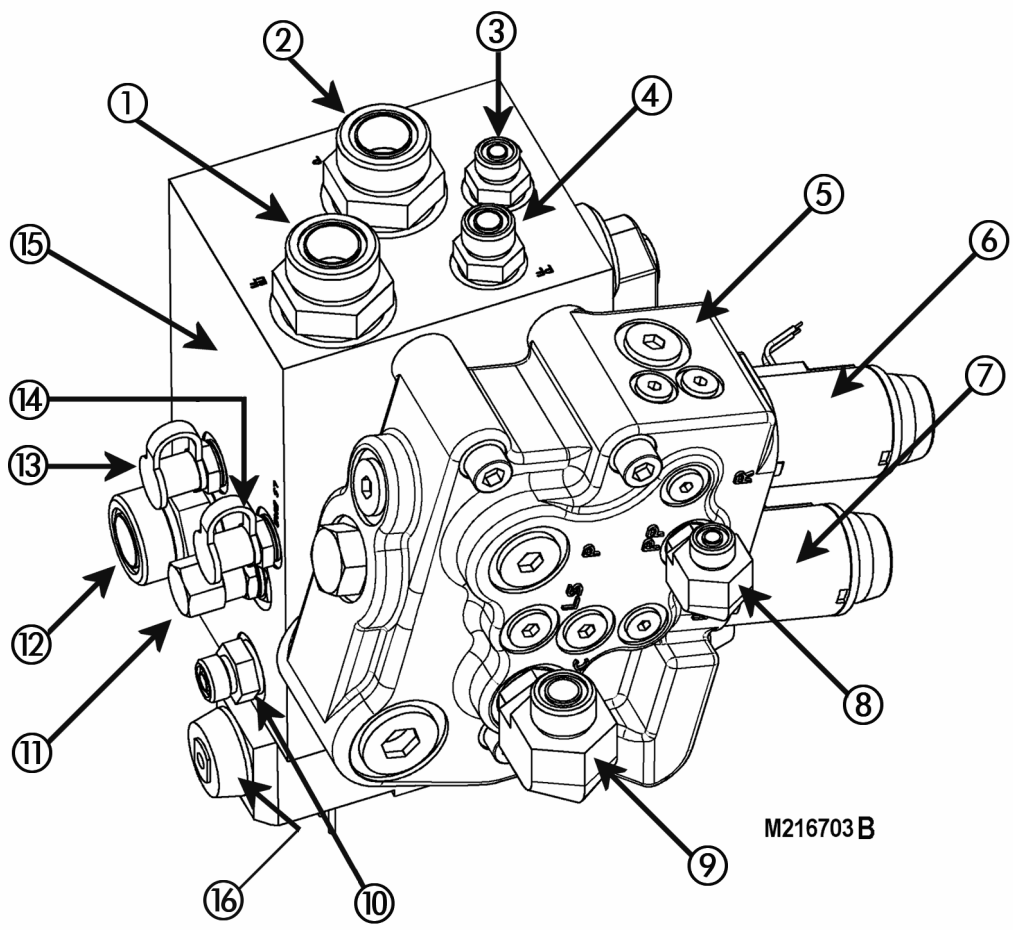
This test is used to determine the spring setting of the high-pressure spool in the compensator. High-pressure standby is the maximum pressure that the PFC pump will develop. High pressure stand-by on is 3000-3100 PSI (207-214 bar). There is no relief valve in the PFC circuit so the high-pressure standby limit serves as the system relief.

TEST PROCEDURE

Attach a 345 bar (5000 psi) gauge to the PFC pump pressure test port (13). Raise the feeder house completely until the system reaches high pressure. **If** the machine is equipped with a **float sensor** the feeder lift switch will have to be released and press a second time to verify that the feeder is raised completely. The gauge should read between 3000-3100 PSI (207-214 bar).

If adjustment is required remove the cap for the adjustment screw located on the compensator. Use an allen wrench to adjust the spring setting. After the adjustment has been made, the test should be repeated to verify the spring setting.

3 STEERING RELIEF SETTING



3.	From Steering Hand Pump Signal	13.	Pump Pressure Test Port
4.	To Steering Hand Pump Supply	14.	Signal Line Test Port

3 STEERING RELIEF SETTING

This test is used to determine the relief valve setting of the steering signal circuit. The steering signal relief valve is set to provide an operating pressure of 169±3 bar (2450±50 psi). If the steering signal is too high, the steering circuit can limit or completely stop the oil flow to the other hydraulic functions.

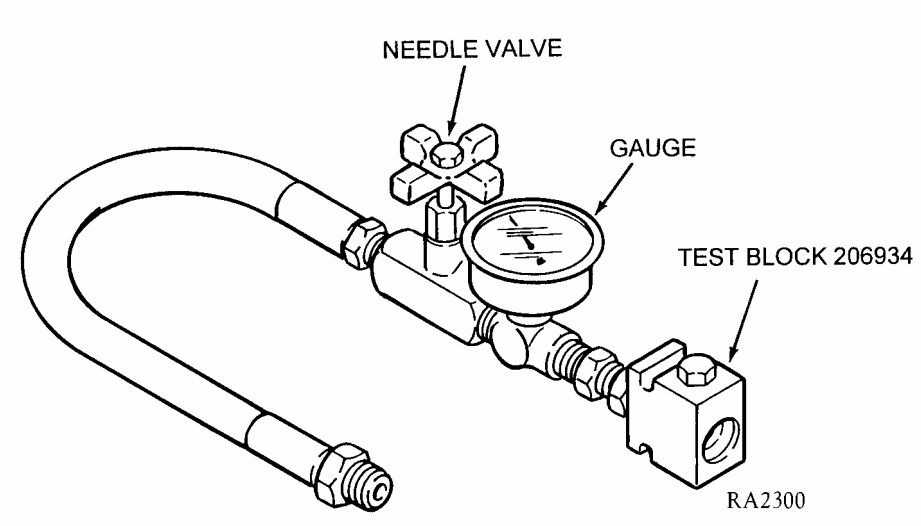
TEST PROCEDURE

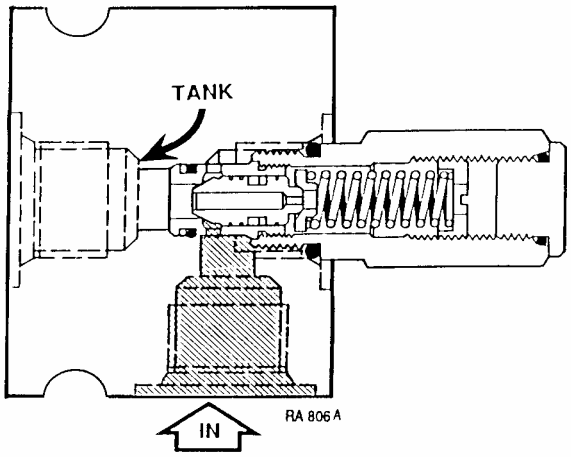
Attach a 345 bar (5000 psi) gauge to the pump pressure DIAG port located on the Main Valve Stack. With the engine at low idle, turn the steering wheel until the steering stops are reached and hold the wheel. The relief valve in the steering hand pump will open. The reading on the gauge should be between 169±3 bar (2450±50 psi).

The relief is located in the steering hand pump and is set from the factory. If adjustment is needed, the steering hand pump must be removed from the combine. The relief valve adjustment is an allen plug located on the mounting surface of the hand pump. The plug will be filled with wax. After removing the wax, turn the threaded plug in to increase the relief valve setting, and out to decrease the setting. After the adjustment has been made, the test should be repeated to verify the spring setting. Before installing the hand pump in the combine, replace the wax with LOCTITE to prevent the adjusting plug from moving.

REMEMBER: Steering from full RIGHT to full LEFT should take approximately 4.5 turns. If the steering system requires more turns, it could be a sign of a hand pump that has too much internal leakage or a steering cylinder with internal leakage. When holding the steering wheel against the stop, continue to apply normal steering pressure on the wheel, there should not be more then approx. 1.5 wheel rotation per minute due to internal leakage.

4 BENCH TESTING COMPONENTS



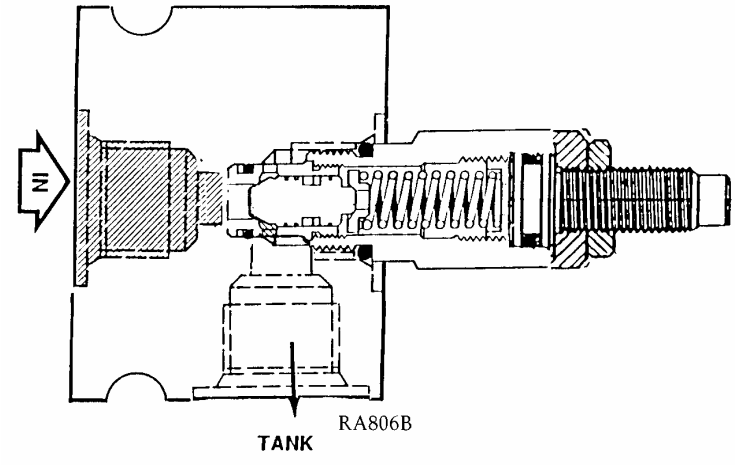


PRESSURIZING THE VALVE FROM THE SIDE.

- "Terrain Tracker Relief"

PRESSURIZING THE VALVE FROM THE END.

- Spreader Drive Relief
- Feeder Thermal Relief"
- Fan Drive Relief



4 BENCH TESTING COMPONENTS

TERRAIN TRACKER, SPREADER/FAN RELIEF AND FEEDER THERMAL RELIEF VALVES

This test is used to determine the pressure settings of the relief valves when the system can not be loaded to relief valve settings.

TEST PROCEDURE

To bench test relief valves use special tool CAS-1905-2, CAS-1905-3 and reducing bushing adapter 1252331C1 (9/16”-18 UNF X 7/8”-14 UNM). A hydraulic hand pump is required to supply pressure to the test block.

TERRAIN TRACKER RELIEF VALVE

To test the terrain tracker relief valves, thread it in to the test block and attach the supply hose to the test block so that the pressure will act on the side of the relief valve. Create enough pressure to open the relief valve. The reading on the gauge should read 207 bar (3000 psi). If adjustment is required, remove the cap and use an allen wrench to turn the threaded plug. Turn the plug in to increase the relief pressure setting, or turn the plug out to decrease the relief pressure setting. After the adjustment has been made, the test should be repeated to verify the relief valve setting.

SPREADER RELIEF VALVE

To test the spreader relief valve, thread it into the test block and attach the supply hose to the test block so that the pressure will act on the end of the relief valve. Create enough pressure to open the relief valve. The reading on the gauge should read 190 bar (2755 psi). If adjustment is required, remove the cap on the relief valve and loosen the jam nut. Use an allen wrench to adjust the screw. Turn the screw in to increase the relief pressure setting, or turn the screw out to decrease the relief pressure setting. After the adjustment has been made the test should be repeated to verify the relief valve setting.

4 BENCH TESTING COMPONENTS

TERRAIN TRACKER, SPREADER/FAN RELIEF AND FEEDER THERMAL RELIEF VALVES

Con't

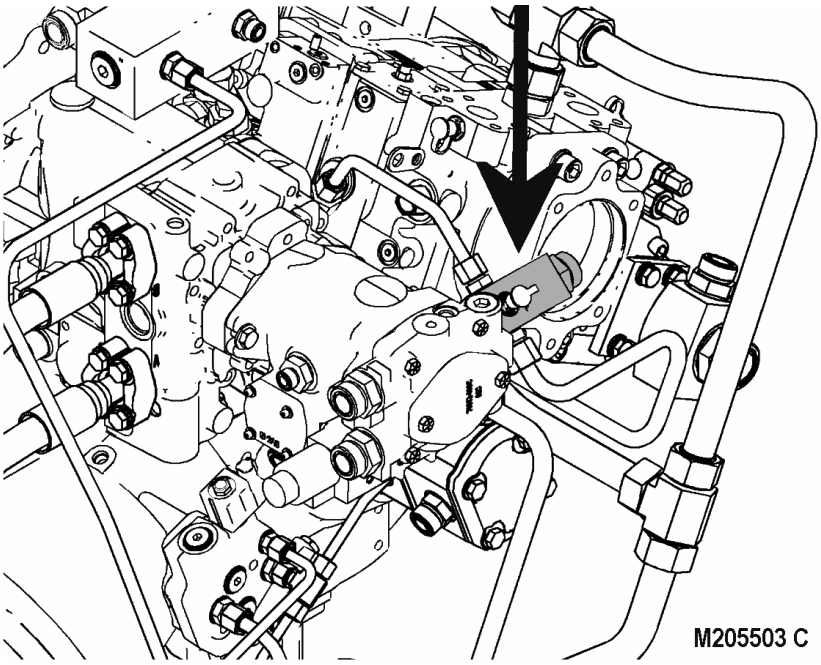
FAN DRIVE RELIEF VALVE

To test the fan drive relief valve, thread it into the test block and attach the supply hose to the test block so that the pressure will act on the end of the relief valve. Create enough pressure to open the relief valve. The reading on the gauge should read 241 bar (3500 psi). If adjustment is required, remove the cap on the relief valve and loosen the jam nut. Use an allen wrench to adjust the screw. Turn the screw in to increase the relief pressure setting, or turn the screw out to decrease the relief pressure setting. After the adjustment has been made the test should be repeated to verify the relief valve setting.

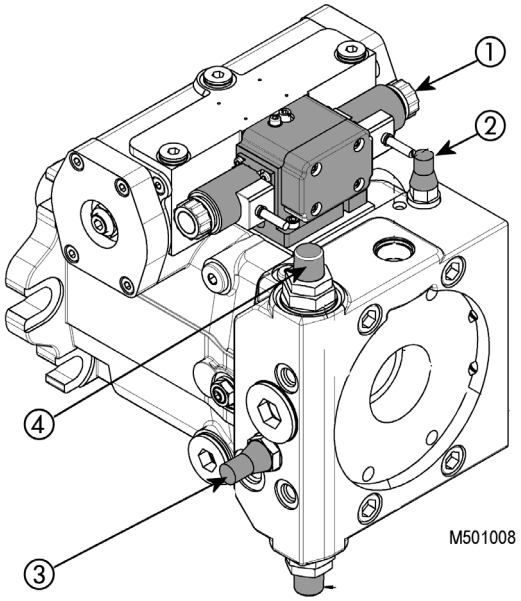
FEEDER LIFT CYLINDER THERMAL RELIEF VALVE

To test the feeder thermal relief valve, thread it into the test block and attach the supply hose to the test block so that the pressure will act on the end of the relief valve. Create enough pressure to open the relief valve. The reading on the gauge should read 276 bar (4000 psi). If the valve drips before it opens at the set pressure the header will settle.

5 CHARGE PRESSURE TEST



Charge Pressure Test Port



3. Charge Pressure Adjustment

5 CHARGE PRESSURE TEST

This test determines the charge pressure regulating valve setting. The charge pressure regulator is set to provide an operating pressure of 30±1.7 bar (425±25 psi) at high idle and hot fluid.

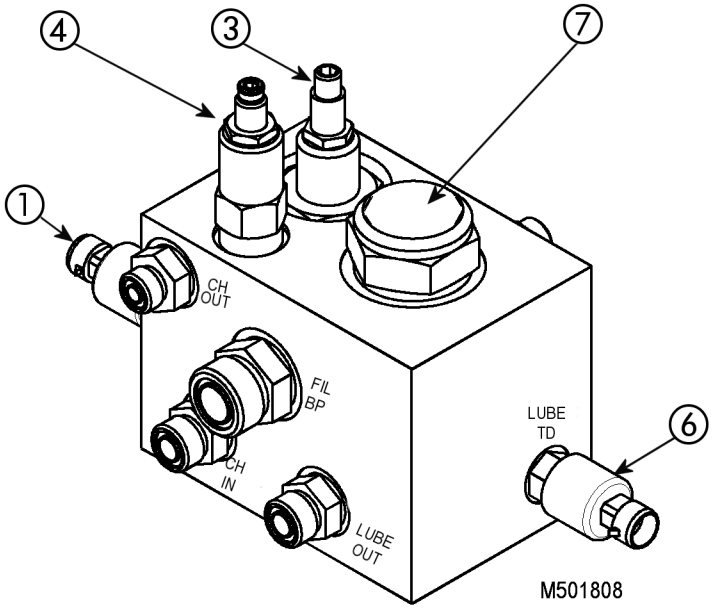
TEST PROCEDURE

Attach a 41 bar (600 psi) gauge to the charge pressure DIAG port located on the charge distribution manifold. With the engine at **HIGH** idle the pressure reading should be within specification.

The regulator (3) is located in the ground drive hydro pump. If adjustment is needed, loosen the jam nut and using an allen wrench turn the center screw in to increase pressure and out to decrease pressure. After making an adjustment, repeat the test to verify the spring setting.

REMEMBER: It would be good to place the feeder, rotor and ground drive hydros under load to verify the system pressure is maintained. The pressure will normally be on the low side when the engine is low idle

6 CONTROL PRESSURE TEST



1.	Control Pressure Diagnostic Port
4.	Control Pressure Adjustment

6 CONTROL PRESSURE TEST

This test determines the control pressure reducing valve setting. The control pressure valve is set to provide an operating pressure of 22±1 bar (320±15 psi) at high idle and hot fluid.

IMPORTANT: Control pressure should not be checked or adjusted without previously verifying the charge circuit pressure and operation.

Wait a Minute… You can monitor the Control Pressure on the cab display by navigating **MAIN>COMBINE INFO>HYDRUALIC.** If the pressure is in question, it may be good to install a gauge at the sensor port to verify the sensor operation.

TEST PROCEDURE

Attach a 41 bar (600 psi) gauge in place of the sensor (1), located on the Control Pressure/Lubrication Valve. With the engine at **HIGH** idle the pressure reading should be within specification.

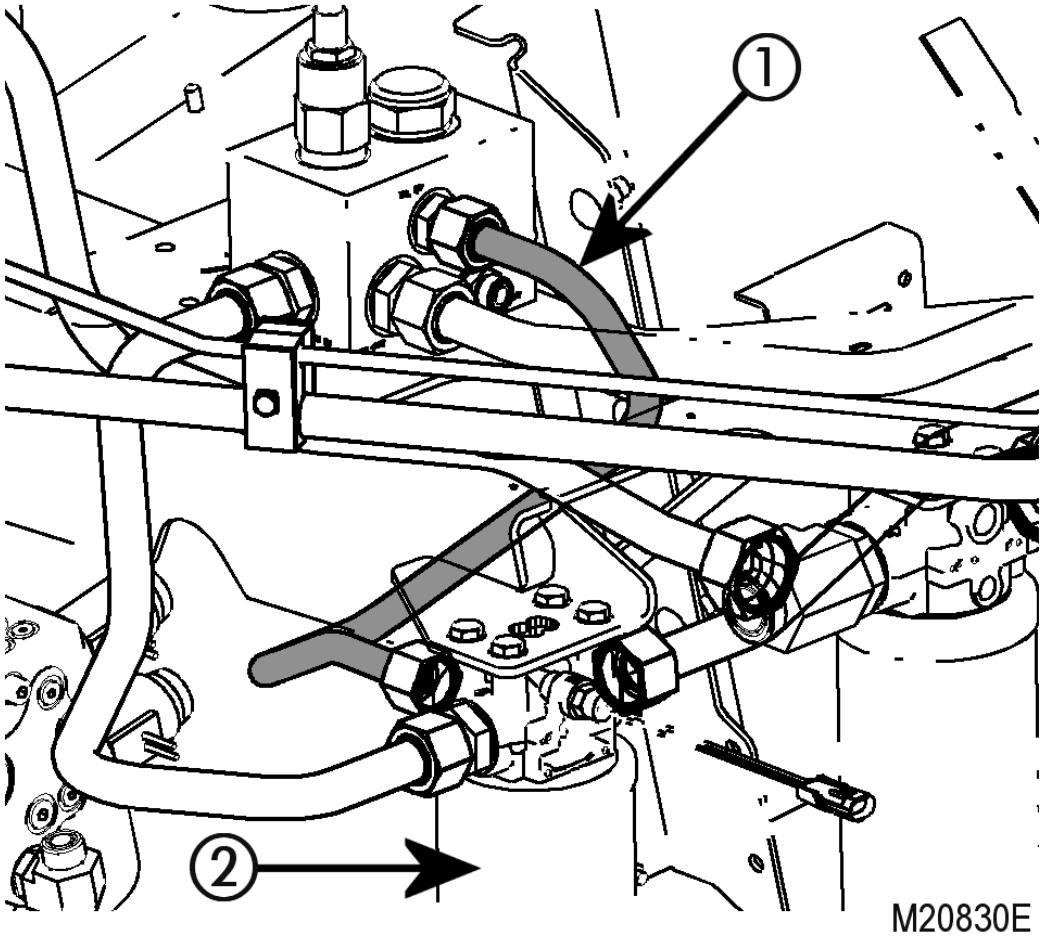
The control pressure reducing valve (4) is located in the valve body. If adjustment is needed, loosen the jam nut and using an allen wrench turn the center screw in to increase pressure and out to decrease pressure. After making an adjustment, repeat the test to verify the spring setting.

REMEMBER: It would be good to activate all associated clutches and hydrostatic drives to determine if any circuit has excessive leakage. The pressure MUST be maintained during clutch and hydro. activation. The pressure will normally be on the low side when the engine is at low idle

REMEMBER: Do NOT exceed 360 PSI (25 bar) with cold oil, we should still see approximately 22±1 bar (320±15 psi) at high idle with hot oil and all systems running.

Wait a Minute… Use the Control pressure check sheet located at the end of this section to diagnose any system leakage.

7 CHARGE FILTER BYPASS TEST



1	Bypass Line	2	Charge Filter

7 CHARGE FILTER BYPASS TEST

This test determines if the charge filter bypass valve is leaking. The charge filter bypass valve should only open when the restriction across the filter is greater then 50 PSID, and then the fluid is directed to the return circuit through the control pressure regulating valve body.

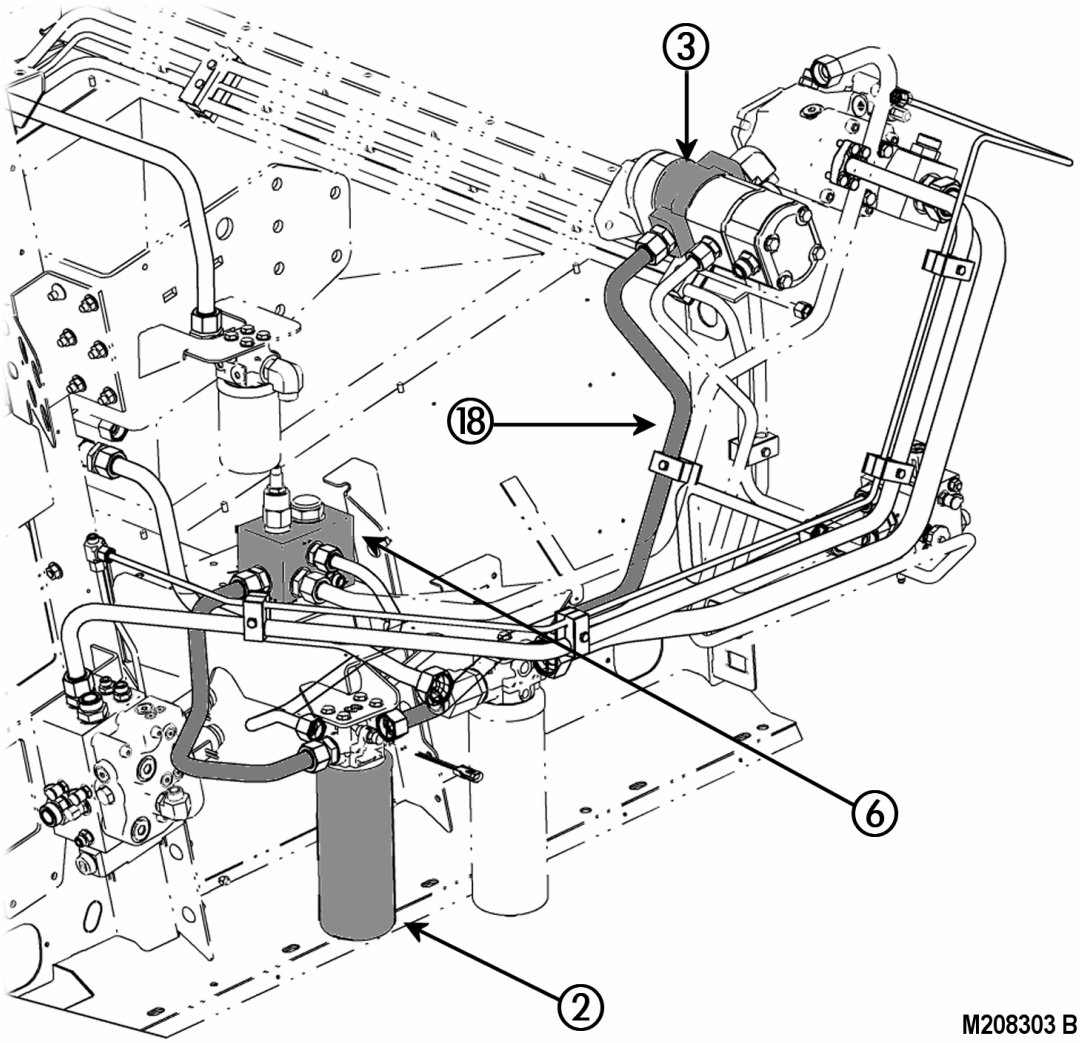
REMEMBER: If the machine is started with cold oil, the by-pass may open and not reseat completely. When making this test, run the machine to warm the oil, shut it down and restart to check for leakage.

TEST PROCEDURE

1. Remove line P# 87109047 (#1), between the charge pressure filter and the control/lube regulator valve.
2. Cap the port on the regulator valve with P# 9847689.
3. Start the combine and collect the oil from the open port on the charge pressure filter head.

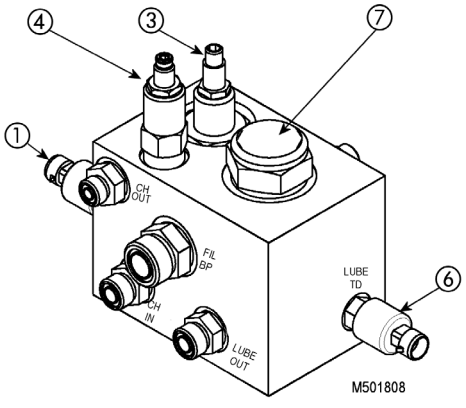
With warm oil, 50°C (120°F) the maximum allowable flow from the filter bypass is 0.5 GPM.

8 PTO GEAR BOX LUBRICATION PRESSURE TEST



2.	Charge Circuit Filter	6.	Control / Lube Pressure Regulating Valve
3.	Gear Pump Assembly	18.	Pump to Filter Line

6.	Lubrication Pressure Sensor “LUBE TD”



8 PTO GEAR BOX LUBRICATION PRESSURE TEST

This test is used to determine the lube pressure regulating valve setting. The lube pressure regulator is set to provide an operating pressure of 3.4 bar (50 +-5 psi).

TEST PROCEDURE

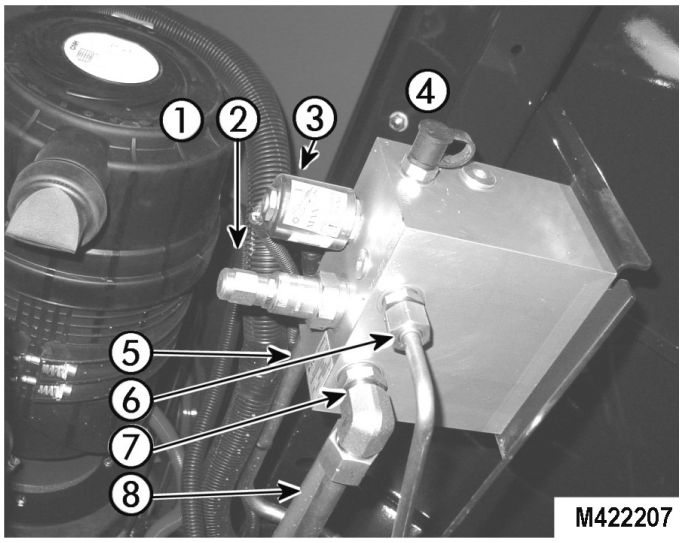
Pressure may be tested by two different methods:

1. Monitored on the display MAIN>COMBINE INFO>HYDRUALIC screen.
2. Remove the lube pressure sensor from the CONTROL/LUBE control valve and install a test fitting.

Attach a 41 bar (600 psi) gauge to the lube pressure DIAG port located on the Control Pressure/Lubrication Valve. With the engine at LOW idle the pressure reading should be within specification, check at HIGH idle to verify operation.

The relief is located in the valve body. The cartage is NOT adjustable. If the pressure is not correct remove and inspect the relief for contamination. If the pressure still remains low the lubrication pump should be flow rated to verify it can produce the proper flow and pressure. If the pump is operating properly, replace the LUBE regulating valve.

9 REGULATED PRESSURE TEST



2.	Regulated Cartridge
4.	Regulated Pressure Port

#9 REGULATED PRESSURE TEST

This test is used to determine the regulated pressure regulating valve setting. The regulated pressure regulator is set to provide an operating pressure of 22-25 bar (320-360 psi).

IMPORTANT: Regulated pressure should not be checked or adjusted without previously verifying the PFC pump's low pressure stand-by is set correctly and operation.

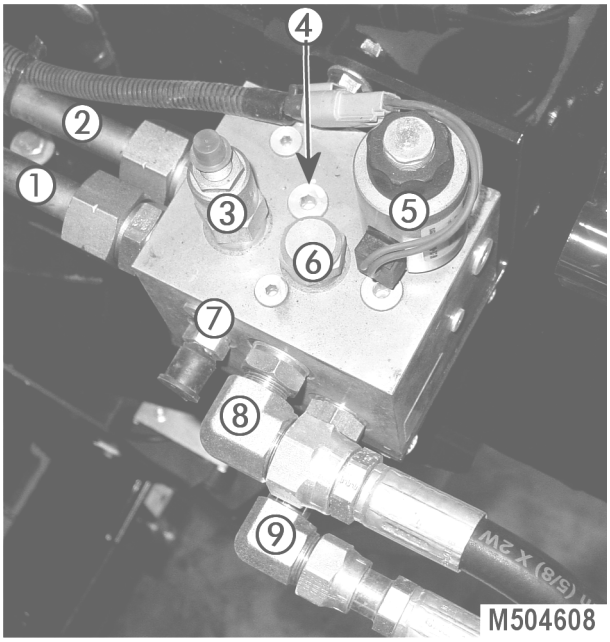
TEST PROCEDURE

Attach a 41 bar (600 psi) gauge to the regulated pressure DIAG port located on the Park Brake Valve. With the engine at LOW idle the pressure reading should be within specification, check at HIGH idle to verify operation.

The relief is located in the valve body. The cartage is adjustable, if pressure is not correct make the required adjustments.

IMPORTANT: Since the regulated circuit is supplied from the PFC pump, which is capable of developing very high pressure, it is very important to activate a function that will place the PFC pump on high pressure standby to verify that the regulating control valve is still working properly.

#10 SPREADER PUMP FLOW TEST



1.	Circuit Return to Cooler or RAS
2.	Supply From Pump
3.	Spreader Circuit Relief
8.	Motor Return Port
9.	Motor Supply Port

10 SPREADER PUMP FLOW TEST

This test is used to determine the efficiency of the spreader pump. The pump will wear internally over time, causing the residue spreader speed to decrease.

REMEMBER: Since all the flow from the spreader pump is directed through the rotary air screen motor on the 8120 a quick RPM check of the screen may be all that is required to determine the condition of the pump. With the engine at high idle, the screen should turn a minimum of 70 RPM. Be sure to verify the condition of the spreader relief valve.

TEST PROCEDURE

1. Remove the supply hose that runs between the spreader valve and the left hand spreader motor (A). Connect the inlet hose from a flow rater to the spreader valve and the outlet hose from the flow rater back to the **hydraulic** reservoir tank.
2. Using the operator controls, set the spreader speed to the maximum setting.
3. Open the restriction valve on the flow rater completely.
4. Start the machine's separator and run the engine at high idle.
5. The pump's output should be above minimum specification.
6. Slowly turn in the flow raters restriction control to verify the systems relief valve, it should be above minimum system specification.
7. The pump flow at approximately 300 psi below the relief valve setting should still be above minimum specification.

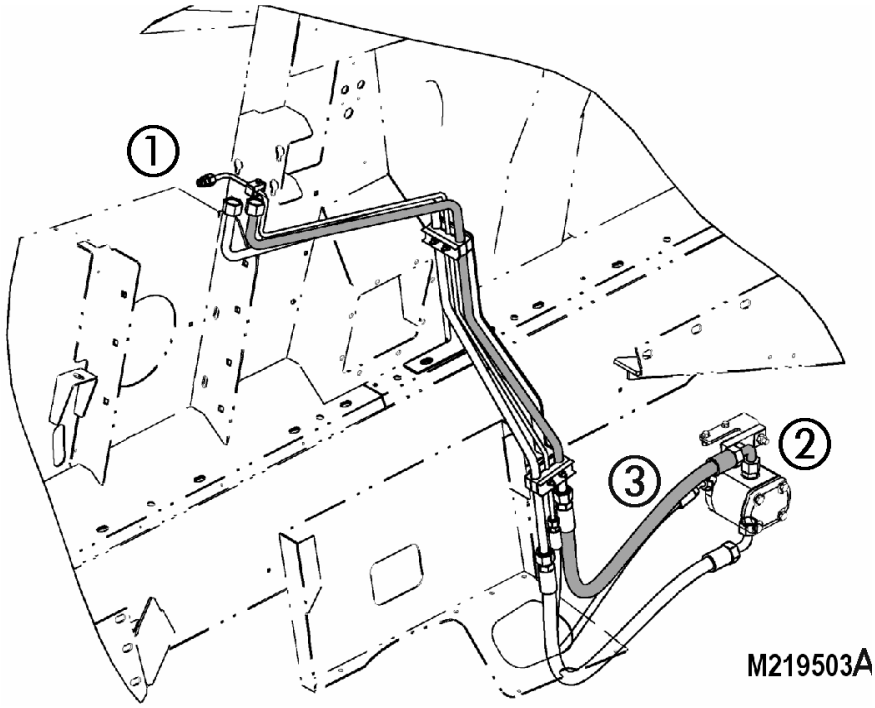
IF FLOW IS BELOW SPECIFICATIONS

1. There could be a problem with the flow control o'rings.
2. There could be a problem with the relief valve o'rings
3. There could be a problem with the control solenoid o'ring's and spool.
4. The pump could be worn excessively.

If the flow is below specifications the flow rater could be installed between the pump and the control valve.

IMPORTANT Use extreme caution if this procedure is used. There is no relief valve in the system when testing in this manner. Be absolutely sure the flow meter restrictor is open when starting the combine engine. Once the machine is started, increase to full throttle and VERY SLOWLY restrict the flow meter NOT to exceed pressure specifications.

11 FAN PUMP FLOW TEST



1. Fan Valve Location
2. Fan Drive Motor
3. Supply Hose to Motor

This test is used to determine the efficiency of the fan drive pump. The pump will wear internally over time, causing the fan speed to decrease.

TEST PROCEDURE

1. Remove the supply hose that runs between the fan drive valve and the fan motor. Connect the inlet hose from a flow rater to the fan valve and the outlet hose from the flow rater back to the **hydraulic** reservoir tank.
2. Open the restriction valve on the flow rater completely.
3. Start the machine's separator, using the operator controls set the fan speed to the minimum setting and run the engine at high idle.
4. While monitoring the fan pump's output increase the fan speed, verifying the solenoid and software operation. The pump's output should be above minimum specification.
5. Slowly turn in the flow raters restriction control to verify the systems relief valve, it should be above minimum system specification.
6. The pump flow at approximately 300 psi below the relief valve setting should still be above minimum specification.

11 FAN PUMP FLOW TEST

IF FLOW IS BELOW SPECIFICATIONS

1. There could be a problem with the relief valve o'rings
2. There could be a problem with the control solenoid o'ring's and spool.
3. The pump could be worn excessively.

If the flow is below specifications the flow meter could be installed between the pump and the control valve.



IMPORTANT Use extreme caution if this procedure is used. There is no relief valve in the system when testing in this manner. Be absolutely sure the flow meter restrictor is open when starting the combine engine. Once the machine is started, increase to full throttle and VERY SLOWLY restrict the flow meter NOT to exceed pressure specifications.



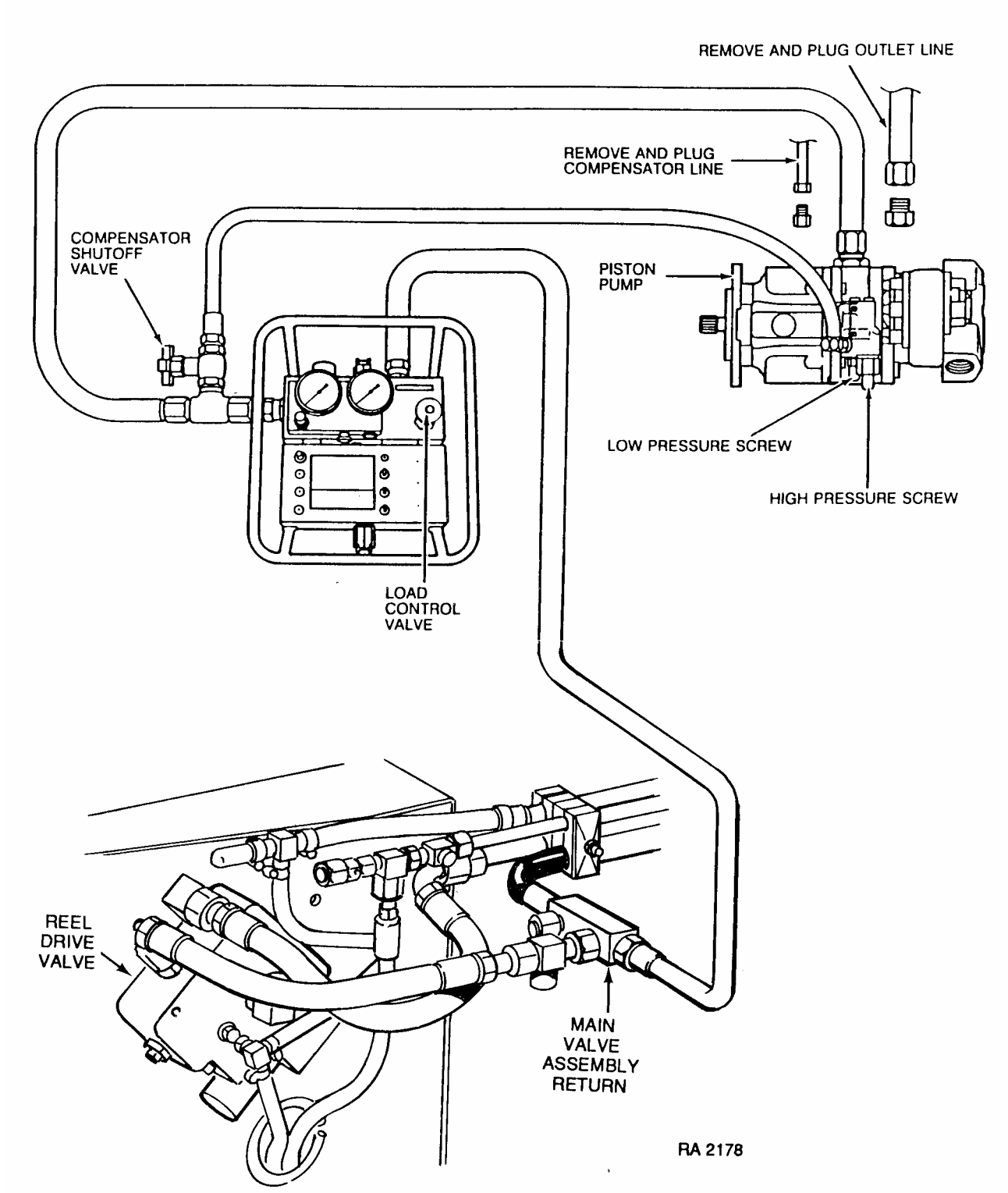
REMEMBER: A quick way that may tell you the condition of the fan relief valve, pump and motor is to:

1. Place the rotor in 1st. range (so the engine can accelerate to high idle quickly), engage the separator and set the fan speed to approximately 900 RPM.
2. Slow the engine to 1780 RPM, the fan is not being controlled at this point, it should be running over 1000 RPM.
3. Move the throttle to high idle very quickly.

RESULTS

The fan should accelerate above 1200 RPM; the speed will be limited by the relief valve. If the pressure approaches relief valve setting, it should be OK. If the fan speed exceeds 1200 RPM before the control circuit reduces it back to the preset speed the pump and motor should be OK. On a 7010, which used a shorter fan and drives easier, the pressure may not reach relief valve setting, but it should still climb into the 3000 PSI range and settle back down once the fan speed is controlled.

12 PFC PUMP FLOW



12 PFC PUMP FLOW

This test is used to determine the oil flow of the PFC pump. When conducting this test, the flow meter should read 166±10% l/m (44±10% gpm). If the reading is less than 143 l/m (38 gpm) there could be a problem with the PFC pump.



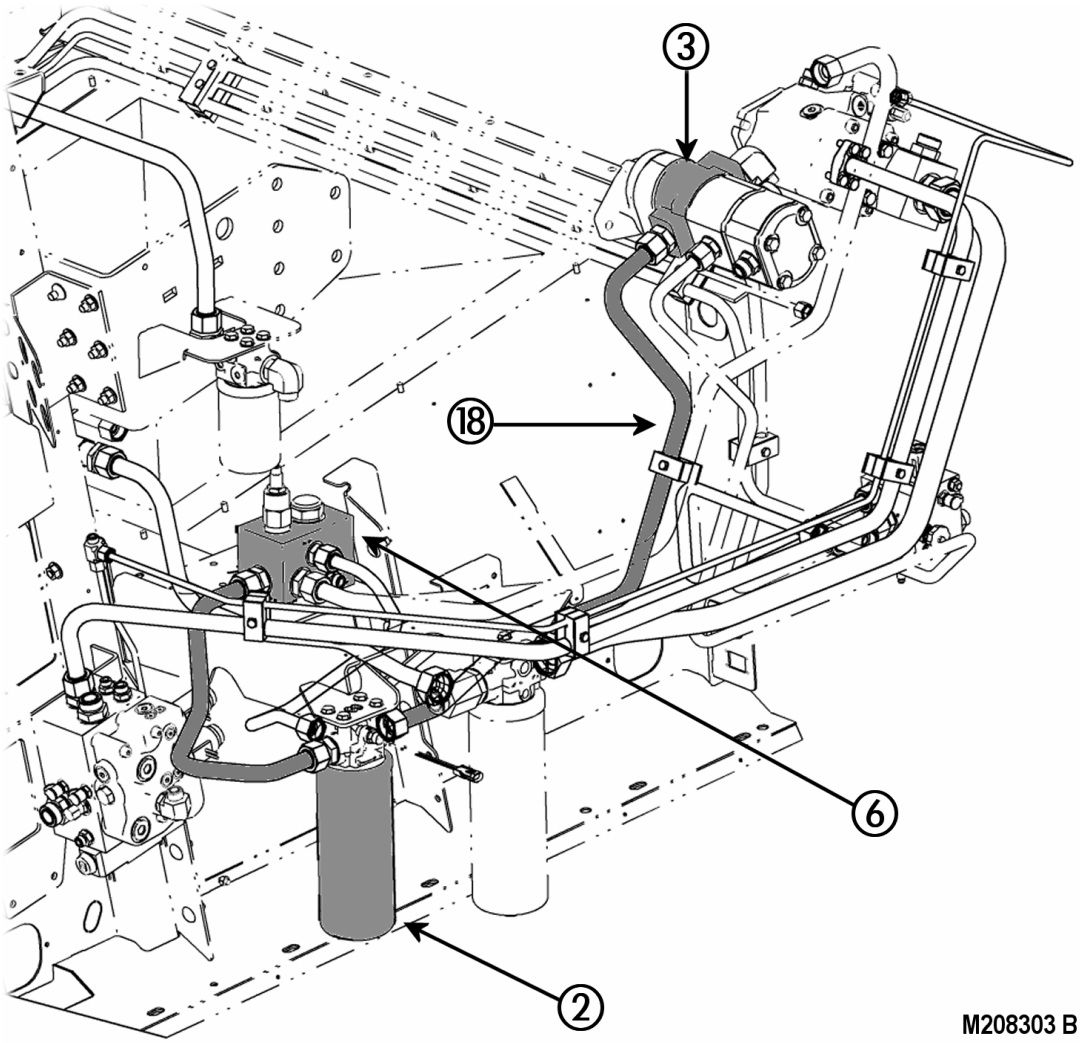
REMEMBER The most common reason for low flow from a PFC pump is NOT due to pump failure, BUT a mis-adjusted or malfunctioning flow control spool in the compensator.

TEST PROCEDURE

Drain all hydraulic oil from the reservoir. Disconnect and cap the outlet line from the PFC pump. Attach the inlet hose for the flow meter to the outlet of the PFC pump. Next, attach the outlet hose for the flow meter to the line that was removed from the PFC pump. Disconnect and cap the signal line. Tee a hose into the inlet hose of the flow meter and connect it to the compensator. Refill the reservoir with Hy-Tran Ultra.

With the flow meter restriction valve fully open, start the engine. Move throttle to high idle position and adjust restriction valve to produce a 138 bar (2000 psi) restriction. The flow meter should read specification. If the reading is under specification, the PFC pump could be damaged.

13 CHARGE PRESSURE PUMP FLOW TEST



2.	Charge Circuit Filter	6.	Control / Lube Pressure Regulating Valve
3.	Gear Pump Assembly	18.	Pump to Filter Line

13 CHARGE PRESSURE PUMP FLOW TEST

This test is used to determine the efficiency of the control pressure supply pump. The pump will wear internally over time.

TEST PROCEDURE

1. Remove the supply hose P# 87282544 (18) that runs between the charge pump and the filter base. Connect the inlet hose from a flow meter to the charge pump and the outlet hose from the flow meter to the filter base. Hose fittings are **1 7/16 - 12 ORFS on both ends of the line**. Adapter fittings 215069 from kit CAS-1906 can be used.

IMPORTANT **Use extreme caution if this procedure is used. There is no relief valve in the system when testing in this manner. Be absolutely sure the flow meter restrictor is open when starting the combine engine. Once the machine is started, increase to full throttle and VERY SLOWLY restrict the flow meter NOT to exceed pressure specifications.**

IMPORTANT **:** Verify the flow meter restriction valve is FULLY OPEN before the combine is started or pump damage will occur. DO NOT use the flow meter to build more than 41 bar (600 psi) or pump damage may occur. **Insure hoses and fittings on flow meter have a 3/4" inside diameter.**

2. Open the restriction valve on the flow rater completely.
3. Start and run the engine at **LOW** idle until you have verified the pressure on the flow rater, then increase engine speed to HIGH idle slowly while monitoring the system pressure.
4. The pump's output should be above minimum specification. It must be above 36 GPM (136 l/M).

IF FLOW IS BELOW SPECIFICATIONS

1. The pump could be worn excessively.
2. There could be problem with the PTO gearbox supply screen.
3. There could be an suction side leak, permitting air to enter the system.
4. There could be a low oil level problem in the gearbox.

#14 CHARGE CIRCUIT SUCTION LEAKS

An air suction leak in the charge circuit can cause the charge and control pressure to be unstable. Normally the system will have a high pitch noise when an suction leak is present.

A method for checking to determine if there is a suction leak is to:

- Run the engine to warm the fluid.
- Shut down the combine and wait 15 minutes.
- Measure oil level in the PTO gear box.
- Crack open a fitting at the drain return manifold.
- Re-measure the oil level.

If level rises 1.5-1.75" on dipstick, suction system should be good. If the oil does not rise, there is a high probability there is a suction leak.

WHY?

As long as the suction side of the control pump is sealed, the fluid in the lines and return manifold should not drain back to the PTO gear box. By loosening a line permits air in to the system, allowing the fluid to return back to the PTO gear box.

#15 CONTROL PRESSURE LEAKS

PRESSURE LEAK TEST

The following test will be used to help identify component leakage in the Control pressure circuit. *Reference the control pressure information earlier in this section*. The test procedure is broken into TWO separate operations:

Control Circuit Pressure Drop Test will be used to monitor the system's pressure while engaging clutch to try and determine if a clutch is leaking an excessive about of fluid.

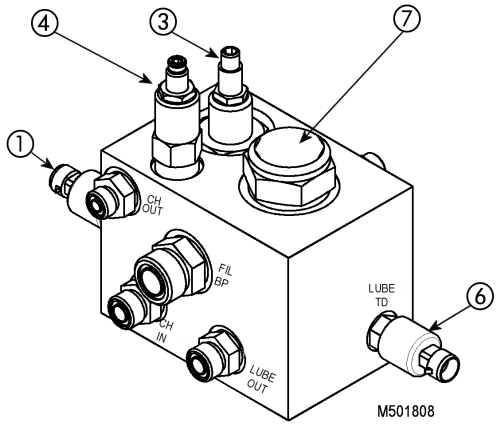
Control Circuit Flow Test will be used to monitor the actual volume of leakage at each clutch. If the pressure drop test does not show up a leak, the flow test may be required to find it.

The clutches associated with the control pressure are the:
Rotor Drive Feeder Drive Beater/Chopper Drive Unloader Drive

CONTROL PRESSURE DROP TEST

A. Operate the machine to bring the PTO gear box fluid up to minimum 38°C (100°F) and maintain the temperature. *This will need to be checked with a heat gun, the PTO sensor which is mounted in the ground drive hydro motor discharge will not be actuate unless the machine is driven.*
B. All testing must be completed with the engine at HIGH IDLE.

C. This test should be performed to verify the accuracy of the sensor before starting the test.
    a) Remove the control pressure sensor (1) from the regulating valve and install an M14X1.5 diagnostic pressure fitting, 84320565. Record a system pressure reading for reference during step B.
    b) Reinstall the sensor and monitor the pressure reading on the cab display by navigating:
    BACK>COMBINE INFO>HYDRAULICS

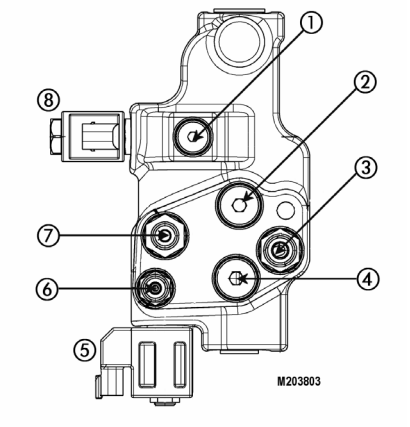


D. The reading that was logged during step A should be very close to the reading in step B.

#15 CONTROL PRESSURE LEAKS

CONTROL PRESSURE DROP TEST, CON'T

E. Remove the RTF clutch solenoids from the cartridge stem on the Rotor control valve and the Feeder control valve. The RTF Solenoid is #5.



IMPORTANT **Removing these solenoids will permit the feeder chain and rotor to creep anytime the engine is running. Be sure to take the proper safety measures.**

F. Verify that the CHARGE pressure is properly adjusted, refer to the "Charge Pressure Test # 5" earlier in this section.

G. Verify that the CONTROL pressure is properly adjusted, refer to the "Control Pressure Test # 6" earlier in this section. At this time make any corrective repairs as need so that the cab display reads approximately the same as the pressure gauge.

1. Base Pressure: With all controls in NEUTRAL record the control pressure. This will be the base line for the next test.

Step =1 _____

2. Unloader Clutch: Swing the unloading auger out of the saddle and engage it. Watch for pressure fluctuation. It will be typical for the pressure to drop momentarily but should come right back.

Disengage the unloader and swing it into the saddle.

Amount of pressure drop from test Step =1 Step =2 _____

#15 CONTROL PRESSURE LEAKS

CONTROL PRESSURE DROP TEST, CON'T

3. Beater/Chopper Clutch: Engage the Rotor "De-Slug" so that the separator will operate without the rotor running. It is important that the de-slug mode be used to isolate the Beater/Chopper clutch properly.

Disengage the separator by returning the separator switch the Off position.

Amount of pressure drop from test Step =1 Step =3 _____

4. Rotor RTF Clutch: Re-install the RTF solenoid on the ROTOR drive ONLY. Do NOT engage any other functions.

Remove the RTF clutch solenoids from the cartridge stem.

Amount of pressure drop from test Step =1 Step =4 _____

5. Feeder RTF Clutch: Re-install the RTF solenoid on the FEEDER drive ONLY. Do NOT engage any other functions.

Amount of pressure drop from test Step =1 Step =6 _____

#15 CONTROL PRESSURE LEAKS

FLOW LEAK TEST

During the control pressure test only one clutch at a time is engaged. There still could be a problem with excess leakage in a clutch that will only show up when multiply clutches are engaged at one time. If during any of the previous test the control pressure did not decrease below 290 psi a flow test will be required to find a clutch that is leaking excessively.

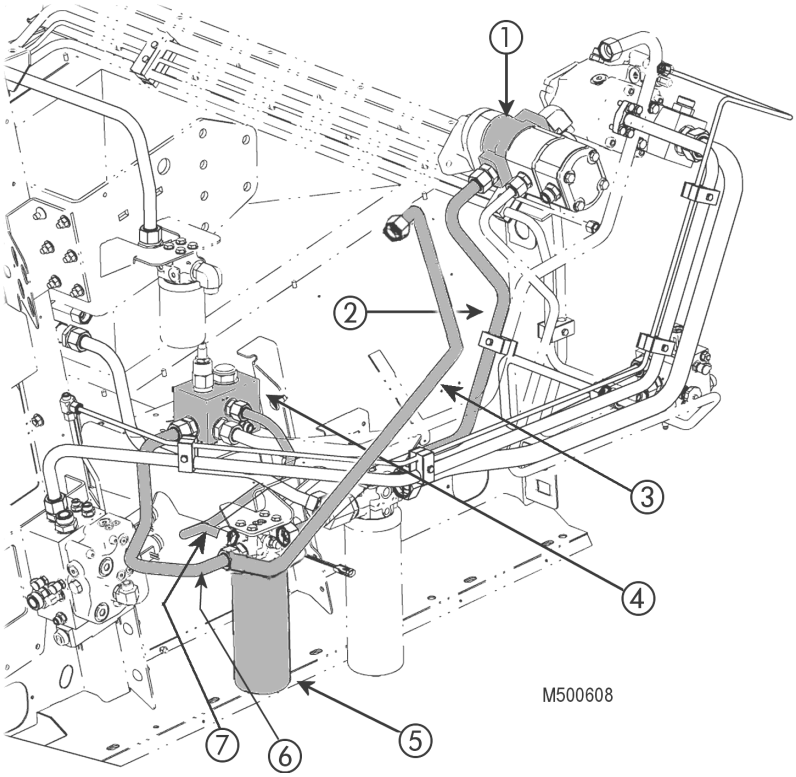
This test will require the installation of a flow meter between the charge pressure filter base and the control/lubrication valve body.

A. Remove the line (6) and insert a flow meter. The supply is coming from the filter base, so the meter's inlet should be connected to the filter base and the outlet to the valve body.

The flow meter needs to be capable of handling a minimum of 12 gpm (45 lpm).

The flow meters restriction valve must remain FULLY OPEN at all times.

The fittings that the flow meter will need to connect to are 13/16 - 16 ORFS Male. Adapter fitting 380002506 found in the hydraulic fitting kit 380040195 may be useful.



The line on the machine may look a little different then the photo.

B. Following and complete steps from #1 up to #7 of the previous "Control Pressure Leak Test".

C. All flow readings should be record after the flow has stabilized. It will be normal for the flow to be excessive while the clutch is engaging. A normal clutch leakage should be 0-1 gpm (3.7 lpm), it should not exceed 1 gpm.

D. REMOVE the RTF clutch solenoids for the Feeder and Rotor drive as outlined in the previous pressure drop test.

#15 CONTROL PRESSURE LEAKS

FLOW LEAK TEST, CON'T

1. Base Line Flow: With all controls in NEUTRAL record the current flow. This will be the base line to judge all the other clutch leakages from.

   Record the flow Step 1= _____

2. Feeder RTF Clutch: Reinstall the feeder RTF clutch, and leave all controls in NEUTRAL. Watch for flow fluctuation. Record the flow once it has stabilized.

   Record the flow Step 2= _____

   Subtract the flow recorded in step #1 from Step #2 to determine the actual leakage for the feeder RTF clutch Actual leakage = _____

3. Rotor RTF Clutch: Reinstall the rotor RTF clutch, and leave all controls in NEUTRAL. Watch for flow fluctuation. Record the flow once it has stabilized.

   Record the flow Step 3= _____

   Subtract the flow recorded in step #2 from Step #3 to determine the actual leakage for the rotor RTF clutch Actual leakage = _____

4. Unloader Clutch: Swing the unloading auger out of the saddle and engage it. Watch for flow fluctuation. Record the flow once it has stabilized.

   Disengage the unloader and swing it into the saddle.

   Record the flow Step 4= _____

   Subtract the flow recorded in step #3 from Step #4 to determine the actual leakage for the unloader clutch Actual leakage= _____

5. Beater/Chopper Clutch: Engage the Rotor "De-Slug" so that the separator will operate without the rotor running. It is important that the de-slug mode be used to isolate the Beater/Chopper clutch properly.

   Disengage the separator by returning the separator switch the Off position.

   Record the flow Step 5= _____

   Subtract the flow recorded in step #3 from Step #5 to determine the actual leakage for the beater/chopper clutch Actual leakage= _____

#15 CONTROL PRESSURE LEAKS

FLOW LEAK TEST, CON'T

6. Rotor ETR Clutch: Engage the rotor as normal, so that the rotor is rotating as normal. Watch for flow fluctuation. Record the flow once it has stabilized.

Disengage the separator by returning the separator switch the Off position.

Record the flow Step 6= _____

Subtract the flow recorded in step #5 from Step #6 to determine the actual leakage for the rotor ETR clutch Actual leakage= _____

7. Feeder ETR Clutch: Engage the rotor AND the feeder as normal, so that the feeder is rotating as normal. Watch for flow fluctuation. Record the flow once it has stabilized.

Disengage the separator by returning the separator switch the Off position.

Record the flow Step 7= _____

Subtract the flow recorded in step #6 from Step #7 to determine the actual leakage for the rotor ETR clutch Actual leakage= _____

Any clutch circuit to show a continuous flow in excess of 1 GPM should be inspected.

"WORKSHEETS"

HYDRAULIC PRESSURE SHEET

INFORMATION REQUIRED		
Date: ____/____/____	PIN Number: _____	Hours: _____

TEST CONDITIONS	
Park the combine so that all hydraulic operations can be activated.	**The Parking Brake Should Be Engaged.**
The hydraulic reservoir and P.T.O. Gearbox should be properly filled and new filters installed.	Oil Temperature must be Above120^{o} F (49° C)

TESTING INFORMATION

Function:	
Pump Involved	
Reservoir Involved	
Test Fitting Location	
Pressure Specifications	
Flow Specifications	

TEST RESULTS:

Engine Speed	Low Idle	High Idle
Circuit Pressure		
Circuit Flow		

"WORKSHEETS"

HYDRAULIC PRESSURE SHEET

INFORMATION REQUIRED		
Date: ____/____/____	PIN Number: _____	Hours: _____

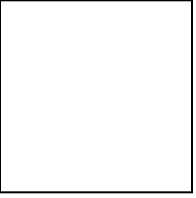
TEST CONDITIONS	
Park the combine so that all hydraulic operations can be activated.	**The Parking Brake Should Be Engaged.**
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TESTING INFORMATION

Function:	
Pump Involved	
Reservoir Involved	
Test Fitting Location	
Pressure Specifications	
Flow Specifications	

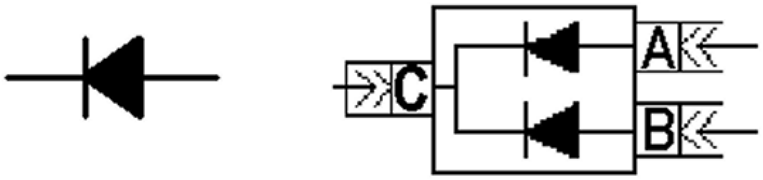
TEST RESULTS:

Engine Speed	Low Idle	High Idle
Circuit Pressure		
Circuit Flow		



AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 - 9120 SERIES AXIAL-FLOW COMBINE



Diode Diode Module

SECTION 50 HOW TO READ SCHEMATICS

Form 5175 1/2010

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RACINE, WI 53404 U.S.A.

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INTRODUCTION

COMPONENT IDENTIFICATION

The electrical schematic index is organized into groupings of components. Each component on the combine is assigned a unique alpha-numeric code that is used in all documentation, and uniquely identifies that component. To locate a specific component in the schematic, use the chart below to determine the label prefix for that component type, and look in that component group in the index to determine which frame the component is located on.

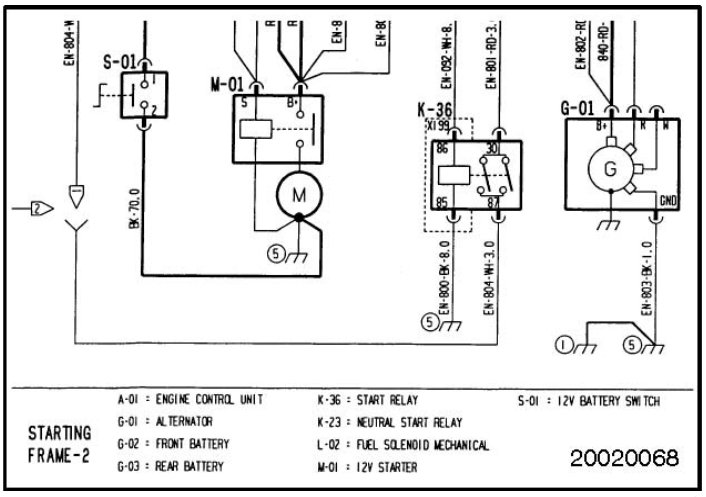
Label Prefix	Component Type
A	Modules
B	Sensors
D	Diode
E	Lights, Lamps
F	Fuses
G	Alternator, batteries
H	Horns, speakers
J	Power Outlets
K	Relays
L	Solenoids
M	Motors, actuators
R	Potentiometers
S	Switches
W	Splice blocks
X	Connectors

REMEMBER: Following schematics are examples only, they do not represent the current combine circuits.

SCHEMATIC FRAMES

The electrical schematic is divided into page-sized frames, and are numbered sequentially. The schematic frames are ordered by system, as follows:

Starting	Fr 1
Engine	Fr 2 -5
Drives	Fr 7 -9
Hydraulic	Fr 10
Header	Fr 11 -14
Feeder	Fr 15
Thresher	Fr 16, 17
Cleaning	Fr 19 -21
Unload	Fr 22
Trash	Fr 23
Precision	Fr 24
Distribution	Fr 25 -31
Lighting	Fr 33 -43
Accessory	Fr 44 -45
HVAC	Fr 46 -48



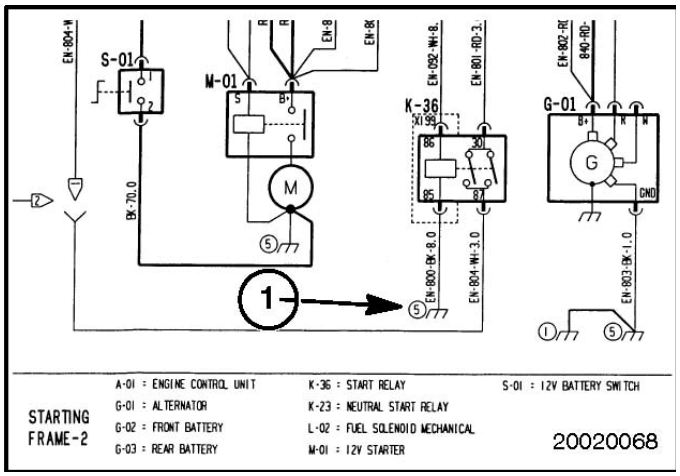
1

INTRODUCTION

FRAME COMPONENT TABLE

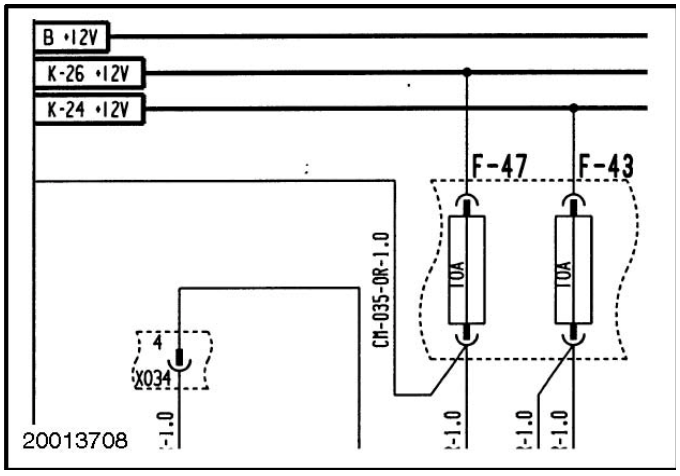
To accurately determine the location of a particular circuit, use the index to locate circuits by component label.

A table following each frame lists all devices shown on that frame, with their label. In most cases, circuits are contained completely within the frame. However, in some cases, wires can cross frame borders to the previous or next frame.



POWER SUPPLY

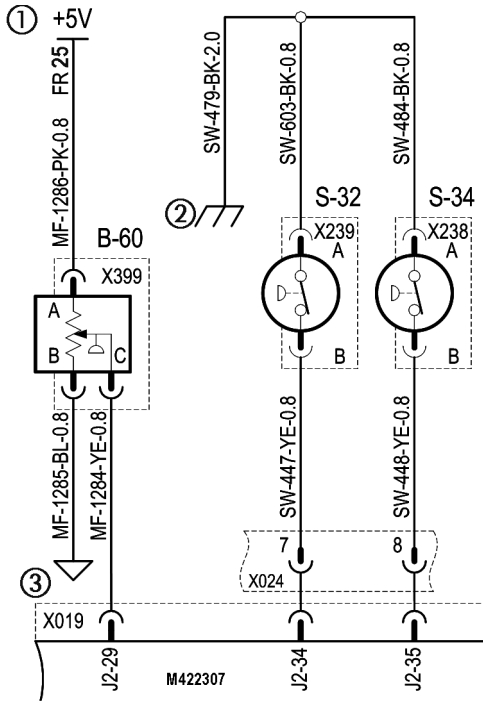
Power runs across the top of each frame, while grounds generally occur at the bottom. Labels are used to identify the power supply on the power wires at the top of the frame. The top wire label “B +12V” indicates this wire is directly supplied by the batteries, while the wires below are supplied by the K26 and K24 relays respectively.



INTRODUCTION

POWER SUPPLY

Power may also be shown as item (1) - +5V. Located on the wire is the location that the power came from - FR-25. By using the wire number the source could be located on the source frame.



INTRODUCTION

GROUNDS

Grounds are identified with a circled number (1), which indicates a specific ground location on the combine. An absence of this circled number indicates that the device is grounded locally.

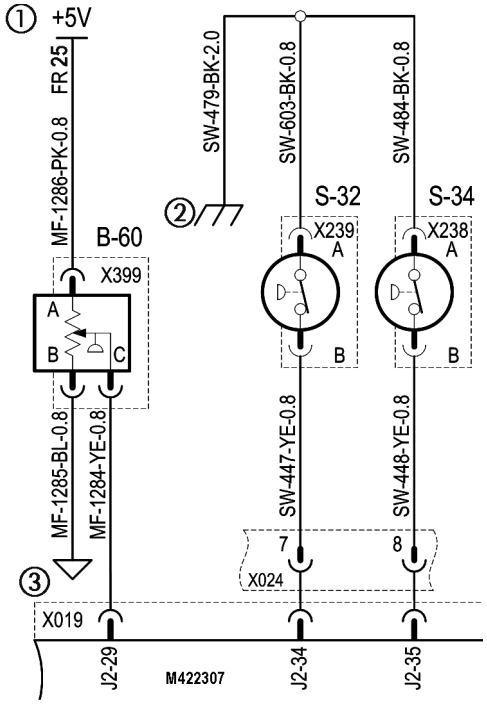


There are five grounding locations on the combine, as listed.

There are two different types of circuit grounds.

Chassis Ground (2): Is a ground that is connector the machine chassis somewhere. These are indicated by a earth type symbol.

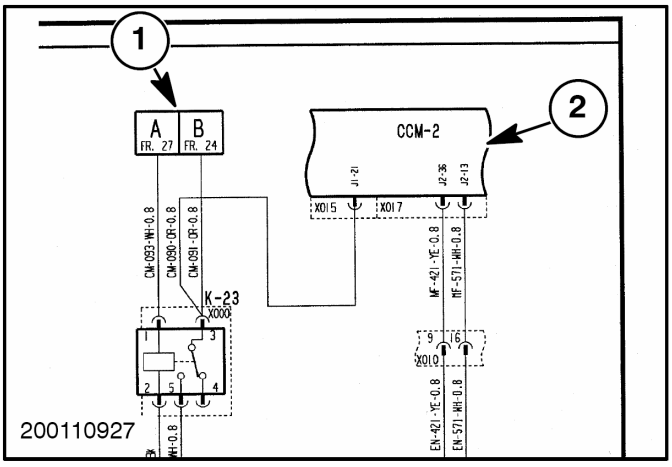
C**ircuit Return (3):** Is a ground that is directed back to a controller and grounded through the controller ground. These are indicated by an arrow type symbol. By using the circle indicator number, refer back to the index for a frame location to source the ground.



INTRODUCTION

PAGE JUMPERS

A minimal number of jumpers, 1, are used to extend circuits to other frames in the schematic. These jumpers are shown as a wire terminating in a square box, with a letter-identifier and a frame number that the wire is jumping to. To continue following the circuit, flip to the identified frame number, and look for a jumper box with the same letter-identifier.

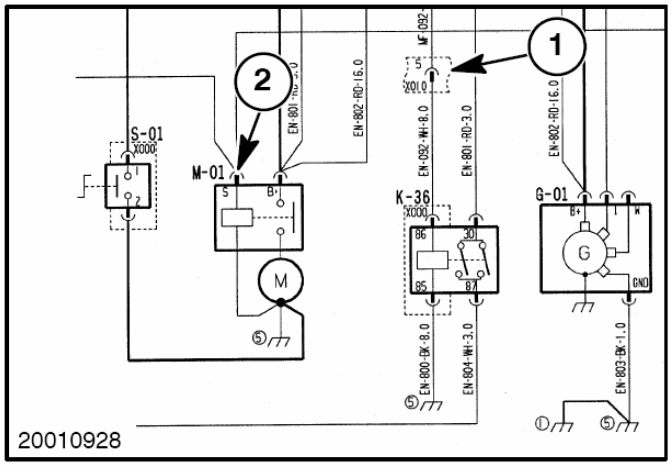


4

Connectors in the schematic are shown as a dotted box around a component, or around connections in a wire, in the case of an inline connector between harnesses. The connector number will be identified in one corner of the box.

CONNECTORS

If only part of the connector is shown, a wavy dotted line, 1, will be shown at one or both ends of the box to indicate that part of the connector is missing, and located in another frame of the schematic. The connectors will identify pins or sockets in each connector.



5

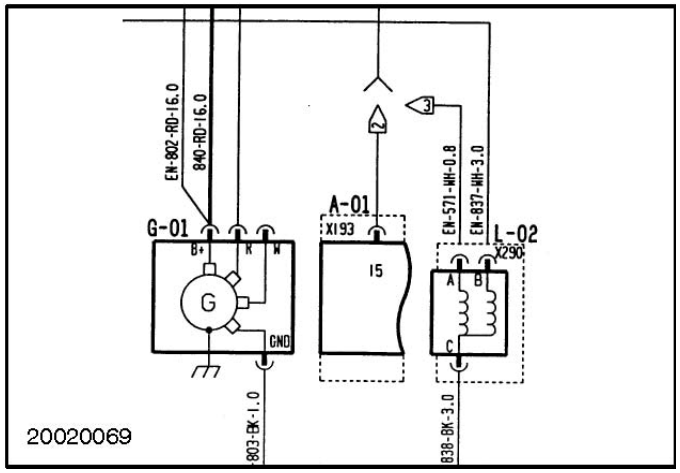
Bolted connections, 2, such as to batteries or alternators, will not have a dotted box surrounding the connection.

In most cases, an entire component is shown on a single frame of the schematic. In some cases, however, the component (typically a computer module), 2, (top of page), may be shown on several frames of the schematic. If only part of the component is shown, a solid wavy line will be shown at one, or both ends of the component to indicate part of the component is missing, and is located in another frame of the schematic.

INTRODUCTION

MACHINE OPTIONS

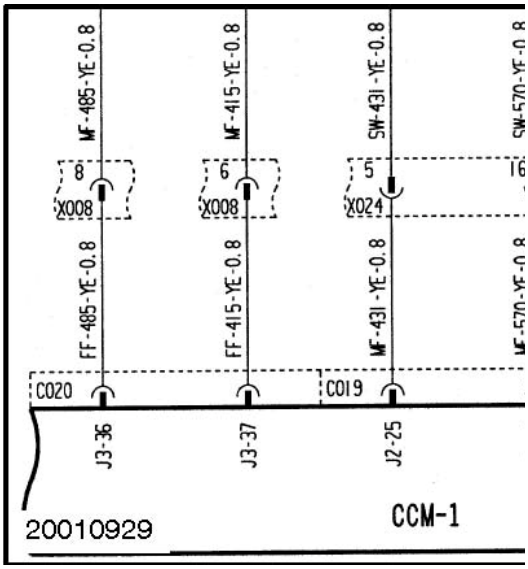
In some cases, the wiring may have slight differences from one machine to another, depending on the specific options that are installed. In these cases, the schematic will show a reverse arrow head on one wire, with two or more arrow heads available to “plug in”. These arrow heads have a number in them to identify the specific option or configuration they represent. The arrow head options are listed at the bottom of the Index frame for reference. The symbol does not indicate that there is a connector at the location.



6

HARNESSES

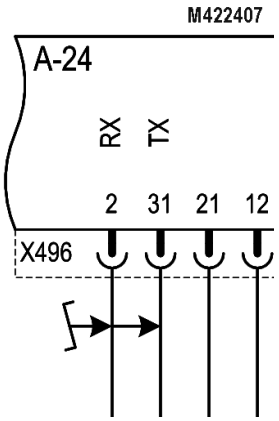
A two digit alpha code is assigned to each harness used on the combine (with the exception of two or three wire jumper harnesses). This label is used on each wire on the schematic to identify which harness any given wire is located in. The harness codes are:



Code	Harness	Code	Harness
MF	Main Frame	EX	Expansion
FF	Front Frame	SW	Straw Hood, Front
LF	Lower Frame	SH	Straw Hood, Rear
CM	Cab Main	LR	Lower Frame Rear
RC	Right Hand Console	PF	Precision Farming
SC	Steering Column	AD	Adapter, Display
CR	Cab Roof	JP	Jumper
OR	Outer Roof	FC	Flip Up Lighting
AC	HVAC	UL	Under shield Lighting
FE	Feeder	UE	Under shield Lighting, Engine
GT	Grain Tank	CC	Concave Clearance
GB	Gearbox	TL	Unload Tube Light
EN	Engine	HH	Header

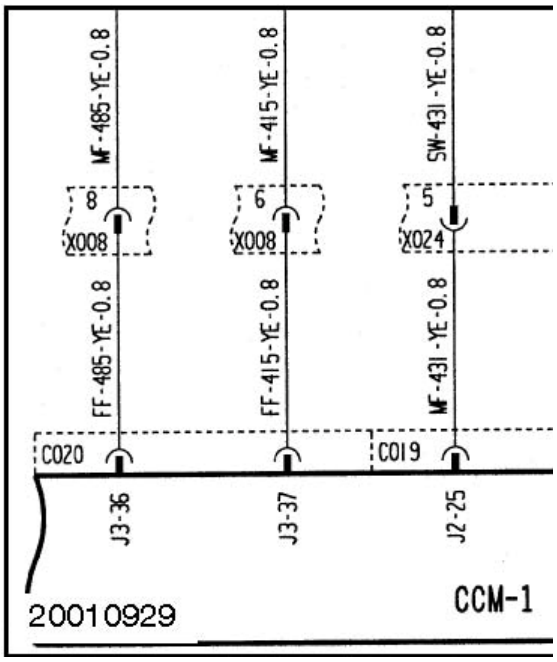
DATA BUS = CAN CIRCUITS

The data bus circuits, which is a twisted pair of wires, is indicated by the symbol as shown on terminals 2 & 31. The CAN wires are in a sheathed cable, separated from other wires, but included in the complete harness.



HARNESSES

All wires in the schematic are labeled to indicate the specific harness they are in, the circuit number, the wire color (see chart below), and the wire size, indicated in square mm cross-section. On the combine, the appropriate circuit number is printed on each wire approximately every 50 mm (2″) to identify it.



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Wire Size Chart	
Square mm	AWG
0.5	20
0.8	18
1.0	16
2.0	14
3.0	12
5.0	10
8.0	8

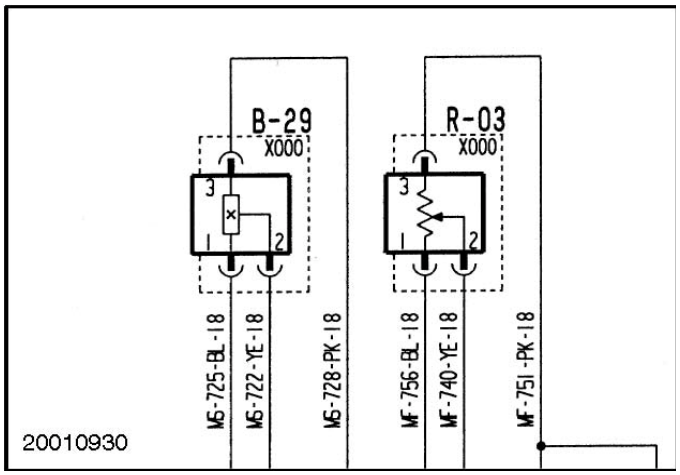
In addition, the wire colors used identify the function of the wire, depending on the type of component that the wire is connected to. The following wire colors are used for the combine wiring harnesses:

Color	Color Code	Function
Black	BK	Ground, Chassis
Blue	BL	Reference Circuit Ground
White	WH	Increasing Actuation
Gray	GY	Negative (Dec.) Actuation
Orange	OR	Switched Power
Yellow	YE	Signal Wires
Red	RD	Battery Voltage
Purple	PU	Lighting
Pink	PK	Positive (Ref.)Voltage
Black w/ White tracer	BK/WH	Clean Ground
Yellow	YE	Can HI
Green	GE	Can LO

SENSORS TYPES

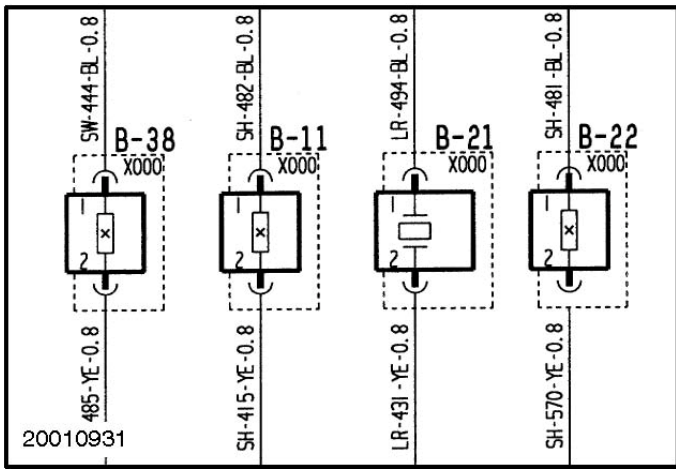
The following tables identify the specific wiring colors and functions, as well as the standard connector location for each wire type for each component group.

3 Wire Sensors (Exp. Potentiometers or Sensors)		
Signal	Pin	Harness Wire Color
Power	1or A	Pink
Ground	2or B	Blue
Signal	3or C	Yellow



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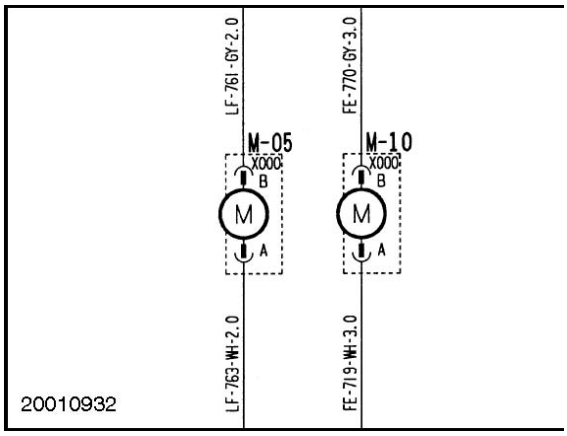
2 Wire Sensors (Exp. Position Sensors or Switches)		
Signal	Pin	Harness Wire Color
Ground	1or A	Blue
Power	2or B	Yellow



10

ACTUATORS

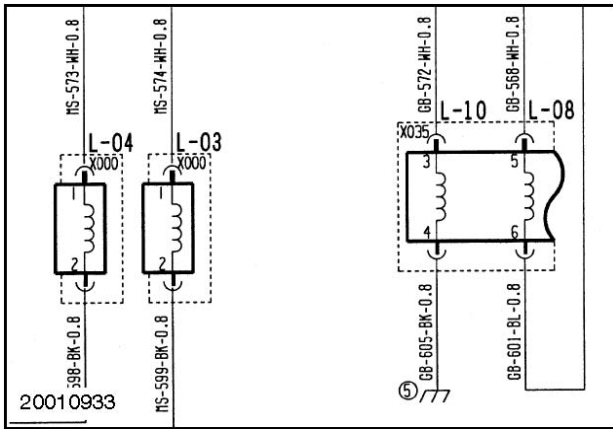
Linear Actuators (motors) (Exp. Shoe)		
Signal	Pin	Harness Wire Color
Ground	1or A	White
Power	2or B	Gray



11

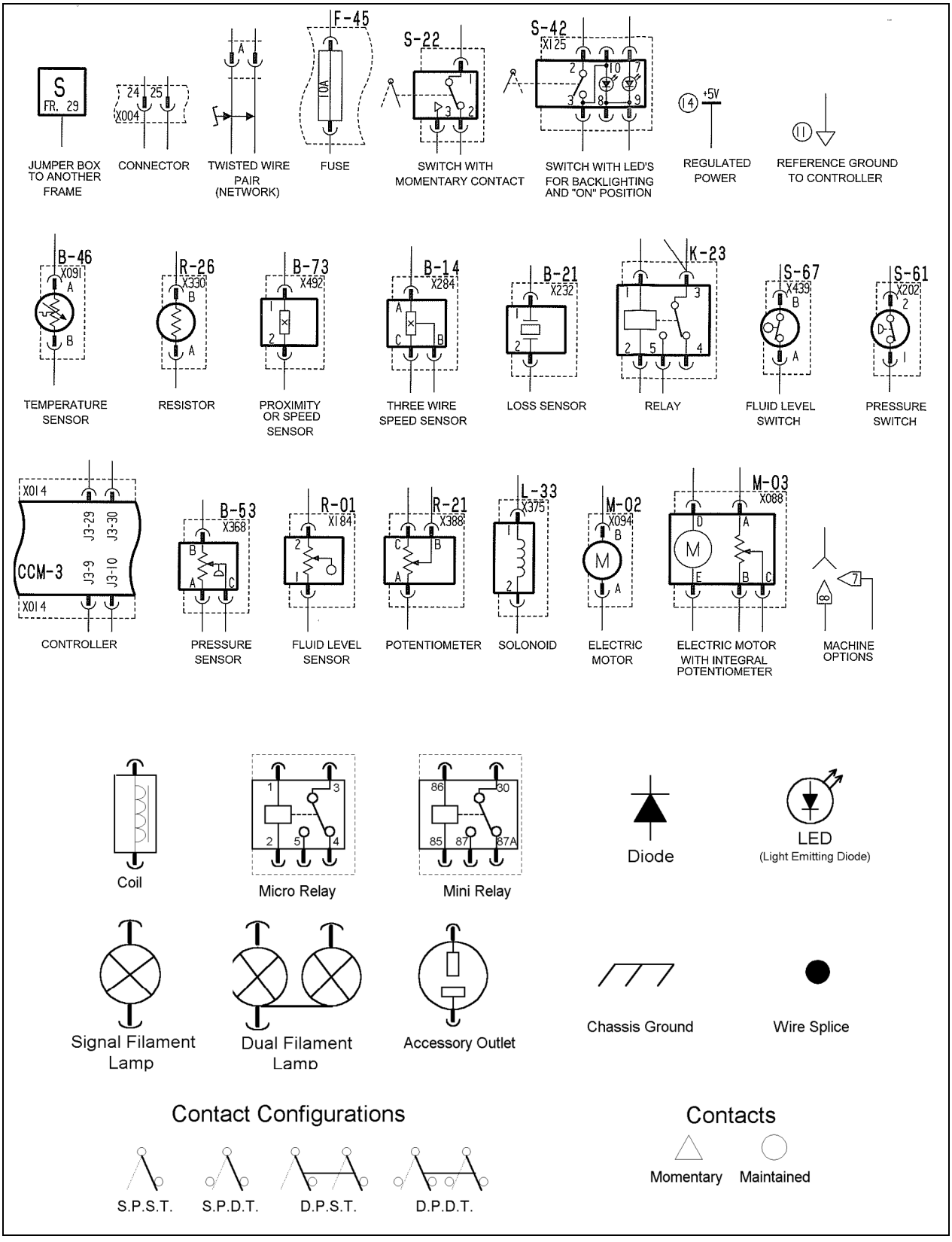
Solenoids w/Current Sensing (Exp. Header Raise/Lower)		
Signal	Pin	Harness Wire Color
High Side	1or A	White
Current Sense	2or B	Blue

Solenoids w/o Current Sensing (Exp. Park Brake Disengage)		
Signal	Pin	Harness Wire Color
High Side	1or A	White
Current Sense	2or B	Black



12

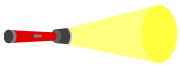
SCHEMATIC SYMBOLS



ELECTRICAL TEST EQUIPMENT

ELECTRICAL TESTING -

The most important aspect of troubleshooting today's sophisticated electrical and/or electronic systems is the test results. A service technician must have confidence in his testing equipment to get accurate readings.

The days of checking a system with a test light have past.  Electronic equipment runs on very low amperage, and a test light can draw enough amperage to burn out a circuit in a control box.

Today's electronics will run on variable voltages. Just because the machine has 12-volt batteries does not mean the system is running on 12 volts. Most machines will have 12-volt circuits, 8-volt circuits and 5-volt circuits. With different voltages being used a test light will be useless, the only way to test a circuit will be with a voltmeter and ohmmeter.

Volt Meter should be used to do all electrical testing and trouble shooting. Remember the circuit must be fully connected and operated to get proper test results. You should be looking for voltage drops to determine where the problems are.

Ohm Meter should not be used to check a circuit unless a voltmeter cannot be used for some reason. The ohmmeter should only be used when checking components or circuits that have a specified resistance. An example would be a solenoid that may have a specified resistance of 7-9 ohms; an ohmmeter is the proper tool to be used.

Listed below is an abbreviated list of electrical tools that can be purchased locally or through the OTC tool catalog.



M133399

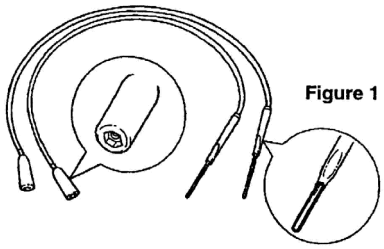
CAS-1559 *Digital Volt/Ohm Meter*
An example would be a Fluke 23

CAS-1559-2
Replacement Probes



An example would be:
Piercing Clips Fluke 1TC26
(**not recommended**)

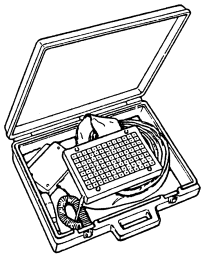
Alligator Clips Fluke 1TC21
Leads 1TC08


Figure 1

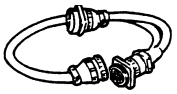
Test Leads Assembly
(diagnostic spoons)

OTC part number FNH00550

ELECTRICAL SYSTEMS DIAGNOSTIC TESTER



In order to test a circuit with a voltmeter, the circuit must be in operation. The *Break-Out Box* lets the technician monitor and test electrical circuits while they are operating them without damaging the wiring harness.



CAS-2110A

In order to connect the *Break-Out Box* to a circuit an adapter harness will be required to convert the harness plugs to the *Break-Out Box* . The adapters are listed for specific equipment, remember as long as an adapter harness will connect to the circuit that is to be tested it will work, although it may be listed for a different product.

NOTE: When using the *Break-Out Box* remember to subtract 2-3 Ohms when taking an Ohm reading for solenoids due to the wiring in the *Break-Out Box.*

Adapter Harnesses

PART NUMBER	PINS/TYPE	APPLICATION
CAS 2435	Amp 14 Pin	92/9300
CAS 2112	Amp 16 Pin	7100, 9200, Com/Cot (header tilt module)
CAS 2114	Amp 24 Pin	9200, Com
CAS 2115	Amp 37pin	7100, 9200 & Cyclo, (header control module)
CAS 2111	Amp 9 Pin	7100, 9200, Com/Cot
CAS 2116	Deutsch 14 Pin	Magnums
CAS 2117	Deutsch 19 Pin	Ce-Wheel Loaders
CAS 2183A	Deutsch 21 Pin	Maxxum & Magnum
CAS 2433	Deutsch 21 Pin	51/5200 & 71/7200
CAS 2118	Deutsch 23 Pin	Ce-Wheel, Airdrills
CAS 2385	Deutsch 24 Pin	Com/Cot
CAS 2657	Deutsch 31 Pin	2300 Series Combine
CAS 2386	Deutsch 40 Pin	Com/Cot
CAS 2384	Deutsch 70 Pin	Com/Cot
CAS 2432	Deutsch 9 Pin	71/7200
CAS 2547	Deutsch 9 Pin	Quadtrac
CAS 2186A	ITT Cannon	Maxxum
CAS 2560	ITT Cannon 12 Pin	L Series Loader/Backhoe
CAS 2434	ITT Cannon 24 Pin	51/5200 (requires overlay CAS2187/104)
CAS 2113	Packard 22 Pin	Com/Cot
CAS 2548	Packard 6 Pin	Quadtrac
CAS 2221	Vac Special 35 Pin	21 Series Wheel

NOTE: The amperage draw through some test lights can "burn out" some components contained within the electronic control modules used on the equipment. This can cause an additional unexpected system failure.

FUNDAMENTALS OF TESTING AN ELECTRICAL SYSTEM

Before any testing is done to the electrical system in question, the service technician must fully understand how the entire system (electrical and hydraulic) functions normally. In many instances, the operation of the system may only need to be explained to the operator, or a simple adjustment made to the system for it to function properly. Referencing the appropriate Operator's Manual will generally resolve these types of problems.

When searching for the cause of an electrical problem, it is desirable to obtain all of the symptoms of the problem from the operator. A few pertinent questions asked of the operator may give you valuable clues as to the cause of the problem. While questioning the operator, a chance remark may well reveal the cause of the problem to an alert service technician. Operate the equipment to see if you can duplicate the problem.

Utilize the easiest and simplest tests first to try to identify the problem. When it has been determined that a problem does exist with the electrical system, the service technician must understand the fundamentals of electricity. Understanding the properties of voltage, amperage and resistance is a must. The service technician has to be equipped with the proper testing equipment to resolve the problem. Use of the CAS-1559 Digital Multimeter is strongly recommended. However, just having the equipment is not enough, the service technician must understand and utilize the functions and features of the Digital Multimeter!

Once the problem has been identified, correct repair procedures must be followed to insure that the problem does not reoccur. Use of the Electrical Connector and Terminal Repair Kit part number ZJI1400004 is ***strongly recommended.*** The kit is equipped with the necessary tools and connectors for proper repairs as well as information on how to utilize the repair tools in the kit. A connector parts guide is available from DMC as number PM 872.



Wait a Minute... What should I use to seal connection to prevent corrosion? Refer to S/B NEN SB 003 01 for a Dielectric Lubricant that may be used on all connection to aid in preventing corrosion and aid in connecting. P/N J822934

ELECTRICAL UNITS OF MEASURE

When testing electrical circuits, there are three basic units of measurements:

Volts: Represents the potential to perform work and may be thought of as pressure in a hydraulic system.

Amps: Represent the amount of current flowing through a circuit and accomplishes the work or purpose of a circuit. Current may be thought of as the volume of gallons moving through a hydraulic circuit.

Ohms "Ω": Resistance to the movement of current. Perfect conductors have 0.0 Ohms and perfect insulators have infinite Ohms "OL". Ohms may be thought of as an orifice in a hydraulic circuit.

When performing electrical tests, the technician not only needs to read the numerical number, but MUST also be aware of the scale the meter is being displayed in.

When the meter is displaying a numerical number there may also be a LETTER scale indicator on the right side. The letter indicates a multiplier to be used to achieve the actual value. The indicators are as follows:

"M" = Mega = 1,000,000
"K" = Kilo = 1,000
"m" = Milli = 0.001



M133399

Example:	Meter is reading	2.45	MΩ
	Actual reading	2.45	MΩ X 1,000,000 = 2,450,000 Ω
		This could be a very poor connection	
Example:	Meter is reading	2.45	KΩ
	Actual reading	2.45	KΩ X 1,000 = 2,450 Ω
		This could be normal reading for a potentiometer	
Example:	Meter is reading	2.45	mV
	Actual reading	2.45	mV X 0.001 = 0.00245 V
		This could be a circuit with a very poor voltage supply	

HOW TO TEST A WIRING HARNESS

VISUAL INSPECTION

Carefully inspect the complete wiring harness for damage. Check for loose or broken wires. Make sure the connector terminals are fully seated and locked in the connector. Insure that the terminals are clean and not damaged. Use of Lectra Clean, part number B17400 or B505513, is recommended, and Dielectric Grease, part number B505516, can be used for lubricant and corrosion protection.

TESTING FOR "OPEN" CIRCUITS

An "OPEN" circuit is defined as a place in a circuit that is separated and does not permit a path for electrical current to flow. This could be a disconnected connector or a broken wire. Because the circuit is open, the circuit resistance, when measured with a Digital Multimeter, will indicate infinite resistance (OL or Open lead).

Test for an "OPEN" circuit by folding the harness in half so that the two connectors are side by side. Test for continuity through each wire using a Digital Multimeter. Use wire colors or connector pin identification numbers to identify the wires at each end of the harness. If the harness is not easily folded in half because of being strapped down, connect two pins together at one connector with a jumper wire. Test for continuity through the wires at the other connector. Repeat this process by moving the jumper wire as needed until all wires are checked.

FINDING AN "OPEN" CIRCUIT

Using a Digital Multimeter set to the Ohms (Ω) scale, connect one probe to each end of the broken wire. Move along the length of the harness, flexing the harness by hand, while watching the Multimeter. Any change on the ohmmeter indicates the damaged area has been located. If the damage cannot be located, find the approximate middle of the harness length. Carefully cut the outer jacket of the harness to reach the wire to be tested. Insert a needle or pin through the wire insulation and connect the meter to the needle or pin. Test for continuity between the middle and the end of the wire.

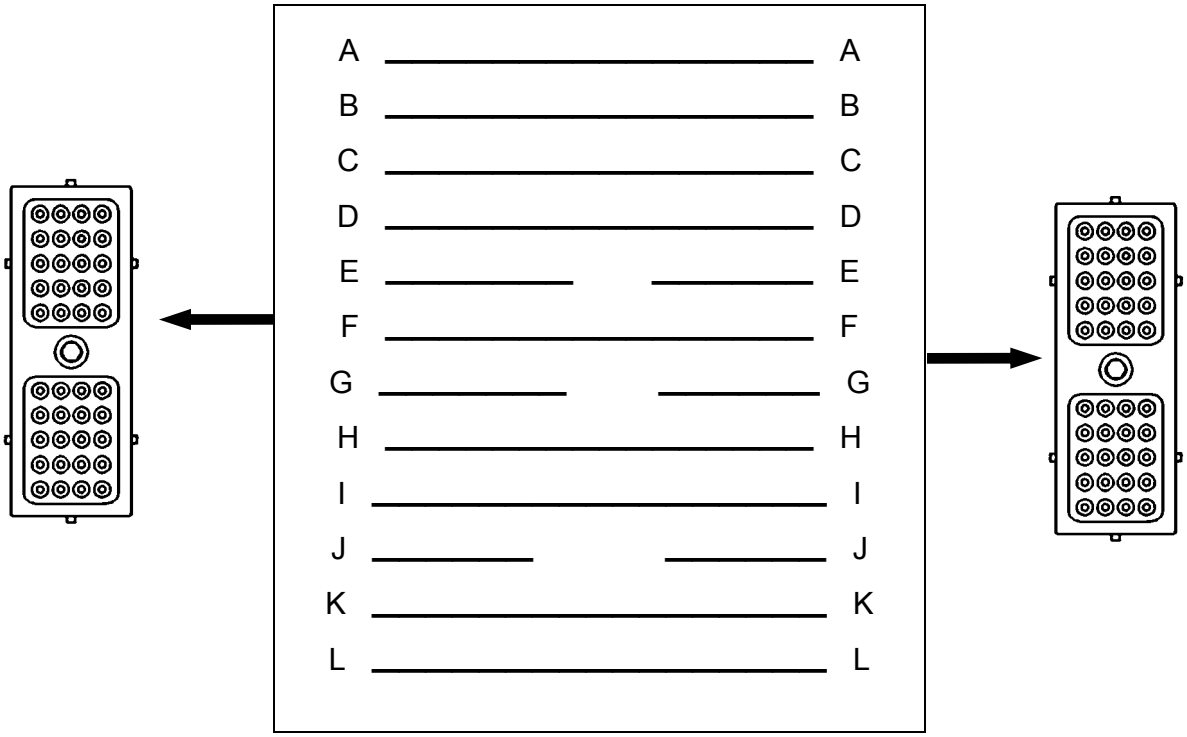
HOW TO TEST A WIRING HARNESS

If the cable is strapped down, it will be necessary to add a length of wire to one probe of the ohmmeter to lengthen the meter leads. If there is continuity, move to another test point farther down the wire and test again.

When no continuity is obtained, the break in the circuit will be between the last points tested which will permit the exact location to be determined.

REMEMBER: a good reading should be less then 2 ohms, although this reading will increase as the length of wire increases. For most of the wiring on a combine, it should be 2 ohms or less when measuring one end of a wire to the opposite end of the same wire.

"Opens"



HOW TO TEST A WIRING HARNESS

TESTING FOR SHORT CIRCUITS

A "SHORT" circuit is defined as an **unintended**, low resistance current path. This means that the current is taking a "shorter" path than it was intended in the original circuit. This could be a result of two or more wires rubbing together (copper to copper) or a wire rubbing the system ground (copper to iron). This results in the shorted circuit having resistance much smaller than specifications as shown on the next page.

Disconnect the harness at both ends. Using a Digital Multimeter set to the Ohms scale, test for continuity between the wires. To accomplish this, at one of the harness connectors, test for continuity between pins as follows:

1-grd	2-grd	3-grd	4-grd
1-2	2-3	3-4	4-5
1-3	2-4	3-5	4-6
1-4	2-5	3-6	4-7
1-5	2-6	3-7	4-8
etc.	etc.	etc.	etc.

By progressively moving through the pin count, no combination of two conductors is missed. Continuity should **NOT** be found between any wires or ground unless shown on the wiring schematic.

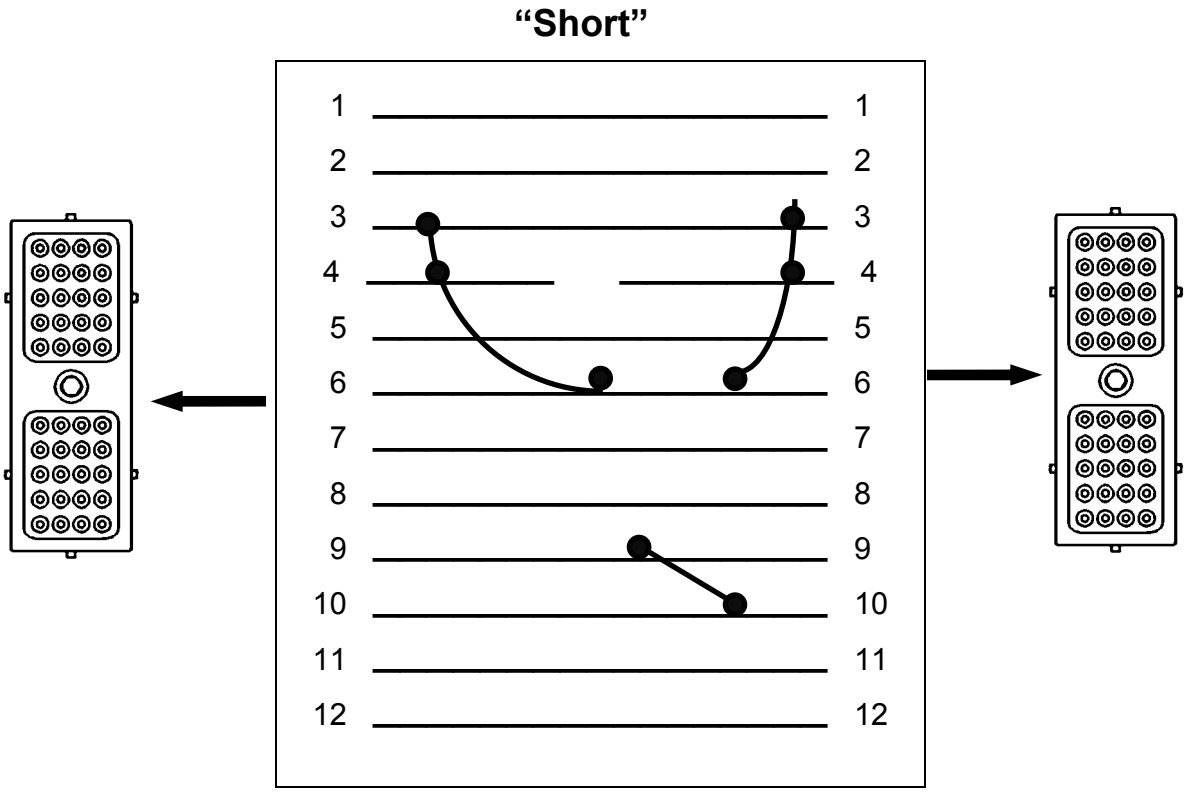


REMEMBER: The best test for finding shorted wires is visually, inspects the harness for damage. If continuity IS found, the wires are shorted.

HOW TO TEST A WIRING HARNESS

FINDING A SHORT CIRCUIT

Connect the Ohm meter probes to the wires in the harness that are shorted to each other. Move along the harness flexing the harness by hand while watching the Digital Multimeter. Any changes in the meter indicate that the damaged area has been located. Carefully cut the outer jacket of the harness to repair the shorted wires.



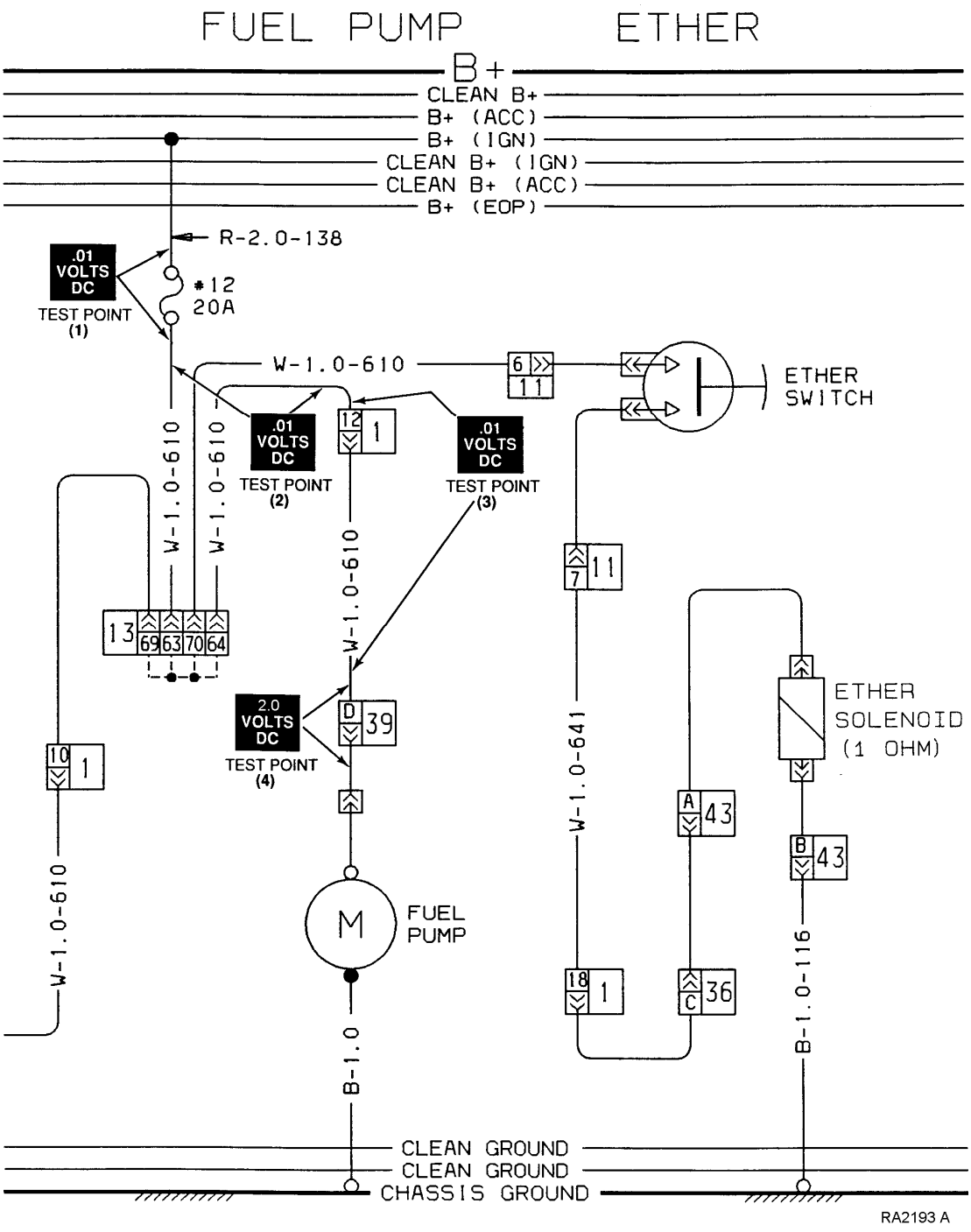
HOW TO TEST A WIRING HARNESS

TESTING FOR HIGH RESISTANCE

A "HIGH RESISTANCE" circuit is defined as an **unintended** resistance to current flow. This means that the circuit must overcome more resistance than normally found in the circuit. Corroded connectors or wires, or a wire in the circuit that is nearly pinched in half could cause this. This may cause the circuit to work erratically or not at all. If the circuit is tested while disconnected from the load, the circuit may or may not indicate the proper resistance and/or voltage level. **A high resistance circuit can generally only be tested when the circuit is under a LOAD** (i.e. solenoid activated, control module resetting, etc.). To properly test for a high resistance circuit, the Digital Multimeter (set to the **VOLT** scale) has to be installed into the completed circuit and **OPERATED.** If a high resistance circuit is present, the voltage recorded when operating the circuit will be lower than specifications.

FINDING A HIGH RESISTANCE CIRCUIT

A Digital Multimeter is used (set to the volts scale) to test for a high resistance circuit. The Digital Multimeter is placed in the circuit so that it becomes a parallel path for the circuit. The completed circuit voltage (as shown on the Multimeter) is then checked between segments of the circuit. **The problem area has been located when the voltage changes noticeably on a segment being checked.** As an example, refer to the next page, the DVM indicates circuit voltage for three of the segments of .01 volt indicating low resistance. The fourth segment of the circuit indicates 2.0 volts, indicating higher resistance. The original circuit is using the DVM to indicate the higher circuit resistance in the fourth segment.


FUEL PUMP
ETHER
B+
CLEAN B+
B+ (ACC)
B+ (IGN)
CLEAN B+ (IGN)
CLEAN B+ (ACC)
B+ (EOP)
R-2.0-138
.01 VOLTS DC
TEST POINT (1)
*12 20A
W-1.0-610
6 11
ETHER SWITCH
.01 VOLTS DC
TEST POINT (2)
12 1
.01 VOLTS DC
TEST POINT (3)
W-1.0-610
W-1.0-610
W-1.0-610
13 69 63 70 64
7 11
2.0 VOLTS DC
TEST POINT (4)
D 39
10 1
W-1.0-610
W-1.0-641
ETHER SOLENOID (1 OHM)
A 43
B 43
M
FUEL PUMP
B-1.0
18 1
C 36
B-1.0-116
CLEAN GROUND
CLEAN GROUND
CHASSIS GROUND
RA2193 A

COMMON COMPONENT TESTING PROCEDURES

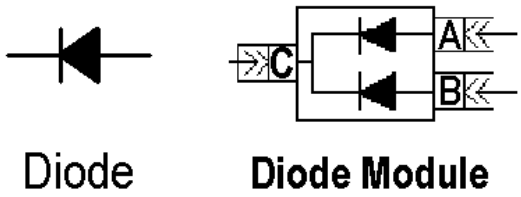
Use the following test procedures for some of the most common components.

1. **Diodes**
2. Potentiometer
3. Relays

DIODES

Diodes are designed to let current pass in one direction only, like a check valve in a hydraulic system. Current flows in the direction that the arrow portion of the diode symbol is pointing. To test a diode we check the voltage drop across it. It take a small amount of energy to start the current flowing, this shows up as a voltage drop. Normally the diodes that we use, should show approx. 0.4-0.5 volts in one direction and "OL" (out of limits) in the other direction.

TEST PROCEDURES



M162500

1. Disconnect the diode completely from the circuit.
2. Using a voltmeter set on "Diode Testing Mode", connect the red lead to one end and black lead to the opposite end of the diode. Record the reading.
3. Reverse the leads and record the reading.
4. One reading should be approx. 0.4-0.5 volts and the other reading should be "OL", if not replace the diode.

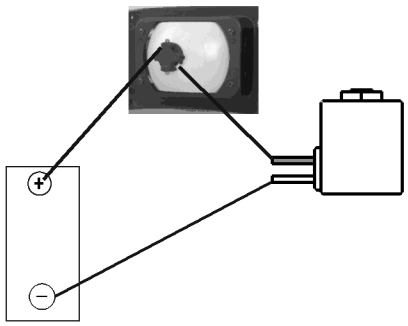
If using a diode module, a connector that encloses multiple diodes, the "C" terminal is always the common terminal (on combines). Using the same method as described above, connecting the leads between terminal "C" and the diode terminal that is to be tested.

COMMON COMPONENT TESTING PROCEDURES

DIODES, CON'T

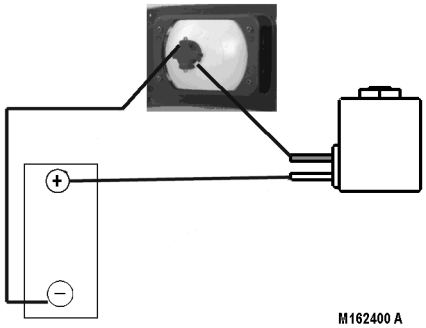
Many solenoid coils have diodes incorporated into them to dissipate the reverse polarity voltage the coils create as the magnetic field collapse. The best way to tell if a coil has a diode built into it, is that it must be wired correctly so the two coil leads will be identified by color or number. If a coil has two unidentified wires, it probably does not have a diode built in. To test this kind of a diode takes a completely different approach. You can not just connect the DVM leads across the coil because the power can flow through the coil windings as well as the diode.

To perform the test the coil must be loaded to its capacity. Use the following instructions and diagram.



M162400

1. Using a 12 volt power source connect the coil and a load (suggested load, head lamp) in series.
2. The load (light) will take the place of the DVM, it will either SHINE or NOT (possibly very dim).



M162400 A

3. Reverse the leads at the power source.
4. The load (head lamp) should operate the opposite from step 2.
5. If the load (head lamp) performed correctly the diode is GOOD.
6. If the load (head lamp) was very dim or does NOT light in both steps 2 and 4 the diode is burned open. If the load (head lamp) was LIT in both steps 2 and 4 the diode is fused close.

COMMON COMPONENT TESTING PROCEDURES

Use the following test procedures for some of the most common components.

1. Diodes
2. **Potentiometer**
3. Relays

POTENTIOMETER

REMEMBER, There are two types of potentiometers, one that operates as an analog unit and one that operates as a digital unit. The following test procedure will only check an analog unit.

A potentiometer is used to vary a voltage signal that is transmitted to an electronic controller. By the varying voltage, a controller can tell when a function, command and/or response has taken place. A potentiometer normally incorporates three wires, position:

- "A", wire "A" normally is used to supply operating voltage to the potentiometer.
- "B", wire "B" normally is used to send a variable voltage back to the controller.
- "C", wire "C" normally is used to send a return signal back to the controller to be used for self testing functions.

REMEMBER, the operations of wire "A" and "C" may be turned around, BUT "B" will always be the variable signal.

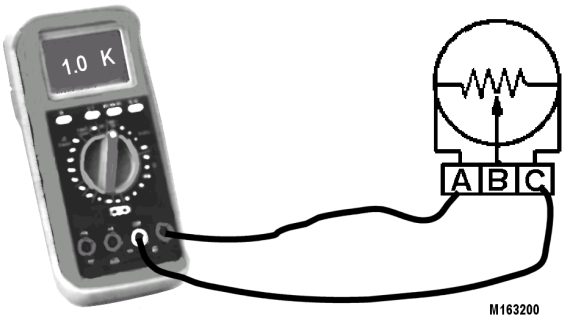
COMMON COMPONENT TESTING PROCEDURES

POTENTIOMETER, CON'T

TEST PROCEDURES

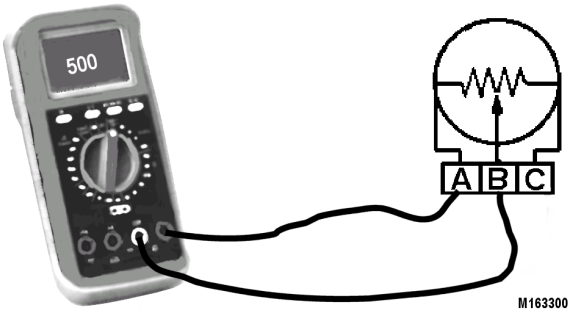
ANALOG POTENTIOMETER TEST

1. Disconnect the potentiometer completely form the circuit.
2. Note the wire connections at the potentiometer body, the "B" wire will always be the center wire.



1 K Ohm Potentiometer
(1,000 Ω)

1. With the DVM set to the Ohm position connect the two leads to the potentiometer's terminals "A" and "C".
2. The DVM should display the specified resistance for the potentiometer being tested. The normal excepted range for a potentiometer is plus or minus 10% of the rated specification.



500 Ω

3. With the DVM connect the two leads to the potentiometer's terminals "A" and "B" and rotate the potentiometer's spindle through it's full travel.
4. On some potentiometers the spindle is restricted to rotate less then one full turn. The resistance should increase and decrease smoothly and consistently with out any skips. Normally the reading should range from 0.0 to the potentiometer's specification.

   On some potentiometers the spindle is not restricted from rotating and will continue to rotate. Normally the reading will range from 0.0 to the potentiometer's specification, BUT there must be a short distance of rotation that shows an open circuit (OL).

COMMON COMPONENT TESTING PROCEDURES

Use the following test procedures for some of the most common components.

1. Diodes
2. Potentiometer
3. **Relays**

RELAYS

A relay is a magnetic activated switch, which incorporates two totally separate circuits. To properly test a relay's operations both circuits must be test individually. The two circuits are:

- The activation circuit
- The circuit that is be toggled **ON** or **OFF**



REMEMBER, normally the fastest way to test a relay is to place it into a circuit that is known to be operating correctly. The CAS-2594 relay extension harness may be used to making testing quicker.

On the relay cover and next to the terminals are numbers representing the terminal function. Following is the normal terminal function, although the function for terminals 1 or 86 and 2 or 85 could be reversed.

Terminals:

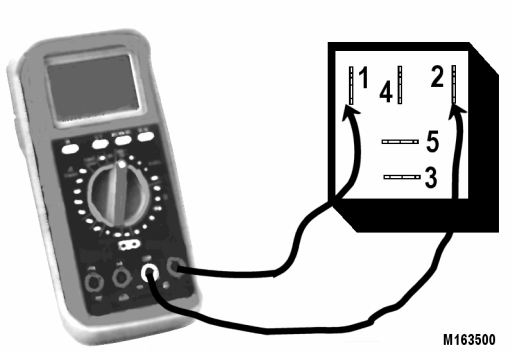
1 or 86 is normally the supply power to activate the relay
2 or 85 is normally the ground for the relay activation
3 or 30 is normally the power supply for the switch
4 or 87 is the N.C. set of contacts
5 or 87a is the N.O. set of contacts

COMMON COMPONENT TESTING PROCEDURES

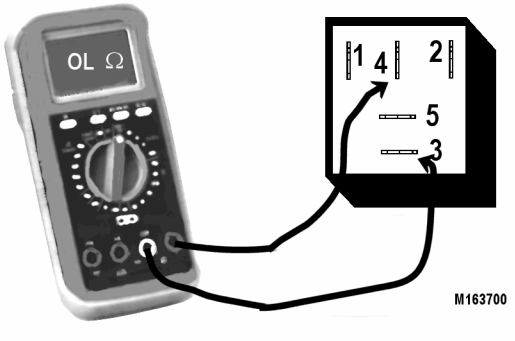
RELAY, CON'T

TEST PROCEDURES

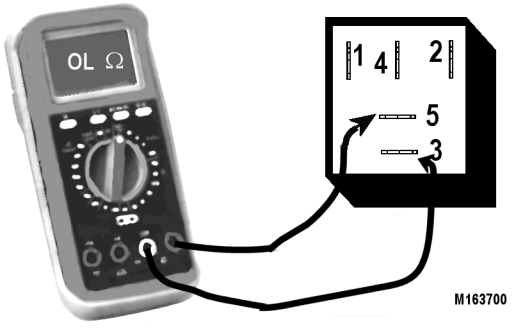
1. Remove the relay form the circuit.
2. Identify the terminal locations.



3. Place the DVM on the Ohm mode and make a connection with the meter's lead and terminals 2 & 1 or 85 & 86.
4. There will normally be between 75-85 Ohms of resistance on a twelve volt relay.



5. Place one lead on terminal 3 and one on 4 or 30 & 87A.
6. There should be less then 1 Ohm of resistance



7. Place one lead on terminal 3 and one on 5 or 30 & 87.
8. There should not be a connection, the DVM should be reading OL.

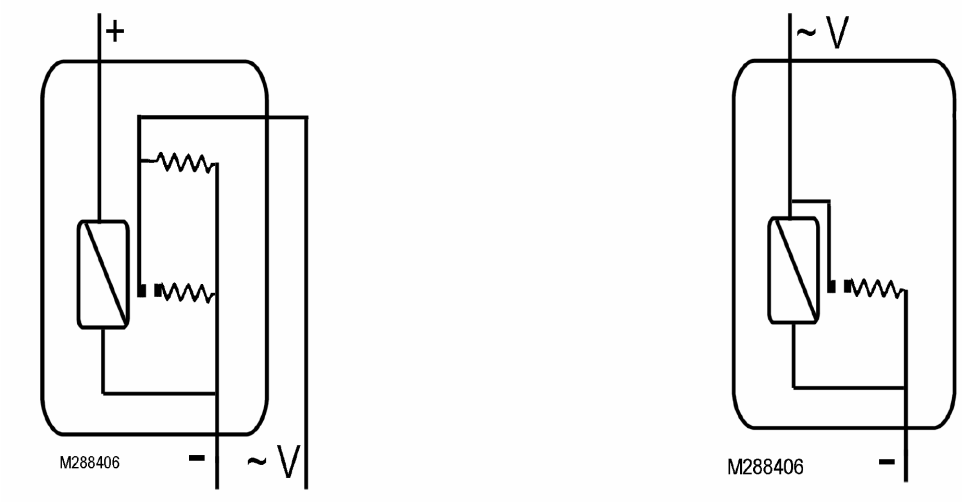
9. If twelve volts is place across terminals 1 and 2 the relay should activate and the readings found in step 6 and 8 should be reverse.

HOW A DIGITAL SENSOR WORKS

Following is a very simplified explanation to the operation of a digital sensor.

ELECTRONIC SENSORS

An electronic sensor can not be bench tested, because it requires voltage to operate. Following is examples of a few common units.



Three Wire Unit

Two Wire Unit

THREE WIRE SWITCH UNITS

The unit will be supplied with an operating voltage, this voltage may be 5V, 8V or 12V and a ground. This voltage is used to create the magnetic field that is required for the sensor to operate. The third wire is the sensing wire; which is also supplied a voltage. The sensing voltage is directed to the ground through a resistor, this will cause the voltage to be reduced. When the switch senses metal the contact will close or open (depending on sensor type) and the sensing voltage now has two different paths to the ground; this will cause the voltage to change. The electronic controller will monitor these voltage changes to determine the signal.

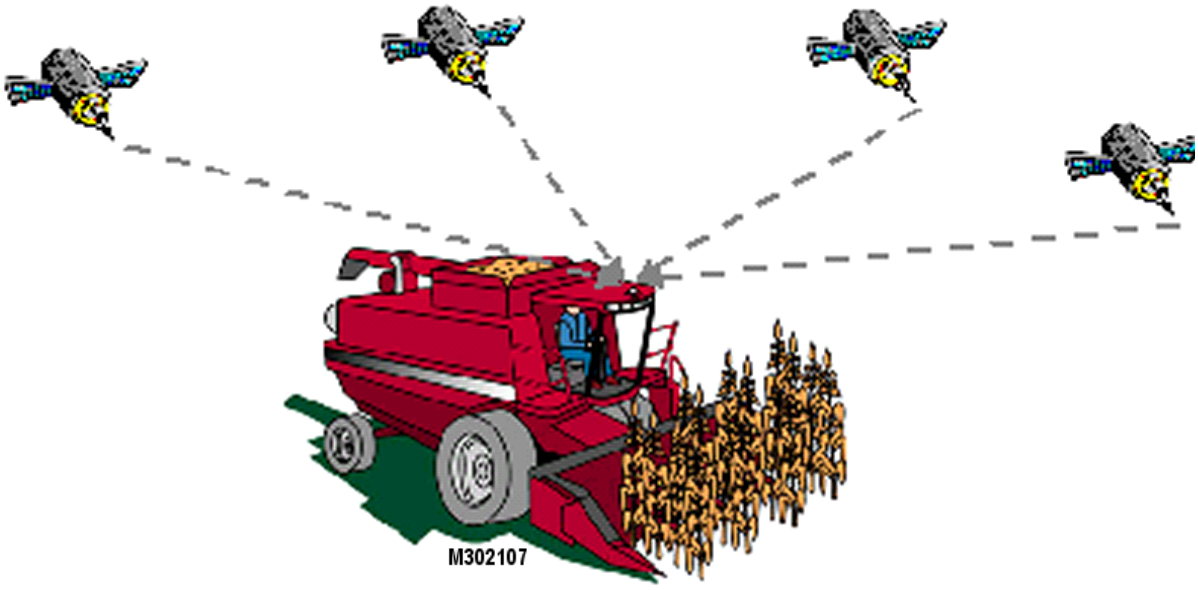
TWO WIRE UNITS

The unit will be supplied with positive powered signal wire, this voltage may be 5V, 8V or 12V and a ground. This voltage is used to create the magnetic field that is required for the sensor to operate. The sensing voltage is directed to the ground through a coil, this will cause the voltage to be reduced. When the switch senses metal the contact will close or open (depending on sensor type) and the sensing voltage now has two different paths to the ground; this will cause the voltage to change. The electronic controller will monitor these voltage changes to determine the signal.

CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7010-9120
AXIAL-FLOW COMBINE



Section 54 Auto Guide

Form 5175 1/2010

CNH America LLC
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RACINE, WI 53404 U.S.A.

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Control Valve----------11
Schematic----------14
Auto Guide Valve Operation ----------15

Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember.



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

GENERAL INFORMATION

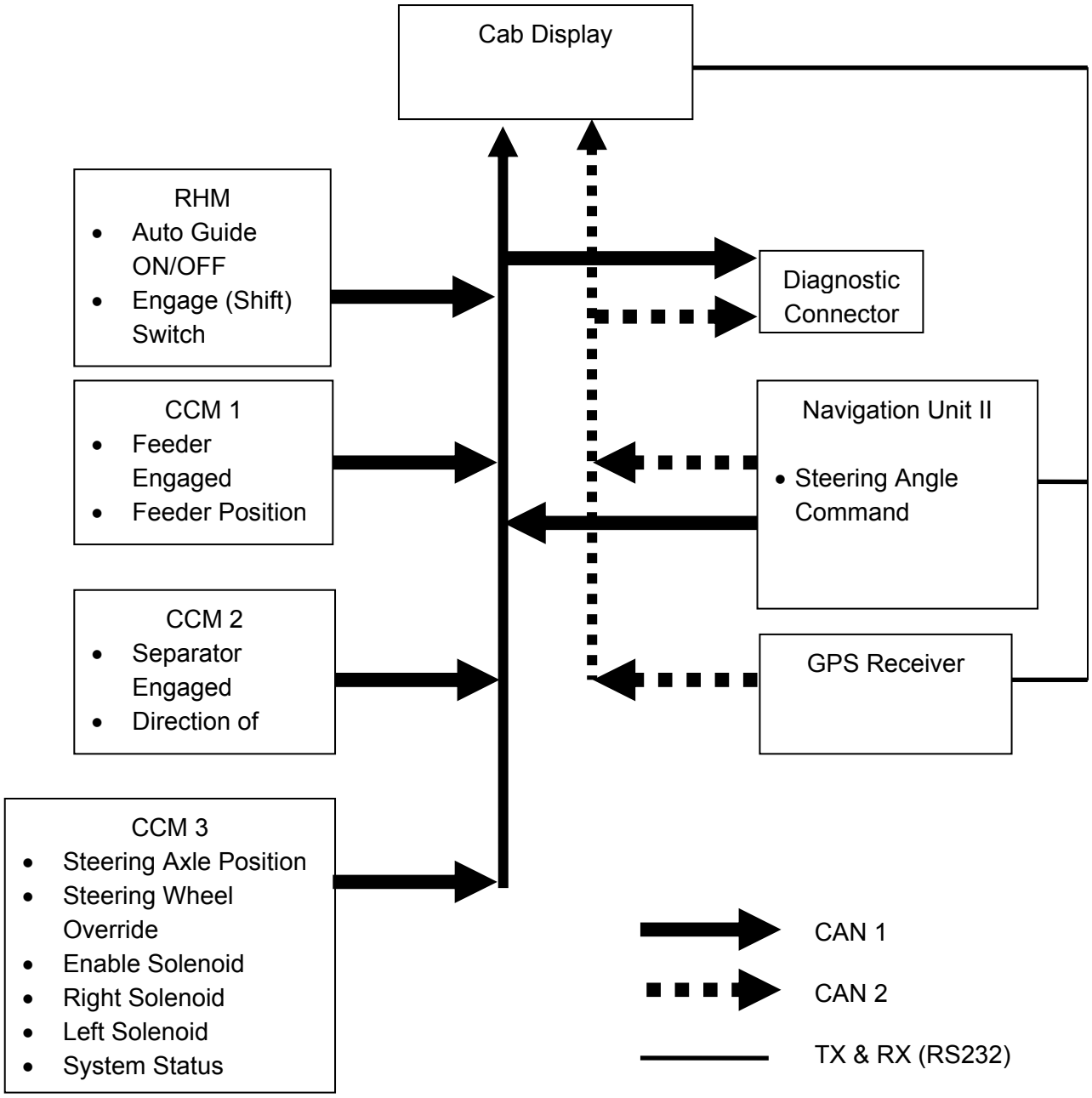
This section is designed to only cover the system components and not the actual operation of setting up the auto guidance system. The system setup is covered in the auto guidance class.



IMPORTANT: This section will only apply to machines that are equipped with the shift button located on the front side of the MFH.

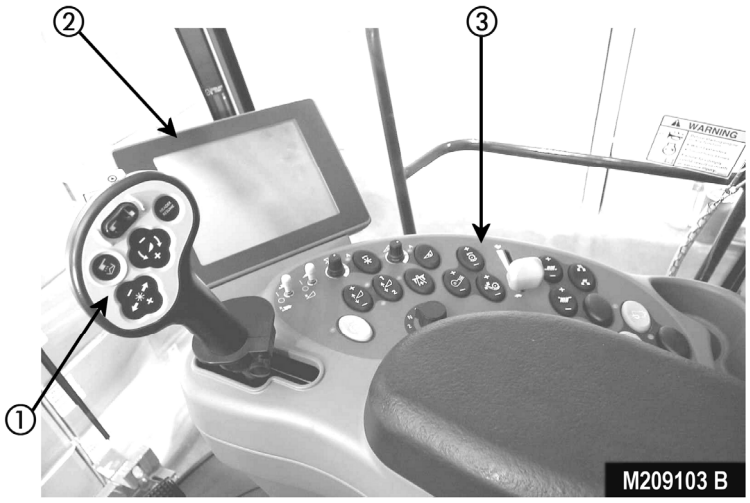
AUTO GUIDE ELECTRONICS

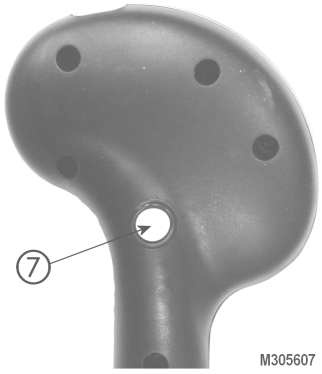
INFORMATION FLOW



AUTO GUIDE ELECTRICAL COMPONENTS

CAB CONTROLS





OPERATOR CONTROL CENTER	
1.	Mulit-Function Handle, MFH
2.	Cab Display
3.	Right Hand Console, RHC

7.	Shift Button - To Activate Auto Guide

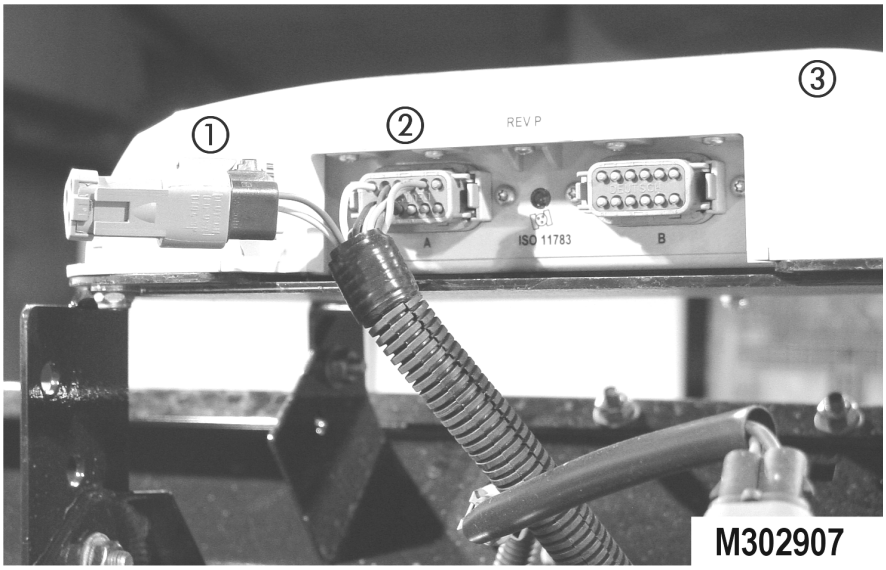


Right Hand Console (RHC)

1.	Separator Engagement
2.	Feeder Engagement
3.	Auto Guide ON/OFF Switch

AUTO GUIDE ELECTRICAL COMPONENTS

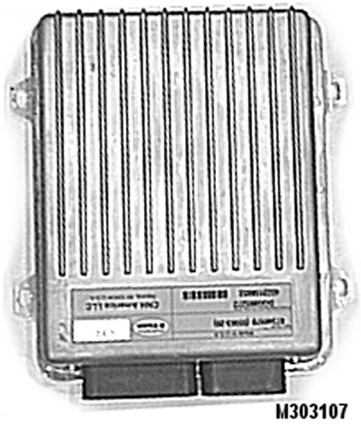
CONTROLLERS



1.	Terminator, CAN-2
2.	Chassis Harness
3.	GPS Receiver

NAVIGATION II CONTROLLER

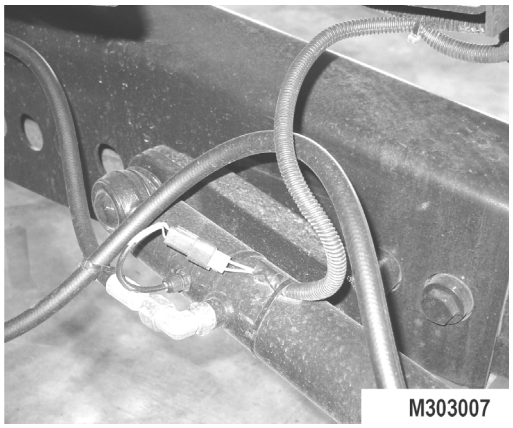
Located under the right hand console



AUTO GUIDE ELECTRICAL COMPONENTS

SENSORS

WHEEL POSITION SENSOR



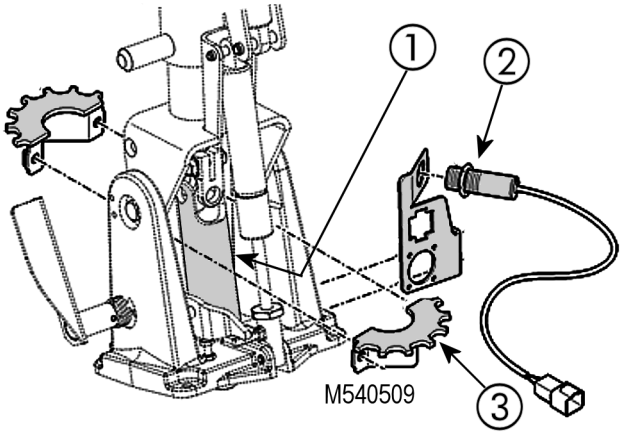
Located in left steering cylinder



1. Sensor fastened into base of cylinder
2. Wiper fastened into ram piston

MANUAL STEERING OVERRIDE SENSOR

1.	Steering Shaft
2.	Motion Sensor
3.	Sensor Target



AUTO GUIDE CIRCUIT OPERATION

REFERENCE MATERIAL:

Electrical schematic frame 23, 32

KEY COMPONENTS:

CCM1 2 & 3, Navigation Unit A-24, Cab Display A-02, GPS Unit A-11, Steering Wheel Position sensor B-69, Rear Axle Angle Sensor B-70, Auto Guide ON Switch S-78, Auto Guide Engage Solenoid L-59, Steer Left/Right Solenoids L57 & 58.

OPERATION:

Auto Guidance is used to maintain the combine's direction of travel without the operator's input.

SYSTEM OFF

The system is automatically switched OFF with each key or by **momentarily** pressing the top portion of the auto guide switch S-78, located on the RHC. The switch is supplied 12V from fuse F-48 once the key switch has been turned to the RUN position. The switch is a momentary, three position switch. By pressing on the top portion of the switch, a momentary 12v signal will be directed out terminal 22 to the RHM connector X029 terminal 14. This will instruct the RHM to place a message on the data bus for the system to shut down. The lower portion of the switch is not used at this time.

SYSTEM ENABLED, BUT NOT "ENGAGED"

The system may be enabled (turned ON) and still not be engaged (operating). To ENABLE the system the operator must:

1. Turn the steering so that the system can recognize the steering position sensor B-69. The system will not ENABLE without verifying the sensor is operational.
2. Press and **hold** for approximately three seconds the top portion of the auto guide switch S-78, directing a 12V signal out terminal 8 to the RHM connector X029 terminal 14. This signal will instruct the RHM to place a message on the data bus for the Pro-600 to display the customers' liability acceptance screen. The operator MUST press the acceptance button.

The system will now be ENABLED.

AUTO GUIDE CIRCUIT OPERATION

SYSTEM ENABLED, AND "ENGAGED"

The operator may request that the system be ENGAGED by pressing a button on the Pro-600 display or by double pressing the shift button (the feeder must be running for the shift button to function). The controllers will monitor the following to determine if the system may be engaged:

- The operator must be in the seat
- The settings and calibration must be completed
- Road mode switch placed in the HARVEST mode
- GPS signal received
- Desired swath selected
- Heading determined
- Ground speed less than 12 mph

RHM

The RHM is monitoring the shift button to determine when press, sending a request signal to activate the auto guidance system. The RHM will place a message on the data bus.

CCM1

The CCM1 will place a message on the data bus as to the feeder engagement and that the feeder is located below the maximum working height. *See section 62 for this circuit*.

CCM2

The CCM2 will place a message on the data bus as to the engagement of the separator and the direction of the combine as determined by the MFH. *See section 66 for the separator circuit*.

CCM3

The CCM3 is going be monitoring several items, placing the information on the data bus for the navigation and cab display controllers to use.

Rear Axle Position Sensor, B-70

The rear axle position sensor is Mounted inside the steering cylinder base (is not serviceable separate) and monitors the ram as it moves. The information is placed on the data bus for the navigation unit.

The sensor's terminal "A" is supplied 12V from the controller connector X013 terminal J2-2 and a return from terminal "B" back to the connector X013 terminal J2-14. The sensor's terminal "C" provides a variable voltage signal to the controller at connector X013 terminal J3-25.

AUTO GUIDE CIRCUIT OPERATION

SYSTEM ENABLED, AND "ENGAGED", CON'T

Steering Wheel Position Sensor, B-69

The steering wheel position sensor is mounted at the base of the steering column and monitors the rotation. This is the operator's means of overriding the system, causing the system to go into stand-by mode. The controller places a message on the data bus.

The sensor's terminal 2 is supplied 8V from the controller connector X013 terminal J2-36 and a return from terminal 1 back to the connector X013 terminal J2-14. The sensor bleeds off the voltage from the controller to the return; this will cause a variable voltage signal at the controller's terminal J-36.

The Cab Display, Navigation unit and DGPS all communicate with each other and when required will place a message on the data bus for CCM3 to activate the solenoids.

CCM3

"ENGAGE"

The CCM3 will activate the steering enable solenoid L-59. This will take the system from the stand-by mode to the active mode.

The CCM3 will direct a PWM power from connector X014 terminal J3-5 to the steering enable solenoid terminal 2, the solenoid is provided a chassis ground.

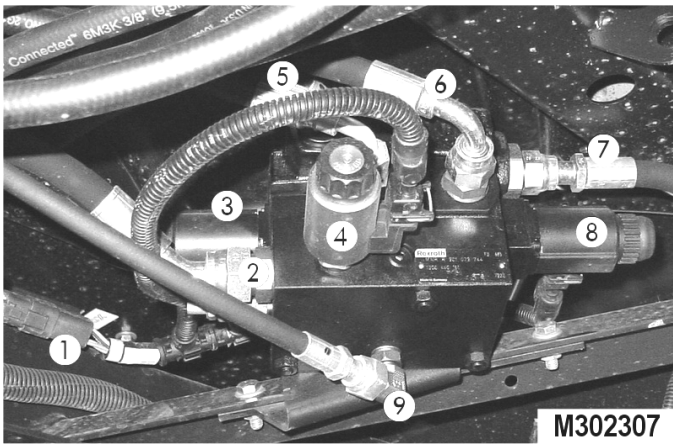
Steering Correction

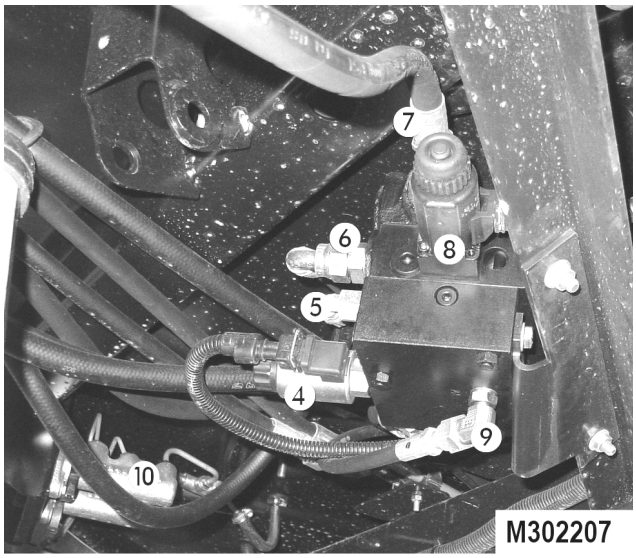
When a steering correction is require, the navigation unit will place a signal on the data bus for the CCM3 to activate either the LH/RH solenoids L-57 or L-58.

The CCM3 will direct a PWM power from connector X014 terminal J3-2 or 1 to the steering solenoids terminal 1, the solenoid return is directed back to the CCM3 at connector X013 terminal J2-20.

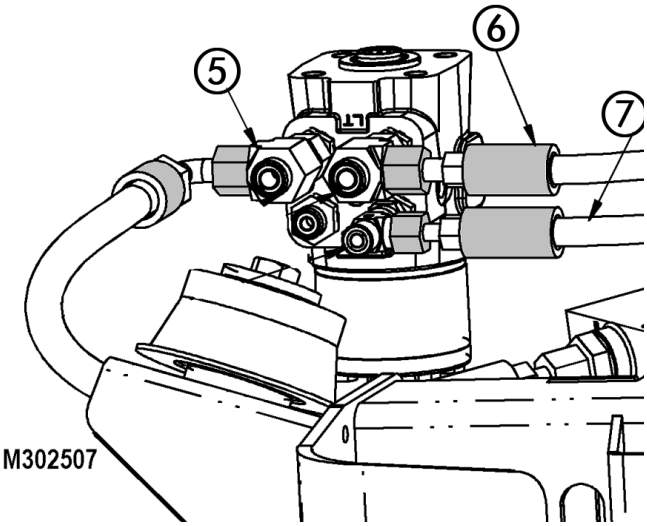
HYDRAULIC CONTROLS

CONTROL VALVE

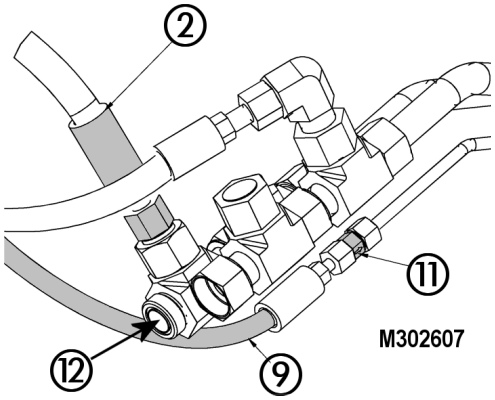




STEERING HAND PUMP



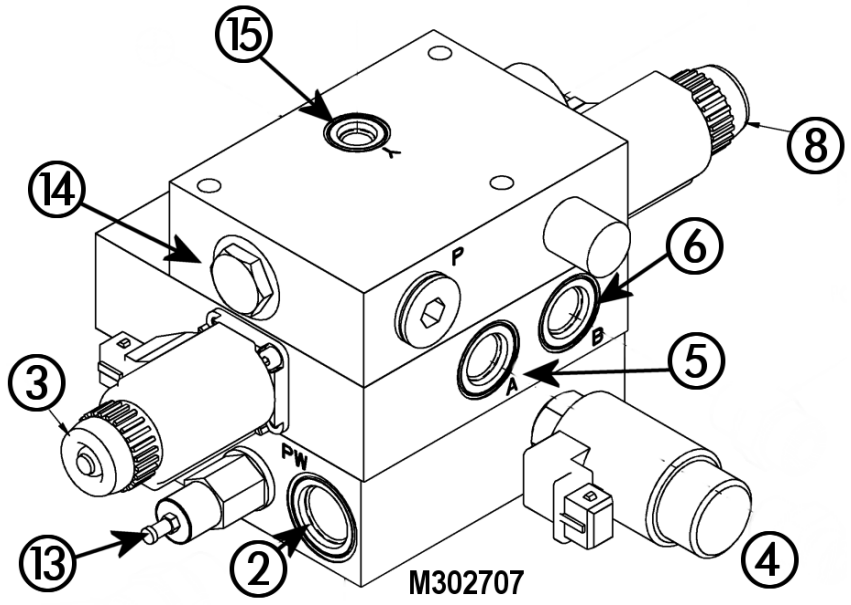
Distribution Tees,
Lower left rear corner of cab



1.	Solenoid Connection	7.	To Tank (hand pump)
2.	Auto Guide Valve Supply, port “Pw” (teed to feeder stack supply)	8.	Left Steer Solenoid, L-57
3.	Right Steer Solenoid, L-58	9.	Signal Line From Feeder Stack, port “Yw”
4.	Auto Guide Enable Solenoid, L-59	10.	Service Brake Valve
5.	Right Hand Steer (hand pump)	11.	Signal Check
6.	Left Hand Steer (hand pump)	12.	Supply To Feeder Stack

HYDRAULIC CONTROLS

CONTROL VALVE

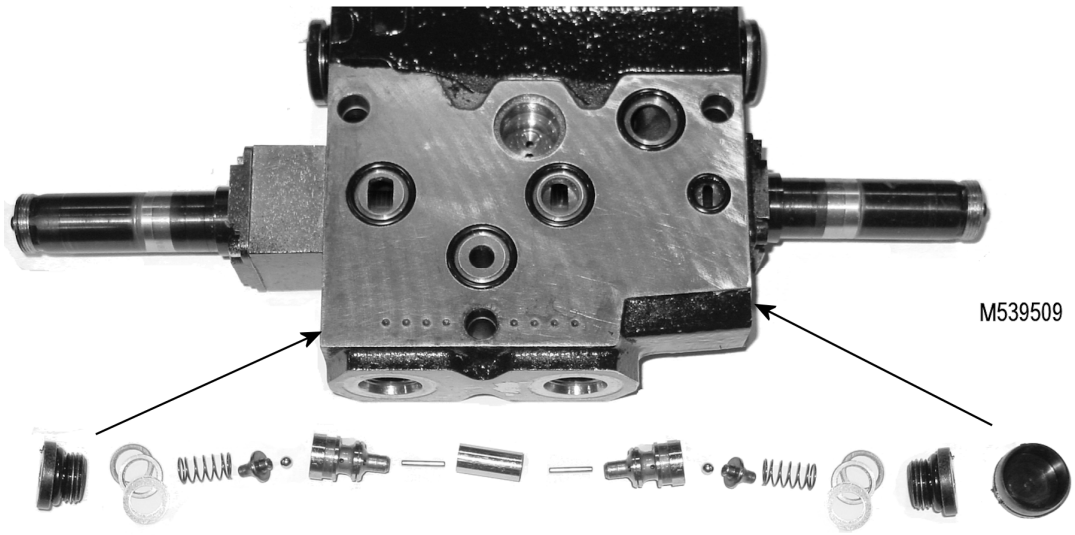


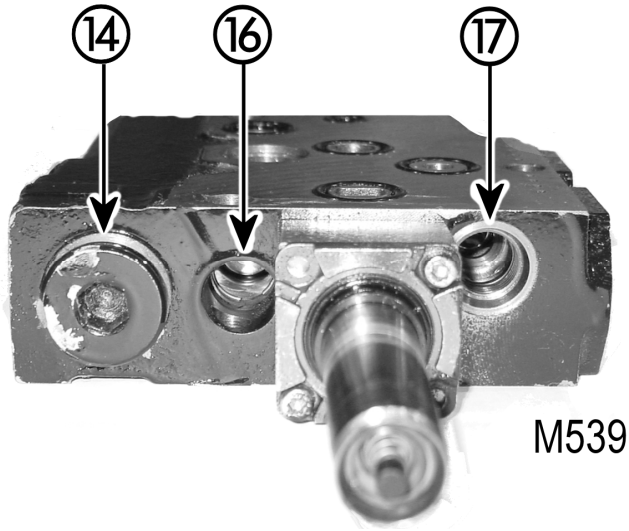
1.	Solenoid Connection	6.	Left Hand Steer (teed at hand pump)
2.	Valve Supply (teed into PFC supply to feeder stack)	8.	Steer Left - Port “B” Solenoid, L-57
3.	Steer Right - Port “A” Solenoid, L-58	13.	Pressure Reducing Valve
4.	Auto Guide “ENABLE” Solenoid, L-59	14.	Pressure Compensating Cartridge
5.	Right Hand Steer (teed at hand pump)	15.	Signal Line to PFC Pump - port “Y”

HYDRAULIC CONTROLS

CONTROL VALVE

Load Checks (17)

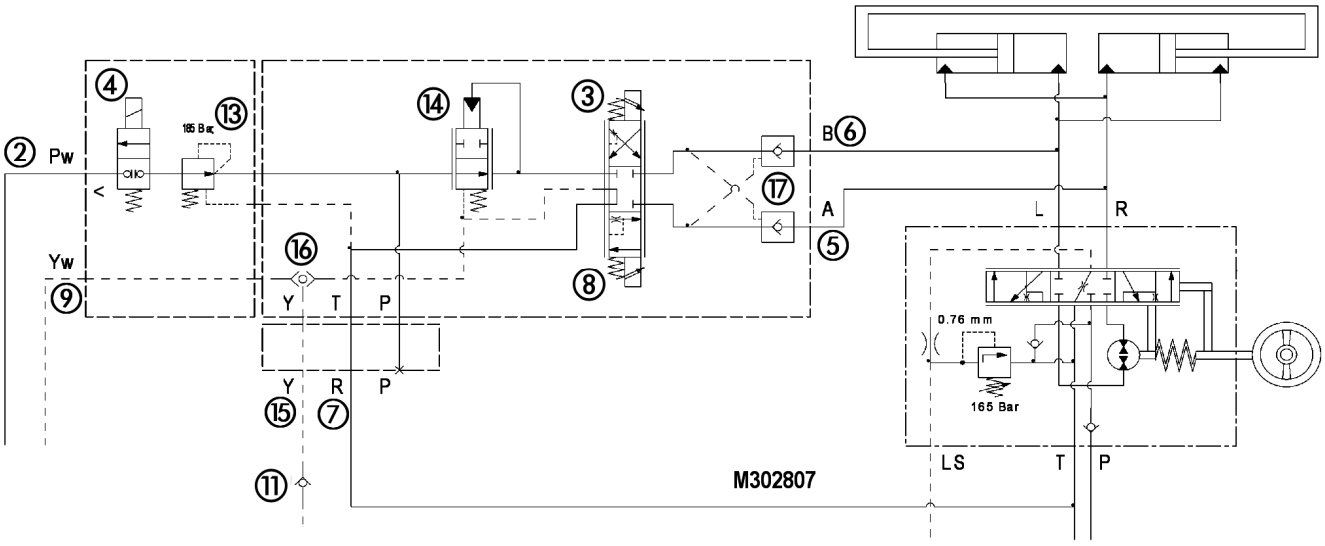




14.	Compensator Spool
16.	Shuttle Signal Check
17.	Load Checks

HYDRAULIC CONTROLS

SCHEMATIC



2.	Valve Supply (teed into PFC supply to feeder stack)	9.	Signal Line From Feeder Stack
3.	Steer Right - Port “A” Solenoid, L-58	11.	Signal Check
4.	Auto Guide “ENABLE” Solenoid, L-59	13.	Pressure Reducing Valve
5.	Right Hand Steer (teed at hand pump)	14.	Pressure Compensating Cartridge
6.	Left Hand Steer (teed at hand pump)	15.	Signal Line to PFC Pump - port “Y”
7.	To Tank (teed at hand pump)	16.	Shuttle Signal Check
8.	Steer Left - Port “B” Solenoid, L-57	17.	Load Checks

HYDRAULIC CONTROLS

AUTO GUIDE VALVE OPERATION

Auto Guide NOT "ENGAGED"

When the auto guide solenoid (4) is NOT activated, the PFC pump supply (2) to the auto guide valve is blocked. The valve is isolated from the supply circuit.

The auto guide valve is isolated from the normal hand pump operation by two load checks (17).

If a signal is generated in the feeder valve stack (9), the shuttle ball (16) will be forced to the right, directing the signal out port 15 to the PFC compensator.

Auto Guide "ENAGED", NEUTRAL (no steering required)

With the auto guide solenoid (4) activated, PFC pump supply (2) is directed to the circuits pressure reducing valve (13) and on to the compensator spool (14) and directional control valve (3 & 8). The total flow will be blocked by the direction control valve.

The reducing valve (13) and compensator (14) valves both monitor the circuit pressure after the valve through a pilot port to the non-spring end of the valve. Even with the circuit in NEUTRAL, the valves may shuttle against the spring any time that the PFC supply exceeds the reducing valve setting of 185 bar (2680 PSI) and/or the compensator setting.

Auto Guide Engaged, "LEFT Steer"

When the navigation unit has decided that a steering correction is required, the correct solenoid on the direction control valve will be activated.

When the LEFT solenoid (8) is activated, the direction control valve will be forced UP. This will direct the PFC pump flow out port "B", this will force the "B" port load check off its set and through a pilot line the "A" port load check will also be forced open. The steering hand pump will isolated itself from the operation.

The directional control spool will also direct the steering pressure to the signal circuit. This signal will be used to control the:

- position of the compensator valve (14). The compensator will monitor the pressure drop across the directional control valve and regulated the flow to the directional control valve to maintain a constant steering rate.
- PFC pump by providing a signal out port "Y" to the pump's compensator. The signal will force the shuttle check valve (16) to the left, this will prevent the signal from flow back to the feeder stack valve (9) if a lower pressure operation was being performed at the same time.

HYDRAULIC CONTROLS

AUTO GUIDE VALVE OPERATION

Auto Guide Engaged, "LEFT Steer", con't

If the circuit pressure should increase above the relief valve setting, the relief will be forced to shuttle DOWN to block the flow of fluid into the circuit. Due to the lack of flow the signal being directed to the PFC pump will also be limited. This limitation is required to permit the steering priority valve to perform correctly.

CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 - 9120 SERIES AXIAL-FLOW COMBINE



SECTION 55 ELECTRICAL CIRCUITS

Form 5175 1/2010

CNH America LLC
700 STATE STREET
RACINE, WI 53404 U.S.A.

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INTRODUCTION

PURPOSE OF THE TRAINING MANUAL

This manual is your guide to the 7120-9120 series Combine Service Training Program.

You will also be able to use it when you are working on these combines in the workshop or in the field.

In writing this manual, we have assumed that you are familiar with the normal methods of servicing agricultural equipment and that detailed explanations in the use of tools and test equipment are not necessary. In the event of any difficulties, you should refer to the Service Manual and to your Service Manager.

USE OF THIS MANUAL

The information contained in this manual is supplementary to material to be found in other sources, it is not a replacement for them. You should always consult Service Manuals, Service Bulletins, Operator's Manuals and Parts Books when necessary.

This manual and the training program that it supports are both designed to help you know when and why you need to make repairs. It will also draw your attention to particular problems that you might encounter and the any special procedures that you must follow.

There is plenty of space in this manual for you to add your own notes and observations.

Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

POWER DISTRIBUTION

The Axial Flow combine uses a large number of electrical circuits and therefore requires a large power distribution network. The system is composed of batteries, fuses, relays and associated circuit components.

Power is supplied from two 12 V batteries, mounted on the left-hand side of the machine below the engine, that supply the circuits. The combine will operate at two different voltage levels, NORMAL operation is at 12V and CRANKING is at 24V. Due to the different voltage levels there will be different testing procedures required for the cranking and charging circuit.

POWER FLOW

REFERENCE INFORMATION:

Schematic Frame: #1, #29

Key Switch OFF Position

The B+ post of the front battery is connected to terminal 30 of the 12/24 volt swap relay and internally out terminal 51 to the main distribution panel in the left rear corner of the cab. The main distribution panel will provide 12 V to the following items at all times: fuses 1, 2, 3, 4, 5, 15, 16,17,18,19, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 38, 39, 40, 41, 42, 50, 51, 52, 53, 54, 55 and 56.

Frame 29

B+ power is directed through F-38 to the key switch terminal 1

B+ power is directed through F-39 to the controllers, CCM1, CCM2, CCM3, RHM, Display and diagnostic connector.

Frame 2

B+ power is also directed through F-01 to the ECU. This provides the controllers a power supply, plus the power required for proper shut down.

Also from the 12/24 volt swap relay, terminal 30 is connected to the Alternator terminal B+ and the engine Grid heater.

POWER DISTRIBUTION

Key Switch RUN Position

When the key switch is placed into the RUN position the switch directs power out terminals 4, 5, and 6.

Terminal 4, direct power to activate the:
Wiper relay K-06 at terminal 1
Accessory 1 relay K-08 at terminal 1
Accessory 2 relay K-03 at terminal 1

Terminal 5, directs power to the ECU terminal 40.

Terminal 6, directs power to the:
CCM1, CCM2 and CCM3 at terminals J1-4
Turn Signal switch terminal 6
Relay K-24, K-25, K-26 terminal 1
Time delay module K-20 terminal 30
Road light Switch S-26 terminal 6

POWER DISTRIBUTION

Key Switch START Position

When the key switch is placed into the START position the switch directs power out terminals 2, 5, and 6.

Terminal 2, directs power to the Neutral Start relay K-23 terminal 3 and the CCM2 terminal J1-21.

Terminal 5 and 6, See Key Switch ON position.

Additional Power Circuits

With the key switch in the ON or START position the CCM1 is powered up and provides a ground for the following relays at connector X018 terminal J1-23:

K-03 This relay provides for K-03 power to F-11, F-12, F-13 and F-14
K-24 This relay provides for K-24 power to fuses F-43, 44, 45.
K-25 This relay provides additional power to CCM2 through fuse F-36, F-37 and F-46.
K-26 This relay provides for K-26 power F-47, 48, 49

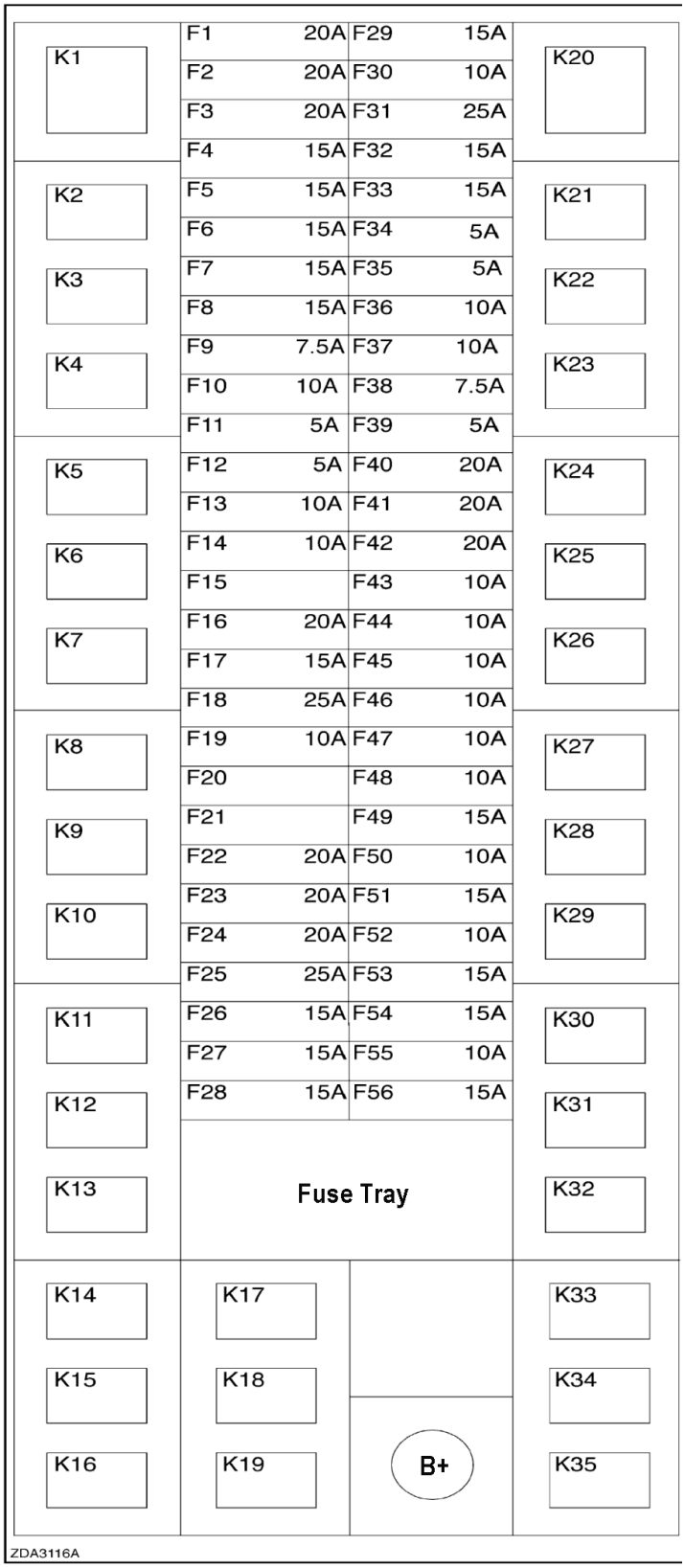
REFERENCE MATERIAL

For complete fuse and relay usage refer to the “Electrical Schematic Index” section.

REMEMBER: For complete engine starting operations refer to the engine section 11 or 12.

POWER DISTRIBUTION

FUSE "F" AND RELAY "K" PANEL



POWER DISTRIBUTION

Fuse “F” Panel

Fuse No.	Amperage	Function
F1	20A	ECU power (Electronic engines only)
F2	20A	Accessory 2 Relay K-03
F3	20A	Accessory 1 Relay K-08
F4	15A	Wiper Relay K-06 (Wiper)
F5	15A	Cigar Lighter
F6	15A	Left-hand outer road/work lights
F7	15A	Right-hand outer road/work lights
F8	15A	Accessory Outlets
F9	10A	Washer/Mirror
F10	10A	Relay K-03 Heated Seat Circuit
F11	5A	Radio
F12	5A	Not Used
F13	10A	Aux. Radio power (Transceiver)
F14	10A	Service Light Switch
F15	15A	Service sockets
F16	20A	Seat pump
F17	15A	Separator blower relay K-09
F18	25A	Main blower relays K-13
F19	10A	A/C clutch relay K-10
F20	7.5A	Left-hand marker/tail lights
F21	7.5A	Right-hand marker/tail lights
F22	20A	Shoe leveling actuator (CCM1 J3-29 & J3-30)
F23	20A	CCM2 Power (J2-11 & J3-7) (Rotary Air Screen Brush)
F24	20A	Concave/grain tank covers (CCM1 J2-11)
F25	25A	Transmission gearshift motor (CCM2 J3-29 & J3-30)
F26	15A	Cranking relay K-15 & CCM3 power (J3-29 & J3-30)
F27	15A	Sieves (CCM3 J2-11 & J3-7) (Sieves, Spreader)
F28	15A	Fuel pump relay K-07
F29	15A	Inner Road/work lights K-21
F30	20A	Header Work light Relay K-22
F31	25A	Cab Roof Light Relay K-01, Outer Road/work lights
F32	15A	High beam (Europe only) K-04
F33	15A	Low beam (Europe only) K-05
F34	20A	Under shield lights Engine and Left side
F35	5A	Radio memory

POWER DISTRIBUTION

Fuse “F” Panel

Fuse No.	Amperage	Function
F36	10A	Combine Control Module 2A J2-2, J3-11
F37	10A	Combine Control Module 2B J2-9
F38	7.5A	Key switch
F39	7.5A	Memory power, CCMs, RHM, Display, Diagnostic Connector
F40	20A	Relay K-24
F41	20A	Relay K-25, CCM2 (J2-2, J2-9 & J3-11) F-36, 37 & 46
F42	25A	Relay K-26
F43	10A	CCM1 (J2-2 & J2-9)
F44	10A	CCM1 (J3-11)
F45	10A	WIF Sensor, GPS, - Rotor, fan, feeder, spreader speed sensors
F46	10A	Display, GPS & Navigation Modules
F47	10A	CCM3 J2-9, J2-2 & J3-11, Moisture Sensor, Sample Motor, Flow Sensor, Rear Axle Angle Sensor
F48	10A	Right-hand console 4 & 5, Front & Rear Switch Panel, MFH, Feeder & Separator Engage, Relay K-28,
F49	10A	Seat, Tank Covers, Crop Edge Guide, Road Light Switch, Beacon Light Switch, Light Switches, HVAC Controller
F50	10A	Side Work Light Relays K-34 & 35, Unload Tube lights Relay K-32,
F51	10A	Horn/Marker lights
F52	10A	Dome lights, Time Delay Module K-20, Brake light relay K-33
F53	15A	Beacon light relay K-29
F54	15A	Lower work light Relay K-30
F55	10A	Rear work light Relay K-31
F56	15A	Hazard lights, Flasher unit
F66	10A	Mirror switch bypass (German)

POWER DISTRIBUTION

RELAY PANEL

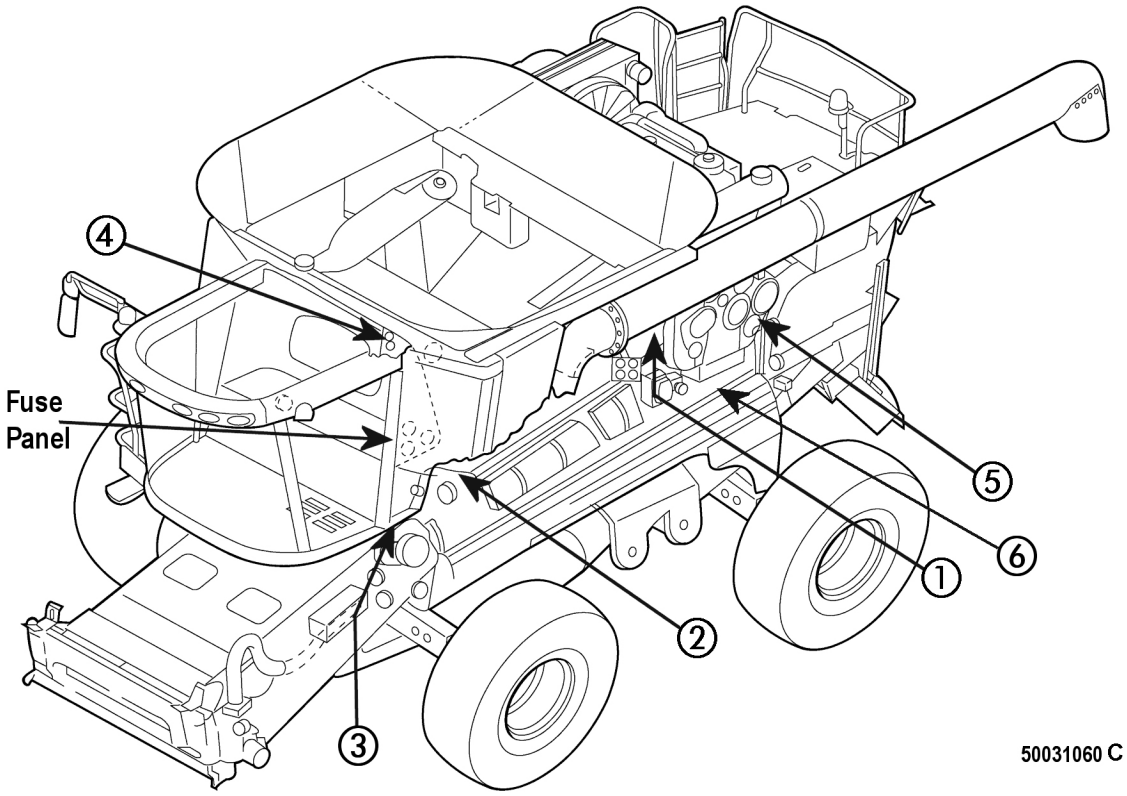
Relay No.	Function
K1	Outer road/work lights
K2	Light Control relay
K3	Accessory 2
K4	High beam (Europe only)
K5	Low beam (Europe only)
K6	Wiper motor
K7	Fuel pump
K8	Accessory 1
K9	Separator Blower
K10	A/C Clutch
K11	NOT USED
K12	NOT USED
K13	A/C Main blower Supply
K14	Not Used
K15	Starting it is used for engine cranking
K16	Concave/covers
K17	Not used
K18	Upper/Lower sieve
K19	Feeder Disengage
K20	Time delay (Exit lighting)
K21	Work lights/Inner road light
K22	Header work lights
K23	Neutral start
K24	K-24 Acc Power
K25	CCM2
K26	K-26 Acc Power
K27	Inner work lights
K28	Not used
K29	Beacon lights
K30	Lower work lights
K31	Rear work lights
K32	Unload tube light
K33	Brake lights
K34	Side exit lights
K35	Side work lights

POWER DISTRIBUTION

RELAY "K" PANEL, CON'T

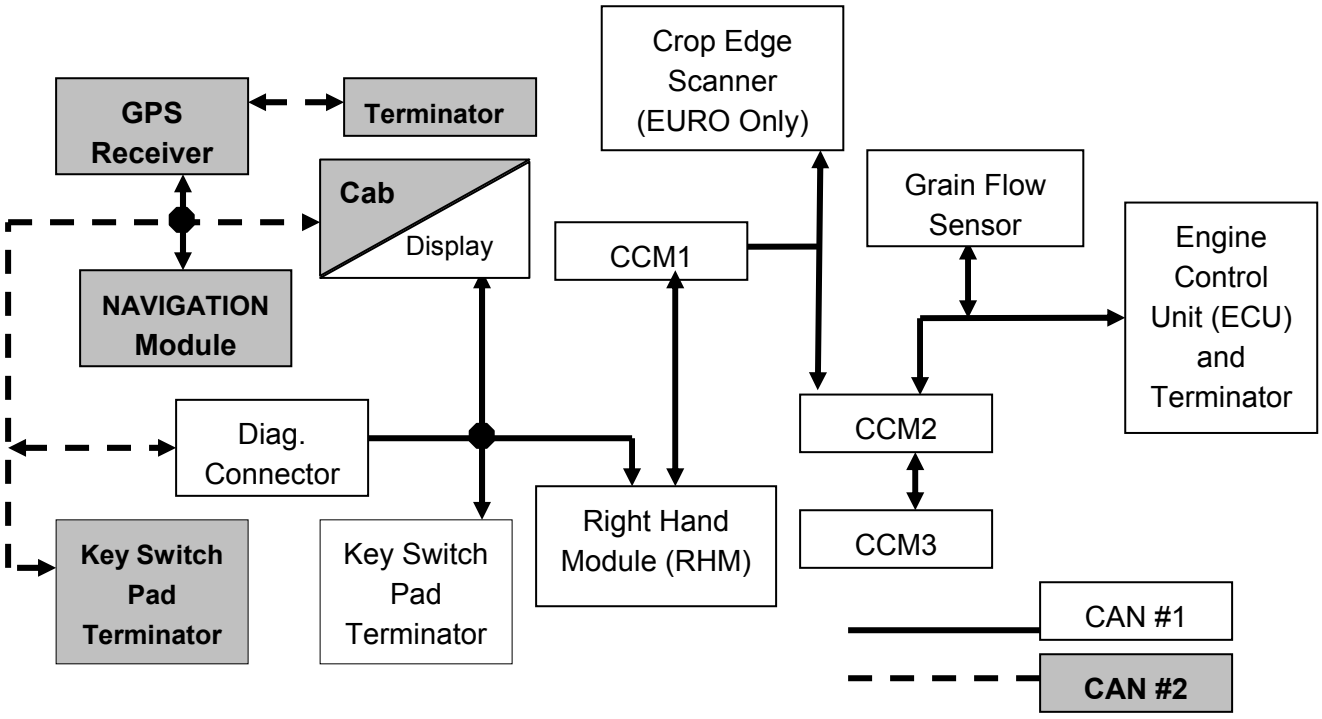
Relays below are not in panel	
K38	24 Volt start relay; above and behind the rear battery
K39	Grid Heater; in the engine intake manifold
K40	Flip up low beam (Europe only)
K41	Flip up high beam (Europe only)
K42	RH Vertical Knife Relay (OPT Europe)
K43	LH Vertical Knife Relay (OPT Europe)

SYSTEM GROUNDS



1.	Rear frame ground stud, below the base of the unloading cylinder anchor just above the four connector bulk head.
2.	Front frame and feeder ground stud; behind and below the cab air filter
3.	Cab ground, floor to left rear cab mount ground
4.	Upper cab ground; behind the left rear radio speaker
5.	Rear battery ground; attached to the main frame behind and above the 12/24V relay.
6.	Clean ground; attached to the rear battery ground clamp
Fuse Panel	Electrical distribution panel ground; base of the fuse panel

CONTROL COMMUNICATIONS



CAN NETWORK, (DATA BUS)

The CAN network is a multiplex system which follows the guidelines established in SAE J1939. Multiplexing, simply stated, is linking two or more digital devices through a network. In the past, if a RPM sensor' information was needed by a tachometer, an engine controller and a transmission, all three devices would need to be hard wired to the RPM sensor. Through the CAN Data Bus only one wire is needed. The information is then accessed through the network by other systems that need it. Any other system on the network that does not care about RPM data ignores the message on the network. On today's high tech machinery, the complexity of wiring can be greatly reduced through the use of the CAN data bus network.

The network is made up of a twisted pair of wires, identified as CAN HI (yellow) and CAN LO (green). These two wires are used to form a "linear bus" network, in that the wires run in parallel from one end of the vehicle to the other, and each module is connected to both wires as a "node"; (referred to as being teed in). These two wires are connected together at each end of the network using a 120 ohm resistor, which is known as a "termination" resistor. Because there is a 120 ohm resistor at each end of the network, the resistance should always be 60 ohms between the CAN HI and CAN LO wires.

CONTROL COMMUNICATIONS

CAN NETWORK, (DATA BUS), CON'T

Each control module is teed into the network, and acts as a separate node on the network. As a control module receives data from sensors, switches and potentiometers, it broadcasts this information on the network for other modules to pick up and use as needed. Each module knows which information it needs through the software programmed into it.

When the network is initially powered up (operator turns key on), each module on the network sends out a message announcing its existence, and looks for messages from other modules on the network. After this initial message, each control module sends out data messages as necessary, and, if necessary, it will send out another broadcast message announcing its existence if it has not sent any messages within the last 5 seconds. This is done in order to monitor each module's status on the network; if a certain module has not transmitted any messages for more than 5 seconds, then the other modules on the network will generate an alarm message indicating that the module is OFFLINE.

Optional control modules, such as the GPS (GPS receiver) and NAVIGATION, must be set to "ON" in the Configuration screens when installed in order for their alarm messages to become active. In addition, like the other modules, they must be powered up at start-up and transmit a message in order to be recognized as being on the network.

Monitor status and software version information may be found by navigating MAIN>DIAGNOSTIC>CAN. The types of status are as follows:

Status	Meaning
Online	Controller is functioning normally.
Offline	Controller was detected, but is no longer communicating.
Not Detected	Controller is not detected on the CAN bus.
Degraded	Controller is operating in a degraded state
Disabled	Controller has disabled itself and is reporting its disabled condition.

.

CONTROLLER SHUT DOWN

When the key switch in placed in the **OFF** position each controller must shut down properly. While operating, all the changes and data is held in a volatile memory for quick access, during shut down it must copy the current operating information to non-volatile memory so that it will not be lost. During this time, the three CCM's and RHM share data files; this means that all four units have the same data files.

CONTROL COMMUNICATIONS

CAN NETWORK, (DATA BUS), CON'T

CONTROLLER START UP

When the key switch in placed in the ON position each controller must start up properly. When starting up, the data is copied to the volatile memory for fast access. During this time, the three CCM's and RHM share data files; this means that all four units compare their data files. This is called voting.

> **Example**: When shutting down all four modules will have the data information from the CCM1. During shut down lets say that CCM3 made a mistake and wrote down the wrong information. During start up CCM1, CCM2 and the RHM have the same information and agree, CCM3 being different is forced to rewrite its memory. This would create a VOTING message.

REPLACING CCM'S OR RHM

If replacing a CCM or RHM, the proper software will have to be loaded and perform at least one (two would be good) key cycle so that the CCM can record the data from the other modules. **NEVER** replace or reload more then one module at a time with out performing a key cycle.

CONTROL COMMUNICATIONS

CAN NETWORK, (DATA BUS), CON'T

MULTIPLE CAN NETWORKS

As machine and customer requirements increase, the amount of data that is required to be handled by the data bus also increases. When the data bus becomes overloaded, systems communications begin to slow down. The machine will be equipped with two CAN networks CAN1 and CAN2; only one of them may be operational, the other optional.

CAN 1 will handle all the operations that we associate with machine operation, this would be the same as what we have seen on the previous 8010's.

Controllers used: Display, RHM, CCM1, CCM2, CCM3, Grain Flow Sensor and ECU. Options would be the NAVIGATION module and Edge Scanner in EURO.

CAN 2 will handle all the Auto Guide and GPS operations, working through the display unit to provide machine directional control.

Controllers used: Display, GPS and NAVIGATION

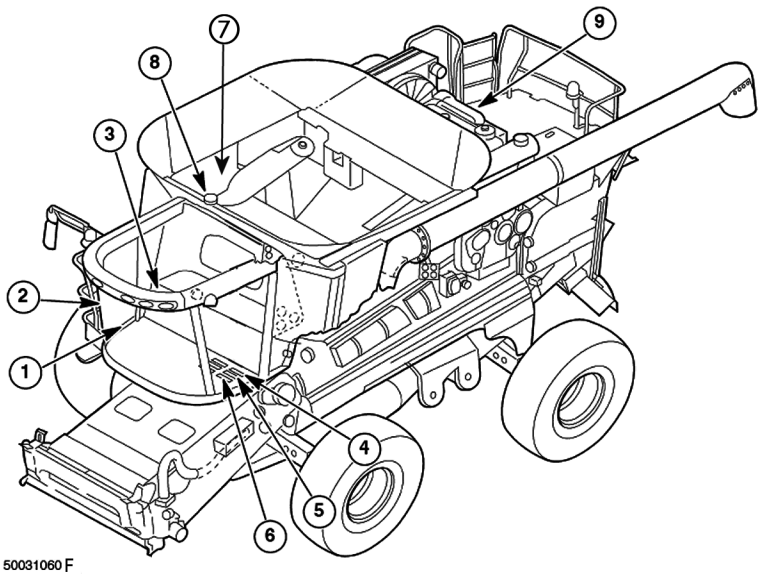
The display and NAVIGATION modules are connected to, and work with both CANs. They will both be in the diagnostic connector, but at different terminal locations.

- Can 1 will use terminals C & D
- Can 2 will use terminals J & H

CONTROL COMMUNICATIONS

CONTROL MODULE LOCATION

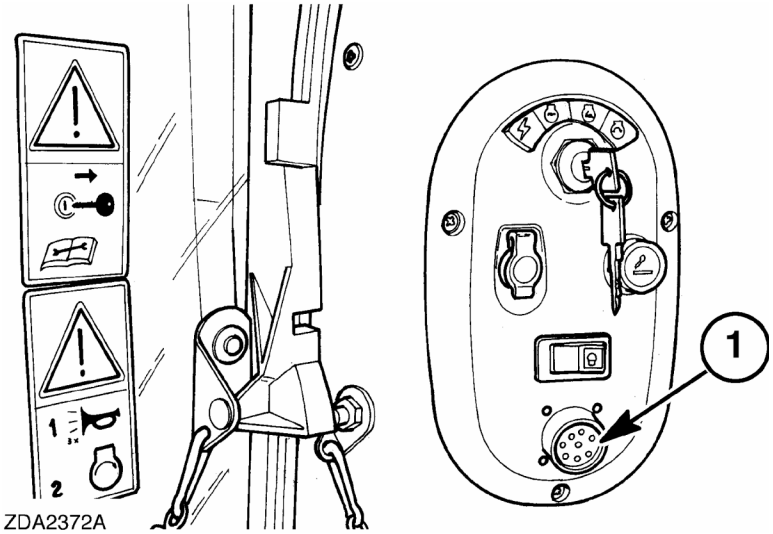
The 7120-9120 combine is equipped with a minimum of 7 electronic modules, and may be equipped with as many as 9 modules, depending on the configuration and options installed. These modules are:



1. Navigation Module, 1 (optional), installed to be a communication link between the auto guide control and the display unit.
2. AFS200 or AFS PRO 600 Display Module, 2; provides the main display of information for the operator.
3. Right Hand Module (RHM), 3; most operator inputs, including from the propulsion handle (MFH), are fed into this module, which then reports this information to the other modules in the network for action.
4. Chassis Control Modules CCM1, this controller mainly manages feeder engagement, header height control, cleaning system self-leveling and concave adjustment. Under instructor's seat Rear position.
5. Chassis Control Modules CCM2, this controller mainly manages threshing engagement, ground drive, unloading tube and engine monitoring. Under instructor's seat Middle position.
6. Chassis Control Modules CCM3, this controller mainly manages rotor drive engagement, remote sieves adjustment, and some precision farming operations. Under instructor's seat Front position.
7. Grain Flow Sensor, 7, [optional] is installed to monitor the grain flow through the clean grain elevator.
8. Differential GPS module, 8, [optional] is available with some precision farming systems, and provides location data to be recorded with the harvest data for mapping purposes.
9. Engine Control Unit (ECU), 9, is installed to provide enhanced engine control and performance.

CONTROL COMMUNICATIONS

DIAGNOSTIC CONNECTOR



A Diagnostic and Maintenance connector, (1) allows the Electronic Service Tool (EST) to be connected to the network, in order to load new operation software into the modules, and to provide more detailed testing and diagnostic abilities.

This is a nine pin connector that provides:

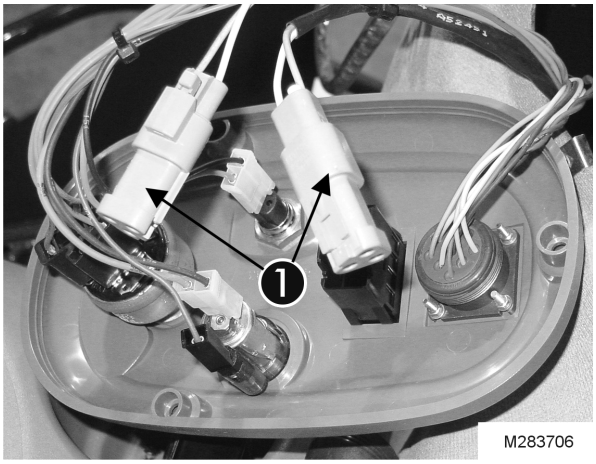
- Power and Ground for the Protocol Adapter Box, pins A & B
- Engine Communications, E (K- line)
- CAN1, C & D
- CAN2, H & J
- Serial Communication (not currently used), F & G (for optional printer)

CONTROL COMMUNICATIONS

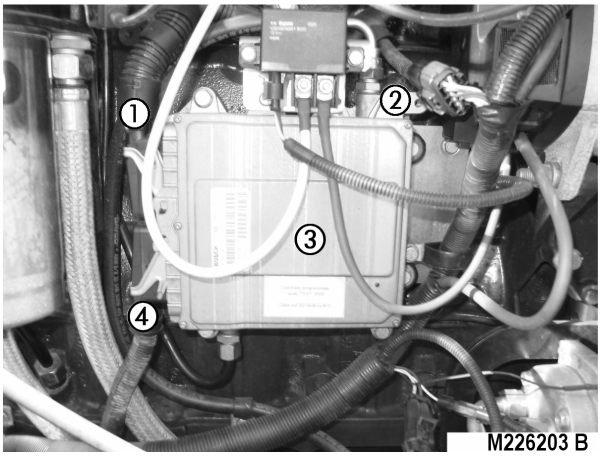
TERMINATORS

There are two terminators installed on all machines for the CAN1 system, one of these is located in the ECU (3) and one behind the key switch pad (1). If the machine is equipped with GPS and/or Auto Guide there will be two additional terminators for the CAN2 system, one of these is located behind the key switch pad (1) and the other is at the GPS receiver (2).

CAN1

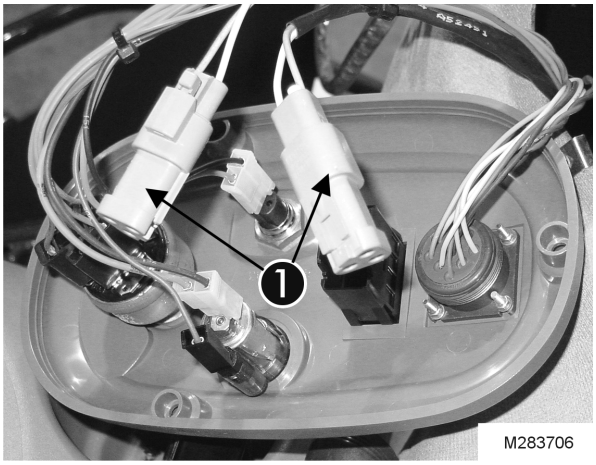


Key Switch Pad Terminator

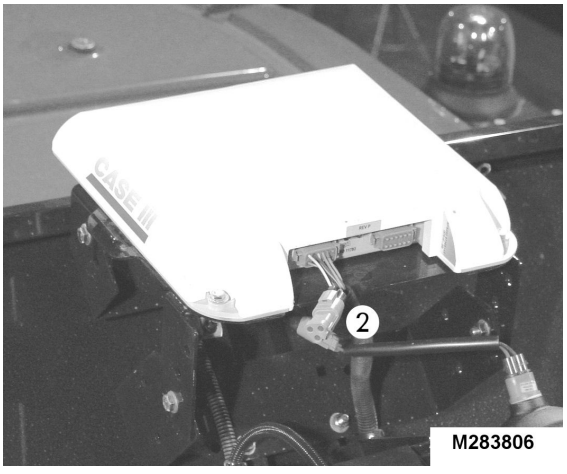


ECU with enclosed Terminator

CAN2



Key Switch Pad Terminator



GPS Terminator

TROUBLE SHOOTING COMMUNICATIONS

There are two main reasons for a loss of communications between controllers:

- The controller is NOT powered up
- Faulty data bus harness

CONTROLLER NOT POWER UP

All controller are supplied with at least two power supplies, one is used for the “Keep Alive Memory” (KAM) for proper shut down and one for powering up the controller. These power supplies may or may not be used to power functions that the controller may be monitoring or controlling. See table below.

GRAIN FLOW SENSOR, B-57

POWER	GROUND	COMMENTS
X223 pin 1 F47	X223 pin 3	Front Frame ground “2”

GPS, A-11

Power	Ground	Comments
X321 pin 10 F45	X321 pin 11 wire 1239 black/white	Power from fuse Ground to battery clean ground

RHM

POWER	GROUND	COMMENTS
X026 pin 13 F39 Main power X026 pins 4 & 5 F48	 X026 pins 15 & 20 X027 pin 4 & 5	B+ power Main power from fuse F42 through Cab power relay K26 to fuse F48 Ground path though connector X001 pin 12 Refer to schematic frames 25, 28 & 29

TROUBLE SHOOTING COMMUNICATIONS

DISPLAY UNIT

Power Supply	Ground	Components Affected
X502 pin 13 (F39)		B+ Power
X502 pin 15 (F46)		Main power
	X502 pin 14	Main Ground

MFH

POWER	GROUND	COMMENTS
X059 Pin 1 F48	X059 pin 2	

GOV (ECU)

POWER	GROUND	COMMENTS
X193 pin 2, 3, 8, 9 (F-01) X193 pin 40 (F-38)	X193 pins 5, 6, 10 & 11	B+ Main power from fuse F01 through ECU Power relay K14 Refer to schematic frame 2 & 29

Note: KAM* = Keep Alive Memory; key-off power.

TROUBLE SHOOTING COMMUNICATIONS

CCM1

A quick way to check to see if the controller is receiving power and is powering up is to check one of the lighting relays K01, K-20, K-21, K-22, K-27, K-30 or K-31 terminal 1 to see if there is 12V when the appropriate light switch is pressed as listed below.

Power Supply	Ground	Components Affected
X018 pin J1-1 (F39)		B+ Power
X018 pin J1-4 (F38, key switch)		Main power; all potentiometers, speed position sensors K-32 Unload Tube Light Relay K-01 & K21, Cab Roof & Distance Work Lights Relay K-27, K-22 & K-30, Header, Lower Work and Road Lights Relays K-31 Rear Work Light Relay
	X018 pins J1-8 & J1-23, X019 pins J2-12 & J2-18	Main module grounds
X020 pins J3-29 & J3-30 (F22)	X020 pins J3-9 & J3-10	Shoe Leveling Actuator M-03
X020 pin J3-7 (F24)	X020 pin J3-16	None
X019 pin J2-11 (F24)	X019 pin J2-3	Concave Clearance Actuator M-04 Grain Bin Covers Actuator M-12
X019 pin J2-2 (F43)		Chaff Spreader valve L-28 Head Raise L-11 Head Lower L-12 Cleaning Fan Valve L-44
X019 pin J2-9 (F43)		Backup Alarm H-08 Brake Limiting Valve L-32 Rear Wheel Assist Valve L-26
X020 pin J3-11 (F44)		Head Tilt CW L-18 Head Tilt CCW L-19 2 Speed Powered Rear Axle L-54/L-55 Header Height accumulator L-06 Feeder Ring to Frame Brake L-50

TROUBLE SHOOTING COMMUNICATIONS

CCM2

A quick way to check to see if the controller is receiving power and is powering up is to check the beacon light relay K-29 terminal 1 to see if there is 12V when the beacon light switch is pressed.

Power Supply	Ground	Components Affected
X015 pin J1-1 (F39)		B+ Power
X015 pin J1-4 (F38, key switch)		Main power; all potentiometers, speed position sensors K-29 Beacon Lighting Relay
	X015 pins J1-8 & J1-23, X016 pins J2-12 & J2-18	Main module grounds
X017 pins J3-29 & J3-30 (F25)	X017 pins J3-9 & J3-10	Transmission Shift Motor M-02
X017 pin J3-7 (F23)	X017 pin J3-16	Draper Header Solenoid L-53
X016 pin J2-11 (F23)	X016 pin J2-3	Rotary Screen Brush
X016 pin J2-2 (F41 & F36)		Unload Tube Clutch L-08 Park Brake Disengage Valve L-10
X016 pin J2-9 (F41 & F37)		Unload Tube IN Valve L-03 Unload Tube OUT Valve L-04
X017 pin J3-11 (F41 & F36)		

TROUBLE SHOOTING COMMUNICATIONS

CCM3

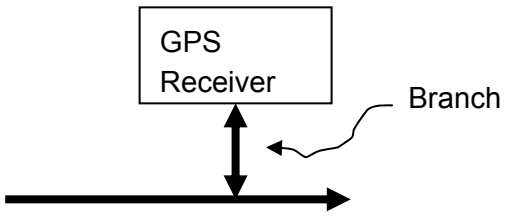
A quick way to check to see if the controller is receiving power and is powering up is to check relay K-18 terminal 1 to see if there is 12V when the any of the rear remote sieve control switches are pressed, (the key must be in the RUN position).

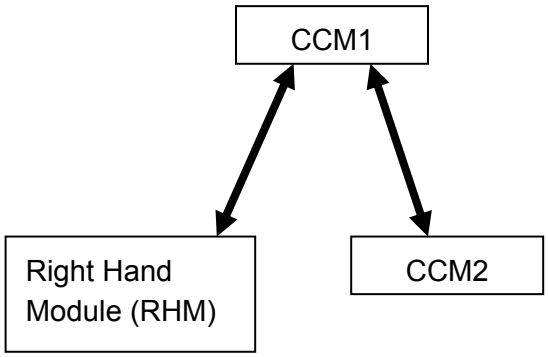
Power Supply	Ground	Components Affected
X012 pin J1-1 (F39)		B+ Power
X012 pin J1-4 (F38, key switch)		Main power; all potentiometers, speed & position sensors K-18, Upper/Lower Sieve Relay
	X012 pins J1-8 & J1-23, X013 pins J2-12 & J2-18	Main module grounds
X014 pins J3-29 & J3-30 (F26)	X014 pins J3-9 & J3-10	TurnTable Actuator M-35
X014 pin J3-7 (F27)	X014 pin J3-16	None
X013 pin J2-11 (F27)	X013 pin J2-3	Upper Sieve Actuator M-08 Lower Sieve Actuator M-07
X013 pin J2-2 (F47)		Bypass Unit Engage Output M-28 (sensor auger)
X013 pin J2-9 (F47)		Vertical Knives R K-42 Vertical Knives L K-43
X014 pin J3-11 (F47)		Rotor Ring to Frame Brake L-46

TROUBLE SHOOTING COMMUNICATIONS

When troubleshooting the data bus you must first determine how the controller is attached to the data bus. **All** controllers are connected to the data bus by a **PARALLEL** connection, BUT some are on branches while others appear to be in series.

<table>
<tr>
<td>Controllers that are on branches include:
• Display Unit
• Yield Monitor Interface Unit (YMIU)
• GPS
• CCM3
• Diagnostic Connector, X065
• Engine Control Unit, (ECU)

Example:
The data bus could check out OK while the GPS unit is still OFF LINE.</td>
<td> 
</td>
</tr>
<tr>
<td>Controllers that appear to be in series:
• CCM1
• CCM2
• RHM
Example:
The RHM and CCM2 could be ON line working and CCM1 could be OFF line.

These controllers incorporate an internal loop that just routes the data bus through the controller. The loop on the circuit board could be open as well as the data bus. In this case we would have to check the data bus harness as well as the circuit board.</td>
<td> 
</td>
</tr>
</table>

The following pages provide for an example on how to check out the CAN1 system.

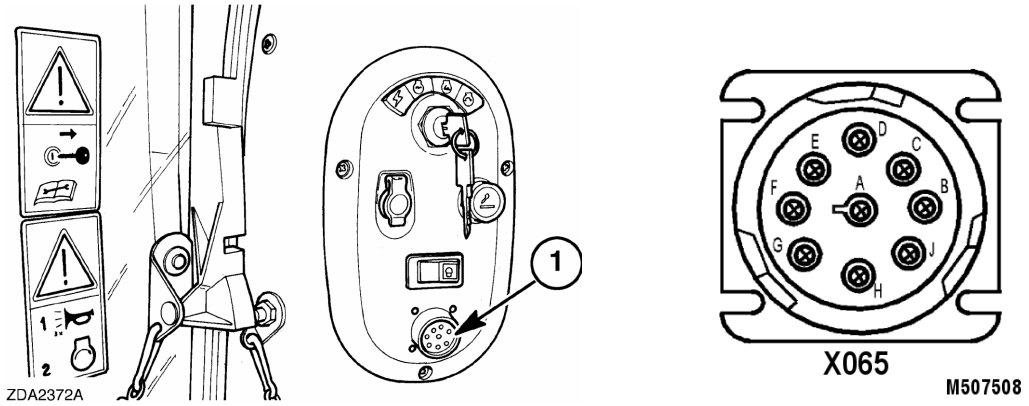
TROUBLE SHOOTING COMMUNICATIONS

CAN1

The alarm message “Communication Lost” with a listing of the appropriate controller indicates that communications has been lost from the controller due to controller or data bus (CAN1 HI and CAN1 LO) network problems. The wires could be shorted together, there could be an open in one of the two wires or a bad controller.

Whenever the controller is communicating you should be able to go to the BACK>DIAGNOSTICS>CAN screen and the controller status and software version for each controller should be displayed. Determining which controllers are ON or OFF line may help to located the problem.

To confirm whether CAN1 HI and CAN1 LO are shorted or open, make the following check at the diagnostic port connector X065 on key switch pad. KEY SWITCH OFF.



STEP 1, DIAGNOSTIC CONNECTOR X065

1. Use a multi-meter to check the resistance between pin D and C on connector X065. This will quickly verify whether there is a short or open in the system.

A. A reading of 0 ohms confirms that CAN1 HI (yellow wire) is shorted to CAN1 LO (green wire). Continue with Step 2.

B. A reading of 120 ohms indicates an open in either CAN1 HI or CAN1 LO. Continue with Step 2.

C. A reading of 60 ohms indicates that the network wiring is okay from end to end. Both terminators are being read. This does not mean each controller is capable of communicating to the data bus.

TROUBLE SHOOTING COMMUNICATIONS

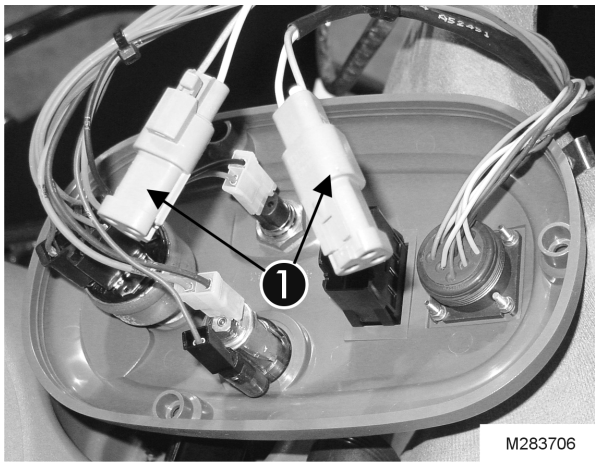
CAN1, CON'T

Wait a Minute... My test shows 60 ohms, but the display shows all controllers "OFF LINE". Remember the display is teed into the data bus, the data bus may be all right but the branch going to the DISPLAY AND/OR NAVIGATION could be OPEN.

IMPORTANT: this test will test the CAN1 backbone from the front terminator back to the ECU, it does not check the DISPLAY or NAVIGATION harness.

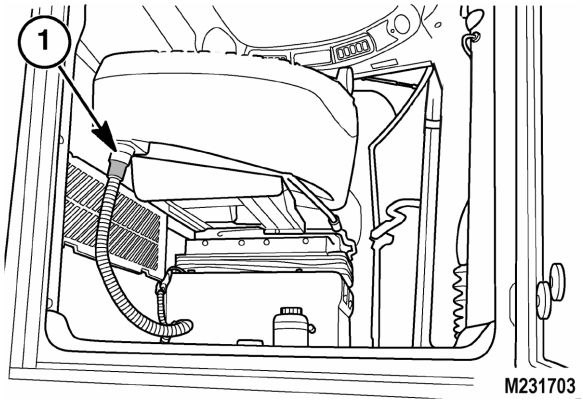
STEP 2, TERMINATOR IDENTIFICATION, R-17 & R-26

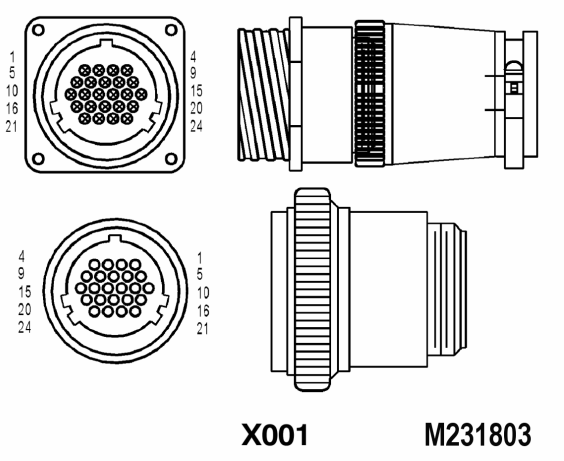
There is no way to visually determine which terminator located behind the key switch pad is connected to CAN1 or CAN2. While the multimeter is connected to terminals C & D remove one terminator at a time. When R-17 is removed the reading should change from 60 ohms to 120 ohms.



TROUBLE SHOOTING COMMUNICATIONS

CAN1, CON'T





STEP 3, CHECKING THE TERMINATOR, RHM, DISPLAY, NAVIGATION

Open the service door on the right side of the cab. Disconnect connector X001. This essentially splits the CAN1 system into three parts:

A. The diagnostic connector and terminator R-17. Using connector X001 on the end of the harness, install an ohmmeter between sockets 6 & 7. This reading should be approximately 120 ohms. Removing the R-17 terminator should make the reading change to an open circuit "OL".

B. The RHM, display and optional NAVIGATION. Each controller has a normal resistance reading of approximately ~38K ohm, if two controllers are connected in a parallel circuit (the CAN is a parallel circuit) the resistance is divided by the quantity of controllers.

   Example: ONE = ~38K, TWO = ~19K, THREE = ~13K.

   Using the pins (console) end of connector X001, install an ohmmeter between pins 6 & 7. Since all machines are equipped with a RHM and DISPLAY the reading should be ~19K, if the machine is equipped with a NAVIGATION module also, then the reading should be ~13K. If the reading is not correct, disconnect the blue connector X506, under the console storage box. Connector X001 is now only checking the RHM and the reading should be ~38K. Using connector X506 pins E & F the ohmmeter would be checking the DISPLAY and/or NAVIGATION if equipped.

TROUBLE SHOOTING COMMUNICATIONS

CAN1, CON'T

STEP 4, CHECKING THE CCM'S, YMIU,

1. Using connector X001 on the end of the harness, install an ohmmeter between sockets 8 & 9. This reading should be approximately 120 ohms, the terminator is in the ECU. Unplug the large plug on the ECU to eliminate the terminator and ECU and the reading should be approximately 9K because of the four controllers that is left on the system. If the reading is incorrect, proceed to the next step.
2. Leaving the meter connected to connector X001 sockets 8 & 9; disconnect connector X003 and leave open, the meter should read ~38K ohms. This is the resistance of the module.
    a. If the reading is "OL" (very high reading) the circuit is open or if low (less then 36K) resistance the circuit is shorted, remove connector X018 and connect the meter between pins J1-20 and J1-19, the reading should be ~38K ohms. We should also check between pins J1-14 and J1-19 to get the same results.

Using the logic listed above check the circuits for the other module to located the problem.

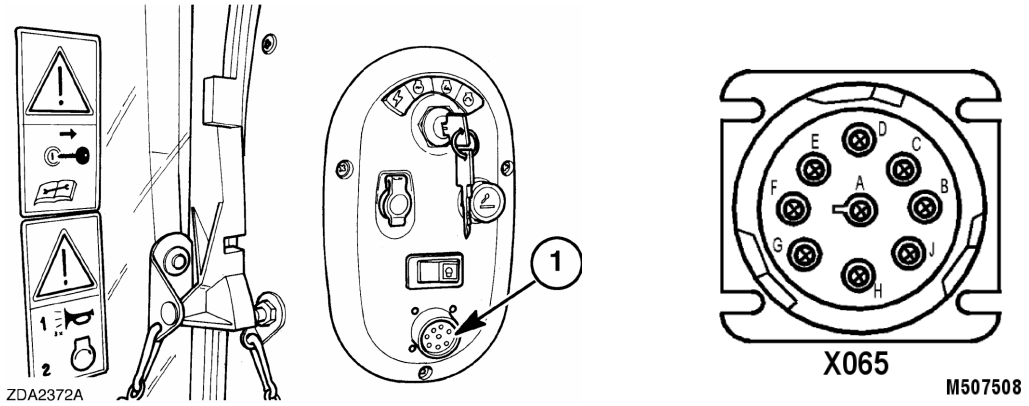
TROUBLE SHOOTING COMMUNICATIONS

CAN2

The alarm message “Communication Lost” with a listing of the appropriate controller indicates that communications has been lost from the controller due to controller or data bus (CAN2 HI and CAN2 LO) network problems. The wires could be shorted together, there could be an open in one of the two wires or a bad controller.

Whenever the controller is communicating you should be able to go to the BACK>DIAGNOSTICS>CAN screen and the controller status and software version for each controller should be displayed. Determining which controllers are ON or OFF line may help to located the problem.

To confirm whether CAN2 HI and CAN2 LO are shorted or open, make the following check at the diagnostic port connector X065 on key switch pad.



STEP 1, DIAGNOSTIC CONNECTOR X065

1. Use a multimeter to check the resistance between pins H and J on connector X065. This will quickly verify whether there is a short or open in the system.
    a. A reading of 0 ohms confirms that CAN2 HI (yellow wire) is shorted to CAN2 LO (green wire). Continue with Step 2.
    b. A reading of 120 ohms indicates an open in either CAN2 HI or CAN2 LO. Continue with Step 2.
    c. A reading of 60 ohms indicates that the network wiring is okay.

TROUBLE SHOOTING COMMUNICATIONS

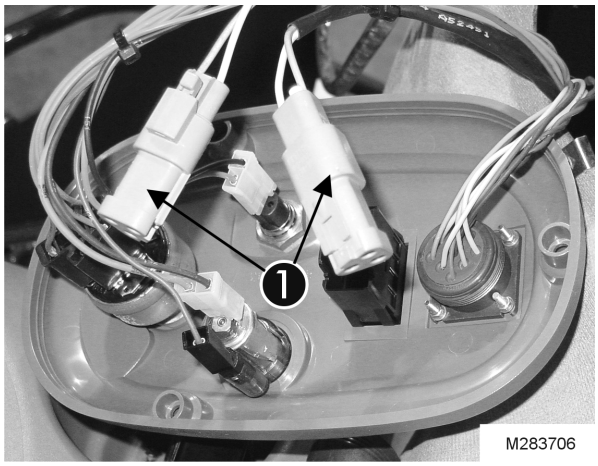
CAN2, CON'T

Wait a Minute... My test shows 60 ohms, but the display shows all controllers "OFF LINE". Remember the display is teed into the data bus, the data bus may be all right but the branch going to the DISPLAY AND/OR NAVIGATION could be OPEN.

IMPORTANT: this test will test the CAN2 backbone from the front terminator back to the GPS reciever.

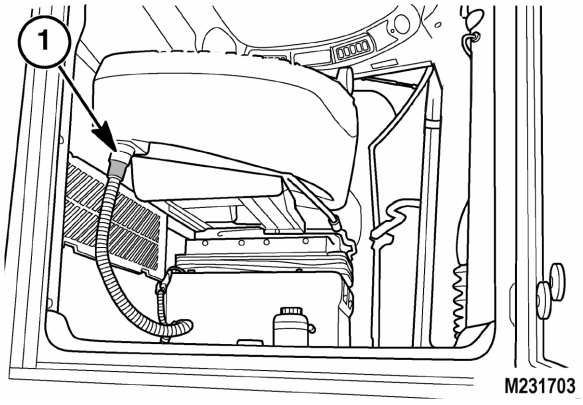
STEP 2, TERMINATOR IDENTIFICATION, R-17 & R-26

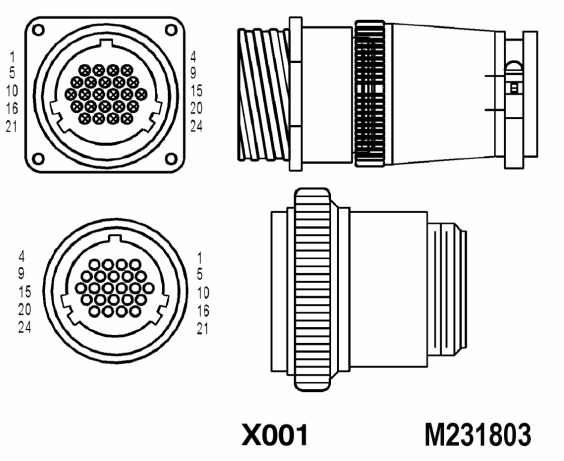
There is no way to visually determine which terminator located behind the key switch pad is connected to CAN1 or CAN2. While the multimeter is connected to terminals H & J remove one terminator at a time. When R-26 is removed the reading should change from 60 ohms to 120 ohms.



TROUBLE SHOOTING COMMUNICATIONS

CAN2, CON'T





STEP 3, CHECKING THE TERMINATOR, DISPLAY, NAVIGATION

Open the service door on the right side of the cab. Disconnect connector X001. This essentially splits the CAN2 system into two parts:

1. The diagnostic connector and terminator R-26. Using connector X001 on the end of the harness, install an ohmmeter between sockets 4 & 5. This reading should be approximately 120 ohms. Removing the R-26 terminator should make the reading change to an open circuit "OL".

REMEMBER: Each controller has a normal resistance reading of approximately ~38K ohm, if two controllers are connected in a parallel circuit (the CAN is a parallel circuit) the resistance is divided by the quantity of controllers.

Example: ONE = ~38K, TWO = ~19K, THREE = ~13K.

2. Using the pin (console) end of connector X001, install an ohmmeter between pins 4 & 5. Since all machines are equipped with a DISPLAY the reading should be ~38K. If the machine is equipped with an optional GPS module, the reading would be 120 ohms due to a terminator being installed at the GPS module. Remove the terminator and the reading should be ~19K, if the machine is equipped with an optional NAVIGATION module also, then the reading should be ~13K.
3. If the reading is not correct, disconnect the white connector X498 under the console right hand console. Connector X001 is now only checking the display and the reading should be ~38K.
4. Using male pins in connector X498 C & D the ohmmeter would be checking the GPS and/or NAVIGATION if equipped, the reading should be ~19K.

OPERATOR WARNING ALARMS

The warning and alarm system will normally progress through a stepped alarm system.

- Shut Down Alarms 
- Alarms 
- Errors
- Prompts 
- Annunciation 
- Full Grain Tank
- Grid Heater

SHUT DOWNS

Audio	Visual	Reappear	Acknowledge	Ignore
Audio alarm sounds until condition corrected, ANNOYING sound	Message persists until acknowledged or condition corrected, STOP indicated	Every 30 seconds	Yes	No

Critical condition requiring immediate operator action to prevent damage (Engine Coolant Temp. HIGH, Engine Oil Pressure LOW).

ALARM

Audio	Visual	Reappear	Acknowledge	Ignore
Audio alarm sounds momentarily, URGENT sound	Message persists until acknowledged or condition corrected	Every 2 minutes	Yes	No

Indicates an abnormal condition requiring operator action (e.g. Fan Speed LOW, Regulated Pressure LOW)

ERRORS

Audio	Visual	Reappear	Acknowledge	Ignore
Audio alarm sounds momentarily, URGENT sound	Message clears after 4 seconds	Every 8 minutes	No	No

Indicates a condition where something is actually broken (e.g. Hydrostatic driver failure). Error text will be limited to what has failed (SPN) and no how it has failed (FMI)

OPERATOR WARNING ALARMS

PROMPT

Audio	Visual	Reappear	Acknowledge	Ignore
Audio alarm sounds momentarily, URGENT sound	Message clears after 4 seconds	Every 8 minutes	No	No

Indicates an illegal condition set by the operator and results in interlock preventing an operation (e.g. Attempting to engage the unloader auger when cradled). The prompt text should indicate what action the operator needs to do to correct the situation.

ANNUNCIATION

Audio	Visual	Reappear	Acknowledge	Ignore
Audio alarm sounds momentarily, PLEASANT sound	Message clears after 4 seconds	Every 8 minutes	No	No

Indicates a normal machine operation state, no immediate action required of operator (e.g. Windrow Mode, Power Boost End PENDING, Fuel Level Low)

FULL GRAIN TANK

Audio	Visual	Reappear	Acknowledge	Ignore
Audio alarm sounds momentarily, HIGH tone sound.	Message clears after 4 seconds	Every 8 minutes	No	No

Indicates a normal machine operation state, no immediate action required of operator (e.g. Windrow Mode, Power Boost End PENDING, Fuel Level Low)

ENGINE GRID HEATER

Audio	Visual	Reappear	Acknowledge	Ignore
Alarm will sound when the key switch is placed in the **RUN** position and the temperature is below the heater trigger point. The alarm will sound continuously while the heater is active. When heating has completed the alarm will double its rate of pulsation to alert the operator that it is time to crank the engine.				

REMEMBER: When an audio alarm is sounded, always review the current message that is being displayed on the cab display unit.

CHARGING CIRCUIT

REFERENCE SCHEMATIC FRAMES:

Frames: #1 and #2

KEY COMPONENTS IN CIRCUIT:

Batteries G02 & G03, 24V Start Relay K-38 and Alternator G01

The alternator is used to maintain the battery voltage and to supply the power required for system operations. As seen in the Starting circuit we use 24V, but the alternator is a 12V unit as is the complete combine electrical system. Using the 24V start relay, the charging circuit can maintain both batteries at the same time. The alternator is self-energizing.

The alternator terminal B+ is connected to the 24V start relay terminal 30 which leads to the POS (+) post of the rear battery to maintain it. From terminal 30 of the start relay there is an internal connection to terminal 51 and 30a. Terminal 30a directs power to the POS post of the front battery to maintain it. The front battery is provided a chassis ground through the start relay terminal 31a which is internally connected to terminal 31, to the NEG post of the rear battery and on to chassis ground.

MANUALLY CHARGING BATTERIES

When manually recharging batteries it should not make any difference which battery the charger is connected to, both batteries will be charged equally due to the circuitry through the 24V start relay. It would be easiest to connect the charger to the front battery. If connecting to the front battery DISCONNECT the charger before trying to crank the engine.

JUMP STARTING

When using slave batteries to jump start the engine there should be a separate battery connected to each combine battery to provide for adequate cranking amperage. If only one battery is used it should be attached to the rear battery only.

CAB DISPLAY UNIT

REFERENCE SCHEMATIC FRAMES:

Frames: #29 and 30

KEY COMPONENTS IN CIRCUIT:

AFS PRO 600 A-02, Ground Point #3, Key Switch S-02, K-24, Fuse F-39 & 48, Data Bus

GENERAL INFORMATION

The display is used to provide two way communications between the operator and the machine controllers. These functions will include the capabilities to monitor system function, make system adjustments, configuration, calibrations, diagnostics and to write information to external memory cards. The unit is designed so that the operating system may be updated at anytime.



Wait a Minute... This is the same AFS PRF600 that we use in the 2500's yield monitor and planter, right? Yes and No. If the unit were loaded with the correct software, it would work on a planter, tractor or combine also. It is NOT advisable to move the units between combines due to the configurations and calibrations.

OPERATION

The unit is connected to the combine through connector X502 which, providing power, ground and the data bus as follows:

Terminal 1	provides the CAN1 bus high side, Yellow
Terminal 2	provides the CAN1 bus low side, Green
Terminal 5	provides the CAN2 bus high side, Yellow, GPS information
Terminal 6	provides the CAN2 bus low side, Green, GPS information
Terminal 9	RS232 communications, GPS information
Terminal 10	RS232 communications, GPS information
Terminal 13	receives B+ power from fuse F-39 to operate on and to write to memory.
Terminal 14	provides a chassis ground at point 3, left rear cab floor.
Terminal 15	receives a power signal from the key switch terminal 6 to active the display, this power is mainly used to tell the display to turn ON.

There is a serial communications connector also, but at this time is has no function.

CAB DISPLAY UNIT

OPERATION, CON'T

When the key switch is turned to the **RUN** or **START** position and terminal 15 receives power the display will turn ON, go through a self test and end up on the "RUN 1" screen. The unit retains all data in a volatile memory as long as the terminal 15 is powered. All GPS data is written to the memory card every 60 seconds.

When the key switch is turned to the **OFF** position, the power loss at terminal 15 signals the display to start the shut down procedures, the unit is operating off the power from terminal 13. All memory is written to non-volatile memory and YIELD/GPS to the memory card.

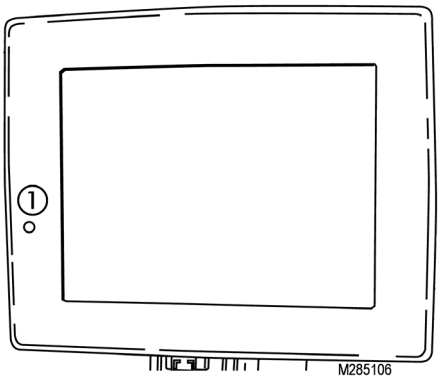
INDICATOR LED

The indicator lamp on the left side of the display (1) provides information about the condition of the display:

OFF = no power or massive failure

YELLOW = probably functional, but there is no software loaded / of the software may be corrupted

GREEN = Operating correctly



CAB DISPLAY UNIT

WHAT SOFTWARE MUST BE LOADED?

Loading software for the display will require the selection of several different files. In order to locate the proper files, use the WIZZARD button in the Electronic Service Tool to gather the correct files. Also remember these key points:

- The display that is be loaded MUST be connected to the EST before the file selection can be made.
- The display MUST be connected to the EST to create a data card for loading the display.
- When the display is connected to the EST, its identification code will be logged onto the data card. This prevents using the data card to load multiply displays.

EXAMPLE OF FILES

SOFTWARE	REQUIRED	OPTIONAL
BSP – Board Support Package	X	
Command Framework: This is the operating system for the display	X	
Combine AFX: This is the combine functional software	X	
Precision Farming: This is the mapping functional software		X
Yield Monitor: This is the yield monitor functional software	X	
Display Defaults		X
Auto Guidance Program		X
Trip Computer		X

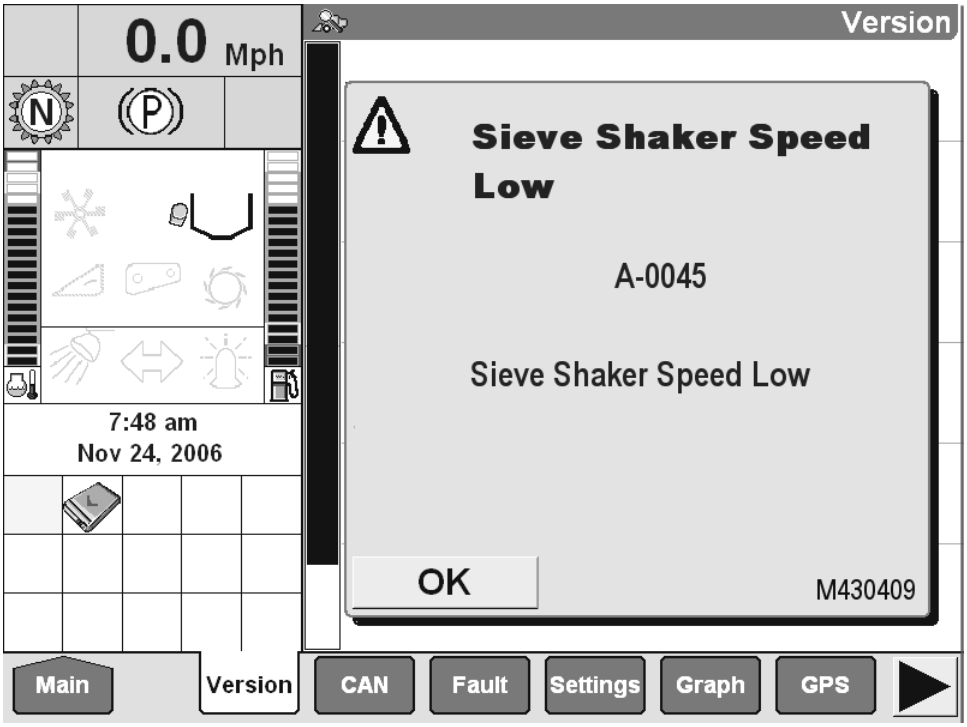
REMEMBER: To determine the software that is currently loaded on the display, following one of the following methods;

1. On the display navigate by pressing the MAIN>DIAGNOSTIC>DISPLAY. This will bring up a listing of the software loaded and version numbers.
2. Using the EST, navigate to the software loading screen, capture the display unit and proceed to the loading process of the display. On the first screen it will list the current software.

REMEMBER: To determine which products are currently support by the display, navigate by pressing the MAIN>TOOLBOX>DISP>CURENT VEHICLE.

SHAFT SPEED MONITOR

The Shaft Speed Monitor is incorporated into the display unit. A message will be displayed for the operator to read.



To get a definition OF the faults navigate to the fault screens by MAIN>DIAGANOSTIC>FAULTS.

To get a definition of the indicator symbols, refer to the operator's manual.

SENSORS

SENSORS

Most of the sensor on the machine may be monitored in two locations:

- Navigate to MAIN>COMBINE INFO> and select the area to be monitored. This shows the actual reading of the sensor's function.
- Navigate to MAIN>DIAGNOSTICS>SETTINGS and select the sensor to be monitored. This will show the functionality of the component. This should be the first place to start your troubleshooting process. When monitoring a sensor's signal voltages, the main thing to look for is that it changes when coming in proximity of metal and away from metal.

Spreader, Rotor and Feeder Speed Sensor

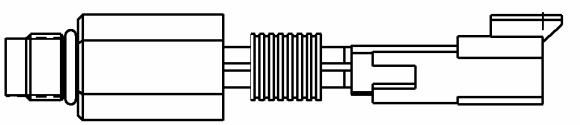
This type of sensor is normally inserted into a gearbox to monitor a gear rotation.

Example:

Spreader speed sensor is supplied 12V at terminal A, 8V at terminal B and a return ground. The signal circuit will provide two voltage levels.

Tooth proximity: 6.7V
Tooth Gap: 1.3V
Air Gap: 0.012" (3mm)

Terminals
A or 1: Supply voltage
B or 2: Signal
C or 3: Return (ground)



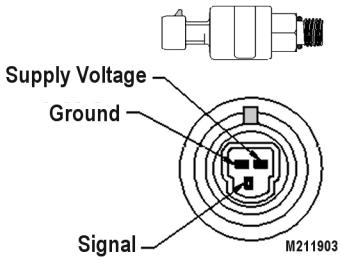
These sensors work by sensing or not sensing metal. The sensor is power by the 12V circuit. The 8V signal circuit monitors the operation. A magnetic field is created across the end of the sensor, (a metal shaving can cause the sensor to malfunction). As the rotating trigger passes by the sensor, breaks the magnetic field, the sensor will open and close an internal circuit, changing the voltage drop across the signal wire. The signal wire will alternate between a high and low voltage, in this case approx. ~6. and ~1. voltage. The voltage is not as important as the fact that it changes and is consistent.

There may be an LED indicator lamp on the sensor frame that will also toggle as the voltage changes.

Float, Control Pressure, Lube Pressure, Park Brake / Regulated Sensor, (HAJ202000 & below)

Example:

Control Pressure sensor is supplied 5V and a return ground. The signal circuit will provide a variable voltage between 0.5V at 0 PSI and 4.5V at 500 PSI. Lube would be ~4.5V at 100 PSI.



SENSORS

Fan, Clean Grain Elevator, Tailings, Chopper, Shaker, Ground Speed Sensors

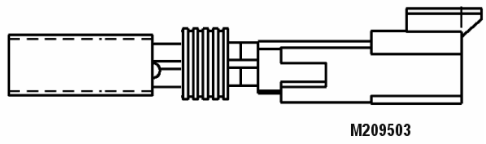
This type of sensor is normally mounted next to a rotating shaft to monitor its speed.

Example:

The Rotor and Fan sensor is supplied 8V and a return ground. The signal circuit will provide two voltage levels.

Tooth proximity:	6.7V
Tooth Gap:	1.9V
Air Gap:	0.012” (3mm)

Terminals
1 or A: Return (ground)
2 or B: Supply voltage



Ladder, Spreader, Unloading Auger Position Sensors

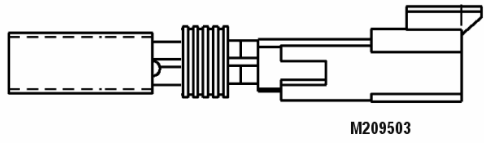
This type of sensor is normally mounted next to moving object to monitor its presences.

Example:

The rear ladder position sensor is supplied 8V and a return ground. The signal circuit will provide two voltage levels.

Tooth proximity:	6.7V
Tooth Gap:	1.9V
Air Gap:	0.012” (3mm)

Terminals
1 or A: Return (ground)
2 or B: Supply voltage



IMPORTANT: Voltage readings listed are only approximate readings, each sensor location will vary. The main thing to look for is that there is a high and low voltage reading.

SHAFT SPEED SENSORS

SENSORS, CON'T

Fuel Level Sensor

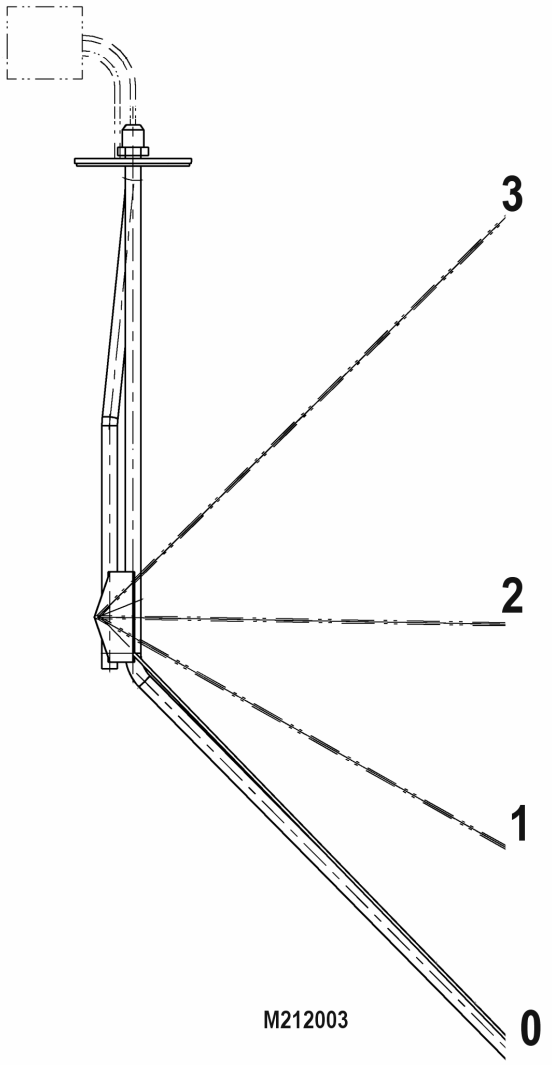
The fuel gauge does not provide a linear level display on float position. The circuit provides for three different zones.
Zones:

0: 5-10 Ohms
1: 108-128 Ohms
2: 185-225 Ohms
3. 315-345 Ohms

The resistance will progressively increase/decrease as the float moves from these points.

Terminals

1: Return
2: Signal



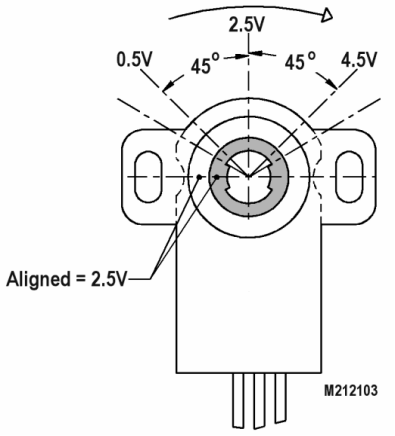
SHAFT SPEED SENSORS

SENSORS, CON'T

Tailings Volume, Lateral Tilt, Feeder Angle, Header Height/Tilt, Concave Sensors

Example:
The feeder angle sensor is supplied 5V at terminal 1 and a return ground at 3. The signal circuit will provide a variable voltage signal between .5-4.5V.

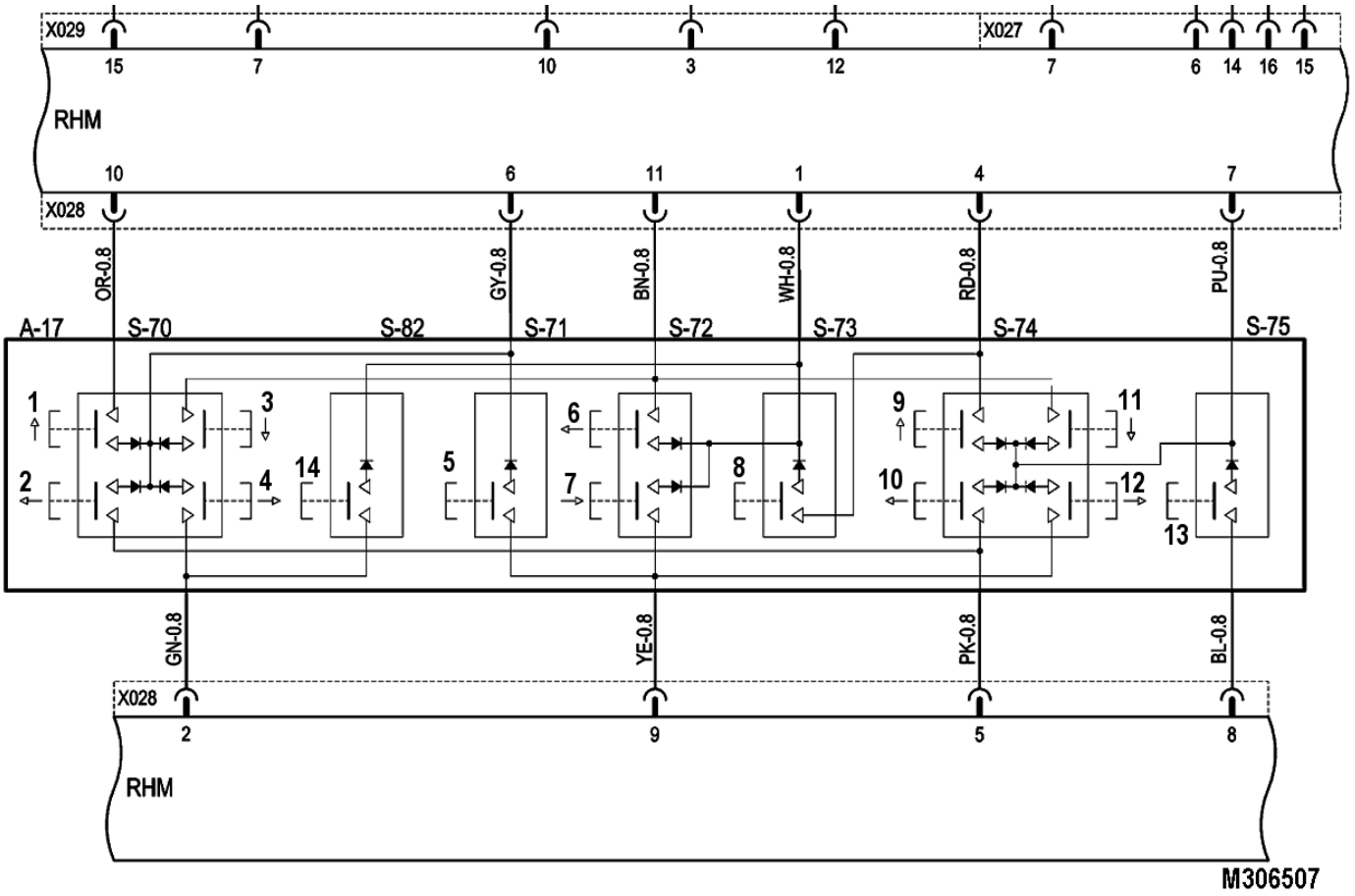
As the pot rotates, the signal should vary. Not all sensor locations will have the same voltage range, it depends on the total rotation of the component.



Terminals
A or 1: Supply voltage
B or 2: Return (ground)
C or 3: Signal

MULTI-FUNCTION HANDLE, (MFH)





Switch	Function
1	Header RAISE
2	Header Tilt LEFT
3	Header LOWER
4	Header Tilt RIGHT
5	Resume
6	Unloader Swing OUT
7	Unloader Swing IN

Switch	Function
8	Unloader Auger Clutch ON/OFF
9	Reel RAISE
10	Reel FORWARD
11	Reel LOWER
12	Reel AFT
13	Emergency STOP
14	Shift Button

MULTI-FUNCTION HANDLE, (MFH)

REFERENCE MATERIAL:

Electrical schematic frames #07, #11, #22, #26

KEY COMPONENTS:

Multi-Function Handle (MFH) and Right Hand Module (RHM)

The MFH is used by the operator to control the most common machine functions, providing the operator with full control with out having to locate various controls that may normally be at varies locations. The MFH will provide the operator with the following controls:

- Ground Speed Control.
- Emergency Stop control, providing the operator with one switch to disengaged the header/feeder and unloading auger clutch operations.
- Unloading Auger Swing, IN and OUT
- Unloading Auger Clutch
- Header Lift and Lower
- Header Tilt
- Reel Lift and Lower
- Reel Fore and Aft
- Header Resume
- Shift Button

For the MFH switch to control all these machine functions, a uniquely designed switching circuit is used. Each function requires a switch closure to 2 terminals on the RHM. The RHM is continuously sampling the potential switch closures one at a time a very rapid rate. When the RHM detects one of these unique switch closures, the RHM will place a message on the data bus for the CCM's to take action.

OPERATION

The MFH is supplied 12V from the RHM at connector X028 terminals 2, 4, 5, 8, 9, 10 and 11 which is distributed to all the switches. Terminals 1, 6 and 7 are sequentially switched to ground at a high rate to provide the sampling for potential switch closure. Signal back feeding is isolated using internal diodes located on the MFH switch panel circuit board.

MULTI-FUNCTION HANDLE, (MFH)

Example: The operator wants to move the unloading auger OUT (switch 6). Looking at the Unloader Position Switch S-72 you can see that it is connect to the RHM at terminals 1 and 11. Terminal 1 is isolated to the unloader circuits, while terminal 11 is connected to additional circuits.

Terminal 11 is supplying voltage to the unloading swing OUT, header LOWER and reel LOWER circuits and terminal 1 is the switched ground to the RHM (the signal wire).

When the unloading swing OUT switch is pressed the RHM will see the voltage at terminal 11 at a low voltage (approximately 0.4) when the RHM switches terminal 1 to ground. When the RHM has terminal 6 or 7 switched to ground, the voltage at terminal 11 will be 12 volts unless header LOWER or reel LOWER are pressed respectively.

In general the RHM knows which switch is pressed in the MFH by knowing which terminal (1, 6 or 7) is switched to ground and which terminal (2, 4, 5, 8, 9, 10 or 11) is at low voltage.



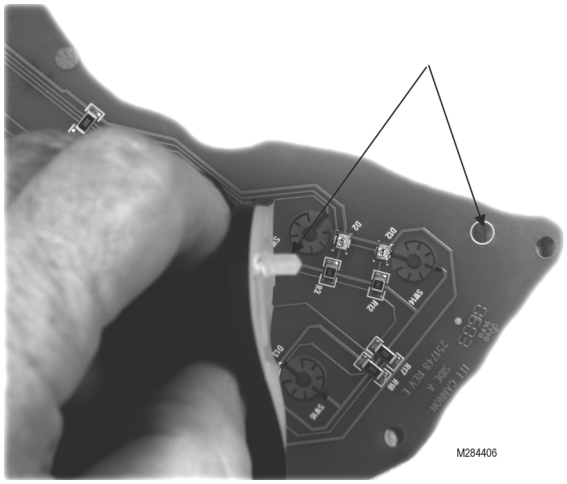
Wait a Minute... How can I trouble shoot this type of system? Even though voltage levels are given above, the switching rate of terminals 1, 6 and 7 would require an oscilloscope to trouble shoot whether a switch was pressed. For trouble shooting, start by using the display and going to the appropriate diagnostic screen to verify a particular switch is working. If there is no indication that the switch is working, further trouble shooting can be accomplished with a handle disconnected from the RHM and a multi-meter set to the Diode setting. Check continuity between the two terminals that the switch closes when pressed.

RHM SWITCH PANELS

Over time the switch pads may become contaminated with dust/dirt and fail to operate consistency. The panel may be disassembled and cleaned with compressed air. When reassembling, be sure to insert the locating pins in the correct pockets.



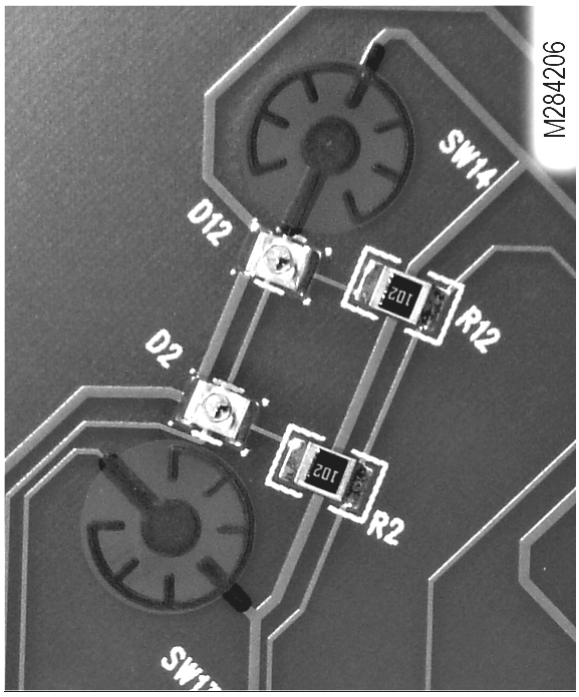
1.-Front Switch Panel, A-13
2.-Rear Switch Panel, A-18



Locating and Locking Pins



Pad Contacts



Switch contacts, SW14
LED's, D12, D2

WINDSHIELD WIPERS



1.	Wiper Switch
2.	Washer Switch

REFERENCE MATERIAL:

Electrical schematic frames # 27, 29, 45

KEY COMPONENTS:

Wiper Switch S-20, Wiper Motor M-25, Washer Switch S-38, Washer Motor M-24, Wiper Relay K-06 and K-08, Fuse F-03, 04 and 09, Splice W-03 and CCM2

WIPER OPERATION

General Information

The windshield wiper may be used to clean the windshield any time the key switch is in the RUN position. The wiper is a one speed unit and does not incorporate parking circuit, when the unit is shut off the wiper arm will remain at the point it was shut off at.

Operation

When the key switch is turned to the RUN position, keyed power is directed to the wiper relay K-06 terminal 1, activating the relay. The relay K-06 is also supplied power from F-04 at terminal 3. When the relay activates power is directed from terminal 3 to 5 to the wiper switch (S-20) connector X135 terminal 2. The switch is a two position maintained switch. When the switch is toggled to the ON position the power is directed from terminal 2 to 3, out to the wiper motor (M25), connector X116 terminal 3. The motor is provided a chassis ground at the roof cab ground point #4.

The switch incorporates a back light that is activated with the head light switch at terminal 7, CCM2 and splice module W-03.

WINDSHIELD WIPERS

WASHER OPERATION

General Information

The washer may be used any time the key switch is in the RUN position to help with the windshield cleaning.

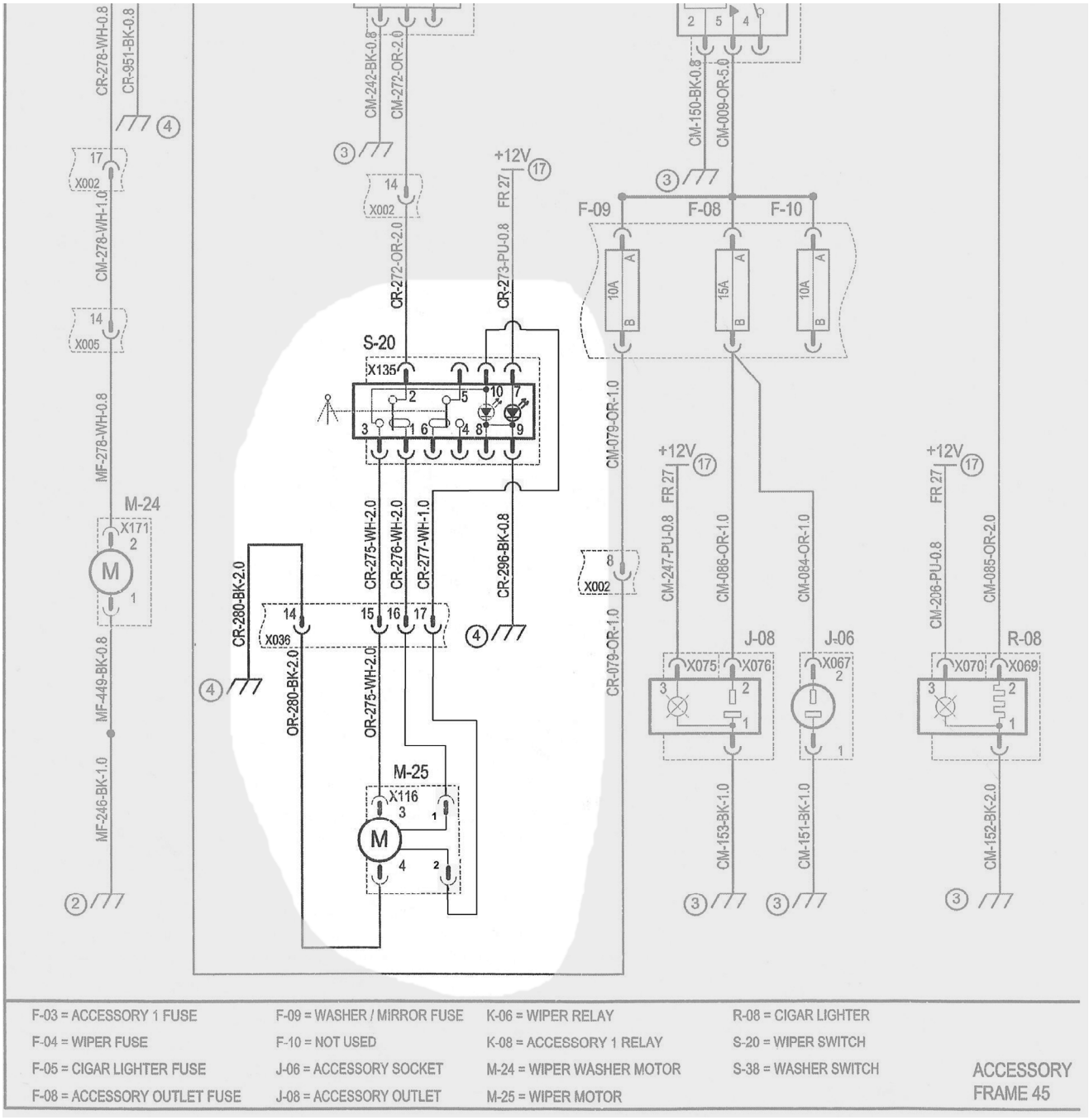
Operation

When the key switch is turned to the RUN position power is directed to the accessory relay K-08 terminal 1, activating the relay. The relay is also supplied power from F-03 at terminal 3. When the relay activates power is directed from terminal 3 to 5 to fuse F-09 and onto the washer switch (S-38) connector X134 terminal 2. The switch is a momentary switch. When the switch is toggled to the ON position the power is directed from terminal 2 to 3, out to the washer motor (M-24), connector X171 terminal 2. The motor is provided a chassis ground at the ground point #2.

The switch incorporates a back light that is activated with the head light switch at terminal 7, CCM2 and splice module W-03.

AUTOMATIC PARKING WIPERS

Modified Wiper Schematic Frame 45.



AUTOMATIC PARKING WIPERS

REFERENCE MATERIAL:

Electrical schematic frames # 45

KEY COMPONENTS:

Wiper Motor M-25, Connector X116, Connector X036, New Wires

WIPER OPERATION

General Information

The windshield wiper is designed to stop whenever the wiper switch is placed into the OFF position, it will not automatically return to a PARK or HOME position. The wiper motor is designed to accommodate PARKING if wired for it. The following provides information on how to rewire the wiper circuit to automatically PARK the wiper on the right hand side of the windshield.

Operation

Refer to electrical schematic frame 45. From the motor connector X116 connect wires as follows:

Connector X116 Wiper Motor	Connector X036 Harness	Connector 135 Wiper Switch
Terminal 1	Terminal 16	Terminal 1
Terminal 2	Terminal 17	Terminal 10
Terminal 3	Terminal 15	Terminal 3
Terminal 4	Terminal 14	



IMPORTANT: This is NOT a procedure that is covered under any warranty conditions.

RADIO

REFERENCE MATERIAL:

Electrical schematic frames #46

KEY COMPONENTS:

Radio A-04, Fuse F-11and F-35, Ground #4, Speakers H-04 – H-07, Accessory Relay K-03, F-02

GENERAL INFORMATION

The radio may be of several different designs with different operation, but all share the same electrical connection. There are two separate circuits used:

- One for radio memory, this maintains the clock and preset stations
- One that the radio operates on

OPERATION

The radio is supplied B+ power from the fuse F-35 to the radio connector X314 terminal 4 at all times. The radio is provided a chassis ground at point #4 in the cab roof.

When the key switch is in the RUN position and the accessory relay K-03 is activated power from fuse F-11 is directed to the radio connector X314 terminal 7 for all radio operations. Each speaker is on its own circuit from the radio to provide for volume control.

The current radio is set at the manufacture for the N.A. radio station frequencies, this may not work is other countries. Below is a method of changing the country settings to let the radio receive the correct frequencies.

RADIO CONFIGURATION

When the radio is being used in a country other that the USA, the radio tuning frequencies can be changed to match the country it is being used in. The countries or regions that are available are USA, Europe/ Australia, Japan, Argentina, China and Saudi Arabia. * The following procedure is used to select the country:

1. With the ignition ON and the radio OFF, Press and hold the DSPL/ Tm Set button until the HOURS digit flashes.
2. Press and release the BAND switch until the desired country or region is displayed.
3. After about 5 seconds the radio will display the time.
4. The radio frequencies are now set to the frequencies for the country or region selected.

REMEMBER If the Saudi Arabia frequencies are selected, the radio can NOT be reset to any other country.

AUXILIARY AND CIGARETTE LIGHTER POWER CIRCUITS

REFERENCE MATERIAL:

Electrical schematic frames #39, 45, 46

KEY COMPONENTS:

Outlet plugs J-01-08, Cigarette Lighter R-08, Fuse F-03, 05, 08 and 15, Key Switch

GENERAL INFORMATION

The operator may use the accessory outlets anytime to operate any 12V function(s) as long as the total power usage does not exceed the fuse rating. The outlets may be broken down into two categories: Powered full time or Key switch powered.

Powered Full Time

These outlets are powered through fuse F-15 for a full load rating of 15 amps.

- J-01 Left cab platform
- J-03 Left service location, under batteries
- J-03 Engine platform, next to engine platform light switch

Powered through fuse F-05

- R-08 Left side of Key switch pad, cigarette lighter

Key Switch Powered, J06 and R-08

These outlets are power through accessory relay K-08 anytime the key switch is in the RUN position and through fuse F-08 for a full load rating of 15 amps.

- J-06 Right side of Key switch pad
- J-08 Between operator's and instructor's seats, standard cigarette lighter socket

Back Lighting

J-08 and R-08 also incorporate a back lighting ring that is activated with the head light switch.

OPERATION

Powered Full Time, J01-05

Outlets J01-05 are supplied B+ power through fuse F-15 and direct chassis ground.
Outlets R-08 are supplied B+ power through fuse F-05 and direct chassis ground.

Key Switch Powered, J-06 and J-08

Outlets J-06 and J-08 are supplied B+ power through fuse F-08 any time the K-08 accessory relay is activated by the key switch and direct chassis ground.

COMMUNICATIONS/RADIO POWER CIRCUITS

REFERENCE MATERIAL:

Electrical schematic frames #45

KEY COMPONENTS:

Connector X141 (J-07), Fuse F-13, Relay K-03

GENERAL INFORMATION

Located behind the overhead right hand blanking plate, (next to the radio), is an empty connector with a 10 amp. 12V and ground lead, this connector may be used to power any 12V function. The power supply is activated by the accessory relay K-03 anytime the key switch is in the RUN position. There is also an antenna cable for the optional roof mounted antenna.

OPERATION

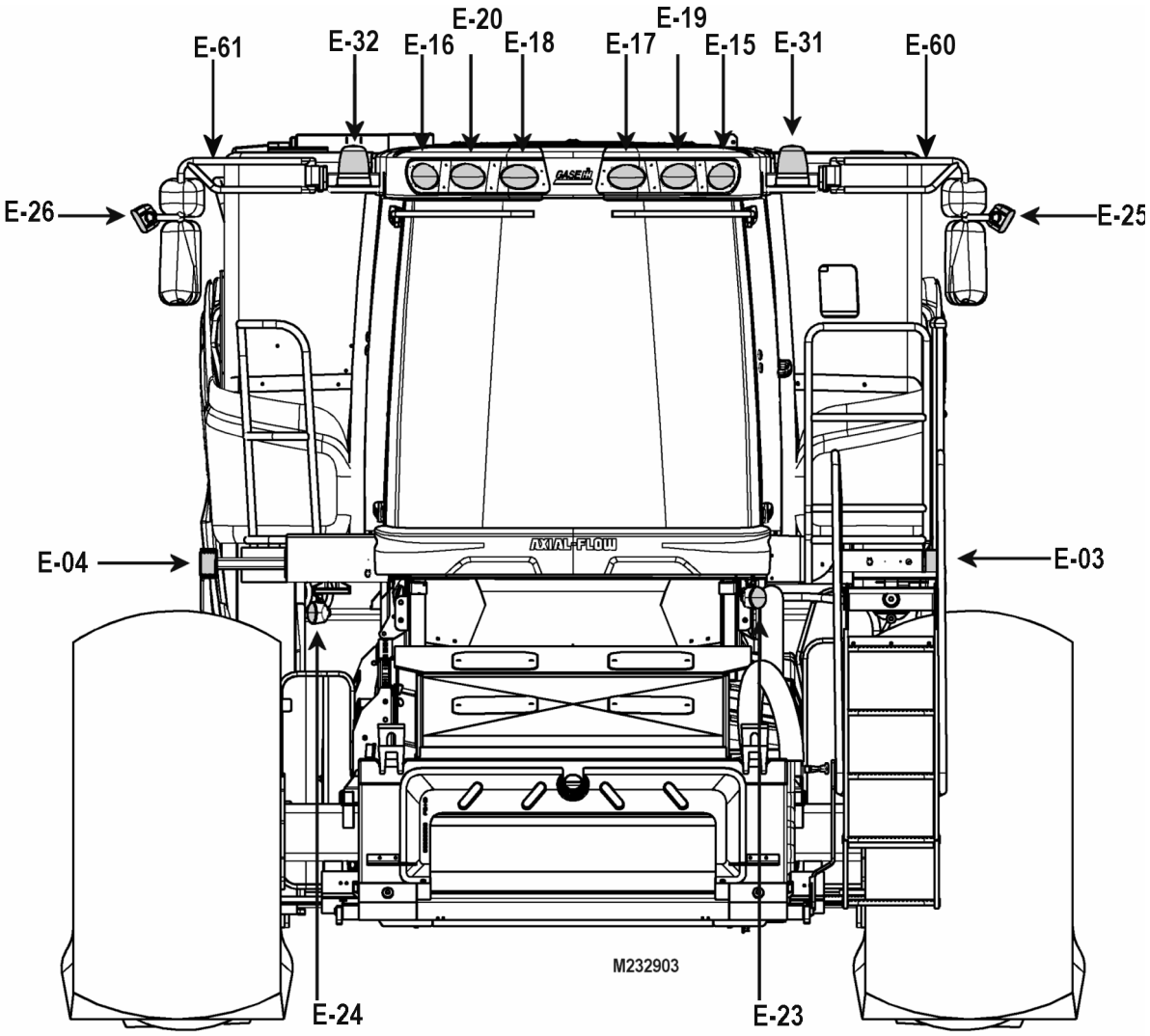
When the key switch is placed into the RUN position, accessory 2 relay K-03 is activated. The relay is also supplied power from fuse F-02 at terminal 3, when activated the power is directed out terminal 5 to supply the K-03 power circuits. Fuse F-13 directs power from the K-03 source to the connector X141 (J-07) terminal 2, this is the orange wire. Terminal 1 is chassis ground.



IMPORTANT: Fuse F-13 can not be greater then 10 amp.

EXTERIOR LIGHTING

NORTH AMERICA LAYOUT

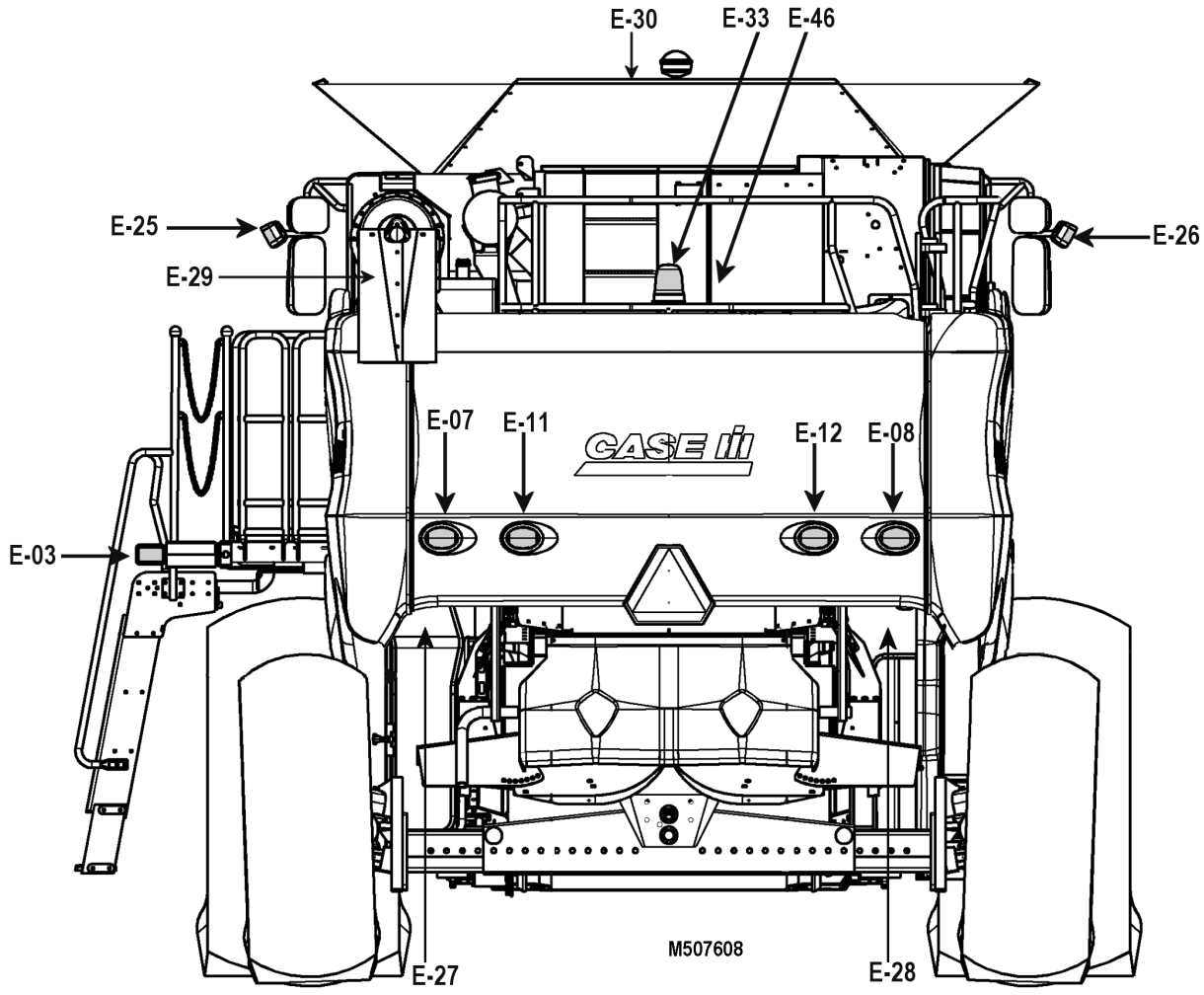


Schematic ID #	Component
E-03	LH Front Hazard Lamp
E-04	RH Front Hazard Lamp
E-15	LH Out Work Lamp
E-16	RH Out Work Lamp
E-17	LH Inner Work Lamp
E-18	RH Inner Work Lamp
E-19	LH Middle Work Lamp
E-20	RH Middle Work Lamp

Schematic ID #	Component
E-23	LH Lower Work Lamp
E-24	RH Lower Work Lamp
E-25	LH Side Work Lamp
E-26	RH Side Work Lamp
E-31	LH Beacon Lamp
E-32	RH Beacon Lamp
E-60	LH HID Field Light
E-61	RH HID Field Light

EXTERIOR LIGHTING

NORTH AMERICA LAYOUT

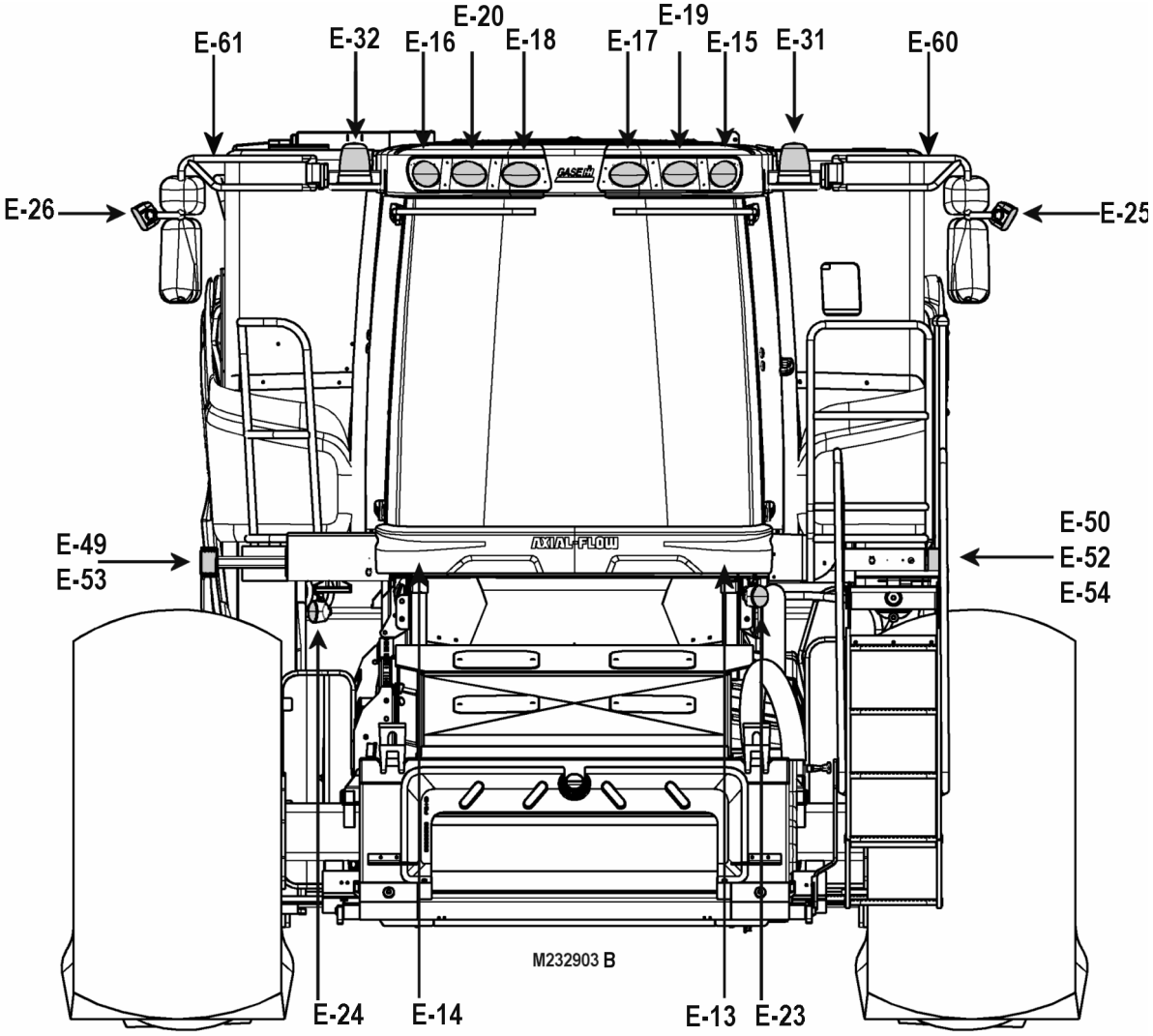


Schematic ID #	Component
E-03	LH Front Hazard Lamp
E-07	LH Turn Signal Light
E-08	RH Turn Signal light
E-11	LH Tail / Brake Light
E-12	RH Tail / Brake Light
E-25	LH Side Work Light
E-26	RH Side Work Light,

Schematic ID #	Component
E-27	LH Rear Work Light
E-28	RH Rear Work Light
E-29	Unloading Tube Light
E-30	Grain Tank Light
E-33	Rear Beacon Light
E-46	Engine Service Lamp

EXTERIOR LIGHTING

EUROPEAN LAYOUT, NOT ALL LAMPS USED IN ALL MARKETS

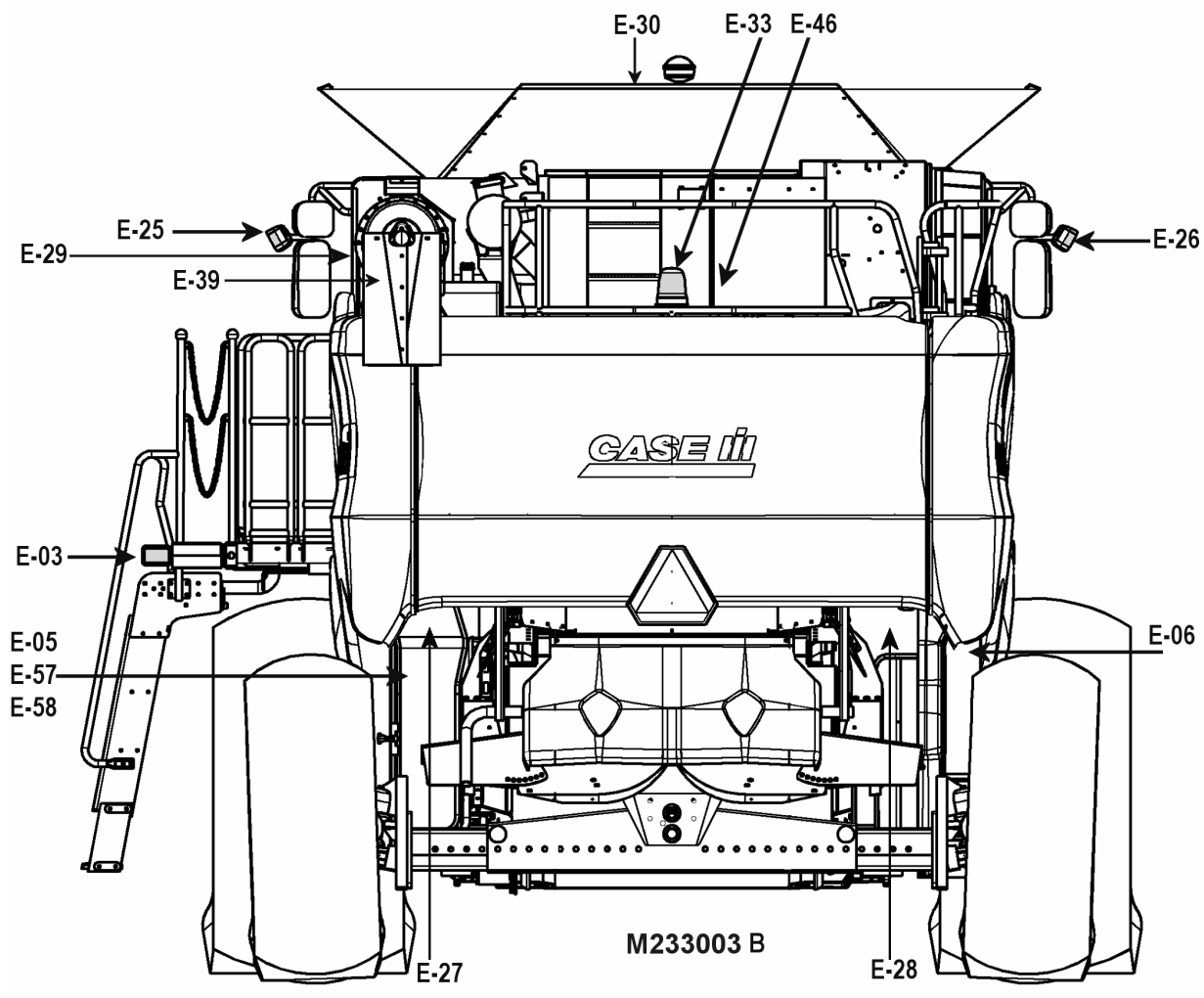


Schematic ID #	Component
E-13	LH Lower Road Lamp
E-14	RH Lower Road Lamp
E-15	LH Outer Work Lamp
E-16	RH Outer Work Lamp
E-17	LH Inner Work Lamp
E-18	RH Inner Work Lamp
E-19	LH Middle Work Lamp
E-20	RH Middle Work Lamp
E-23	LH Lower Work Lamp
E-24	RH Lower Work Lamp
E-25	LH Side Work Lamp

Schematic ID #	Component
E-26	RH Side Work Lamp
E-31	LH Beacon Lamp
E-32	RH Beacon Lamp
E-49	RH Position Lamp
E-50	LH Position lamp
E-52	LH Flashing Lamp
E-53	RH Front Lamp
E-54	LH Front Lamp
E-60	LH HID Field Lamp
E-61	RH HID Field Lamp

EXTERIOR LIGHTING

EUROPEAN LAYOUT, NOT ALL LAMPS USED IN ALL MARKETS



Schematic ID #	Component
E-05	LH Rear Flashing Lamp
E-06	RH Rear Flashing Lamp
E-25	LH Side Work Lamp
E-26	RH Side Work Lamp
E-27	LH Rear Work Lamp
E-28	RH Rear Work Lamp

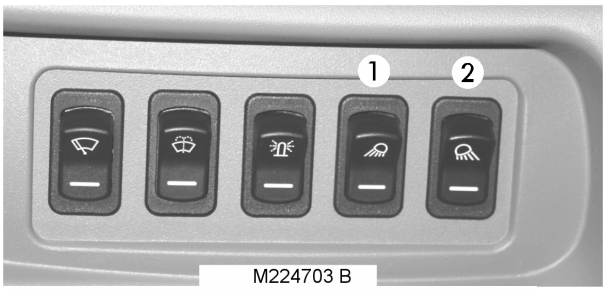
Schematic ID #	Component
E-29	Unload Tube Lamp
E-30	Grain Tank Lamp
E-33	Rear Beacon Light
E-39	Unload Tube Warning Lamp
E-57	RH License Lamp
E-58	LH License Lamp
E-46	Engine Lamp

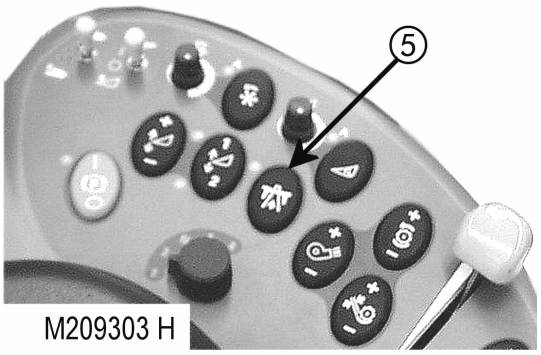
EXTERIOR LIGHTING

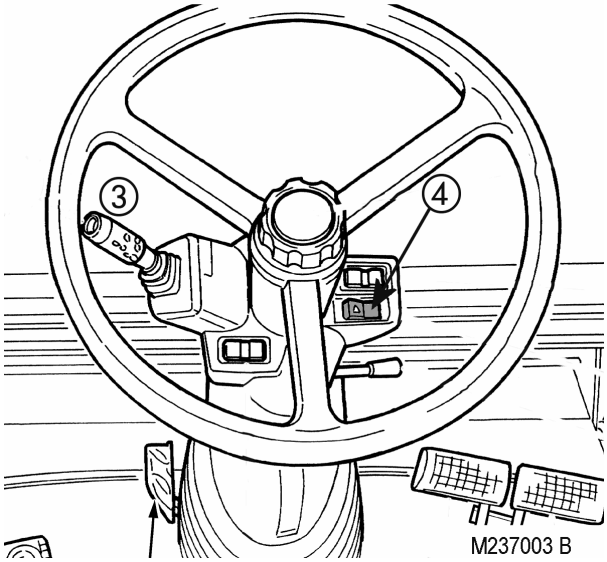
The lighting system on the AFX combine provides for highway and field operations through a combination of exterior lights that are controlled by a combination of eight operator-controlled switches and one system controlled.

- Road Light Switch, S-26
  - Turn Signal Switch
  - Road Lights, (Tail Lights Only)
  - High / Low Beams, (Euro Only)
- Front Work Light Switch, S-43
- Rear Work Light Switch, S-44
- Hazard Switch, S-25
- Beacon Light Switch, S-41
- Cab Door Switch, S-40
- Brake Pressure Switch, S-39
- MFH operation
- Engine Controller, A-01
- Feeder Angle Sensor, R-03

LIGHTING CONTROLS







1.	Rear Work Light Switch	4.	Hazard Switch
2.	Front Work Light Switch	5.	Road Mode Switch
3.	Road Light Switch		

EXTERIOR LIGHTING

EXTERNAL LAMP ASSIGNMENTS

	Optional Beacons Lamps	Cab roof lights E20, 19, 15, 21	Cab roof lights low beam (Near) E18, 17	Cab roof lights high beam (Distance) E18, 17	Stubble lights	Grain tank light	Unloader tube light (Note 3)	Rear work lights	LH side work light	RH side work light	Taillights	Backlighting, SSM and roof console light. (Note	Distance HID lighting (Mirror mtg)
Rear worklight switch (Note 2)						X	X	X				X	
Front worklight switch 2nd position & hazard or road mode **OFF**.		X		X	X						X	X	
Front worklight switch 3nd position & hazard or road mode **OFF**.		X		X	X						X	X	X
Front worklight switch 2nd position & hazard or road mode **ON**.													
Front worklight switch 3nd position & hazard or road mode **ON**.													
Stalk switch 1st position											X	X	
Stalk switch 2nd position											X	X	
Header raise 50% (Note 4)									X	X			
Stalk switch RH or LH turn (Note 6)									X	X			
Cab door open (Note 1)									X	X			
Hazard and both worklight switches **ON**		X	X								X	X	
Optional Beacon Lamps (Note 8)	X												
Reverse Drive (Note 7)								X					
Feeder Raised Above Stop Height									X	X			

EXTERIOR LIGHTING

EXTERNAL LAMP ASSIGNMENTS, CON'T

Notes:

1. LH and RH Side light illuminates for 120 seconds when cab door is OPENED or CLOSED when the key switch is in the **OFF** position.
2. When the "Hazard switch" is switched **ON**, rear worklights shut **OFF** independent of the switch position.
3. The unload tube light will turn **ON** (time delay 3 seconds) and **OFF** based on the position of the unload tube. (**Off** when in saddle). Work lights must be on.
4. Front worklight switch must be **ON** before the side worklights will illuminate when the header is raised above the maximum working height setting.
5. Backlighting on propulsion handle and RH console switch panel is illuminated when key switch is **ON**.
6. Front work light switch must be **ON** for this function to work, side lights will not come **ON** during ROAD mode NASO only.
7. When the ground drive hydrostatic drive is operated in the REVERSE mode and the FRONT work lights switch is in one of the **ON** positions the rear work lamps will be illuminated to provide lighting.
8. The beacon lamps will be illuminated momentarily when the key switch is turned to the **ON** position and with the grain tank sensors.

EXTERIOR LIGHTING

WARNING AND TURN SIGNAL FLASHER UNIT

REFERENCE MATERIAL:

Frames: #33 and 36

KEY COMPONENTS:

Flasher Unit A-05

LOCATION:

Mounted on the left side (in side) of the steering column

The flasher unit A-05 is used to control the warning and turn signal lamps, its operation will be discussed with each operation later in this section. The following information is to provide for terminal call outs and function.

This is the units pigtail and not the machines harness.

TERMINAL	COLOR	INPUT / OUTPUT	FUNCTION
1.	Red	IN	B+ Power
2.	White	IN	Hazard Switch
3.	Blue	OUT	Left Group of Lamps
4.	Brown	OUT	Right Group of Lamps
5.	Black	OUT	High Beam Indicator
6.	Green	IN	Chassis Ground
7.	Yellow	IN	Right Turn Signal
8.	Rose	IN	Left Turn Signal
9.	Violet	IN	ISO / NASO
10.	Grey	OUT	Left Rear Lamp
11.	Orange	OUT	Right Rear Lamp
12.	Light Blue	OUT	Trailer #2

Using the display screen and navigating to MAIN>TOOLBOX>ELECTRCIAL, the flasher operation may be toggled between ISO and NASO operation. NASO is the standard for North America. ISO provides for a different flasher rate then NASO.

When using the turn signals, NASO causes the opposite lamp to stay lit solid while the ISO standard causes the opposite light to go dark.

EXTERIOR LIGHTING

HAZARD LIGHT OPERATION

REFERENCE MATERIAL:

Electrical schematic frames # 33, 34, 35

KEY COMPONENTS:

Fuse F-56, Hazard Switch S-25, Flasher Module A-05, Lights E-01,E-02, E-03, E-04, E-05, E-06, E-07, E-08, and Euro only, E-51, E-052, CCM1 and CCM2.

GENERAL INFORMATION

The hazard switch will be used to activate the warning lights. The lights, if moveable, must be positioned to provide oncoming and trailing motorist of the machines width and slow traveling speed. When the hazard switch is pressed to the maintained **ON** position two actions will take place:

- If the turn signals are not activated the warning flashers that are mounted on the front marker arms of the combine, as well as the header and header wagon when equipped will be activated.
- If the work lights switch is **ON** the REAR work lights and SIDE work lights will be de-activated.

The lights will flash at approximately 60 cycles per minute.

OPERATION:

The hazard switch, S-25 is supplied B+ from fuse F-56 at connector X259 terminal 2, this power also supplies the flasher module, A-05, at terminal 1. The flasher module is supplied a chassis ground at connector X255 terminal 6.

When the hazard switch is pressed to the **ON** position, power is directed out terminal 3 to the flasher module terminal 2, CCM2 connector X015 terminator J1-15 and internally to terminal 7 of the switch's **ON** indicator lamp.

EXTERIOR LIGHTING

HAZARD LIGHT OPERATION, CON'T

OPERATION: CON'T

The flasher module will direct pulsating power output from terminal 4:

- to the flasher lamp indicator located in the steering column connector X257 terminal 10,
- lamp E-04 connector X356 terminal B
- lamp E-51 connector X352 terminal 1
- lamp E-06 connector X302 terminal 1
- trailer connector J-09 terminal R
- RH header flasher E-02 connector X304 terminal A

The flasher module will also direct pulsating power output from terminal 3

- to the flasher lamp indicator located in the steering column connector X257 terminal 7
- lamp E-03 connector X357 terminal B
- lamp E-52 connector X353 terminal 1
- lamp E-05 connector X301 terminal 1
- trailer connector J-09 terminal L
- RH header flasher E-01 connector X303 terminal A

OTHER CONDITIONS:

When the CCM2 connector X015 terminal J1-15 senses a power supply it will place a message on the data bus for the CCM1 to disable

- Terminal J1-18 to relay K-31 for lamps E-27 and E-28
- Terminal J1-24 to relay K-35 for lamps E-25 and E-26.
- Terminal J1-12 to relay K-32 for lamp E-29
- Terminal J1- 05 to relay K-27, K-22 and K-30 for lamps E-17A , 18A, 19, 20, 23, 24, 30, 60 and 61.

When relay K-27 is deactivated power is directed out terminal 4 to the head light low beams E-17B and E-18B. Power is also directed to relay K-02 terminal 4 and out terminal 3 to fuses F-20 and F-21.

- F-20 will direct power to the tail lamp E-11B and the trailer plug J-09 terminal 58L. (Euro E-03A, 05, 39, 50 and 54)
- F-21 will direct power to the tail lamp E-12B and the trailer plug J-09 terminal 58R. (Euro E-04A, 49, 53, 57, 58, 06, 40 and 41)

EXTERIOR LIGHTING

TURN SIGNAL OPERATION, (NASO)

REFERENCE MATERIAL:

Electrical schematic frames # 36,
Flasher unit is mounted inside of the steering column

KEY COMPONENTS:

Turn Signal Switch S-26, Turn Signal Indicator E-09, Fuse F-56, Flasher Module A-05, Lamps E-01, E-02, E-03, E-04, Euro Only E-51 and E-52, CCM1 and CCM2

LOCATED:

Inside the steering column

GENERAL INFORMATION

The turn signal switch may be toggled to provide right or left turn signals and may be used to activate the Side Work Lamps. Flasher rate is increase when compared to the Hazard rate.

OPERATION:

Example: When the turn signal is toggled to make a RIGHT turn.
The turn signal switch is supplied power at terminal 6 from the key switch terminal 6 anytime the key switch is in the RUN or START position. The switch is a N/O switch. When the switch is toggled it will direct a 12V signal out terminal 2 to:

- the flasher controller A-05 terminal 7 telling it to activate the right side lamps E-02, E-04 and E-09 in a flashing mode and the left side lamps E-01 and E-03 to illuminate continuously.
- the CCM1 terminal J1-9 tells the controller a right turn has been requested. This information is used to determine whether the Side Work Lamps should be illuminated.
- On EURO machines the opposite warning lamps will NOT be illuminated continuously.

Flash rate should be between 60-85 NASO and 60-120 EURO cycles per minute.

OTHER CONDITION:

If the front work light switch is in the ON position the two side lights (E-25, E-26 will be activated along WITH the turn signals.

REMEMBER: Refer to the Hazard light operation to see how the flasher unit directs power out terminals 3 and 4 to the individual lamps.

EXTERIOR LIGHTING

BEACON LIGHT OPERATION

REFERENCE MATERIAL:

Electrical schematic frames # 39

KEY COMPONENTS:

Fuse F-49, F-53, Beacon Switch S-41, Lights E-31, E-32, E-33, Relay K-29, CCM1 and CCM2, (Euro Only E-05 and E-06, Relay K-33)

GENERAL INFORMATION

The beacon switch will be used to activate the optional (standard on EURO) beacon lights. The lights may also be influenced by other machine operations:

- When the key switch is placed into the RUN position the beacons will be activated for a period of two seconds to provide a warning to anyone standing close to the machine.
- Will be activated when the grain tank is filled to provide an indicator to the grain cart operator.

OPERATIONS

Once one of the above conditions is met the CCM2 will activate the beacon relay, K-29.

Beacon Switch, S-41: The beacon switch is supplied 12V from the fuse F-49 at terminal 2. The switch has two detented positions, **OFF** and **ON**. When the switch is pressed to the **ON** position voltage is directed out terminal 3 to the CCM2 connector X015 terminal J1-2, providing a signal for the CCM2 to activate the beacons. Inside the switch there is also an internal connection to terminal 10 to provide power for the LED indicator.

If the CCM2 is receiving a signal from the beacon switch, it will provide voltage out connector X015 terminal J1-24 to the beacon relay K-29 terminal 1 to activate it. The relay also receives operating voltage at terminal 3 from the fuse F-53. The relay will direct voltage out terminal 5 to the three beacon lamps.
EURO only: The CCM2 also directs power out terminal J1-18 to activated relay K-33 at terminal 1. Terminal 3 is supplied power from fuse F-52 at terminal 3. The relay will direct power out terminal 5 to lamps E-05 and E-06 terminals 3.

OTHER CONDITIONS, (REFERENCE SECTION 74 GRAIN HANDLING)

1. When the CCM2 receives power due to the key switch being turned to the **ON** position, the CCM2 will activated the beacons for two seconds.
2. When the CCM2 receives a signal that the grain tank sensors has tripped by means of the of the data buss, it will activate the beacons lights. See section 74.

EXTERIOR LIGHTING

BRAKE LIGHT OPERATION

REFERENCE MATERIAL:

Electrical schematic frames # 09, 35, 38

KEY COMPONENTS:

Fuse F-52, Brake Light Relay K-33, Brake Pressure Switch S-39, Lights E-11, E-12, MFH, ECU and CCM2.

GENERAL INFORMATION

The brake lamps are activated anytime the combine speed is decreased to inform anyone that may be following the machine that it may be preparing to stop. The lights may be influenced by other machine operations:

- When the right brake pedal are pressed, raising the brake pressure.
- When pulling the multi-function handle toward the **NEUTRAL** zone rapidly.
- When the engine is about to shut down due to an engine Auto-Shut-Down situation.

OPERATIONS

The brake lamp relay K-33 is supplied B+ power at terminal 3 from fuse F-52. Once one of the above conditions is met the CCM2 will direct voltage out connector X015 terminal J1-18 to the brake relay K-33 terminal 1, activating the relay. The relay will direct voltage from terminal 3 out terminal 5 to the two rear brake lamps E-11 terminal A, E-12 terminal A and terminal 54 of the trailer connector causing the brake lamps to illuminate.

EXTERIOR LIGHTING

FRONT - WORK AND ROAD LIGHTS

REFERENCE MATERIAL:

Electrical schematic frames # 34, **35**, 36, 37, **40**, **41**, **42**

KEY COMPONENTS:

Front Work Light Switch S-43, Road Mode Switch S-12, Hazard Switch S-25, Relays K-01, 02, 21, 22, 27, 30, Fuses F-21, 22, 29, 30, 31, 54, Lamps E-**15**, **16**, **17**, **18**, **19**, **20**, **23**, **24**, **30**, **60**, **61**, (additional Euro lamps: 05, 06, 39, 40, 41, 49, 50, 51, 52, 53, 54, 57, 58) CCM1

GENERAL INFORMATION

The Front Work light switch S-43 directs a signal to the CCM1 to control all the front work lamps for field and road operations. The difference in operations is whether the Road Mode switch S-12 or Hazard switch S-25 is toggled to **ON**. This switch will also illuminate the RHC overhead lamp.

REMEMBER: The Rear Lamp Switch S-44 controls the Rear lamps.

OPERATIONS

Front Work Light Switch in "OFF" Position

The front work light switch S-43 is a two pole, three position detented switch:

- Terminal 2 is supplied 12V from fuse F-49, this will provide the signal voltage from the switch to the CCM1 for requested lights. The contacts between terminal 2 and 3 will be OPEN.
- Terminal 6 is supplied a chassis ground from ground point #4, this ground will be used by the optional **mirror** bracket mounted High Intensity Lamps (HID). The contacts between terminal 6 and 5 will be OPEN.

EXTERIOR LIGHTING

FRONT - WORK AND ROAD LIGHTS, CON'T

Front Work Light Switch in the CENTER "ON" Position, Road Mode and Hazard Switch "OFF"

When the switch is toggled to the center position **ON** 12V is directed out terminal 3 to the CCM1 connector X018 terminal J1-3.

1. The CCM1 will direct 12V out terminal J1-5 to relay K-22, K-27, and K-30 terminal 1, activating them.
    - Relay K-22 is supplied power from fuse F-30 at terminal 3. When activated the power is directed out terminal 5 to optional lamps E-60 and E-61. Lamps E-60 and E-61 will **NOT** be illuminate because of **NO** ground supplied.
    - Relay K-27 is supplied power from fuse F-29 at terminal 3. When activated the power is directed out terminal 5 to lamps E-17 terminal B and E-18 terminal B.
    - Relay K-30 is supplied power from fuse F-54 at terminal 3. When activated the power is directed out terminal 5 to lamps E-23, E-24 and E-30 terminals 1.

2. The CCM1 will direct 12V out terminal J1-11 to relay K-01 terminal 86 and K-21 terminal 1 activating both relays.
    - Relay K-01 is supplied 12V from fuse F-31 at terminal 30 When activated, the power is directed out terminal 87 through fuse F-07 to lamp E-16 and F-06 to lamp E-15.
    - Relay K-21 is supplied 12V from fuse F-29 at terminal 3. When activated the power is directed out terminal 5 to relay K-27 terminal 3. Relay K-21 is used to turn the power **ON** and **OFF** to relay K-27.
    - Relay K-27 is used to toggle roof lights E-17 and E-18 between HIGH beam (terminal B) and LOW beams (terminal A). HIGH beams are **ON** during FIELD mode and LOW beams during ROAD mode.

Work Light Switch in the SECOND "ON" Position, Road Mode and Hazard Switch "OFF"

When the switch is toggled to the second position **ON,** 12V is directed out terminal 3 to the CCM1 connector X018 terminal J1-3 as in position one, AND the ground at terminal 6 is directed out terminal 5. This ground is directed to lamps E-60 and E-61, which were already powered from relay K-22.

EXTERIOR LIGHTING

FRONT - WORK AND ROAD LIGHTS, CON'T

OTHER CONDITIONS

In North America, the operator is required to engage the Hazard lights when driving the combine on the road, therefore, the system automatically places the roof lights into a Road Mode state. The hazard switch S-25 is the only way to toggle the roof HIGH/LOW beam lights E-17 and E-18 from HIGH to LOW. When toggling **ON** the Hazard switch, a signal is also directed to the CCM2 terminal J1-15 placing a message on the data bus that the Hazard switch in **ON**. The CCM1 will respond to this message by discontinuing power output on terminal J1-5 placing the front lights in a **Road** Mode.

- Relay K-22 will be deactivated, turning **OFF** its lamps E-60 & 61.
- Relay K-30 will be deactivated, turning **OFF** its lamps E-23, 24 & 30.
- Relay K-27 will be deactivated, directing its power out terminal 4. The power will be directed in TWO directions, one is to the lamps E-18 terminal A and E-17 terminal A for LOW beams, and the other to relay K-02 terminal 4.
  - Relay K-02 is NOT activated so the power is directed out terminal 3 to fuses F-20 and F-21.
    - F-20 directs power to lamps E-03 terminal A, E-11 terminal 3, and J-09 terminal 58L.
    - F-21 directs power to lamps E-04 terminal A, E-12 terminal 3 and J-09 terminal 58R

EXTERIOR LIGHTING

FRONT - WORK AND ROAD LIGHTS, EUROPE ONLY

REFERENCE MATERIAL:

Electrical schematic frames #36

KEY COMPONENTS:

Road Light Switch S-26, CCM1, Relays K-04, 05, Fuses F-32, 33, 51, Lamps: 03, 04, 13, 14, 49, 50, 53, 54, 57, 58)

GENERAL INFORMATION

The Road light switch S-26 is a multi-function switch with many positions. Rotating the knob turns on the headlights, tail/position and console lights. Pulling the knob will control the lower headlight HIGH/LOW beams.

REMEMBER: The North America machines are not equipped with lower headlights but will turn on the taillights as described below..

OPERATIONS

Road Light Switch in "OFF" Position

- All contacts in the switch are OPEN and NO lamps are turned on.

Road Light Switch Rotated to SECOND "ON" position

When the road light switch is rotated to the second **ON** position, 12 volts is directed out terminal 1 to relay K-02 terminal 5. A jumper wire also provides 12 volts to terminal 1, which activates the relay and closes contacts 5 to 3. 12 volts is then directed from terminal 3 to fuses F-20 and F-21 turning on tail lights E-03 and E-04 terminals A and position lamps E-49, E-50, E-53 and E-54.

Road Light Switch Rotated to THIRD "ON" position

When the road light switch is rotated to the third **ON** position, 12 volts is not only directed out terminal 1, but also out terminal 7 to relay K-05 terminal 1. Relay K-05 is supplied voltage from fuse F-33 at terminal 3. When the relay activates this voltage is directed out terminal 5 to lamps E-13 and E-14 terminals 2.

Road Light Switch PULLED Toward the Operator

When the road light switch is pulled towards the operator, contacts 8 and 4 are closed directing 12 volts from fuse F-51 out terminal 4 to relay K-04 terminal 1. Relay K-04 is also supplied 12 volts from fuse F-32 at terminal 3. When the relay activates the 12 volts is directed out terminal 5 to lamps E-13 and E-14 terminals 3.

EXTERIOR LIGHTING

FRONT - WORK AND ROAD LIGHTS EUROPE, CON'T

- Relay K-21 is supplied 12V from fuse F-29 at terminal 3, when activated the power is directed out terminal 5 to relay K-27 terminal 3. Relay K-21 is used to turn the power **ON** and **OFF** to relay K-27 (additional functions on other equipment).

The CCM1 will direct 12V out terminal J1-5 to relay K-27, K-22 and K-30 terminal 1, activating the them.

- Relay K-22 is supplied power from fuse F-30 at terminal 3, when activated the power is directed out terminal 5 to lamps E-19 and E-20, and optional E-60 and E-61. Lamps E-60 and E-61 will **NOT** be illuminated because of **NO** ground supply.
- Relay K-27 is supplied power from fuse F-29 at terminal 3, when activated the power is directed out terminal 5 to lamps E-17 terminal A and E-18 terminal A.
- Relay K-30 is supplied power from fuse F-54 at terminal 3, when activated the power is directed out terminal 5 to lamps E-23, E-24 and E-30.

Work Light Switch in the second "ON" Position, Road Mode and Hazard Switch "OFF"

When the switch is toggled to the second position **ON** 12V is directed out terminal 3 to the CCM1 connector X018 terminal J1-3 AND a ground at terminal 6 is directed out terminal 5. This ground is directed to lamps E-60 and E-61, which were already powered from relay K-22.

OTHER CONDITIONS

When toggling **ON** the Hazard switch a signal is also directed to the CCM2 terminal J1-15 or the Road mode switch a signal is directed to the RHM connector X029 terminal 16, a message will be placed on the data bus. The CCM1 will discontinue the power output of terminal J1-5.

- Relay K-22 will be deactivated, turning **OFF** its lamps.
- Relay K-30 will be deactivated, turning **OFF** its lamps.
- Relay K-27 will be deactivated, directing its power out terminal 4. The power will be directed in TWO directions, one is to the lamps E-18 terminal B and E-17 terminal B for LOW beams, and the other to relay K-02 terminal 4.
  - Relay K-02 is NOT activated so the power is directed out terminal 3 to fuses F-20 and F-21.
    - F-20 directs power to lamps E-**03** terminal A, **11** terminal B, (also 05, 39, 50, 54 Euro lamps) and J-09 terminal 58L.
    - F-21 directs power to lamps E-**04** terminal A, **12** terminal B, (also 40, 41,49, 53, 57, 58 Euro lamps) and J-09 terminal 58R

EXTERIOR LIGHTING

REAR - WORK AND ROAD LIGHTS

REFERENCE MATERIAL:

Electrical schematic frames # 34, 35, 36, 37, 40, 41, 42

KEY COMPONENTS:

Rear Work Light Switch S-44, CCM1, Relays K-31, 32, 34, 35, Fuses F-50, 55, Road Mode Switch S-12, Hazard Switch S-26, Lamps E-**25**, **26, 27**, **28**, **29**, RHM

GENERAL INFORMATION

The Rear Work light switch S-44 switch will direct a signal to the CCM1 to control the rear, unloading tube, RH and LH side work lamps for field operation.

REMEMBER: The Front Lamp Switch S-43 controls the Front lamps.

OPERATIONS

Work Light Switch in "OFF" Position

The work light switch S-44 is a two position detented switch:

- Terminal 2 is supplied 12V from fuse F-49, this will provide the signal voltage from the switch to the CCM1 for requested lights. The contacts between terminal 2 and 3 will be OPEN.

Work Light Switch in the "ON" Position, Road and Hazard Switch "OFF"

When the switch is toggled to the **ON** position 12V is directed out terminal 3 to the CCM1 connector X018 terminal J1-15. The CCM1 will direct power out terminals:

- J1-18 to relay K-31 terminal 1. The relay is also supplied power from fuse F-55 at terminal 3. Once the relay is activated the power is directed out terminal 5 to the lamps E-27 and E-28.
- J1-12 to relay K-32 terminal 1. The relay is also supplied power from fuse F-50 at terminal 3. Once the relay is activated the power is directed out terminal 5 to the lamp E-29.
- J1-24 to relay K-35 terminal 1. The relay is also supplied power from fuse F-50 at terminal 3. Once the relay is activated the power is directed out terminal 5 to the lamp E-26 and to relay K-34 terminal 5 to lamp E-25.

EXTERIOR LIGHTING

REAR - WORK AND ROAD LIGHTS, CON'T

OTHER CONDITIONS

- When either the Road Mode or Hazard switch is toggled **ON** the CCM1 will dis-continue power output on terminals J1-18, J1-12 and J1-24, shutting down the rear lamps.
- When the Unloading Auger tube is in the home saddle the CCM1 will dis-continue power output on terminal J1-12, shutting down the tube lamp.
- When the header height position is BELOW the set point, at which the acre counter is turned **ON** or **OFF**, the CCM1 will toggle the power output at terminal J1-24 to control the operations of the Side Lights.
- When the operator's door switch changes mode (OPEN or CLOSED) the CCM1 will activate terminal J1-24 to provide for exit lighting.

EXTERIOR LIGHTING

CAB DOME LAMP

REFERENCE MATERIAL:

Electrical schematic frames #38

KEY COMPONENTS:

Left Door Switch S-40, Fuses F-52, Cab Dome Lamp E-34

GENERAL INFORMATION

The dome lamp provides the operator with an interior lamp that may be operated in one of three modes:

- **OFF**, when pressed to it limits in one direction. The switch contacts will not provide a ground at any time.
- **ON**, when pressed to it limits in the opposite direction. This position does NOT shut OFF with the key switch.
- **Auto**, when pressed to the center position. In this position the lamp will illuminate any time the operator's door is open.

OPERATIONS

Fuse F-52 directs B+ voltage to the relay K-33, K-20 and the dome lamp E-34 connector X296 terminal 1. Connector X129 terminal 1 provides a ground for turning the lamp on continuously and terminal 2 provides a ground through the door switch S-40.

The door switch is a N/C switch, it will be closed whenever the door is OPEN, providing a ground for the lamp.

EXTERIOR LIGHTING

EXIT LIGHTING

REFERENCE MATERIAL:

Electrical schematic frames #38, 42

KEY COMPONENTS:

Left Door Switch S-40, Relays K-20, 34, Fuses F-38, 50, 52, Lamps E-**25**, **26,** Key Switch S-02

GENERAL INFORMATION

The Exiting light will be activated anytime the operator's door switch changes position. The lamps should illuminate for approximately 120 seconds.

OPERATIONS

Door Open

The door switch S-40 is a N/C switch, it will provide a ground path when the door is opened. Fuse F-52 directs power to the time relay K-20 terminal 87a and the cab dome lamp E-34 terminal 1. The time relay K-20 is an electronic relay with a built in circuit board. The relay will direct approximately 3.3 V out terminal 86 to the operator's door switch S-40. (When the dome lamp is in place there will be B+ power at this location while the door is closed). When the door is OPEN this voltage will be bled off to the ground and will NOT be seen.

When the door is opened and the switch provides a ground for the relay terminal 86, the relay will sense the voltage change and activate the side lamps. Power will be directed out terminal 87 to relay K-34 terminal 1, activating the relay.

Relay K-34 is supplied power from fuse F-50 at terminal 3. When the relay is activated it will direct power to each side lamps E-25 and E-26. The lamps will be illuminated for approximately two minutes, then the time relay will deactivate and shut down relay K-34.

EXTERIOR LIGHTING

SIDE WORK LAMPS

REFERENCE MATERIAL:

Electrical schematic frames #38, 42

KEY COMPONENTS:

Road Light Switch (Turn signal switch) S-26, Front Work Light Switch S-43, Feeder Angle sensor R-03, Relays K-20, 34, Fuses F-38, 50, 52, Lamps E-25, 26, Key Switch S-02

GENERAL INFORMATION

The side work lamps may be activated manually for continuous operation or automatically to provide for additional light during headland turns.

OPERATIONS

Manual Operation

The operation is influenced by the position of the Front Work lamp switch S-43. When the work light switch is activated and the turn signal switch S-26 is toggled to the RIGHT or LEFT turn position the side work lamps will illuminate, the switch may be left in the turn mode position or placed back into the OFF position. The side lamps will remain ON until the turn signal switch is cycled again.

The CCM1 will determine what position the Front Work lamp switch is in. If it is **OFF** only the Hazard lamps will operate due to the flasher unit, if the switch is **ON** the CCM1 will ALSO active the side work lamps by directing power out connector X018 terminal J1-24 to relay K-35 terminal 1. Relay K-35 is also supplied power from fuse F-50 at terminal 3. When the relay is activated it will direct power out terminal 5 to the lamps E-25 and E-26 terminals A.

Automatic Operation

When the threshing and feeder operations are engaged and the feeder is RAISED above the maximum working height point (the point at which acres are counted or not counted) the side lamps will automatically be activated to provide for additional turning light.

SIEVE LAMPS

SIEVE LAMPS

REFERENCE MATERIAL:

Electrical schematic frames #42

KEY COMPONENTS:

Sieve Lamp Switch S-54, Lamps E-37 and E-59, Fuse F-14

GENERAL INFORMATION

The sieve lamps are used to provide light inside the threshing area while making adjustments and repairs. The lamp housing incorporates a thermo circuit breaker that will prevent the lamps from over heating. If the housing should get to hot due to debris, the breaker will open and reset itself when the unit has cooled sufficiently. When installing the lamps, make sure that the thermo breaker is mounted on the top.

OPERATIONS

When the key switch is placed into the **RUN** position the K-03 accessory relay is activated, providing power to the fuse F-14. This fuse provides power to terminal A of the sieve switch S-54, which is mounted next to the front battery. The switch is a two position maintained switch. When the switch is toggled to the **ON** position power is directed out terminal B to the lamps E-37 terminal A and E-59 terminal A. The two lamps are chassis grounded at ground point (1).

UNDER SHIELD (SERVICE) LAMPS

UNDER SHIELD (SERVICE) LAMPS

REFERENCE MATERIAL:

Electrical schematic frames #38

KEY COMPONENTS:

Under Shield Lamp Switch S-63, Engine Lamp Switch S-64, Lamps E-42-46, Fuse F-34

GENERAL INFORMATION

The under shield lamps are used to provide light inside the threshing area while making adjustments and repairs.

OPERATIONS

Fuse F-34 is supplied power from the B+ supply. This fuse provides power to terminal 2 of the service and engine lamp switches S-63 and 64. The service lamp switch is mounted outside of the front battery and the engine lamp switch is mounted at the top left of the rear service ladder. The switch is a two position maintained switch.

When the service lamp switch is toggled to the **ON** position power is directed out terminal 1 to lamps E-42 thur E-45 terminal A. The four lamps are chassis grounded at ground point (2).

When the engine lamp switch is toggled to the **ON** position power is directed out terminal 1 to lamps E-46 terminal A. The lamp is chassis grounded at ground point (1).

HEATING VENTILATION AIR CONDITIONING SYSTEM

H.V.A.C. OPERATIONS

The AFX series H.V.A.C. system will operate in one of the following modes:

- Cab Pressurization
- Ventilation
- Defog
- Automatic Temperature Control (ATC)



PRESSURIZE MOTOR

The purpose of the pressurizing motor is to keep the cab pressurized to prevent dust from entering the cab. The pressurizing motor will run anytime the key switch is in the **RUN** position and K-09 relay circuit is activated. The operator does not control this operation nor feel the air circulation within the cab. The pressurizing motor (located at the back of the cab air filter canister) draws air from outside of the cab through the cab air filter. The cab must be pressurized to a minimum of 0.5" water. The main cab air filter is located behind the access panel on the front left side of the grain tank. See testing cab pressure later in this section.

HEATING VENTILATION AIR CONDITIONING SYSTEM

VENTILATION CONTROL

Ventilation is **unconditioned** cab air being drawn from the **inside** of the cab, through the re-circulation filter, through the evaporator/heater core and blown out through the cab vents (air that the operator can feel). When the ATC control button is pressed **OFF** position, (the digital display will be dark) the ATC mode will be turned **OFF**. The temperature control will have NO effect on the system, the ATC controller will close the water valve completely. The blower control will be used to control the volume of air being forced out of the cab vents. The blower speed is infinitely variable from an **OFF** position (counter clockwise) to a **HIGH** (clockwise) position. The blower motor is located in the lower right corner of the cab. A re-circulation filter is located in the lower right back wall of the cab.

The blower motor will respond in one of two ways:

1. If the ATC control button is in the **OFF** position before the key switch is turned to the **RUN** position the blower will run at the current blower control setting.
2. If ATC control button is placed in the **OFF** position AFTER the key switch is turned to the **RUN** position, the blower will STOP operating. To activate the blower motor, the blower motor speed control must be rotated approx. 30° in either direction. Once the blower motor has been activated, the speed may be adjusted to a desired speed.

DEFOG

Defog is used to clear off the windows by using the A/C to lower the humidity in the air and using the heater to warm the air enough to dry the windows. The ATC control button must be pressed to activate the AUTO controls and the mode button toggled to DEFOG and the windshield icon will be displayed in the digital display. The temperature control knob may be adjusted to any setting. If the cab vent temperature is too cold the temperature control may be rotated clockwise to provide some additional heating of the air. The cab temperature will be monitored by the re-circulation air sensor, and be maintained at the temperature control setting by cycling the heater valve. While operating in the defog operation the compressor will run continuously, unless the evaporator sensor determines the evaporator is too cold and could start to freeze up.

The ATC controller will automatically control the blower motor speed as required to maintain the temperature desired. It will be normal for the vent temperature to be cold during early morning start up, due to low engine temperature. If the operator reduces the blower speed until the engine warms up, the ATC controller will disengage the auto mode of the blower speed. To re-activate the auto mode for the blower motor speed, the ATC control button MUST be toggled to reactivate the auto position.

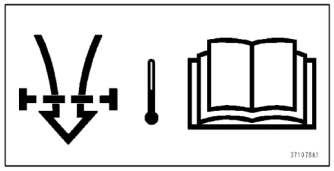
HEATING VENTILATION AIR CONDITIONING SYSTEM

AUTOMATIC TEMPERATURE CONTROL

Air conditioning cools or heats the cab air before blowing the air out through the cab vents. The ATC control button will be pressed to the auto position. The ATC control button is pressed to turn ON the ATC control and the mode button toggled so that the "**A"** appears on the temperature display indicating the system is operating in the ATC Control mode. The operator will adjust the temperature control to the desired temperature. The temperature display will display the DESIRED cab temperature not the actual cab temperature. The working range of the ATC system will be 16^0–32^0C (61^0–89^0F). If the cab vent temperature is too cold the temperature control should be rotated clockwise to a higher temperature setting. If the cab vent temperature is too warm the temperature control should be rotated counterclockwise to a lower temperature setting. In ATC operation it may take several minutes for the cab temperature to stabilize. The cab temperature will be monitored at the re-circulation filter by a temperature sensor and be maintained at the level to which the temperature control is set. Once the cab temperature has stabilized, the controller will maintain it within +/- 2^0F by controlling the blower fan speed, water valve and the compressor if required. This **will be** actual cab air temperature and not A/C evaporator temperature.



IMPORTANT It is extremely important that the re-circulation filter area behind the operator's seat MUST not be plugged or obstructed.



While the system is operating in the "Auto" mode the "**A**" will be displayed in the temperature display window. If the cab temperature is being maintained, but the operator decides that a different volume of air coming from the cab vents would be nice and manually adjusts the blower speed control, the system will drop blower motor control out of the auto mode. The "**A**" will no longer be displayed. The system will still be trying to maintain the desired temperature at the blower speed the operator has selected. To re-activate the auto mode for the blower motor speed, either control button MUST be toggled to reactivate the auto position.

The blower speed control position has no effect on the speed the blower will operate at when the "**A**" is being displayed.

HEATING VENTILATION AIR CONDITIONING SYSTEM

AUTOMATIC TEMPERATURE CONTROL (ATC), CON'T

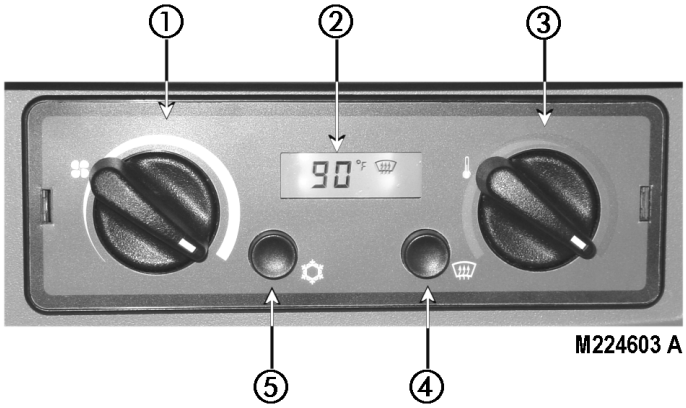
If the temperature control is rotated fully clockwise, the display will indicate above 32^0C (90^0F), the A/C compressor will be locked out and the water valve will be opened completely. The system will drop out of auto mode and the "A" will not be displayed in the display window. This will be maximum heat. When the control is rotated counter-clockwise the auto mode will be re-activated.



If the temperature control is rotated fully counter-clockwise, the display will indicate below 15^0C (60^0F), the water valve will be closed completely and the A/C compressor will be operating full time. The system will drop out of auto mode and the "A" will not be displayed in the display window. The evaporator sensor will prevent the system from freezing up. This will be maximum cooling. When the control is rotated clockwise the auto mode will be re-activated.

HVAC COMPONENTS

HVAC CONTROL PANEL, (A-09)



1	Blower Control	4	Mode Control Button
2	Auto Operation Display	5.	ATC Control Button
3	Temperature Control		

ATC Control Button, (5)

The operator selects ATC Control by pressing the left hand button one time, the digital display window will be illuminated. When illuminated the mode of operation will be displayed along with the desired temperature. The button toggles between two modes:

"O" = OFF, the cab blower motor may be run, but the air will not be conditioned and the display will NOT be illuminated.

"A" = Auto, the system will warm or cool the air as needed to maintain the cab temp and the display will be illuminated.

Located: In the overhead switch panel.

Mode Control Button, (4)

Once the operator has activated the ATC control, the mode button is pressed to toggle between AUTO and DEFOG. The digital display window will be illuminated with the symbol displayed. The button toggles between two modes:

"A" = Auto, the system will warm or cool the air as needed to maintain the cab temp and the display will be illuminated.

= Defog, the system will run the A/C compressor full time and warm the air to defog the windows and the display will be illuminated.

Located: In the overhead switch panel.

HVAC COMPONENTS

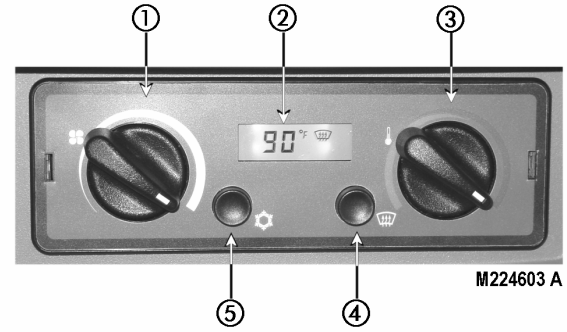
SYSTEM COMPONENTS, CON'T

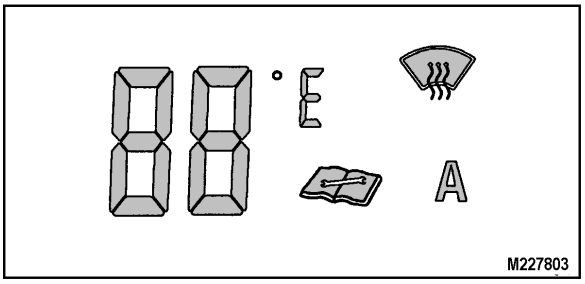
Temperature Control Potentiometer, (1)

The temperature control gives the operator control over the temperature of the air being dis-charged from the cab vents. Turning the control clockwise will increase the temperature of the air and turning the control counter-clockwise will lower the temperature of the air. The temperature control is a potentiometer rated at 10K ± 10% ohms.

Location: In the left control knob, left hand overhead switch panel.

Display Unit, (2)





The display provides the operator with information about the systems performance.

- It provides the desired cab temperature reading selected by the operator. The display reading may be in Fahrenheit or Celsius. To make the changed between reading there is a ground wire located under the left rear corner of the cab at the main ground boss. Attaching the wire to the ground provides for Celsius readings.
- It illuminates an icon "A", when the system is operating in the automatic climate mode.
- When the "A" is not illuminated the blower motor speed MUST be manually controlled and "Auto" mode will only control the water valve and compressor, while trying to maintain the set temperature.
- It illuminates an icon of a windshield when the system is in the Defog mode.
- It illuminates an icon of a book when the system is not operating correctly. Along with the book icon a fault code will also be displayed to assist the technician making the correct repairs.

Location: - In the left hand overhead switch panel.

HVAC COMPONENTS

SYSTEM COMPONENTS, CON'T

Blower Speed Control Potentiometer, (3)

The blower speed control gives the operator control over the speed of the blower motor. Turning the blower clockwise will increase the speed of the blower, producing more airflow out of the cab vents, turning the control counter clockwise will reduce the air flow.

If the ATC control button has been pressed, the blower speed control position will have NO effect over the blower's speed. The ATC controller will increase or decrease the blower motor speed as needed to maintain the desired cab temperature. If the blower motor control is adjusted, the controller will release the automatic control over the blower motor speed. The blower motor will only operate in the manual mode if the "A" is NOT displayed. The ATC control button must be toggled **OFF** and back **ON** to reset the automatic blower motor operating mode. The automatic temperature control will always be operating whether the "A" is displayed or not. The blower control is a potentiometer rated at 10K $\pm$ 10% ohms.

When operating in the Auto Climate or Defog mode, the blower will make a speed increase for every 2°F difference there is between the temperature set point and the actual cab temperature sensed by the cab temperature sensor.

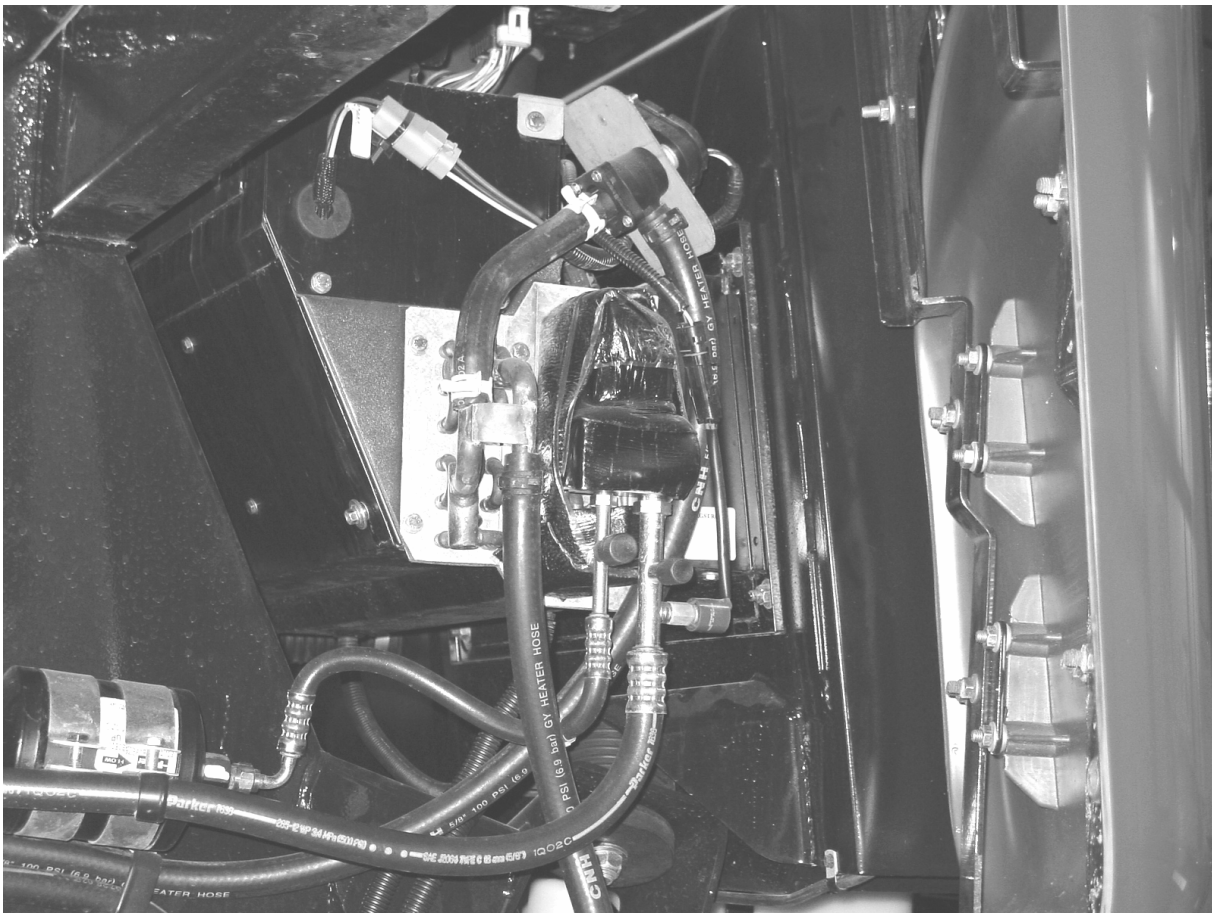
If the evaporator sensor senses that the evaporator temperature is below 80°F (26°C), and system is calling for heat the blower speed will not be increased until the evaporator temperature has increase.

Location: In the overhead switch panel

HVAC COMPONENTS

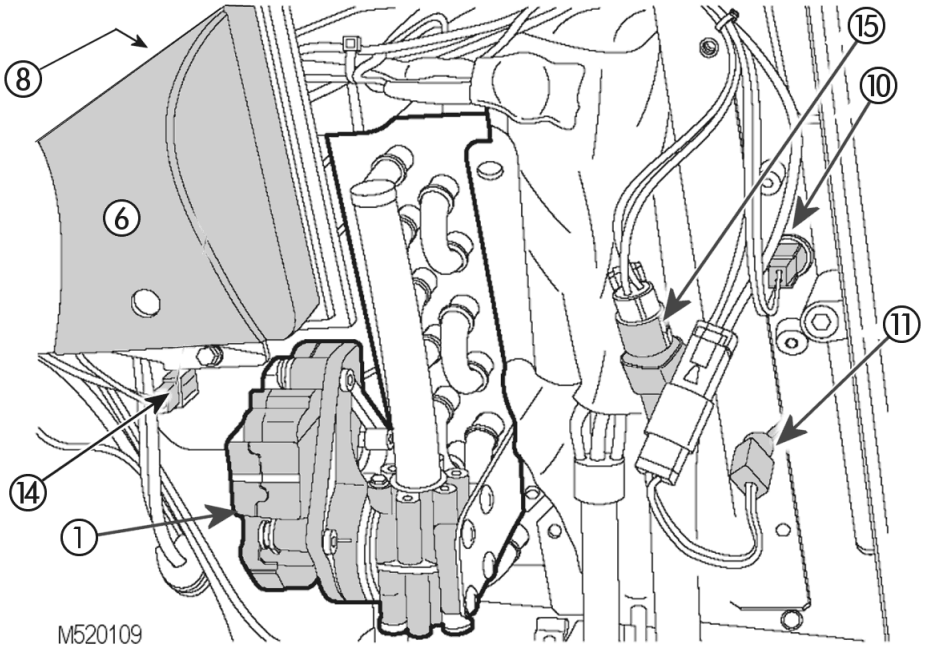
SYSTEM COMPONENTS, CON'T

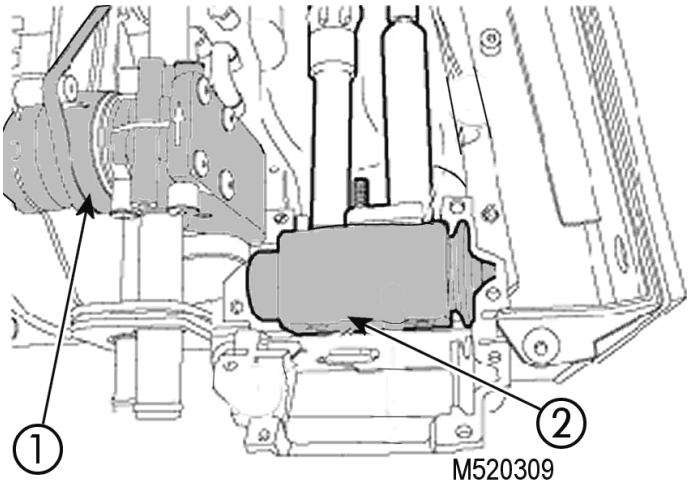
REAR LOWER RIGHT CORNER OF CAB



HVAC COMPONENTS

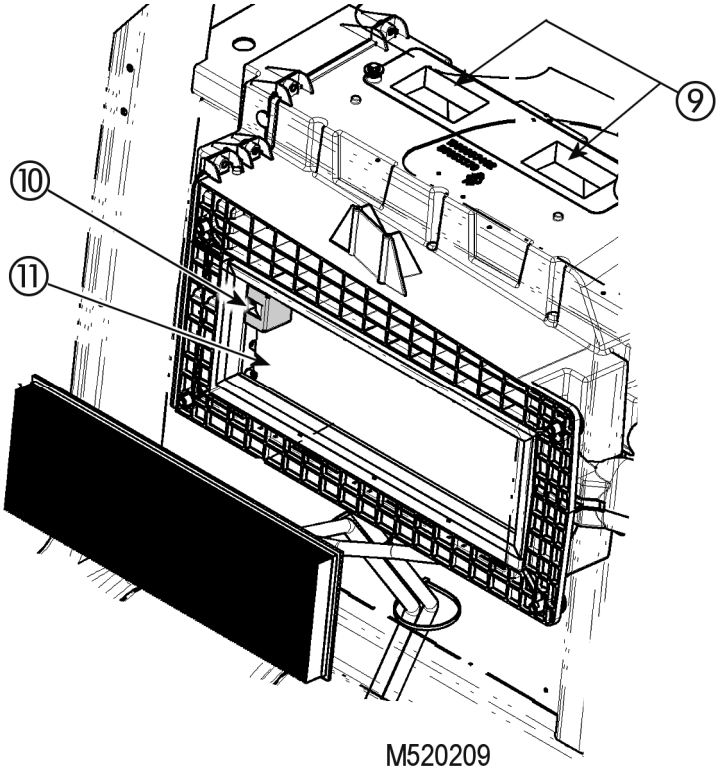
VIEWED FROM THE RIGHT HAND END





1.	Heater Water Valve and Motor, M-16	10.	Cab Temperature Sensor, B-26
2.	Expansion Valve	11.	Evaporator Freeze Sensor, B-28
6.	ATC Control Module (may be mounted on the left end of unit), A-15	14.	Outlet Temp. Sensor, B-27
8.	Blower Speed Controller, A-14 Mounted behind the ATC control (6)	15.	Low Pressure Sensor

HVAC COMPONENTS



M520209

Viewed From Inside The Cab

9.	Blower Motor & Outlets, F-18	11.	Evaporator freeze Sensor, B-28
10.	Cab Temperature Sensor, B-26		

HVAC COMPONENTS

SYSTEM COMPONENTS

Separator (pressurizer) Blower, M-18

The cab is kept pressurized to keep dust and dirt out with a separator blower. The separator blower will run when the key switch is placed into the RUN or START position, the operator has NO control over the separator blower operation. The cab must be pressurized to a minimum of 0.5" H_2O of pressure. The pressure may be checked with a manometer that is used to check engine blow-by, refer to test procedures in this section or the service manual.

Location: Inside the cab air filter canister

Blower Motor, M-09 (9)

The blower motor is used to re-circulate air that is in the cab, through the heater/evaporator cores and sends it out through the cab vents. The blower motor does not draw air from outside of the cab. Air is drawn through the paper re-circulation filter located in the lower right corner of the cab. The blower is a variable speed motor, controlled by the HVAC controller and linear driver. The motor is controlled through the ground circuit to the motor.



IMPORTANT For proper A/C operation the re-circulation MUST be kept clean and free from obstructions.

Location: Lower right hand corner of cab, in behind of the evaporator.

HVAC COMPONENTS

SYSTEM COMPONENTS

ATC Controller, A-15 (6)

The ATC controller is used to control the complete HVAC system. All inputs signals are directed to the controller and all controlling outputs are sent from the controller. The controller will compare the temperature set point against the cab temperature sensor every 0.5 seconds and make adjustments as required.

Located: Mounted on the right hand side of the evaporator unit.

Blower Speed Controller, A-14, (8)

The linear drive is used to control the current flow to the blower motor, controlling the speed and air output of the motor. Due to a linear driver operating at a high temperature it must be installed correctly.

Located: Mounted behind the ATC controller, in the air intake plenum.

Water Valve, M-16, (1)

The water valve controls the flow of hot engine coolant through the heater core. When the operator requests a temperature change, the HVAC controller will activate the water valve. The water valve will shut OFF completely. On the top of the water valve is a round indicator that will rotate as the water valve is operating, giving an indication that the water valve is working.

Located: Right hand end of the evaporator unit

Outlet Temperature Sensor, B-27 (14)

The outlet temperature sensor monitors the discharge air temperature to help maintain the desired cab temperature.

Located: In the blower discharge plenum.

HVAC COMPONENTS

SYSTEM COMPONENTS, CON'T

Cab Temperature Sensor, B-26 (10)
The cab temperature sensor monitors the return air as it flows through the re-circulation filter. It sends a signal to the ATC controller as to the current cab temperature. It has a female connector. See testing procedures later in this section.
Located: Under the re-circulation filter.

Evaporator (Freeze) Sensor, B-28 (11)
The evaporator sensor monitors the evaporator temperature. The ATC controller uses the signal to control the A/C compressor to prevent the evaporator from freezing. The sensor's location with in the evaporator core is very critical. The sensor must be pressed in completely.
Located: Inserted in through the right side of the evaporator housing

Low Pressure Switch, S-48
The low-pressure switch monitors the refrigerant pressure on the suction side of the A/C system. If the pressure drops a signal will be sent to the ATC to de-activate the compressor. The low-pressure switch must send 4 signals with in a 60-second period before the ATC controller will lock out the compressor. It is a N.O. (normal open) switch and green in color. The switch will be held closed during normal operation. Closes at approx. 20 psi and opens at 4 psi.
Located: At the expansion valve

High Pressure Switch, S-47
The high-pressure switch monitors the refrigerant pressure on the compressor's discharge side of the A/C system. If the pressure increases above the set point of the pressure switch a signal will be sent to the ATC to de-activate the compressor. The high-pressure switch must send 2 signals with in a 60-second period before the ATC controller will lock out the compressor. It is a N.C. (normal closed) switch and red in color. The switch will be closed during normal operation.
Located: In the engine compartment next to the compressor.

HVAC COMPONENTS

SYSTEM COMPONENTS, CON'T

Compressor Relay, K-10

The compressor relay is used to open or close the high amperage (3-4 Amps) circuit for the compressor clutch. The ATC controller controls the relay.

Located: In the fuse panel.

Blower Speed Relay, K-13

The blower relay is used to supply the power for the blower motor and blower speed controller. The HVAC controller controls the relay.

Located: In the fuse panel.

Separator Blower Motor Relay, K-09

The separator blower relay is used to supply the power for the blower motor and blower speed controller. The key switch controls the relay.

Located: In the fuse panel.

Recirculation Filter

The recirculation filter is a paper filter that is used to filter the air being drawn into the evaporator/heater core. It is very important for proper operation of the HVAC system that the recirculation filter area be unobstructed so the blower motor can draw air through the evaporator core.

Located: Inside lower right corner of the cab

HVAC COMPONENTS

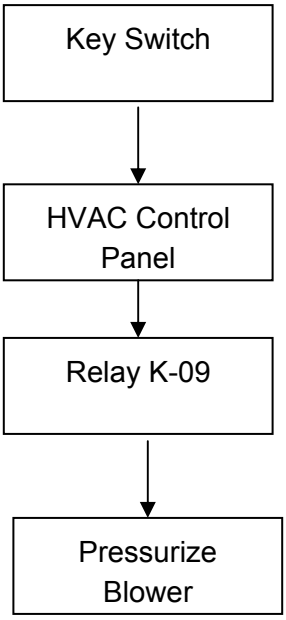
SYSTEM COMPONENTS, CON'T

COMPONENT USAGE

Mode of Operation	Pressurization	Ventilation	Defog	Heat A/C
Component				
Pressurizer Motor	X	X	X	X
ATC Control Button		X	X	X
Temperature Pot.			X	X
Temperature Display			X	X
Blower Motor		X	X	X
Blower Speed Pot.		X	X	X
ATC Controller		X	X	X
Blower Speed Controller		X	X	X
Water Valve			X	X
Cab Temperature Sensor			X	X
Evaporator Sensor			X	X
Low Pressure Switch			X	X
High Pressure Switch			X	X
Compressor Relay			X	X
Display Unit			X	X

HVAC SEQUENCE OF EVENTS

CAB PRESSURIZATION



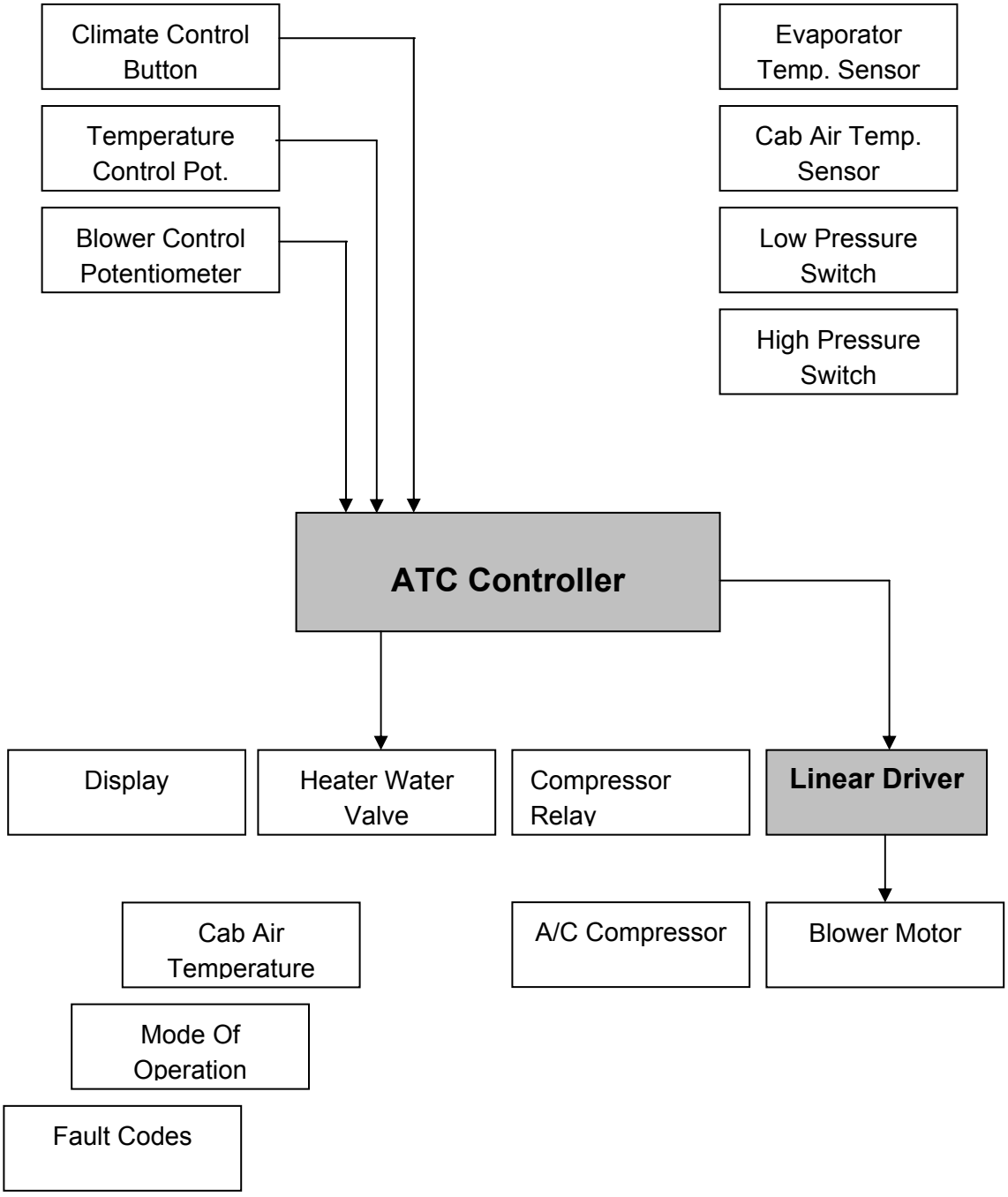
Cab pressurization is fresh outside air drawn through the cab filter and dis-charged in front of the evaporator coil. The operator will not feel the presence of the airflow.

- The operator may place the HVAC controls in any position.
- When the operator turns the key switch to the RUN position, F-49 and F-17 will provide power to activate the K-09 relay.
- When relay K-09 closes, voltage will be supplied to the seperator motor.

The motor should run any time the key switch is placed in the RUN or START position.

HVAC SEQUENCE OF EVENTS

CAB VENTILATION



HVAC SEQUENCE OF EVENTS

CAB VENTILATION

Cab ventilation is un-conditioned air flowing out of the cab vents, air that the operator can feel.

1 The operator presses the ATC control button to the "OFF" position, (the display window goes dark).

2 The operator turns the key switch to the **RUN** position.

3 The ATC controller will monitor the position of the ATC control button to determine how it should operate.

4 The operator will rotate the temperature control fully counter-clockwise. The ATC controller will close the water valve completely.

5 The blower motor will operate in the following manner:

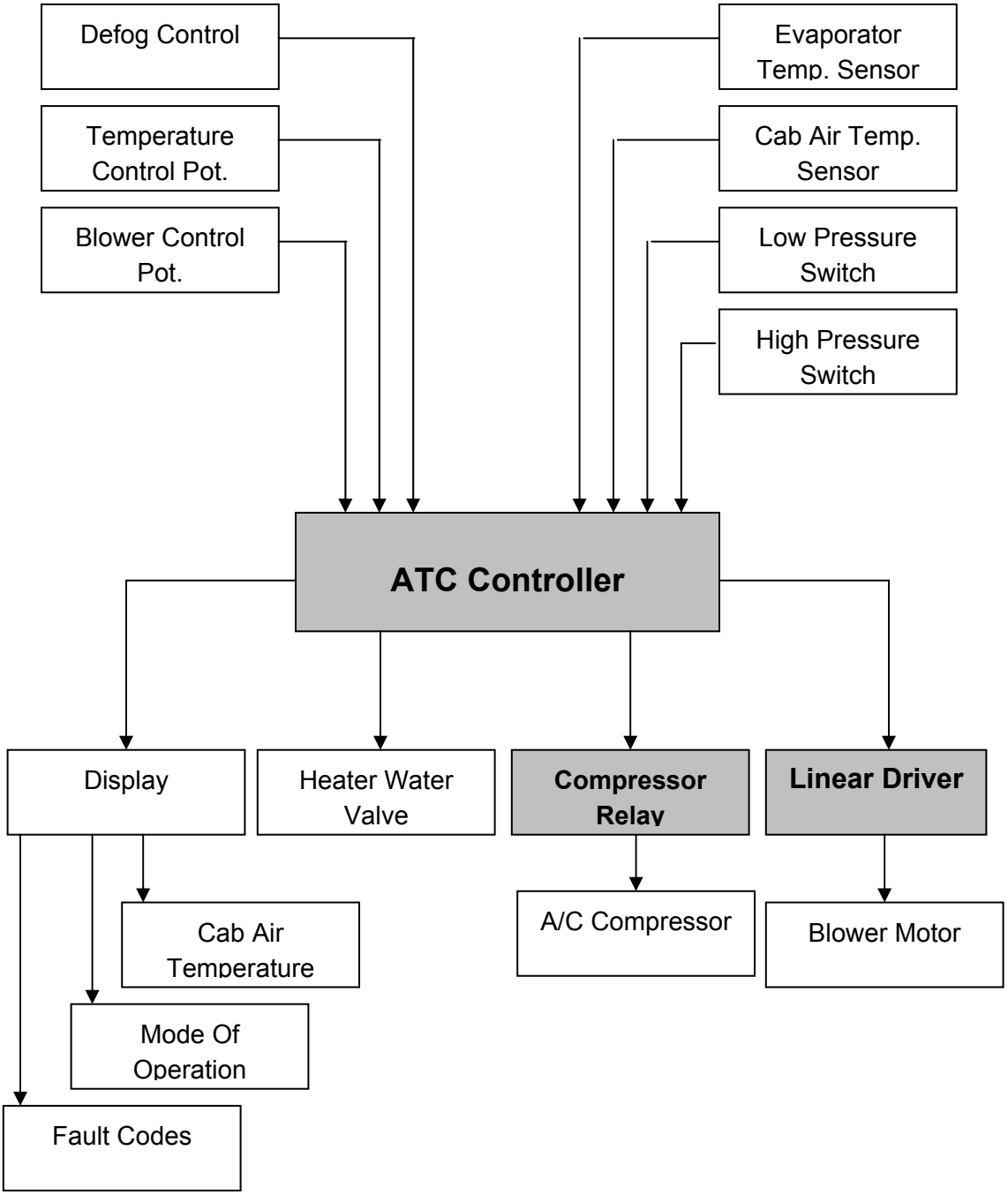
a) If the ATC control button is placed to the **OFF** position BEFORE the key switch is turned to the **RUN** position, the blower will operate at the selected speed. The operator can adjust the blower speed as required.

b) If the key switch is placed in the **RUN** position AND THEN the ATC control button is placed in the **OFF** position the blower motor will not operate. By placing the ATC control button in the **OFF** position, the operator is telling the HVAC controller to shut down the complete system. The blower motor will not run until the blower motor control is rotated approximately 30° to activate it, then the operator may adjust the blower speed as required.

6 The blower motor speed may be adjusted through out its complete range.

HVAC SEQUENCE OF EVENTS

WINDOW DEFOG



HVAC SEQUENCE OF EVENTS

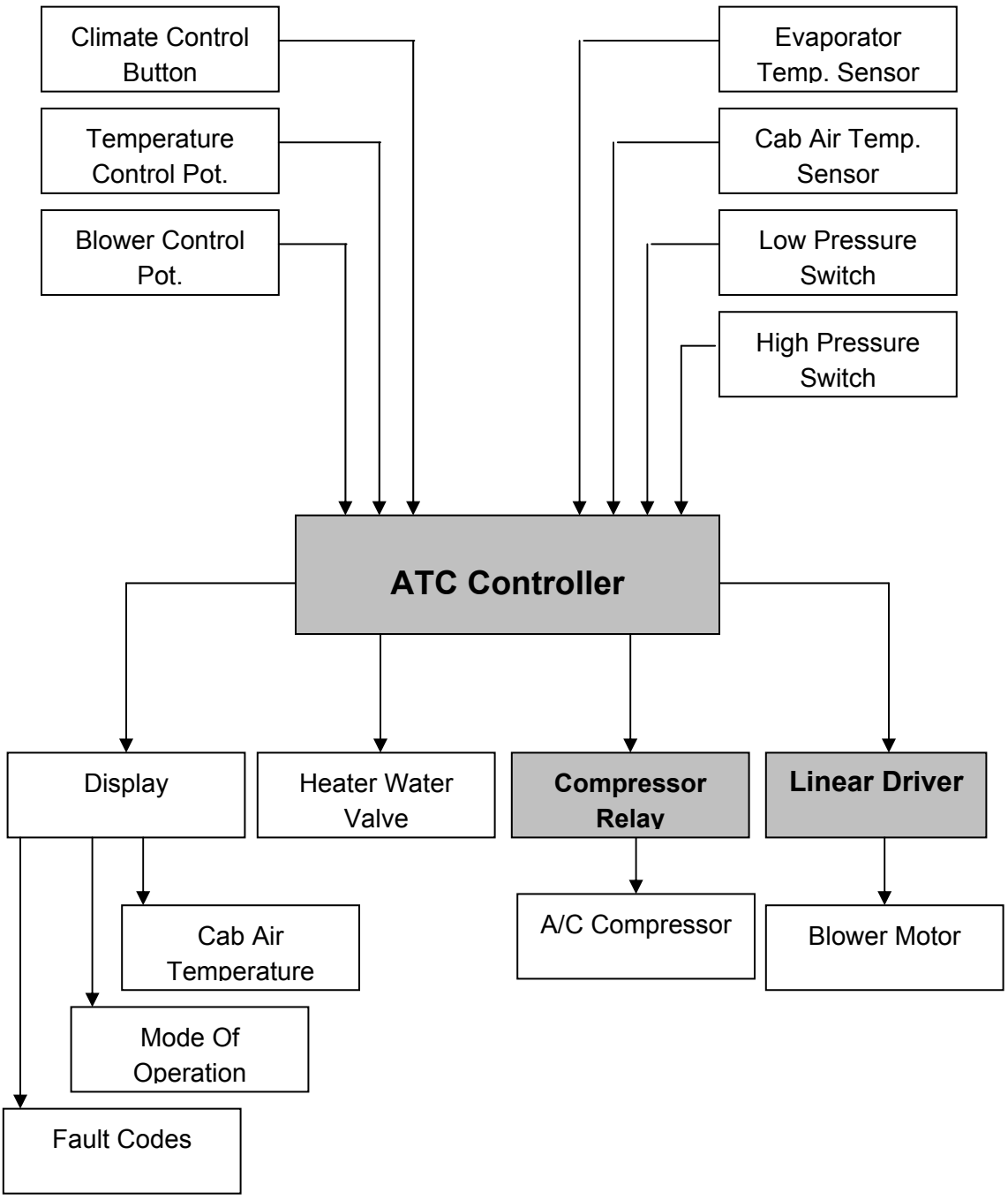
WINDOW DEFOG,

Window Defog is conditioned air flowing out of the cab vents, intended to clear the windows of moisture and fog.

1. The operator starts the engine and the key switch is in the run position.
2. The operator presses the ATC control button and toggles the mode button to the **ON** position.
3. The HVAC controller will monitor the position of the ATC control and mode buttons to determine how it should operate.
4. The HVAC controller will illuminate the display. The display will have the " " symbol illuminated to inform the operator of the mode the HVAC is operating in.
5. The HVAC controller will engage the A/C compressor; it will run full time unless the evaporator sensor determines the evaporator is freezing. This operation removes the moisture from the air.
6. The HVAC controller will monitor the temperature control setting and position the water valve to maintain the desired temperature.
7. The display will show the desired temperature set by the operator using the temperature control.
8. The HVAC controller will automatically control the blower motor speed by sending a signal to the linear driver.
9. If the operator changes the blower motor speed, the HVAC controller will release control of the blower motor speed. The system will still automatically engage the A/C compressor and regulate the water valve attempting to maintain the desired temperature, using the blower motor speed set by the operator. The ATC control button must be cycled to the **OFF** position and back to the **ON** position before the blower speed will be controlled automatically.

HVAC SEQUENCE OF EVENTS

CAB HEAT/AIR CONDITIONING



HVAC SEQUENCE OF EVENTS

HEAT/AIR CONDITIONING, "A"

Heat/Air Conditioning is totally conditioned air flowing out of the cab vents, intended to maintain a constant desired cab temperature. Temperature display setting of 61^0F to 89^0F

1. The operator starts the engine and the key switch is in the run position.
2. The operator places the ATC control button in the **ON** position and toggles the mode button so that the "**A**" is being displayed.
3. The HVAC controller will monitor the position of the ATC control button to determine how it should operate.
4. The HVAC controller will illuminate the display. The display will have the "A" symbol illuminated to inform the operator of the mode the HVAC is operating in.
5. The HVAC controller will monitor the temperature control setting and determine if the A/C compressor, the water valve and/or the blower motor must be regulated to maintain the desired cab temperature set by the operator using the temperature control.
6. The HVAC controller will monitor the cab temperature, using the cab temperature sensor located behind the recirculation filter.
7. The HVAC controller will monitor the evaporator temperature, using the evaporator sensor to prevent the evaporator from freezing up.
8. If the operator changes the blower motor speed, the HVAC controller will release control of the blower motor speed. The system will still automatically regulate the compressor and water valve attempting to maintain the desired temperature, using the blower motor speed set by the operator. The ATC control button must be cycled to the **OFF** position and back to the **ON** position before the blower speed will be controlled automatically.

HVAC ELECTRICAL OPERATION

POWER AND GROUND SUPPLY

REFERENCE MATERIAL:

Electrical schematic frames #47, #48, #29, #27, 28

KEY COMPONENTS:

Key Switch S-02, Relay K-26, Fuses F-49, F-17, F-18, F-19, CCM2, Splice Block W-03, HVAC control panel A-09, ATC controller A-15.

Power Supplies

K-26 Relay Power Supply

Once the key switch is placed in the **RUN** position the K-26 relay closes to provide power throughout the machine. Fuse F-49 is supplied by the relay and directs power to the HVAC control panel terminal C2. This power supplies all the circuit controls and sensors.

Fuses, (B+)

- F-17 provides the power to relay K-09 for the seperator motor
- F-18 provides the power to relay K-13 for the blower motor
- F-19 provides the power to relay K-10 for the compressor clutch

CCM2

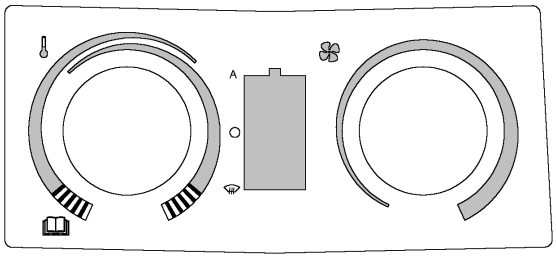
When the light switch is turn **ON** the CCM2 connector X015 terminal J1-11 directs 12V to the HVAC terminal C1 to provide for back lighting the controls.

Grounds

The ground is provided at three locations:

- Point 3, Cab Floor
- Point 4, Cab Roof
- Point 5, Engine Ground

HVAC ELECTRICAL OPERATION



PRESSURIZATION, (SEPERATER MOTOR)

For components used refer to the previous component usage chart.

Power

Voltage is supplied from F-49:

- to the seperater motor relay K-09 terminal 1
- to the cab blower motor relay K-13 terminal 1
- to the blower speed control connector X152 terminal 4

Ground

From the seperater motor connector X143 terminal B to ground point (3).
From the blower speed control connector X152 terminal 3 to ground point (3)

The F-49 directs voltage to the seperater relay K-09 terminal 1 activating the relay. The relay directs power out terminal 5 to the seperater motor M-18. The motor is provided a chassis ground at ground point (3). The motor will run as long as the key switch is in the **RUN** or **START** position.

HVAC ELECTRICAL OPERATION

VENTILATION

For components used refer to the previous component usage chart.

Power

Voltage is supplied from F-49:

- to the seperater motor relay K-09 terminal 1
- to the cab blower motor relay K-13 terminal 1
- to the blower speed control connector X152 terminal 4

Ground

From the seperater motor connector X143 terminal B to ground point (3).
From the blower speed control connector X152 terminal 3 to ground point (3)

The cab blower speed control potentiometer receives voltage from the ATC control terminal 28 by way of the HVAC panel terminal C-15. As the blower speed control is rotated the voltage will increase/decrease as it is bled off to the return wire. The ATC control module A-15 monitors the varying signal voltage to determine the control's position. The speed control uses a common ground circuit that is directed out of the HVAC panel C-16.

The F-49 directs a 12V supply to the blower relay K-13 terminal 1 to activate it. When the relay activates a 12V supply from fuse F-18 is directed out terminal 5 to the blower motor M-34 and the blower speed control A-14 terminal 4.

The ATC controller will send a command signal voltage from terminal 5, to the blower speed control A-14 terminal 2. The controller will control the ground for the motor at terminals 3 according to the command signal received from the ATC controller.

The blower motor speed will be controlled manually when the digital display is dark and automatically OR manually when the ATC control button has been pressed and the digital display is illuminated.

HVAC ELECTRICAL OPERATION

DEFOG MODE CONTROL

For components used refer to the previous component usage chart.

Power

Voltage is supplied from F-49:

- to the seperater motor relay K-09 terminal 1
- to the cab blower motor relay K-13 terminal 1
- to the main ATC controller terminals 4, 12 and 17, this powers up the ATC control module A-15, and to the water valve M-16 terminal A.
- To the HVAC control panel connector X128 terminal C2 to active the control panel

Voltage is supplied from F-19:

- to the A/C compressor relay K-10 terminal 3

Ground

From seperator motor to ground point (3)
From the A/C compressor clutch to ground point (5)
From the HVAC control panel connector X128 terminal C16 to ground point (4)

The ATC controller directs a 5V power out terminal 25 to the HVAC panel terminal D7 for the defog mode and terminal 26 to the HVAC panel terminal D5 for ATC mode. When the ATC control button is toggled to activate the AUTO functions (illuminating the control panel) a ground wire is supplied to the mode switch for Defog and ATC. By toggling the mode switch to the Defog mode the voltage that the ATC controller was monitoring on terminal 25 will be bled off to the ground through terminal C16, dropping the voltage on terminal 25 while the voltage on terminal 26 remains at 5V. When the voltage **DROPS** on the ATC controller terminal 25, the controller knows that the operator has selected the defog mode of operation.

The ATC controller terminal 15 will provide power to the A/C compressor relay K-10 terminal 1. The relay will activate, closing the relay contacts between terminals 3 and 5. Battery voltage will be supplied to the compressor clutch. The compressor will be engaged full time with NO respect to the cabs temperature, only the evaporator temperature sensor can signal the ATC controller to dis-engage the clutch if the evaporator temperature approaches a freeze level. This operation will lower the moisture level of the cab air. The air being dis-charged through the vents will be cold.

The ATC controller, terminal 23, sends voltage to the evaporator sensor B-28 terminal 1. As the temperature of the sensor changes so does the sensor's resistance. The supply voltage from terminal 1 will be bled off through the sensor to terminal 2. Terminal 2 is a common ground wire to the chassis ground. The ATC controller uses the varying voltage at the controller's terminal 23 to control the ground that sent from the ATC control module terminal 15 to the HVAC control.

HVAC ELECTRICAL OPERATION

DEFOG CONTROL, CON'T

The ATC controller terminal 29 directs voltage to the HVAC panel terminal D1 to monitor temperature control setting. As the temperature control is rotated, the supply voltage from terminal D1 will be bled off through the potentiometer to terminal C16. Terminal C16 is a common ground wire. When the temperature control is rotated the supply voltage ATC terminal 29 will vary, this change is the voltage signal the ATC controller uses to determine the temperature control setting. Minimum heat is provided at approximately 10 o'clock of the temperature control. Maximum heat is provided at the clockwise position of the temperature control.

The ATC controller monitors the cab temperature sensor B-26 to determine the water valve's required position to maintain the desired temperature. The ATC controller terminal 21 sends voltage to the cab temperature sensor terminal 1. As the temperature of the sensor changes so does the sensor's resistance. The supply voltage from terminal 1 will be bled off through the sensor to terminal 2. Terminal 2 is a common ground wire to the chassis ground 3. The ATC controller uses the varying voltage at the controller's terminal 21 to determine the correct position of the water valve and speed of the blower motor.

The ATC controller will control the heater valve M-16 as required to maintain the correct temperature. The heater valve M-16 terminal A receives a 12V supply voltage from the F-49. The water valve is chassis grounded through terminal C. The ATC controller terminal 3 sends a variable command voltage signal to the heater valve at terminal D. The heater valve rotates until the valve's position matches the command signal being received from the ATC controller.

The ATC controller will send a command signal from terminal 5 to the blower motor controller A-14 terminal 2. The blower speed control will control the ground for the blower motor according to the command signal received from the ATC controller.

If the operator would like to change the blower speed, the blower speed control may be manually adjusted. Once the blower speed has been manually adjusted, the ATC will only try to maintain the selected cab temperature by operating the heater valve. The ATC controller, terminal 28, sends voltage to the HVAC panel terminal C15. As the blower speed control is rotated, the voltage is bled back through terminal C16 to a common ground. The ATC control module monitors the varying supply voltage terminal 28 to determine the control's position.

HVAC ELECTRICAL OPERATION

ATC CONTROL

ATC module will monitor the actual cab temperature to maintain the cab's temperature. The difference between defog and climate control mode is that the ATC controller will cycle the A/C clutch and/or water valve as required to maintain the selected cab temperature.

The ATC controller directs a 5V power out terminal 26 to the HVAC panel terminal D5. When the ATC control button is pressed to activate the AUTO functions and the mode button is toggled to the DEFOG setting the voltage will be directed back out terminal C16 to a common ground. When the voltage **DROPS** on the ATC controller terminal 26, the controller knows that the operator has selected the ATC mode of operation.

Review the DeFog operation.



REMEMBER In climate control operation, it may take several minutes for the cab temperature to stabilize at the temperature setting. Also, when making a temperature setting change, the cab temperature will not change immediately.

HVAC ELECTRICAL OPERATION

HIGH PRESSURE SWITCH

The A/C high-pressure switch S-47 is a normally closed (N/C) switch. The ATC controller directs voltage out terminal 33 to the high-pressure switch terminal A. Terminal B of the switch is provided a return back to the ATC control terminal 36. When the pressure in the system exceeds 400 PSI, the high-pressure switch will open and the voltage on the terminal 33 at the ATC controller will increase due to the loss of ground. This signals the controller that an over pressure has occurred. If the condition exists twice in one minute, the ATC controller will deactivate the power at terminal 15. The ATC controller terminal 20 will direct a message to the HVAC terminal D10 to display fault code 01. The fault code will alternately flash on the display with the current temperature set point temperature set point and the  book symbol will appear on the display.

LOW PRESSURE SWITCH

The A/C low-pressure switch S-48 is a normally open (N/O) switch. The ATC directs voltage out terminal 35 to the low pressure switch terminal B. Terminal A of the switch is provided a ground at terminal 36. When the pressure in the system drops below 4 PSI, the low-pressure switch will open and the voltage on terminal 35 at the ATC Controller will increase due to the lack of a ground through the switch. This signals the controller that a low pressure has occurred. If the condition exists 4 times in one minute, the ATC controller will deactivate the power at terminal 15. The ATC controller terminal 20 will direct a message to the HVAC terminal D10 to display fault code fault code 02. The fault code will alternately flash on the display with the current temperature set point and the  book symbol will appear on the display.

HVAC TROUBLESHOOTING

The HVAC system will provide the technician with useful information about its condition through two different methods

1. Component Testing

When certain components fail, they will operate in un-controllable modes. This operation should help to lead the technician to the failed component.

2. Fault Codes

When certain failures occur, the ATC will display fault codes in the Temp. Display. The technician can use the fault codes to help diagnose the failure quickly.

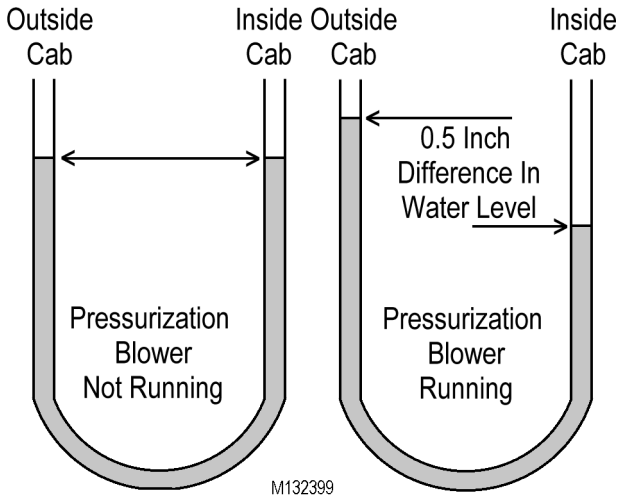
FAULT CODES

The ATC controller provides the operator with fault codes if a component or circuit is not performing correctly. The fault code will be displayed on the temperature display and will alternately (flash) with the cab temperature set point. If more than one fault occurs at the same time, those fault codes will be displayed in numerical order. The fault codes are "self healing", meaning if the condition is corrected and the ATC controller has not latched out a function, the fault code will be removed from the display. Refer to the fault code tables for explanations.

CAB PRESSURIZATION

Symptom
Inside the cab is dirty and the cab air filter is plugged.

Manometer Used For Checking Cab Pressure



Make out of clean hose, (1/4" - 3/8") and route through cab door.

CAB PRESSURIZATION

Normally Operating Circuit	
The cab should maintain 0.5" H_2O pressure minimum, to prevent dust and dirt from filtering in.	➢ Check Cab pressure.

Test	Results	If Not, Do This
Supply voltage test With the engine running, the engine oil pressure indicator lamp MUST BE "OFF".		
Step 1 Remove the cab air filter. Install the manometer and check for cab pressure.	Normal pressure must be at least 0.5" H_2O pressure	➢ **OK**, reinstall the cab air filter and recheck. By re-testing the condition of the cab air filter will be verified. ➢ **NOT OK**, see step 2.
Step 2 Verify the cab-pressurizing blower is running. DON'T PUT YOUR HAND IN THE BLOWER DISCHARGE CHUTE.	Blower should run anytime that the KEY switch is in the RUN or START position.	➢ **OK**, see step 3 ➢ **NOT OK,** check out the blower motor electrical circuit.
Step 3 Check the cab for air leaks while the cab pressurization blower is operating.	There should not be air leaking from the cab.	Points to inspect, ➢ Around the pedals, the foam pads should contact the bottom of the cab. ➢ Around the air plenum pipes as they go up the rear cab post, the foam pads should seal tight. ➢ Verify the cab doors are closing completely ➢ Verify the sealing of any additional cab mounted equipment that may have been added to the machine.

Additional Information
Verify that all the connections and hoses between the cab air filter and the cab are intact, not restricting air flow nor letting in dust and dirt.

HVAC TROUBLESHOOTING

NORMAL SYSTEM VOLTAGE READINGS AT THE ATC CONTROLLER

ATC Controller Connector X397		Function Key Switch In the "RUN" Position	Open Circuit Voltage	Normal Readings
Terminal Location	Wire #			
3	955 YE	Monitors the position of the water valve		Full Heat 7.8 V Full Cold 0.8 V
5	953 YE	Sends a signal voltage to the PWM module		Full Fast 4.0 V Full Slow 0.0 V
11	959-WH	Signal for the cold box actuator		Open=30% Bat+ Closed=50% Bat+
15	911-BL	Provides a power to the compressor clutch relay.		0.0 Volts (AC OFF) 12 Volts (AC Selected)
4 12 17	924 OR	Switched power supply (C2 to D11)		SW 12V
18	954 BK	Ground		Ground
20	923-YE	Display Data		
21	952 BL	Sends a voltage to the Cab Temp. sensor	5 Volts	2.8 at 70°F voltage will drop as the temperature at the sensor increases
22	958-WH	Sends a voltage to the Outlet Temp. sensor	5 Volts	2.3 at 70°F voltage will drop as the temperature at the sensor increases
23	951 BL	Sends a voltage to the Evaporator sensor	5 Volts	2.3 at 70°F voltage will drop as the temperature at the sensor increases
25	920 BK	Sends a voltage to the ATC control button	5 Volts	0.0 Volts with the switch in the Defog position.
26	918 YE	Sends a voltage to the ATC control button	5 Volts	0.0 Volts with the switch in the ATC position.
27	960-WH	Ground for Centigrade		
28	912 YE	Sends a voltage to the blower motor control pot	6 Volts	Full Fast 3.0 V Full Slow 0.0 V
29	914 YE	Sends a voltage to the temp. control pot.	6 Volts	Full Heat 3.0 V Full Cold 0.0 V

PRESSURE SWITCHES OPERATION, TERMINALS 33-36

	Both Open		High Closed Low Open (or reversed)		Both Closed	
	Blue Terminal B	Yellow Terminal A	Blue Terminal B	Yellow Terminal A	Blue Terminal B	Yellow Terminal A
High Pres.	0.0V	B+	3.3V	3.3V	5.2V	5.2V
Low Pres.	B+	0.0V	B+	3.3V	5.2V	5.2V

FAULT CODE

Fault Code	CAUSE	FAIL MODE
1	High pressure switch - Wiring or cycling. Switch OPENS for longer then one minute or cycles 2 times with in the minute	Heat mode - compressor clutch disabled
2	Low pressure switch - Wiring or open. Switch OPENS for longer then one minute or cycles 4 times with in the minute	Heat mode - compressor clutch disabled
3	Blower speed select pot open/shorted to power	Auto blower speed
4	Temperature select pot open/shorted to power	72ºF Set point
5	Recirc. pot open/shorted to power	**Not used on combine**
6	Mode select pot open/shorted to power	**Not used on combine**
7	Cab temp sensor wiring - open, short, ground, power	Manual mode - compressor clutch disabled
8	Evap temp sensor wiring - open, short, ground, power	Heat mode - compressor clutch disabled
9	Outlet temp sensor wiring - open, short, ground, power	Doesn't limit blower speed on startup
10-18		Not currently implemented
19	No data from control module	Depends on cause of problem

The display on the combines receives data from an RS-232 type serial data signal, and not the CAN like the tractors.

SEAT (OPERATOR PRESENCE)

REFERENCE MATERIAL:

Electrical schematic frames #27

KEY COMPONENTS:

Fuse F-49, Seat Switch S-05, Relay K-26, CCM2

GENERAL INFORMATION

The seat switch is used by the system to indicate when an operator is present, the lack of an operator will cause the following operations:

- Auto Header and Drive Functions will be disabled
- Ground drive will be disabled
- Engage Park Brake warning activated

OPERATION

The fuse F-49 provides a 12V power supply to seat switch S-05 terminal A. The switch is N/O when the operator is NOT present. When an operator sets down, the seat switch will be closed. The 12V supply is routed through the switch out terminal B to the CCM2 connector X015 terminal J1-9. The CCM2 will place a message on the data bus that the operator is present.

SEAT HEATING

REFERENCE MATERIAL:

Electrical schematic frames #46

KEY COMPONENTS:

Seat Control Unit A-30, Seat Heat Switch S-86, Heat Coil R-31 & R-32

GENERAL INFORMATION

The seat incorporates heating coils that will warm the seat bottom and back.

OPERATION

Seat Controller

The controller A-30 is supplies battery voltage from F-10 at connector X585 terminal 6 and a chassis ground at connector X585 terminal 5. The control will be used to supply the seat heat switch and heating coils.

Heat Switch

The seat heat switch S-86 is supplied 12V from the control connector X584 terminal 1 to the switch terminal 2. When the switch is closed the voltage from terminal 2 will be directed out terminal 1 back to the controller connector X584 terminal 2.

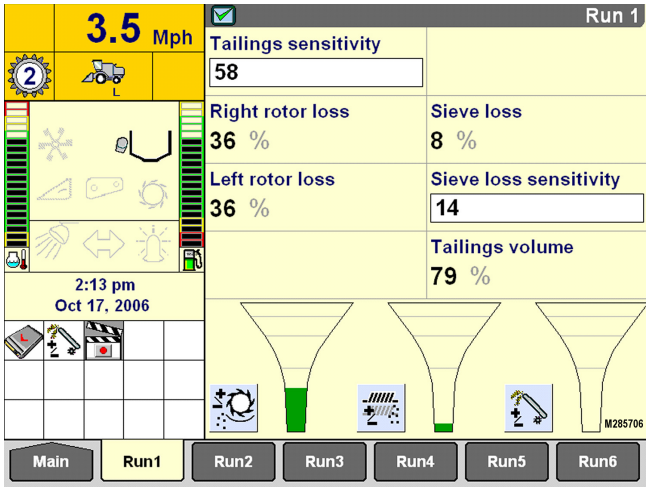
Heating Coils

GRAIN SCAN MONITOR

GENERAL INFORMATION

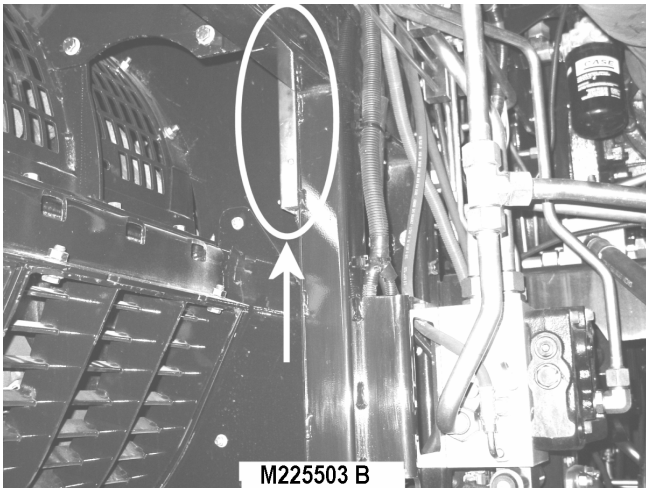
The grain scan monitor is used to alert the operator when conditions have changed, causing the volume of grain loss to change. The grain scan monitor is NOT intended to be used to make combine adjustments, but only used to indicate harvesting changes. The loss indication is based on the number of strikes the sensor receives within one second, distance traveled is not factored into the calculations.

GRAIN SCAN ITEM





Upper Sieve Grain Scan Sensor



Left Hand Rotor Grain Scan Sensor

GRAIN SCAN MONITOR

REFERENCE MATERIAL:

Electrical schematic frames 20, 26, 27

KEY COMPONENTS:

Upper Sieve Sensor B-21, Right B-20 and Left B-19 Rotor Sensors, CCM1, CCM2

UNIVERSAL DISPLAY

The Universal Display is used to monitor the grain loss during harvest. The operator may place the following scan functions on any of the RUN screens.

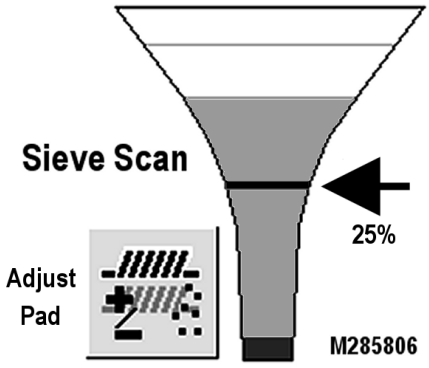
1. **ROTOR Loss**; This selection will let the operator monitor an averaged performance of both rotor sensors. The more that the cone is darkened the more loss that is being recorded.
2. **SIEVE Loss**; This selection will let the operator monitor the performance of the sieve sensors. The more that the cone is darkened the more loss that is being recorded.



Wait a Minute... If I don't leave the SCAN ROTOR or SCAN SIEVE on one of the screens, will I be alerted when the loss has increased. NO, if it is not placed on one of the RUN screens it will not be monitored.

GRAIN SCAN MONITOR

HOW TO SET



1.	Volume Area Filled
2.	25% Bar

While the machine is harvesting at the predetermined rate the operator would:

1. Disregard all reading from the grain scan monitor until all the harvesting adjustments have been made to the machine; the machine is performing to the operator's expectation. This is when the operator has determined the current losses, if any are acceptable.
2. **Sieve Sensors**: Using the "SIEVE Loss "Adjust Pad" set the amount of cone fill, this is like adjusting the needle location on a 2300's monitor. The fill will vary by the numerical number selected. Normally a smaller number will be used for heavy crops.
3. **Rotor Sensors**: Using the "ROTOR Loss "Adjust Pad" set the amount of cone fill, this is like adjusting the needle location on a 2300's monitor. The fill will vary by the numerical number selected. Normally a smaller number will be used for heavy crops

As the funnel approaches the upper limits, the color will change to YELLOW and RED as an indication that the current limits are unacceptable.

GRAIN SCAN MONITOR

OPERATIONS

Rotor Sensors

The rotor sensors B-19 and B-20 are supplied with 8V at their terminal 2 from the CCM2 connector X016 terminal J2-26 right side and J2-25 left side. The sensors are supplied a ground circuit from their terminal 1 back to the CCM2 connector X016 terminal J2-14. Each time grain strikes a sensor the supply voltage will change due to the sensor directing it to the ground. The two rotor sensor signals are received and placed on the data bus by the CCM2. The display will average and display the readings.

Upper Sieve Sensor

The sieve sensor B-21 is supplied with 8V at terminal 2 from the CCM1 connector X019 terminal J2-25. The sensor is supplied a ground circuit from terminal 1 back to the CCM1 connector X019 terminal J2-14. Each time grain strikes the sensor the supply voltage will change due to the sensor directing it to the ground. The sieve sensor signal is received and placed on the data bus by the CCM1. The display will display the readings.

TESTING	RESULTS
Key switch in the RUN position	
Check for supply voltage from CCM	**Open Circuit** approx. 8V
Check for supply voltage from CCM	**Operating Voltage** approx. 6.4, this can be checked on the display under diagnostics. The two rotor sensors can be separated on the display for testing.
Check for ground	Return wire to CCM reference ground less then 2 ohms
When tapping on the sensor in question	The voltage should decrease progressively from light taps to heavy taps.

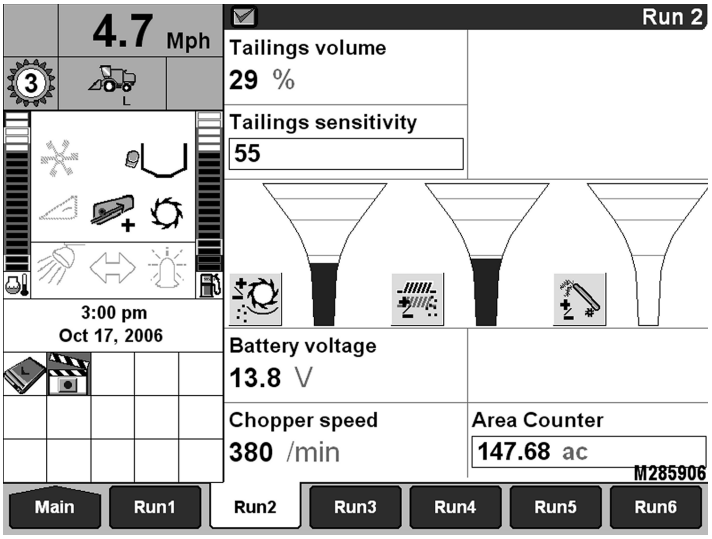
TAILING VOLUME METER

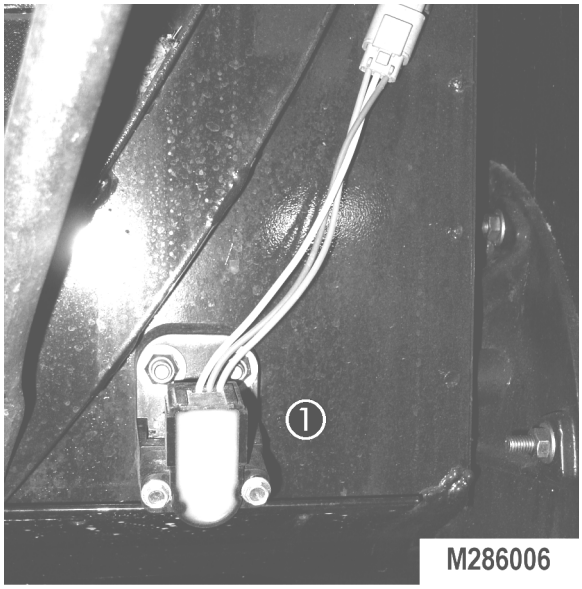
GENERAL INFORMATION

The tailing volume monitor is used to alert the operator when conditions have changed, causing the volume of returns to change. The tailings monitor is NOT intended to be used to make combine adjustments, but only used to indicate harvesting changes. The volume indication is based on the movement of the sensor, much like a fuel level sensor. The level in the funnel should be changing constantly.

There may be times with a large piece of trash could get lodged behind the sensor arm and prevent it from floating. If the reading stays constant for a period of time the operator should check the sensor for freedom of movement.

TAILING VOLUME ITEMS







Tailing Sensor

TAILING VOLUME METER

REFERENCE MATERIAL:

Electrical schematic frames 20, 26, 27

KEY COMPONENTS:

Tailings Volume R-29, CCM2

CAB DISPLAY

The Cab Display is used to monitor the tailing volume during harvest. The operator may place the following functions on one of the RUN screens.

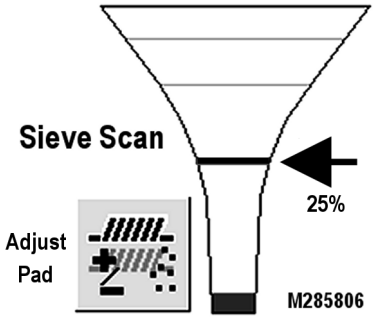
1. Tailings Volume, This selection will let the operator monitor the volume level with out taking up as many spaces on the display as the meters require. If this selection is used then the tailing volume alarm should also be placed on the screen in order to make adjustments to the reading.
2. Loss Meters, This selection will let the operator monitor the performance of the sensor through a funnel type graphic, four spaces are required to install this feature.
3. Tailings Volume Alarm, This selection allows the operator to change when the alarm will be displayed.



Wait a Minute... If I don't leave the tailing monitor on one of the screens, will I be alerted when the volume has increased. Yes.

TAILING VOLUME METER

HOW TO SET



1.	Volume Area Filled
2.	25% Bar

While the machine is harvesting at the predetermined rate the operator would:

1. Disregard all reading from the tailing monitor until all the harvesting adjustments have been made to the machine and the machine is performing to the operator's expectation. This is when the operator has determined the current losses, if any are acceptable.
2. **Tailing Sensors**: Using the Touch Pad, set the required amount of cone fill before the alarm is triggered. Normally a smaller number will cause the alarm to activate quicker.

As the funnel approaches the upper limits, the color will change to YELLOW and RED as an indication that the current limits are unacceptable.

TAILING VOLUME METER

OPERATIONS

Tailings Sensor

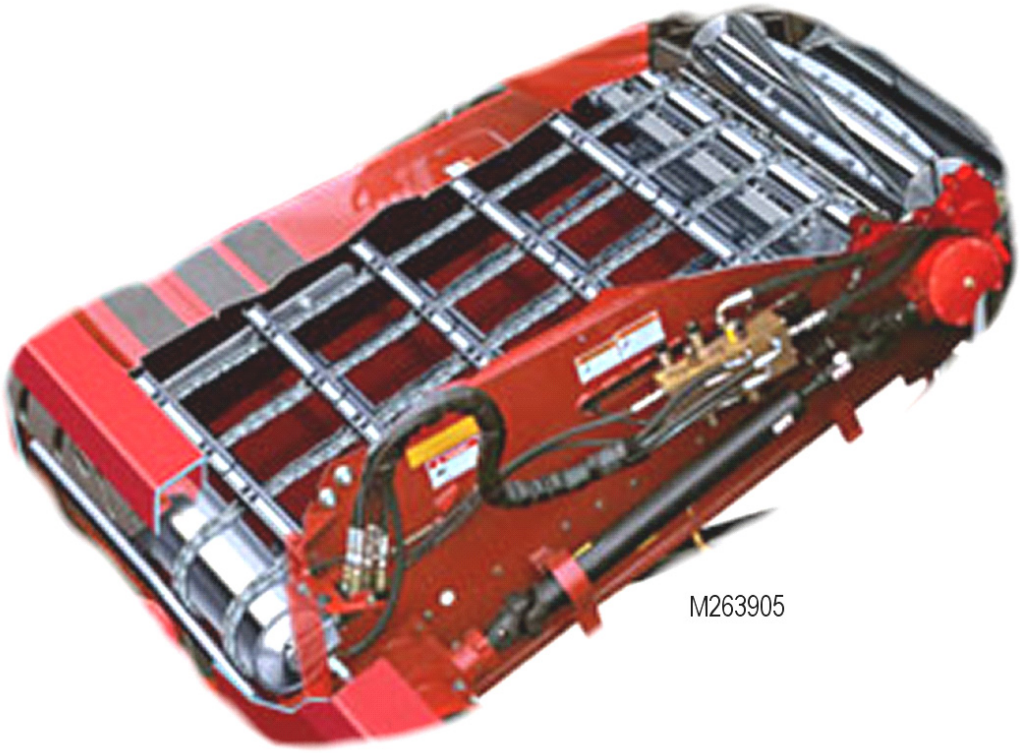
The Tailing sensors B-29 is supplied with 5V at terminal 1 from the CCM2 connector X016 terminal J2-31. The sensor is supplied a ground circuit from their terminal 3 back to the CCM2 connector X016 terminal J2-14. The CCM2 terminal J3-22 is monitoring the signal wire for voltage changes. As the sensor arm is moved the signal wire voltage will change.

TESTING	RESULTS
Key switch in the RUN position	
Check for supply voltage from CCM2, terminal 1. (pink wire)	**Open Circuit** approx. 5V
	Operating Voltage approx. ~4.9
Check for ground, terminal 3. (blue wire)	Return wire to CCM reference ground less then 2 ohms
Sensing voltage when rotating the sensor, (yellow wire)	This can be checked on the display under diagnostics. The voltage should vary with sensor movement.

CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 - 9120 SERIES AXIAL-FLOW COMBINE



SECTION 62 FEEDER HOUSE

Form 5175 **1/2010**

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RACINE, WI 53404
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Printed in U.S.A.

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Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

SPECIFICATION

ID#	COMPONENT	SUPPLY DCV	WORKING RANGE	RESISTANCE: OHMS AT 70°F (25°C)	NORMAL POSITION
	Accumulator Solenoid	Battery		7.5	Main Machine Valve
	Seat Switch	Battery			N/O
	Resume Button	Battery			N/O
	Header Type Sensor	5V		A TO B = 75 A TO E = 150 A TO F = 450	On Header Harness
	Feeder Position Angle Sensor	5V	0.5 – 4.5V	N/A	Upper Right Feeder Pivot
	Right and Left Height/Tilt Sensors	5V	0.5 – 4.5V	N/A	On Header
	Right and Left Center Height Sensors	5V	0.5 – 4.5V	N/A	On Header
	Float Pressure Sensor	5V	5 – 95% of supply voltage		Main Machine Valve
	Raise / Lower Solenoids	PWM		6.4-6.8 10.8 at 350°F (180°C)	
	Right / Left Tilt Switch	Battery			N/O
	Header Tilt Angle Sensor	5V	0.5 – 4.5V		Lower Right Feeder Side
	Right / Left Tilt Solenoids	PWM		4.8 – 5.2 7.8 – 8.4 at 350°F (180°C)	
	Feeder speed sensor	12 vdc		1.3+-v = metal 6.7+-V = no metal	Upper Feeder Gear Box
	RTF (on/off) clutch solenoid	12 vdc	0 - 1.3 ampere	9.2 ohms	Feeder CVT Valve
	ETR (PWM) clutch solenoid	12 vdc	0 - 1.9 ampere	6.4 ohms	Feeder CVT valve
	Pump (+) (-) coil	12 vdc	0 - 2.2 ampere	5.6 ohms	Feeder pump
	Feeder switch, 2P3T	12 vdc	0 - 3 ampere	0.1	RHC, front
	Feeder speed potentiometer	5 vdc	0.14 - 4.85 vdc	10K +/- 1%	RHC, mid section

SPECIFICATION

FEEDER	LENGTH	WIDTH	WEIGHT
Feeder House	94”	54”	W/Rock = 2830 W/O Rock = 2640
Feeder Chain	W/Rock = 165” W/O Rock = 186”	36 Slates 42 Slates	
Feeder Chain & Sprocket Width	H557 Chain		4 X 3 chain Four Chain Strands– Three rows of slats
Feeder Lift Cylinders	Standard Cylinders		3 in (75 mm) 8500 lb (3580 kg)
	Heavy Lift Cylinders		3.5 in (90 mm) 11000 lb (5000 kg)

FEEDER DRIVE RPM RANGE AT 2100 ENGINE RPM

7010-9010

	Rock Trap Shaft (Not Displayed)	Feeder Chain Shaft (Not Displayed) Top Sprocket Tube 11T	Header Shaft (Speed is Displayed as "Feeder Speed") Forward	Reverse
Corn or Pick-Up Header	581-871	296-444	456-698	130
Grain Head	581-726	296-370	456-570	130
Draper Header	726	370	570	130

7120-9120, PRIOR TO Y9G207601

	Rock Trap Shaft (Not Displayed)	Feeder Chain Shaft (Not Displayed) Top Sprocket Tube 15T	Header Shaft (Speed is Displayed as "Feeder Speed") Forward	Reverse
Corn or Pick-Up Header	825-1240	222-334	460-690	130
Grain Head	825-1006	222-270	460-570	130
Draper Header	1006	270	570	130

These RPM's are +/- 10% and may depend upon software version



Wait a Minute... Rock trap gear set may be changed back to a slower speed.

7120-9120, Y9G207601 AND LATER

	Rock Trap Shaft (Not Displayed)	Feeder Chain Shaft (Not Displayed) Top Sprocket Tube 15T	Header Shaft (Speed is Displayed as "Feeder Speed") Forward	Reverse
Corn or Pick-Up Header	581-871	222-334	460-690	130
Grain Head	581-726	222-270	460-570	130
Draper Header	726	270	570	130

These RPM's are +/- 10% and may depend upon software version

General Information

Once the header has cut and gathered the material, it is delivered to the feeder house for transporting to the transition cone. The function of the feeder house is two fold:

1. First to control the position of the header in relationship to the ground. This permits the header to remain in the most optimal position for harvesting.
2. Secondly to deliver a uniform mat of material to the transition cone of the combine. The uniformity of the mat being delivered starts with a properly operated header. Different options and adjustments can change the control of the mat in the feeder house.

BASIC FUNCTIONS

1. Cutting and Gathering (covered in the “Header” section)
2. **Positioning the Header and Feeding the crop**
3. Threshing
4. Separating
5. Cleaning
6. Distribute Crop Residue
7. Grain Handling
8. Record Data (covered in the AFS course)

This section incorporates all areas of the feeder house including:

1. Feeder components, operation and adjustments
2. Adjustments
3. Attachments
4. Controls and Configurations
5. Drives
6. Header Recognition
7. Hydraulics
8. Electronics

The operator’s manual and service manual will be valuable resources for additional information.

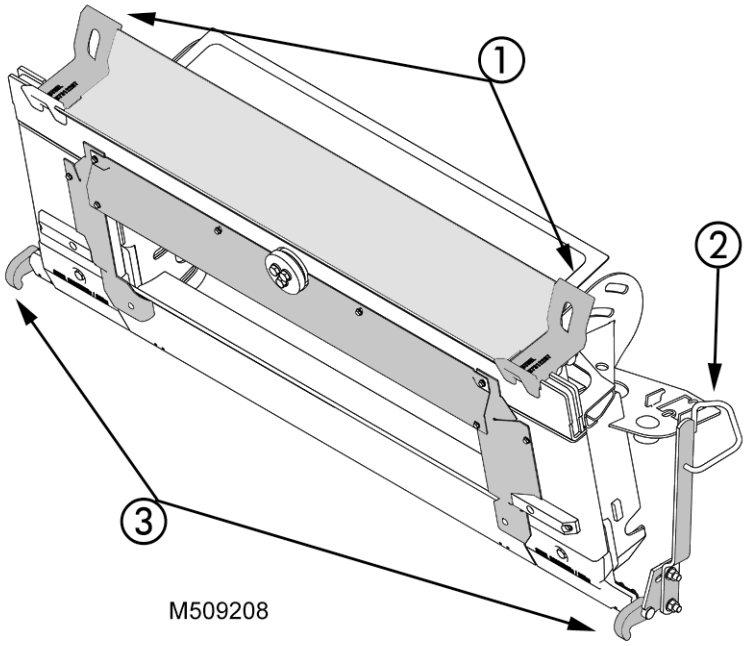
Header Saddle

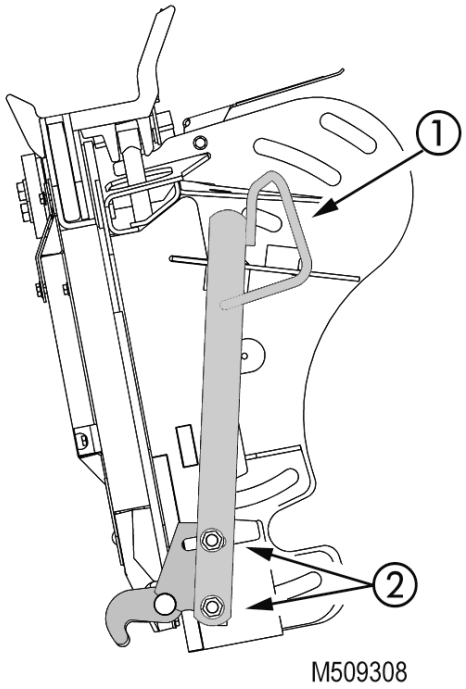
The feeder house incorporates a header saddle, which is used to connect a header to the feeder house. The saddle also incorporates adjustments:

- For adjusting the angle of the header front to back. It is critical for the header to be operating at the designed angle to provide for ground sensing and for picking up crops. This is a manual adjustment that will require changing due to tires sizes and may require adjusting due to field conditions.
- For leveling the header side to side. It is critical when operating close to the ground. This is a manual adjustment. This is only for the MY 2004 and prior machines, starting in MY2005 a fixed (side to side) face plate was installed.
- The saddle may also incorporate the Terrain Tracker attachment to provide automatic header leveling side to side. This system will require a calibration.
- There is also a header latch to secure the header to the saddle.

IMPORTANT: Only headers that are designed to adapt to the feeder saddle should be used; 2000-3000 series Corn, 2000 series direct cut, 2000's drapers and 2016 pick-up headers.

Use the latch adjusting bolts to make sure that the arm latches it to the catch on the header.





1.	Saddle
2.	Header Latch Lever
3.	Header Latch

1.	Latch Locking Bail
2.	Latch Adjusting Bolts

HEADER SADDLE

SADDLE ANGLE

The saddle angle adjustment is use to set the header at the correct operating angle to enter the crop. This is the angle where the header should provide the optimum ground sensing and crop feeding.

REMEMBER: Tire size is critical to this adjustment; it will change the feeder housing angle and operating range. Also remember if the tires are sinking into the ground 10" it will have the same effect as installing shorter tires, so ground conditions may dictated when and how to make this adjustment.

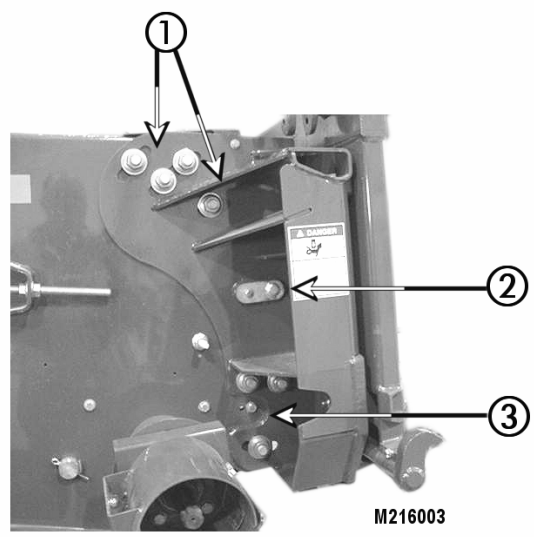
	HEADER BACK SHEET	CORN STRIPPER PLATES	DRAPER
To determine the header angle, place an angle finder on the back vertical sheet of the grain headers when at their correct operating height (on the ground).	17 Deg. Forward		
A corn head may also be checked by placing an angle finder on the stripper plates when the head is at the correct operating height.	17 Deg. Forward	23 Deg. Forward	

Wait a Minute... Do I have to readjust the feeder chain after changing the angle of the feeder saddle? The saddle pivots at the center pin, so the front drum to saddle face dimensions change very little.

To Adjust

1. Remove the header.
2. Loosen the clamping bolts at #1 (4 bolts) and #3 (3 bolts). Loosen bolts on the right and left side of the feeder, a total of 14 bolts.
3. Pivot the saddle on the pivot pin #2 to the desired position.
4. Tighten all bolts previously loosen in step 1 to the specified torque in the operator's manual.

Torque: 100 ft. lb. Plus 90 deg., final torque should be around 408-460 ft. lbs.



Left Side of Feeder Housing

HEADER SADDLE

LEVELING THE SADDLE, (MACHINES WITH OUT TERRAIN TRACKER)

Machines that are not equipped with a Terrain Tracker system do NOT have provisions for leveling the header right to left.



REMEMBER: Tire air pressure is critical to this adjustment; it will change the feeder housing levelness if one tire is low on pressure. Also check to see that the header is completely seated in the saddle pockets.

To determine the header levelness, make a measurement from a common header frame to the ground on each end. The two measurements should be as close as possible.



Wait a Minute... My combine is equipped with the Terrain Tracker attachment, do I still have to level the system. The Terrain Tracker will require a “CALIBRATION” procedure.

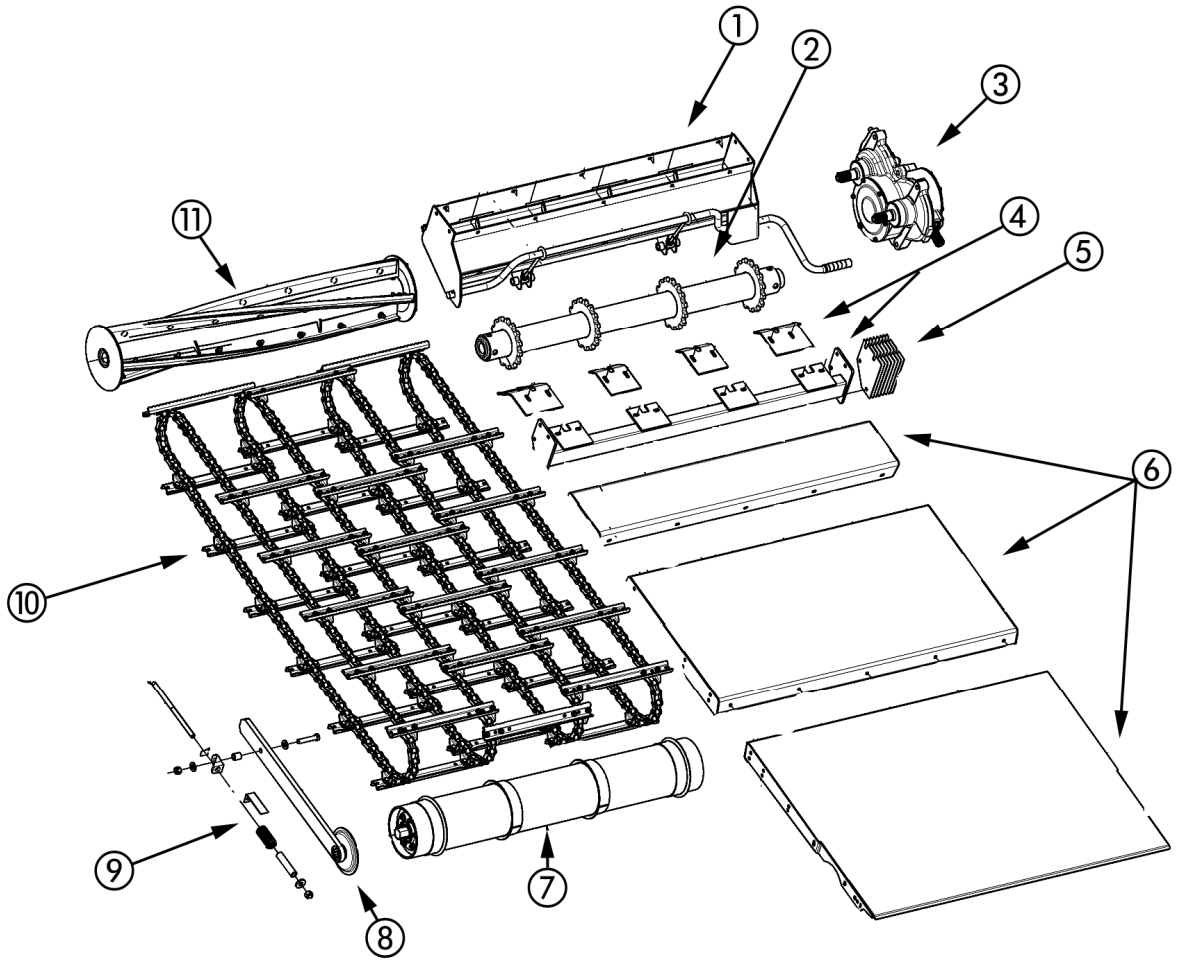
HEADER SADDLE

ATTACHING A 2608 FOLDING CORN HEAD

On an 8 row folding 2600 series chopping corn head, short drive shafts from the feeder house to the header drive are used. When installing this head on a machine equipped with a Terrain Tracker, a shorter throw tilt cylinder is required to prevent damaging the feeder to header drive shafts. There is a cylinder with a shorter 3.3" stroke, (part# 87282646). This cylinder will limit the total travel distance of the Terrain Tracker system. If the customer needs the full travel for beans or other crops, the original cylinder would have to be installed.

When replacing the cylinder, the machine will require “Terrain Tracker Calibration”.

Feeding



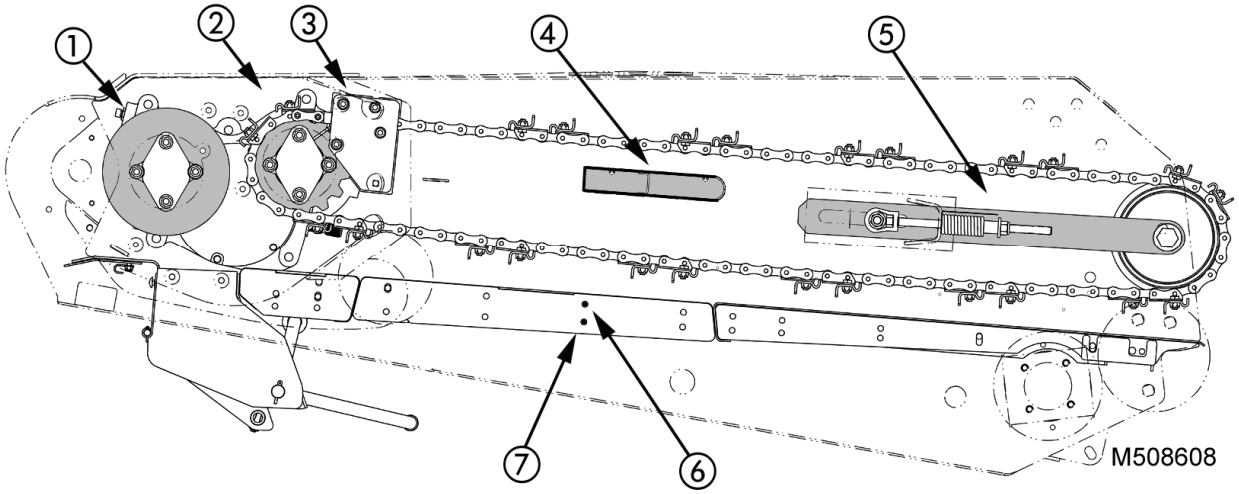
1.	Rock Trap Frame and Sump (Optional)	7.	Lower Feeder Drum
2.	Upper Feeder Chain Shaft	8.	Lower Drum Arm
3.	Upper Feeder Gearbox	9.	Feeder Chain Spring Tensioning Assembly
4.	Feeder Chain Stripper Bar and Plates	10.	Feeder Chain
5.	Stripper Bar Shims, (Left Side Only)	11.	Rock Trap Beater (Optional)
6.	Lower Feeder Panel		

FEEDING

Once the header has cut and gathered the material, it is delivered to the feeder house of the combine. The function of the feeder house is 4 fold:

1. Transition the crop flow from the header to the combine. This is influenced by the distance between the header cross auger and the feeder front drum and type of feeder chain.
2. Provide an even flow of material to the transition cone area. The flow may be influenced by the feeder chain type, tension, speed and if equipped with a stone trap.
3. Provide the threshing area of the machine with stone protection if conditions require it.
4. Position the header at the desired working position.

The feeder chain is driven by the feeder Power Plus drive, which provides for a variable speed range of 222-334 RPM (upper drive shaft speed) or a fixed speed clutch (covered in section 63). The flow of material is moved from the headed to the transition cone at approximately 6.3 mph (556 ft per minute @ 270 RPM) and must be uniform in thickness and continuous for the combine threshing and separating areas to perform at their optimum.



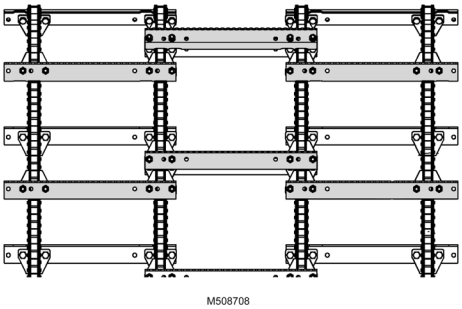
1.	Rock Trap Beater	5.	Feeder Chain Spring Tensioning Assembly
2.	Upper Feeder Chain Shaft	6.	Floor plate mounting W/ Rock Trap
3.	Feeder Chain Stripper Bar and Plates	7.	Floor plate mounting W/O Rock Trap
4.	Feeder Support and Plastic Chain Guides		

FEEDING

FEEDER CHAIN

The feeder chain delivers the cut and gathered crop to the impeller / transition cone area. The feeder chain incorporates four chains connected together by three rows of slats, the chain is identified by “4 X 3”. It’s driven by a tubular shaft, which incorporates four 15 tooth drive sprockets, NOT interchangeable with the 10 series which used 11 tooth sprockets. The shaft has a splined hub on the left end, which slips over the output shaft on the upper feeder gearbox. A large bolt slides through the right hand carrier bearing and threads into the right end of the shaft. The drive is protected by an internal multi-plate friction clutch. There is only one feeder house although it may incorporate a stone trap within it. When a stone trap is installed shorter feeder chains will be required.

- Serrated slats set at 7 pitch (7 chain links between slats, outside chains),is standard from the factory. The serrated slats have the serration rolled directly into the slat material.



The serrated slats have been proven to improve feeding. When we look at crop damage from the feeder house it is normally due to uneven feeding, the mat of material should help to cushion and protect the crop from feeder chain damage.

Wait a Minute… When would I want to use Smooth slated chains? Smooth slates are NOT available for the new feeder chain.

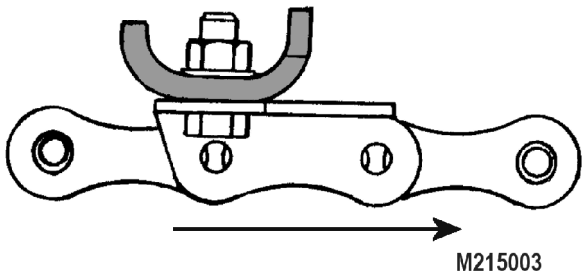
MASTER LINKS

The chains are held together with master links. The master link style has been changed back to the “S” wire retainer, away from the thread pin and nut, for a more secure retaining link.

FEEDING

Each slat also has a leading edge, which is slightly higher than the trailing edge. The leading edge should contact the crop first as it rolls around the feeder drum. Feeder chain slats are bolted (10 mm bolts) to the feeder chain, do not reuse the hardware. Torque the hardware to 50-60 ft. lbs. Do not over-tighten. The length of the feeder chain depends whether the feeder is equipped with a rock trap or not. If equipped with a rock trap the feeder chain will be shorter.

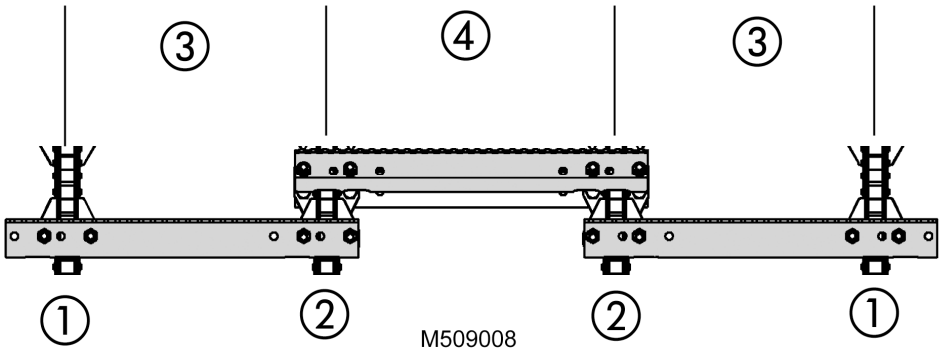
FEEDER CHAIN	LENGTH
W/ Rock Trap	165”
W/O Rock Trap	186”



The feeder chains MUST be installed with the slats straight across, so that the slats are not in a bind.

SLAT MOUNTING

The slats are all the same and have two sets of mounting holes, see example below.



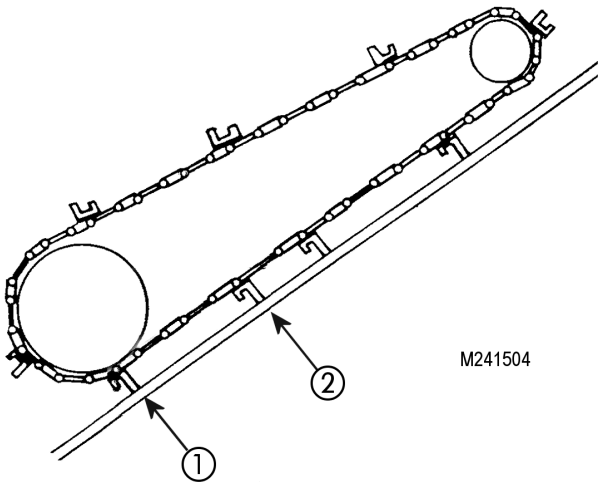
1.	Inner Set of Holes	3.	14 in. center to center
2.	Outer Set of Holes	4.	15.5 in center to center

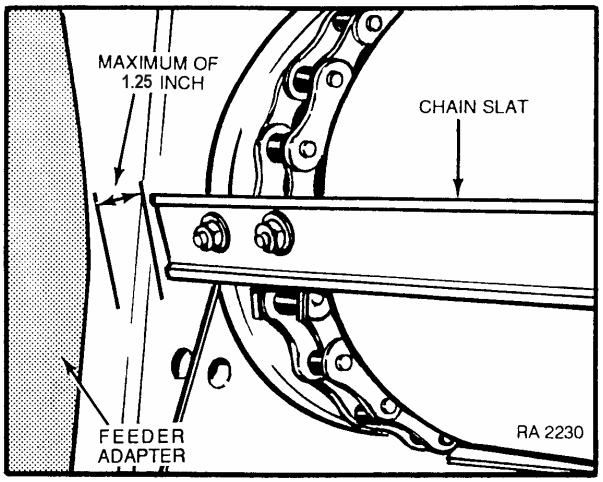
FEEDING

FEEDER CHAIN ADJUSTMENTS

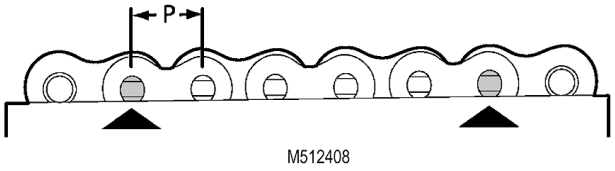
The tension and forward location of the feeder chain is adjusted by moving the lower feeder drum forward or backward.

- The chain should be adjusted evenly on both sides and have maximum clearance of 1.25 inches from slat tip to plastic feeder face. This is determined by chain length. If this distance is greater, poor feeding will result. **In normal operation this distance should be reduced to a point of just clearing the front feeder face and/or header auger. This adjustment would requiring adding additional links in pre-delivery.**





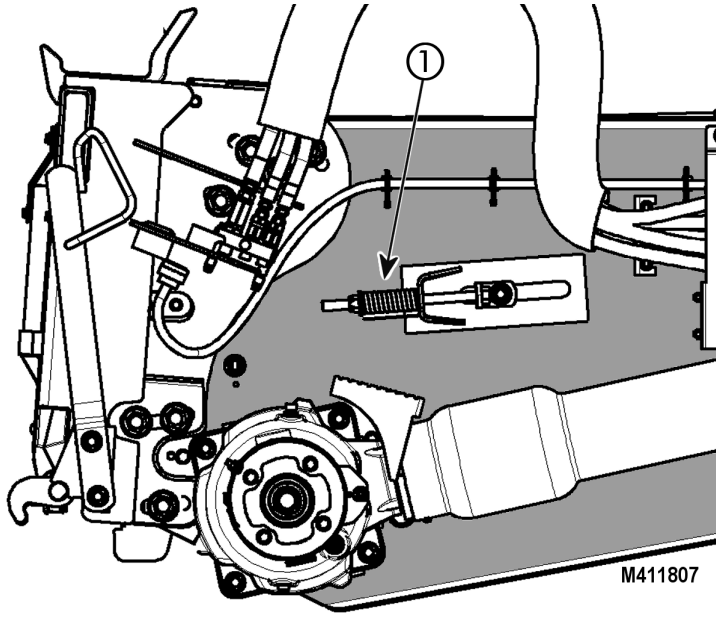
REMEMBER: A feeder chain is worn out when its length has increase by 3%, or when the distance between -5- chain pitches exceeds 8 3/8 inches when tensioned.



FEEDING

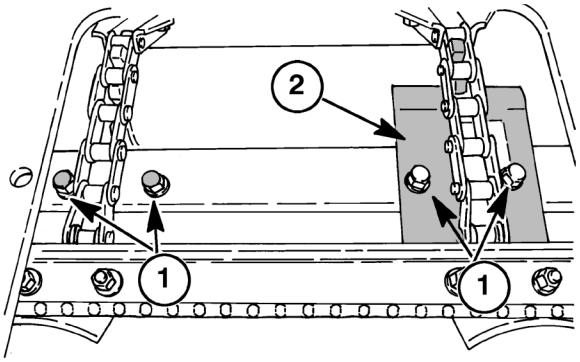
FEEDER CHAIN TENSION ADJUSTMENTS

The feeder chain tensioning system incorporates springs (1), inner tube spacer and gauge to maintain the proper tension. The chain is properly adjusted when the spring washer is in line with the gauge; which should bring it very close to the inner spacer tube. The tube will not prevent the operator from over tensioning the chain; it will prevent the spring from giving when a wad of material comes in the feeder. Run the feeder for a couple of minutes to verify that the tension is retained.



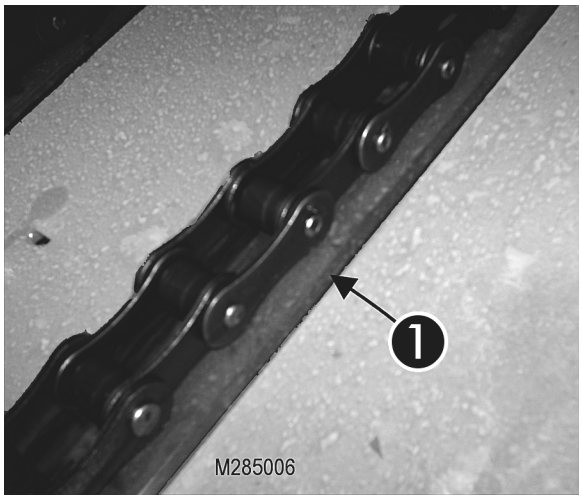
FEEDER STRIP OFF PLATES

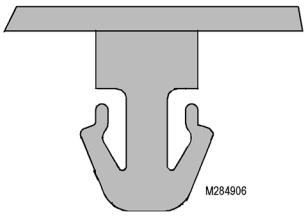
If field/crop conditions cause material to wrap around the feeder chain drive sprockets, the chains will begin to stretch and jump timing. When operating in these conditions it would be advisable to install stripper plates (2) at each of the drive sprocket locations to help prevent wrapping. The strippers should be adjusted to 0.02 – 0.06" running clearance at the sprocket hub.



FEEDING

CHAIN WEAR STRIP



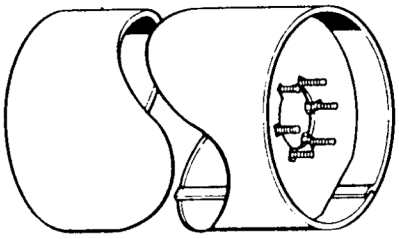


Strip retain pins

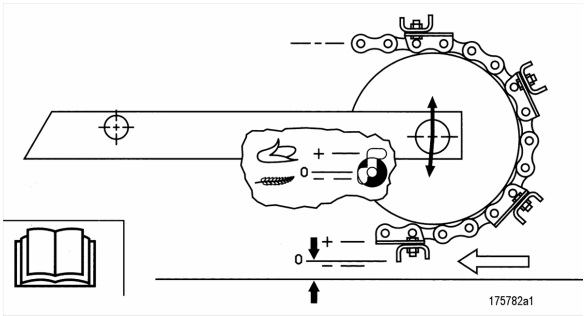
The return side of the feeder chain rides on nylon strips (1); these strips will wear at the lead and tail edges. When a groove wears into the strips the edge of the master link's retaining pin will wear and fall out; this cause the feeder chain to come loose.

STANDARD FEEDER DRUM

The standard feeder drum is located at the front of the feeder house. It is the support and lower guide for the feeder chain. The drum is supported by two pivoting arms which allows it to float up and down. On the standard drum, the feeder chain slats protrude out from the drum approximately 2 inches. This will provide for an aggressive feeding action of pulling the material from the header auger.



RA1239

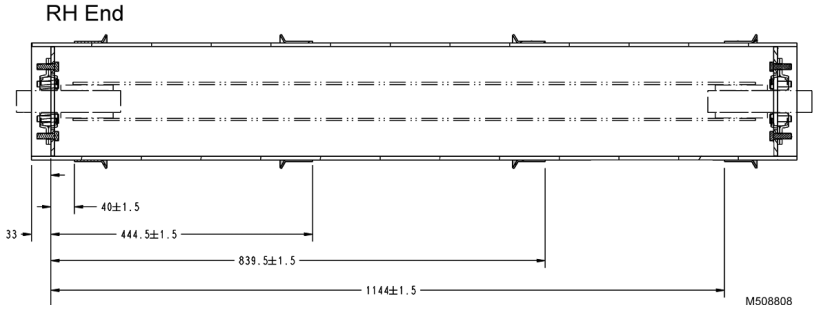


REMEMBER: The feeder chain may eventually wear into the drum and/or make noise. The drum incorporated thicker walls to improve service life. The drum diameter has changed so the steel wear strips that are available through parts will not fit, but the rubber noise silencing strips could be made to work.

FEEDING

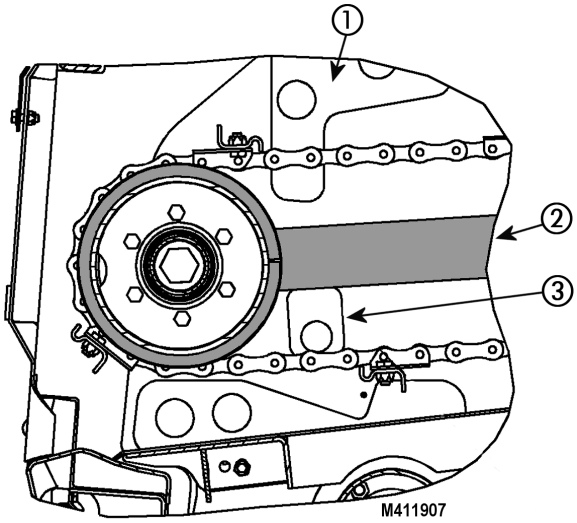
FRONT DRUM CHAIN GUIDES

Drum chain guides help to hold the feeder chain in alignment with the rear drive sprockets and protect the drum itself from wear. They may be replaced as need.



FEEDER DRUM ADJUSTMENTS

The upper (1) and lower (3) drum limiting stops determine the feeder drum position. The lower stop is adjustable while the upper stop is not.



LOWER DRUM STOP

The lower drum stop may be placed in one of three position, UPPER, MID, and LOWER. There is a position indicator hole located below the adjusting bolt to aid in positioning the stop. When the hole is FULLY closed the drum is in the LOWER position, when FULLY open the drum will be in the UPPER position and when PARTIALLY open it will be in the MID position.

For most crops, the lower drum stop should be adjusted to the highest position, the crop flow should be contacting the drum below its centerline. The lower position may be used to promote feeding in certain crops. When running in the lower setting remember to reset the chain tensioning.

FEEDING

FEEDER DRUM ADJUSTMENTS

LOWER DRUM STOP, CON'T

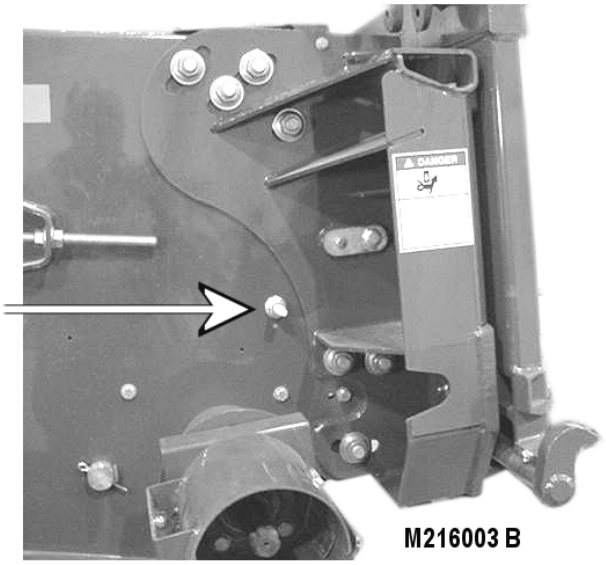
To adjust the drum up or down, loosen the lower drum stop bolt (one on each side), move the drum to the desired location and tighten the bolts. Anytime the drum position is changed, the feeder chain tension should be readjusted.

To Adjust

1. Raise the front feeder drum and block in the raised position.
2. Loosen the lock nut on the adjusting bolt.
3. Using the end of the bolt rotate the lower stop so the TALL side is directly up and square with the drum arm. The indicator hole below the adjusting bolt should be OPEN.
4. Tighten the jam nuts on the adjusting bolts.

For Most Crops Upper Position

Note:
Always adjust the lower stops on both sides of the feeder house to the same position.

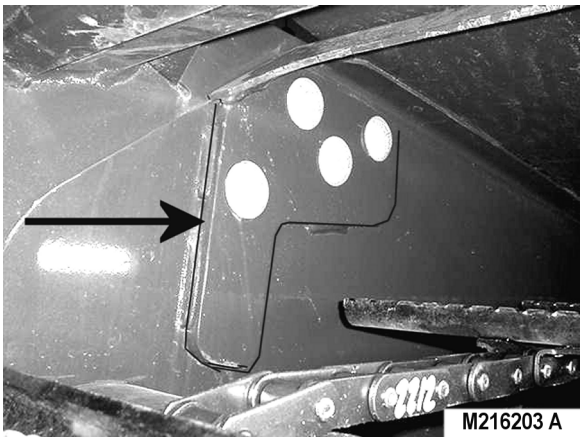


Right Side of Feeder House

REMEMBER: The feeder chain will require adjusting when changing the lower stop position.

UPPER DRUM STOP

The upper drum stop is a welded stop with NO provision for adjustments.



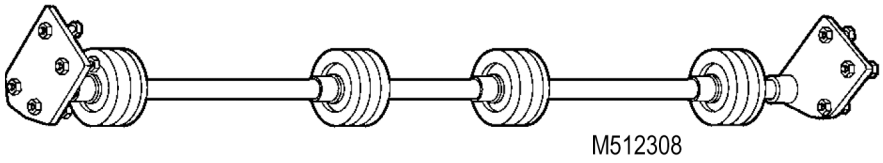
FEEDING

FEEDER CHAIN SILENCER KIT, 20 SERIES = 73340166

10 SERIES = 87298321

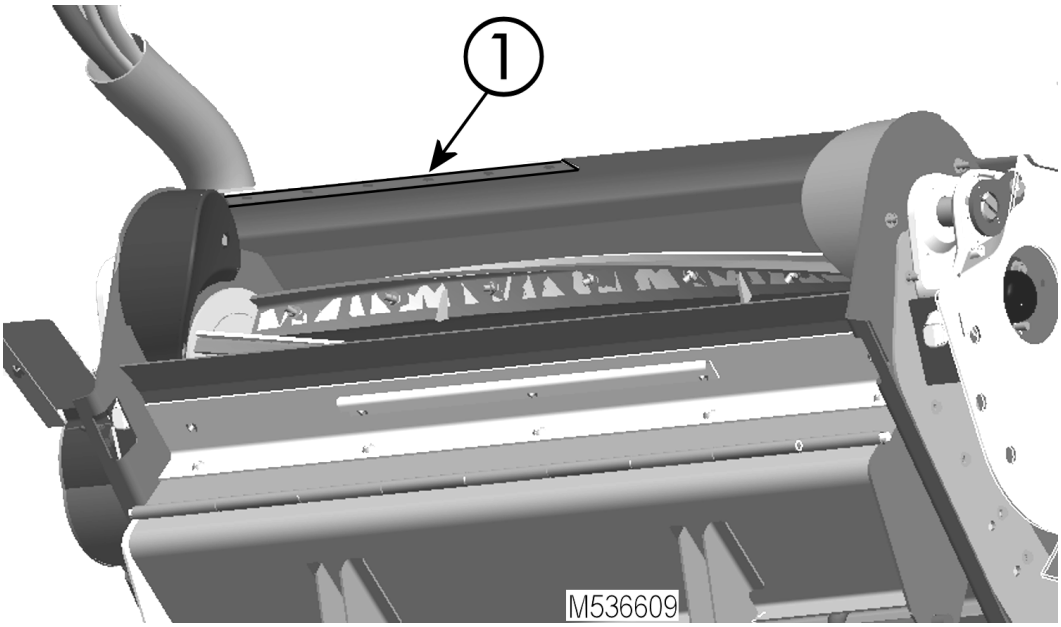
Only on feeders NOT equipped with a rock trap, a feeder chain silencer kit could be installed. The kit helps to lift the feeder chain off the drive sprocket, preventing the sprocket from trying to carry the chain around and also reduces some wear on the sprockets.

The silencer roller kit mounts in the forward set of holes that would be used by the sprocket stripper bar if a rock trap was installed.



UPPER FEEDER WEAR STRIP

An upper feeder wear strip (1) was add to prevent the upper feeder plate from excess wear. For MY10 the strip has been lengthened approximately 100 mm.



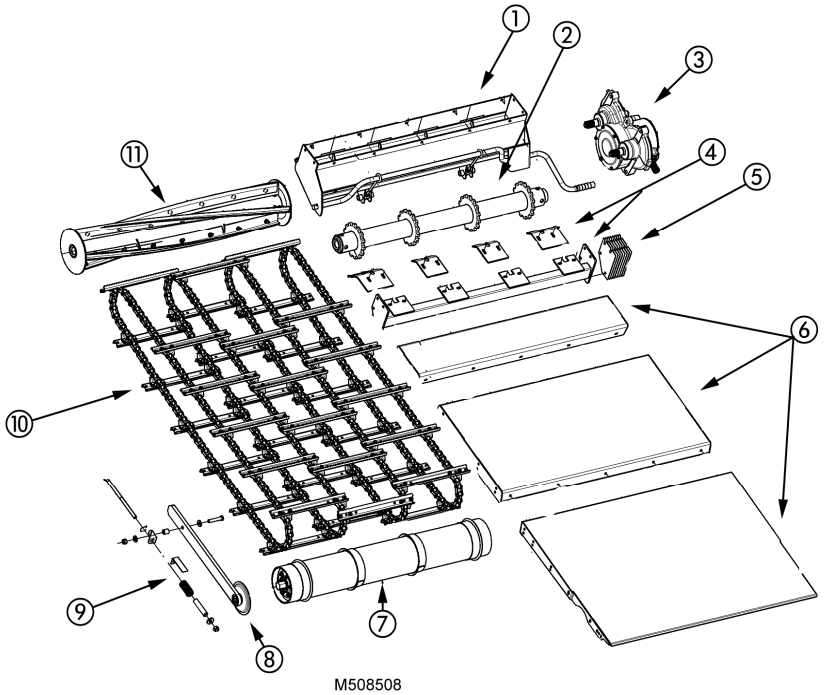
Rock Trap

The rock trap (option) is housed with in the standard feeder housing between the feeder chain and the transition cone. It consists of a beater (10) equipped with four helical blades, a collection box (1) directly under the beater, and a trap door in the collection box. As the crop material passes the beater, any rocks that come in contact with the beater will be driven into the collection box. The beater is driven directly from the upper feeder gearbox (3), (there are two gearbox options, one with and one without the stone trap) on the left side of the combine. The rock trap must be emptied at regular intervals by opening the trap door. If the material that is in the rock trap is allowed to become hard, rocks may not be forced into the collection box. The more rocks in the field, the more frequent the trap should be emptied.

When installing a rock trap the upper feeder chain drive shaft (2) is moved forward so the rock trap can be inserted between the feeder chain and the transition cone. The feeder house does not require replacing.

The beater speed is not adjustable, except through the use of the variable speed feeder / header drive. When you increase header speed, you also increase beater speed. The available speed adjustment depends on the header installed. If a grain head is installed on the combine, the beater RPM varies from 827-1006 RPM as the feeder chain drive shaft varies from 222-270 RPM. If a corn or pickup head is installed on the combine, the beater varies from 827-1240 RPM as the feeder chain drive shaft varies from 222 to 334 RPM. If a draper head is installed there will not be any change in speed.

1.	Rock Trap Frame and Sump (Optional)
3.	Rock Trap / Upper Feeder Gearbox
11.	Rock Trap Beater



FEEDING PROBLEMS

If experiencing feeding problems start with the following items to correct the problem:

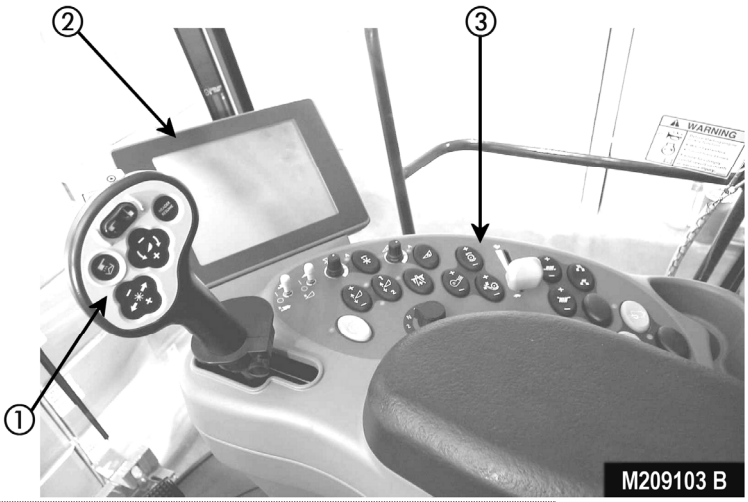
1. Do not overlook the obvious, the header must be adjusted and run properly to provide a consistent, steady flow of crop material to the feeder house (refer to the operators manual for the header being used). Do not feed the material in slugs or wads. This greatly reduces capacity and is abusive to the entire combine.
2. The feeder chain and drum stops must be properly set to take the material away from the header in a consistent manner. Normally the front drum should be raised, helps to prevents the crop from being pushed into the center of the drum; but in some cases with very slipper crops it may be advisable to lower the front drum.
3. Does the machine have the proper type of feeder chain for the crop being harvested? Make sure the chain is installed in the proper direction. The slightly higher leading edge of the slats must contact the crop first.
4. Check to make sure the wear blade that mounted on the leading edge of the rotor auger blades are not excessively worn. If the tips are severely rounded, this will limit the ability of the auger to receive the crop from the feeder.
5. Lengthen the feeder chain as required to move it as close to the header auger as possible without contact.
6. The chain may be loosen past the tension guide no more then ¼ inch in order to let the chain sage closer to the feeder floor. If the chain jumps timing on the drive sprockets they will require tightening.
7. When running a 2020 or 2010 in light crops install header auger flight extensions to increase the density of the windrow of material that is being feed from the header into the feeder. Flight extensions can promote additional wear on the center two chains since those chains will be doing most of the work.

ROCK TRAP FEEDING PROBLEMS

When confronted with a feeding problem on a combine with a rock trap, consider the following:

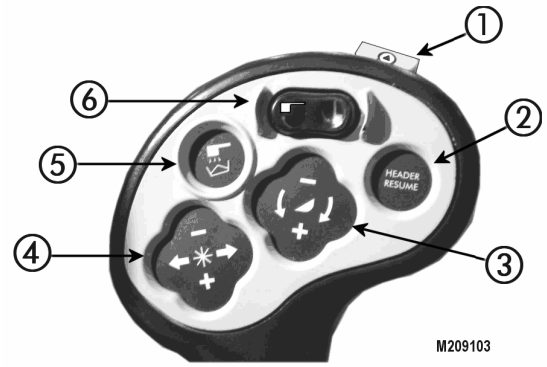
1. If rocks are not a problem during the current condition, a sump cover (through parts) may be installed over the rock sump. This may help feeding, but will eliminate rock protection.
2. Serrated blades (87360866) may be installed on the rock trap rotor to promote more aggressive feeding. Normally two across from each other are enough, slide them IN on the slotted holes.
3. If the feeder gearbox has a gear set that operated the rock trap beater at 1000 RPM, it would be advisable to change it out for a 700 RPM drive. All the 10 series used a 700 RPM drive and the 20 series was changed back to 700 RPM starting at PIN# Y9G205959, Kit 84177488 can be used to convert a 1000 RPM drive to a 700 RPM.

Operator's Controls



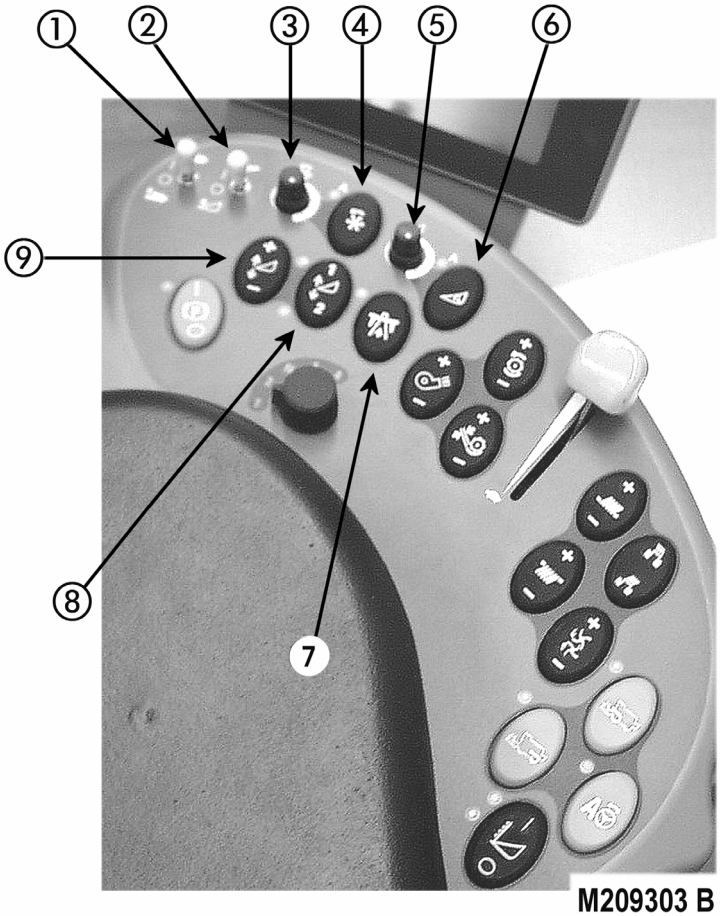
OPERATOR CONTROL CENTER

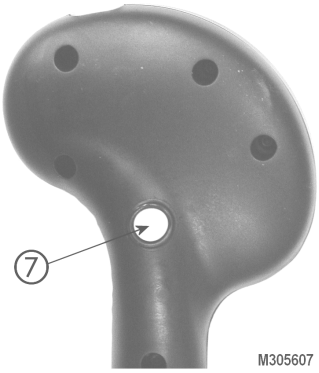
1.	Mulit-Function Handle, MFH
2.	Cab Display
3.	Right Hand Console, RHC



MULTI-FUNCTION HANDLE

1.	Feeder Stop
2.	Resume
3.	Header Raise/Lower Tilt Right/Left
4.	Reel Raise/Lower, Fore/Aft
5.	Unloader Engagement
6.	Unloader Swing
7.	Shift Button





Right Hand Console (RHC)

1.	Separator Engagement
2.	Feeder Engagement
3.	Reel Speed Control
4.	Auto Reel Speed Control
5.	Feeder Speed Control
6.	Auto Feeder Control
7.	Road Switch
8.	Set Switch
9.	Header Position INCREASE/DECREASE Switch

CAB DISPLAY UNIT

The display will be used to display operating information, to provide the operator the means of monitoring the header functions, and to make configuration changes.

REMEMBER: The cab display unit may be referred to as AFS PRO 600 or DispC+.

IMPORTANT: **Different software versions may require different settings. The next few pages are in reference to Display software version 21.*.**

MACHINE ITEMS TO BE CONFIGURED

Screen: MAIN > TOOLBOX > FEEDER

Feeder Type, Select **CVT** for variable feeder speed or **Fixed**

Min. Auto Feeder Speed ground speed (MPH) at which feeder speed is at the minimum. May also be set with ACS.

Max. Auto Feeder Speed ground speed (MPH) at which feeder speed is at the maximum. May also be set with ACS.

Screen: MAIN > TOOLBOX > HYDRAULIC

Accumulator, **YES** if unit is equipped with ride control (standard equipment)

CAB DISPLAY UNIT

HEADER CONFIGURATIONS

REMEMBER: In most cases a "**Header needs to be defined**" error message will appear when a header is attached the first time. The following is a list of the common item that will require configuring and will be associated with the header TYPE SENSOR. Once configured a key cycle is require to save the data and clear the error. **NOT ALL ITEMS WILL BE SHOWN WITH ALL HEADER TYPES.**

Screen: MAIN>TOOLBOX>HEAD 1

Maximum Work Height: Formerly known as STOP HEIGHT, this sets where the transition from counting to not counting acres occurs. Also controls the side lights and auto reel speed functions.

Header Type: Will change automatically with Header Type Sensor

Frame Type: Select Rigid, Flex or Folding depending on header configuration

Cutting Type: Select **ROWS** or **PLATFORM** for acre counting purposes. Corn heads will allow only ROWS

Rows

Total Rows: For Corn heads this is the maximum number of rows

Rows in use: For Corn heads this is the normal number of rows being harvested

Row Spacing: For calculating total width of header. # rows X row spacing = width

Target Work Width: For non Corn heads this is the normal width of crop that is cut

Platform

Header Width: For non Corn heads this is the maximum width of crop that can be cut

Target Work Width: For non Corn heads this is the normal width of crop that is cut

Width Adjust Step: For non Corn heads this is the amount by which cut width will be adjusted while harvesting using WORKING WIDTH. Acre counter.

Head Center Offset: For headers that are not centered, this determines how the GPS, if equipped, will align the passes of yield maps. A positive number is offset right. A negative number is offset to the left.

CAB DISPLAY UNIT

HEADER CONFIGURATIONS

Screen: MAIN>TOOLBOX>HEAD 1, con't

Header Alarm: Set to ON or OFF if operator wants to hear when acre counter is stopping or starting to count.

Header Alarm rings: Number of beeps operator will hear when the acre counter stops counting. Can be set from 1 to 5.

Auto Cut Width: Will reset the actual header cutting width as determined by the GPS system. An operator would not have to manually reduce the cutting width during harvesting point rows.

Overlap Mode: Determines how the Yield Maps will handle the difference between Total rows and Rows in use or Header Width and Target work width. Can be set to MANUAL or AUTO. In MANUAL, the Operator will determine when to FLIP the unused header side. In AUTO mode, the system will FLIP automatically when the header is raised above the MAX. WORK HEIGHT (stop height)

Work Width Reset Mode: Determines how the acre counter will be reset after reducing the Target Work Width for point rows. Can be set to MANUAL or AUTO. In MANUAL, the Operator will determine when to RESET to the normal TARGET WORK WIDTH. In AUTO, the acre counter is automatically reset to the programmed TARGET WORK WIDTH when the feeder is raised above the MAX. WORK HEIGHT (stop height)

Feeder Speed: Feeder speed range will operate in one of three ranges, nominal = fixed for drapers headers, lower range = nominal and slower for auger and chopping corn headers, and full range = nominal, slower and faster for corn and pick-up headers

Screen MAIN>TOOLBOX>HEAD 2

Header Pressure Float: Set to YES if equipped with Float Pressure Sensor. Set to NO if not equipped. (Recommended to turn this function to NO in N.A.)

Pressure Float Override: Determines when Pressure Float will override RTC. The lower the number the sooner override will occur. Range is dependent on Header Type.

Auto Height Override: Determines when AHHC will override RTC. The number entered here represents how close the header will get to the ground before AHHC will override RTC. Must have a header with AHHC sensors attached and be running in RTC.

Ride Control: Determines if the Ride Control Accumulator is ON or OFF. May also be set from a RUN screen if programmed from MAIN>TOOLBOX>LAYOUT

CAB DISPLAY UNIT

Screen MAIN>TOOLBOX>HEAD 2

HHC Lower Rate: Header Lower Rate. May also be set on a RUN screen if programmed from MAIN>TOOLBOX>LAYOUT. Range is from 0 (slow) to 250 (fast)

HHC Height Sens: Header Height Sensitivity. May also be set on a RUN screen if programmed from MAIN>TOOLBOX>LAYOUT. Range is from 0 (slow) to 250 (fast)

HHC Tilt Sens: Header Lateral Tilt Sensitivity. May also be set on a RUN screen if programmed from MAIN>TOOLBOX>LAYOUT. Range is from 0 (slow) to 250 (fast)

Reel Speed Min: Sets ground speed (MPH) at which the reel will run at minimum speed. Range is from 0 to 6.2 MPH

Auto Reel Speed Slope: Determines the ratio of reel to ground speed when in the automatic mode. Range is from 100, 1:1 to 190, 1.9:1

Reel Drive: Determines if the reel will operate. YES if installed, NO if not installed.

Reel Speed Sensor: Set to YES if reel speed sensor is installed and NO if not installed.

Reel Fore-Aft: Determines if Reel Fore-Aft Control will operate. Set to YES if installed and NO if not installed.

Reel Height Sensor: Set to YES if reel height sensor is installed and NO if not installed.

Reel Distance Sensor: Set to YES if reel distance sensor is installed and NO if not installed

Reel end Dividers: Set to YES if active (powered) end dividers are installed. Set NO if no active end dividers are installed.

Header/Knife Fore-Aft: Set to YES if header tilt valve (draper) or knife fore-aft (2030) is installed. Set to NO if not installed. This allows the MFH Shift+Reel Fore-Aft to control function. Does not work if set to NO.

Hydraulic Deck Plates: Set to NO if no adjustable deck plates installed. Set to Hydraulic if hydraulic deck plates are installed. Set to Mechanical if electric deck plates installed. Hydraulic or Mechanical allow Reel Fore-Aft to control this function.

Sensor Stuck Detection: Function not known at time of print

Header Lateral Tilt: Set to YES if Terrain Tracker is installed. Set to NO if Terrain Tracker is not installed. If set to NO, Terrain Tracker will not function.

Auto Header Lift: Determines if the header will automatically lift if the MFH is moved to the reverse slot. May not be active on 7010 or 8010 combines. May be set to YES or NO.

HHC Raise Rate: Header Raise Rate. May also be set on a RUN screen if programmed from MAIN>TOOLBOX>LAYOUT. Range is from 0 (slow) to 250 (fast)

CAB DISPLAY UNIT

ITEMS TO BE PROGRAMMED TO THE OPERATOR CONFIGURABLE RUN SCREENS

For normal operation the operator will have to make changes to the way the header operates. The following items should be selected and added to the Operator Configurable Screens: Run 1-6 under run for easy access.

Screens: MAIN > TOOLBOX > LAYOUT and the desired screen.

Recommended functions to be selected: (examples only)

FUNCTION	SCREEN NAME	DEFAULT IS RUN SCREEN 4
Ride Control	**Ride CTL ADJ**	Most Convenient
Header Raise Rate	**H RAISE RATE**	Most Convenient
Header Lower Rate	**H LOWER RATE**	Most Convenient
Height Sensitivity	**H HGT SNS ADJ**	Most Convenient
Tilt Sensitivity	**H TILT SNS ADJ**	Most Convenient

ACS OPERATIONS

For the Auto Crop Settings (ACS) and headland mode to operate, specific items must be entered. Headland mode is triggered when the **SHIFT** button is held and the **RESUME** button pressed at the end of the field, causing certain operator selected machine settings to change.

1. There must be a **TASK** active. Navigate by pressing the BACK>RUN>#2, this is the default location for the Grower, Farm, Field Task entry screen. Fill in all the required information.
2. There must be a **Work Condition** active. Navigate by pressing the BACK>ACS>WORK. Fill in all the required information.

CAB DISPLAY UNIT

OPERATOR CONTROLS THAT MAY BE ADDED

HEADER HEIGHT OPERATIONS

REMEMBER: Some of the following items may be added to any of the RUN screens. It would be operator preference as to which screen to place them on.

HHC RAISE RATE

The operator uses the raise rate control to adjust the speed of the header. The setting range is from 0 (slow) to 250 (fast)

HHC LOWER RATE

The operator uses the lower rate control to adjust the speed of the header. The setting range is from 0 (slow) to 250 (fast)

Height Sensitivity Control. (H HGT SNS AD)

The operator uses the sensitivity control to adjust response of the header to changing ground conditions in Auto Height or Float. The setting ranges from 0 for the least to 250 for the most sensitivity.

HEADER TILT OPERATION

Tilt Sensitivity Control, (H TILT SNS A)

The operator uses the sensitivity control to adjust the response of the header to changing ground conditions in Auto Height or Float. The setting ranges from 0 for the least to 250 for the most sensitivity.

ACCUMULATOR OPERATIONS

Ride Control

The operator uses the ride control to turn the accumulator ON/OFF during field operation. The accumulator is used to provide shock absorption for the header lift system, to smooth out the ride. In Float, the accumulator is always on regardless of the setting. The operator will use the accumulator to provide shock absorption for the header lift system, to smooth out the ride. For the accumulator valve to be active there MUST be a header recognized.

RIGHT HAND CONSOLE CONTROLS

ON Road Switch, S-12

The accumulator will automatically be turn ON (open) when the On the Road switch located on the RHC is toggled to the ROAD position. The On The Road switch also disables certain operator controls from operating.

Located: On the Right Hand Console

HEADER HEIGHT OPERATION

Header Raise / Lower Command Switch,-S-70

The operator will use the switch to manually raise or lower the feeder house. The switch is a momentary switch in the Raise or Lower position.

Location: On the Multi-Function Handle

Set #1 and #2 Switch, S-04 & S-68

The operator uses the switch to set two different cutting heights. The AUTO mode (RTC, Auto Height or Float) is determined by the height of the header when the Set#1 or Set#2 is pressed. When an Auto mode is active, the Set switch is enabled.

- If cutting wheat and the crop was very tall on one end of the field while very short on the opposite end the operator could set the cutting height to operate at two different heights and use the RESUME button to toggle between them.
- The operator could use the switch to set an “End of Row” height. Use one of the settings for cutting height and one setting for turning at the end of the field, using the RESUME button to toggle between them.

Location: On the Right Hand Console

HHC Fine Adjust Increase / Decrease Switch, S-6

The operator used the switch to change the position of the header when operating in one of the automatic modes. The switch is a momentary switch in the Increase or Decease position. For an example, in Auto Height, the header may be raised until the cutter bar has fallen down to a maximum of 93% of the travel learned during GROUND calibration. The header may be lowered until the cutter bar has been pressed up to a maximum of 13% of the travel learned during GROUND calibration.

Location: On the Right Hand Console

RIGHT HAND CONSOLE CONTROLS

HEADERS, CON'T

Resume Switch, S-71

The operator uses the resume switch to activate the AUTO header mode. By pressing and releasing the momentary switch the system automatically transitions to the AUTO mode. The type of header and how it is configured determines the actual AUTO mode and cutting height specified by the operator with the Set#1 or Set#2 switches. Actuating the RESUME switch again toggles to the other setting, Set#2 or Set#1.

Location: On the Multi-Function Handle

Shift Switch, S-82

The operator uses the shift switch to change the reaction of the following buttons:

- **Shift Switch**: Double press (double click) for Auto Guide activation
- **Header Tilt Left/Right + Shift Switches**: to adjust the Edge Guidance Offset when AccuGuide system is enabled.
- **Reel Fore/Aft + Shift Switches**: to adjust the draper head tilt or Corn head stripper plates
- **Header Resume + Shift Switches**: to activate the Headland Mode.

Location: On the back of the Multi-Function Handle

HEADER TILT OPERATIONS

Resume Switch, S-71

The operator uses the resume switch to activate the Auto Tilt mode. By pressing and releasing the momentary switch the system automatically transitions to the Auto Tilt mode, **IF** the header height is also transitioning to Auto Height or Float.

Location: On the Multi-Function Handle

Tilt Left / Right Command Switch, S-70

The operator uses the Tilt Left / Right switch to manually tilt the feeder house. The switch is a momentary switch in the Left or Right position.

Location: On the Multi-Function Handle

SENSORS

Feeder Position (Angle) Sensor, R03

The feeder position sensor is used to provide the CCM1 a signal as to where the feeder house is located within its range of travel. The system must be must be calibrated to learn the travel of the sensor. See calibrated “Feeder Height” and “Ground Calibration”.

Located: Upper right hand feeder pivot.

Feeder Tilt Angle Sensor, R-02

The feeder tilt angel sensor is used to provide the CCM1 a signal as to where the feeder face is located within its range of travel. The sensor must be calibrated to the system. See calibrated “Header Tilt”.

Located: Right hand side of the feeder at the feeder face.

Float Pressure Sensor, B-29

The Float pressure sensor is used to provide the CCM1 a signal as to the pressure in the feeder lift cylinders. The information is used to set the ground pressure operating point and to set the range of the HHC Fine Adjust Increase and Decrease switches when operating the header in Float. The sensor must be calibrated to the system. See “Float Calibrations”. The sensor is used with Rigid or Flex Grain headers.

Located: In the main valve assembly, left side of machine in front of batteries.

Right Height / Tilt Potentiometer, R-13

The right height / tilt pot. is used to provide the CCM1 a signal as to the position of the header or cutter bar in relationship to the ground. The information is used when operating the header in Auto Height mode. The sensor must be calibrated to the header. See “Ground Calibrations”. The sensor is used with Grain and Corn headers.

Located: On the right hand end of the grain header or under the right divider point on a corn head.

Left Height / Tilt Potentiometer, R-12

The left height / tilt pot. is used to provide the CCM1 a signal as to the position of the header or cutter bar in relationship to the ground. The information is used when operating the header in Auto Height mode. The sensor must be calibrated to the header. See “Ground Calibrations”. The sensor is used with Grain, Corn, Draper and Pick-Up headers.

Located:

- On the left hand end of the grain header or
- Under the left divider point on a corn head.
- In the center of the Draper header at the adapter.
- On the left side of the Pick-up header.

SENSORS

Right Center Height Potentiometer

For future use.

Left Center Height Potentiometer, R-19

The left center pot. is used to provide the CCM1 a signal as to the position of the header in relationship to the ground. The sensor must be calibrated to the header. See “Ground Calibration”. The sensor is used with Corn heads.

Located: On the center divider point on a corn head.

Header Type Sensor, R-20

The header type sensor is used to provide the CCM2 a signal as to the type of header: Corn, Grain, Draper or Pick-Up.

Located: On the header near the header feeder harness interface.

SYSTEM CALIBRATION

CALIBRATE "FEEDER HEIGHT"

The Header Height calibration procedure is used to let the system learn the full travel of the feeder and the current required to activate the Raise / Lower solenoids.

REMEMBER: During the procedure the feeder will be operated by the controllers automatically, take proper safety precautions.

1. Turn the accumulator **OFF** if equipped.
2. Locate a flat area where the header can be lowered until the feeder lift cylinders are **TOTALLY** retracted with out any restrictions.

REMEMBER: It is recommended that the header be removed during the procedure.

3. Feeder must be **OFF** and the machine **NOT** moving.
4. Using the display enter the calibration procedure.

   MAIN > Calibration >FEEDER
5. Press the START button.
6. When instructed to, momentarily press the header RAISE command switch. The header will lower completely, the position of the feeder position sensor will be learned. The header will momentarily raise to learn the required current to activate the raise solenoid.
7. When instructed to, momentarily press the header RAISE command switch. The header will raise completely, the position of the feeder position sensor will be learned. The header will momentarily lower to learn the required current to activate the lower solenoid.

.

IMPORTANT: If any of the header command switches are pressed during the operation the calibration procedure will be aborted.

IMPORTANT: The feeder position sensor must report a minimum change of 1.54V when the feeder moves from the max down position to the Max UP position or the system will not accept a calibration and will fault out.

SYSTEM CALIBRATION

CALIBRATE "GROUND CALIBRATION"

The ground calibration procedure is used to calibrate the height indicator and Auto Header Height Sensors on header equipped with Auto Height Control. The process lets the system learn the full travel of the header sensors.

All the calibrations will be completed at the same time with the following requirements:

- Locate a flat area for the header to let the header down on.
- Feeder must be **OFF**.
- The combine must not be moving.

Headers

1. If equipped with header height sensors, all linkages MUST be free to pivot.
2. Lower the header completely and hold the DOWN button for -2- seconds after the header stops moving.
    - This will calibrate the height display as being ground level. The upper limit indicator number will vary with tire size.
    - If equipped with a header height sensor the header controller will learn the FULLY on the ground rotational limit of the sensor(s).
3. If equipped with header sensor(s) raise the header completely with out letting go of the RAISE button.
    - The header height sensor(s) the header will stop moving mid-way of its travel for approximately 1.5 seconds and then continue to raise. The header controller will learn the FULLY off the ground rotational limit of the sensor(s).
    - If this is the FIRST raise cycle after a key switch cycle and the machine is equipped with a float pressure sensor, the header will stop near the top of it travel. See "Float Calibration" below.

The operation of calibrating the **height indicator and auto header height sensor** should only have to be done again if adjustments are made to the header or a different header is used.

CALIBRATE "FLOAT SENSOR"

The Float calibration procedure is used to calibrate the working pressure range of the currently installed grain header. The **float sensor** will automatically be calibrated on the first RAISE cycle after a key switch cycle. When the header is fully raised the first time after cycling the key switch, the controller will stop the header near the top of its travel. This prevents the operator from filling the lift cylinders with high-pressure stand-by pressure. The header controller will learn the pressure required to hold the header of the ground. This will only occur if the machine is set for a GRAIN header and once per key cycle.

SYSTEM CALIBRATION

CALIBRATE "HEADER TILT"

The header tilt calibration procedure is used to let the system learn the full travel of the feeder face and the current required to activate the tilt Right / Left solenoids.

REMEMBER: During the procedure the header will be operated by the controllers automatically, take proper safety precautions.

1. Locate a flat area where the header can be tilted to its extreme limits with out any restrictions.

REMEMBER: It is recommended that the header be removed during the procedure.

2. Feeder must be **OFF** and the machine **NOT** moving
3. The operator MUST make sure the combine and feeder are level to provide a starting point. *The machine does not have to be perfectly level, but the feeder face must be parallel with the machine's front axle.*
4. Using the display enter the calibration procedure.

   BACK > Calibration >HEADER LATERAL TILT
5. Press the START button.
6. When instructed momentarily press the header RAISE command switch. The current position of the faceplate position sensor will be learned as the center of the travel. The faceplate will pivot fully to the left (counter clockwise), the position of the tilt angle sensor will be learned. The header will momentarily pivot to the right to learn the required current to activate the right tilt solenoid.
7. When instructed momentarily press the header RAISE command switch. The faceplate will pivot fully to the right (clockwise), the position of the tilt angle sensor will be learned. The header will momentarily pivot to the left to learn the required current to activate the left tilt solenoid.

IMPORTANT: If any of the header command switches are pressed during the operation the calibration procedure will be aborted.

HEADER RECOGNITION

Headers that are attached to the AFX combines will automatically be recognized as to the type. The recognition comes from a built in “Header Type Sensor” on the header that directs the correct voltage to the correct wires to the combine. Headers are assigned to one of four types, Corn, Grain, Pick-up or Draper.



Wait a Minute…Why does the combine have to recognize the attached header?

Each header may be equipped with different attachments and options that require different operator controls.

Example:
2408 corn head may or may not have hydraulically adjusted stripper plates.

- If the unit is equipped with adjustable stripper plates, the reel Fore/Aft controls will be used to make the stripper plate adjustments. This will only work if the operator selected installed on the HEADER 2 configuration screen during header set-up.
- The acre counter will be automatically set for the header width that the operator defined on the HEADER 1 screen during header set-up.
- Automatic header height functions will recall the position the header was operated at the last time it was used.
- The variable speed feeder’s operating RPM ranged will be set for the header type.

There can be a maximum of five headers assigned and configured on the machine. That means the operator could have a corn head, flex header, rigid header, draper header and default header assigned at one time. So as the operator changes between headers the combine will automatically recall how it was used the last time, making the operator’s job easier.

These changes will be driven by the signal from the header TYPE sensor, this will change the settings on the MAIN>TOOLBOX>HEADER 1 & 2.

HEADER RECOGNITION



Wait a Minute…Won't the flex and rigid headers both be classified as GRAIN headers?

Multiple units of the same type may be entered on the machine at one time.

Example:
The operator owns a 2020 30ft. Flex header and a 2010 25ft. rigid header, both will use the same "Header Type Sensor". The combine will not be able to distinguish between the two headers. The operator will configure both headers as GRAIN headers, (that will take up two of the possible four configured headers). The operator will need to disconnect the header type sensor from one of the headers say the 2010 and define this header as a **default** GRAIN header. Now when the 2010 header or no header is attached, the combine will think the default 25ft header is attached. When the 2020 is attached, the combine will sense the header type sensor and know the 30ft header is attached.

When a header is attached that does NOT have a type sensor or the type sensor has failed the combine will operate with using the configuration that was associated with the last type sensor that was detected. If a DEFAULT head has been configured, that configuration will be used any time the type sensor is missing.

HEADER RECOGNITION



Can we look at an example:

Equipment: 8010 combine
2412 30” Corn head
2010 25ft. Grain head for rice
2020 30ft Grain head for soybeans
2062 36ft. Draper header for wheat

Mr. Big grower is going out to harvest his wheat crop and install his 2062 header for the first time. When attached the operator receives a message on the display that the “Header Needs to be Defined.” The operator will have to define the header using the touch pads on the display, (explained later). The operator is changing from wheat to corn. When the corn header is attached for the first time the operator will get another “Header Needs to be Defined” message, the operator will have to enter the information required for the corn head. If the operator returns to the 2062 header the combine will automatically recognize it and make the configuration changes. The operator changes to soybeans so the 2020 flex header is installed for the first time creating the same message as before, so the operator will have to define and configure the header. When the operator changes to rice with the 2010 header there will NOT be a message to define and configure the header. The combine will still think it is connected to the 2020 header. The operator will need to disconnect the header type sensor from the 2010 header and define it as a default grain header. Now whenever the 2010 or no header is connected, the combine will think the 2010 is connected. When the operator changes back to the 2020, the combine recognizes the change because of the header type sensor.

If the operator has assigned all four headers, (1-corn, 2 Grain, 1 Draper) but tries his neighbors pick-up header. This header being the fifth type to be connected to the machine will cause the oldest not used configured header to be replaced with the pick-up header and requires configuration. Since the draper used for wheat was the oldest defined header it will be replaced, so the new headers would be 1-Corn, 2 Grain and 1-Pick-up headers.

But, what if I try my neighbor’s XYZ header that is not equipped with a “Header Type Sensor”? If the header is not equipped with a sensor or the sensor is not operating properly the operator will have to manually define and configure another default header.

HEADER RECOGNITION

REMEMBER: The combine remembers the last default header that was attached and automatically selects it when NO header type sensor is detected.

REMEMBER: The definitions (features, size etc.) for the last 4 defined headers are always remembered. Manually changing the header type automatically selects the definitions the operator selected for that header. Changing to a header with a header type sensor automatically selects the header type and the definitions.

Modes Of Operations

HEADER MODES

The feeder (header) may be operated in a number of different modes and with different headers for a variety of different harvest situations. The modes of operation may be:

MANUALLY

When the header RAISE / LOWER switch on the MFH is activated the header operations will be in MANUAL. In manual operation the header raises or lowers only while the operator is pressing the command switch. The only electronic operations being used will be the raise and lower rate controls. The feeder position will be displayed on the display for the operator's convenience. This mode would be used when connecting headers to the machine or harvesting crops above the ground level.

RETURN TO CUT

The RTC control is used to set and maintain a pre-selected cutting height above the ground level. It will normally be used while cutting standing crops such as corn, wheat, etc. The operator will be able to control header cutting position using the controls on the MFH, RHM and the display.

RETURN TO CUT OVER RIDE

If an obstacle is encountered (the cutter bar comes in contact with the ground) in field operation, while the header is being operated in the RTC mode, the header controller can momentarily enter a different operating mode (Auto Height, or Float if equipped) to overcome the obstacle. This will only occur if the header is configured with ground height sensors or the combine is equipped with the Float option and the system is operational. After the obstacle is overcome, the header controller will return to the RTC mode.



REMEMBER: Because of this operation, when the flex cutter bar on a 2020 header is locked up ridged for cutting OFF the ground, the header electrical cab will need disconnecting. Also set the header DEFAULT TYPE to "GRAIN" and define it.

MODES OF OPERATIONS

MODES OF OPERATION, CON'T

AUTO HEIGHT CONTROL

The AUTO height control is used to maintain a pre-selected header height above the ground while the cutter bar remains in ground contact. This system reacts much quicker than an operator could manually. This system is used primarily for cutting crops at ground level such as soybeans. The operator will control the position of the header, which in turn controls the angle of the cutter bar.

FLOAT CONTROL

The Float control is used to maintain the header on the ground at a pre-selected ground pressure. Typically this mode is used for harvesting crops that must be cut at ground level with a non-flex header.



Wait a Minute… There was NO mention of a MODE switch to select the AUTO mode of operation desired. How do I get started? The mode of operation is automatically selected when the operator determines the operating position of the header.

MODES OF OPERATIONS

HOW DO I GET STARTED

GENERAL:

1. each new header that is attached for the first time will require defining, review all steps for the MAIN>TOOLBOX>HEADER 1 AND HEADER 2, and if a corn, pickup or grain head MAIN>TOOLBOX>FEEDER for MIN/MAX feeder speed settings..
2. Each new header that is attached to the combine needs to be calibrated to the combine. The operator needs to perform a “GROUND CALIBRAITON”. If pressure float is an installed option and the header is a grain header, the operator needs to perform a pressure float calibration.
3. Set the operating mode(s) and desired cutting height(s).
4. Use RESUME to quickly transition to and between the mode(s) and desired cutting height(s).

MODES OF OPERATIONS

HOW DO I GET STARTED, CON'T

SETTING THE OPERATING MODE AND CUTTING HEIGHT:

1. Engage the separator and feeder.
2. Manually lower or raise the header to the desired cutting height.
3. Press the SET #1 switch and the light next to the #1 will turn on. If the header and ground height sensor(s) are off the ground, the Mode will be RTC and the cutting height will be this feeder position. If the ground height sensors are in contact with the ground but the header is still off the ground, the mode will be Auto Height and the cutting height will be this ground height. If the header is on the ground and the header is a grain head, the mode will be Pressure Float and the cutting height will be on the ground at this ground pressure.
4. Use the INCREASE and DECREASE switches to fine adjust the cutting height or float pressure setting.
5. To set a second operating mode and cutting height, repeat step 2 then Press the Set #2 switch and the light next the #2 will turn on. Use the INCREASE and DECREASE switches as necessary.

THE RESUME OPERATION:

With the separator and feeder engaged:

1. While in MANUAL mode (the resume switch HAD NOT been pressed since engaging the feeder drive), actuating the RESUME switch, the header will be lowered or raised to the cutting height specified by the SET #1 or SET #2 switch. The cutting height is the last one operated in.
2. While in AUTO mode, (the resume switch HAS been pressed at lest one time since engaging the feeder drive) and the header is at the cutting height specified by SET #2, actuating the RAISE or LOWER switch goes to MANUAL mode. When the RESUME switch is actuated, the header will returned to the cutting height specified by the SET #2 switch.
3. While in AUTO mode, actuating the RESUME switch, the header will be lowered or raised to the cutting height of the other SET switch. For example: if the header is at the cutting height specified by the SET #1 switch, actuating the RESUME switch causes the header to operate at the cutting height specified by the SET #2 switch. Actuating the RESUME switch again will return the header to the cutting height of the SET #1 switch.
4. While in AUTO mode, holding the SHIFT button and pressing the RESUME button will cause the feeder to lift above the MAXIMUM WORK HEIGHT. This will cause the acre counter to stop counting acres and enters the headland mode.

MODES OF OPERATIONS

MODES OF OPERATION, CON'T

CLEARING THE SET POINTS



IMPORTANT: When trying to set and reset the SET #1 and SET #2 position things may not always work right, this would be a good time to clear out the settings and start over. To clear the current settings:

1. Start the Feeder Drive
2. Raise the feeder full UP
3. Press the SET #1 and SET #2 switches one at a time
4. As normal reset the positions the operator wants to run at

METHODS OF USING THE SETTING SWITCH



Wait a Minute… The setting switch has 2 positions (SET #1, Set #2), PLUS the SHIFT+RESUME. How would I use the 3 settings?

First the operator has to decide whether the SHIFT button is to be used or not.

Examples with out using the SHIFT button.

Example 1: Cutting Soybeans

The mode is Auto Height (ground sensing) and the cutting height is 3 inches for Set #1. The mode is RTC and the cutting height is 2 feet for Set #2. While harvesting in the field, you are operating at 3 inches specified by SET #1. You get to the end of the field and actuate the RESUME switch. The header automatically raises 2 feet as specified in SET #2. You do a quick 180, actuate the RESUME switch and the header is back to the 3 inches specified by SET #1 for harvesting.

MODES OF OPERATIONS

MODES OF OPERATION, CON'T

METHODS OF USING THE SETTING SWITCH

Example 2: Cutting Wheat

The mode is RTC and the cutting height is 8 inches for Set #1. The mode is Pressure Float and the cutting height is lightly on the ground for Set #2. While harvesting in the field say wheat, you are operating at 8 inches specified by SET #1. You come to some downed crop and actuate the RESUME switch. The header automatically lowers to the ground as specified by SET #2 to harvest the downed crop. The crop is standing again, actuate the RESUME switch and the header is back to the 8 inches as specified by Set #1. When you reach the end of the field, you would press the header RAISE button to raise header, causing it to go into MANUAL mode. You do a quick 180, actuate the RESUME switch and the header is back to the 8 inches as specified by Set #1.

REMEMBER:

The ground calibration and the 2 settings, SET #1 and SET #2 are specific to the header type. Once the headers are set up as described above, you can swap the headers and the combine will adjust accordingly: automatically if the headers have type detection sensors, manually through the display if not. The combine can accommodate 4 different header types: Corn, Grain, Draper and Pick-up.

Examples Using the SHIFT button.

Example 1: Cutting Corn

The mode is Auto Height (ground sensing) and the cutting height is set with the divider points at 6 inches for Set #1. The mode is RTC and the cutting height is set with the divider points at 2 feet for Set #2. While harvesting in the field, you are operating at 6 inches specified by SET #1 (the crop is down). You get part way across the field and the crop is standing good, the operator presses the RESUME button to toggle to the set #2 position, 2 feet above the ground. Both set points are below the MAXIMUM WORK height so the acre counter never stops.

When the operator reaches the end of the field, the SHIFT button is held and the RESUME button pressed, (both released), and the header is raised above the MAXIMUM WORK height so the acre counter stop counting. You do a quick 180, actuate the RESUME switch and the header is back to the 2 foot position as specified by Set #2.

MODES OF OPERATIONS

HEADER TILT

GENERAL

Header tilt® is an attachment that allows the combine header (2400 series corn head and/or 2010 and 2020 grain header) to automatically follow the ground contour laterally up to five degrees in either direction independent of the combine. Header tilt® is used in conjunction with Auto Height Control. This system is used primarily for cutting soybeans, harvesting corn, or any crop where it is necessary to cut close to the ground.

Header tilt® has two standard operating modes: Manual and Automatic. The operating mode is determined by the height mode the header is operating in. If the header is operating in RTC when the RESUME button is pressed and released the Header tilt will operate in MANUAL mode. If the height mode of the header is Auto Height mode the Header tilt will operate in AUTO mode when the RESUME button is pressed.

MANUAL OPERATION (M)

When the Header tilt® is in the Manual mode, the header may be manually tilted left or right to anywhere within the operating range, as needed, by the Header Control Switch on the propulsion lever. When the Header Control Switch is released, the header will remain in the same position throughout the entire operating range of the feeder until the Header Control Switch is again activated. The manual mode is used when the header is operated above the ground and field terrain following is not required.

AUTOMATIC OPERATION (A)

The Separator and Feeder Switch must be **ON** for Automatic mode to operate. The Automatic mode has two different operating modes within the full operating range of the feeder: Auto-Self Centering and Ground Sensing.

- Auto-Self Centering mode levels the header to the combine when the header RAISE command button is pressed or if the pressing of the RESUME button transition from a ground sensing mode to the RTC mode of operation. This mode will only be activated if the header had been running in Auto Height or Float mode when the RAISE or RESUME command was received.

- Auto Tilt mode (ground sensing) automatically tilts the header left or right within the tilt operating range, as needed, to follow the ground contour. Auto tilt only occurs when operating in Auto Height or Float mode. Pressing the tilt Right or Left button will cause the Auto tilt to transition to the MANUAL mode. The Resume button would require pressing to reactivate the AUTO mode.

FEEDER DRIVE OPERATIONS

HOW SHOULD THE FEEDER DRIVE SYSTEM OPERATE?

The feeder drive has very specific operating requirements and must operate in one of six modes at all times. The system is in control of all feeder operations, maintaining RPM, monitoring, troubleshooting and warnings.

MODES OF OPERATION

OFF

The operator will have placed the feeder control switch into the **OFF** (center-detented) position the feeder should not be powered and should be at rest. Immediately after the operator has started the engine, electrical power is applied to the CCM1 controller and the feeder should be at rest. The ETR clutch is disengaged but the RTF clutch is engaged to assure the feeder is at zero speed and the feeder switch is in the "OFF" position.

CALIBRATION

The calibration mode provides the ability for the electronics to learn clutch fill times and current required to activate the feeder drive pump and clutch solenoids. The calibration mode is activated through the display unit. These values are stored in non-volatile memory. Calibration should be done at least once every harvest season and upon pump or clutch replacement.



Wait a Minute... Should this be performed during pre-delivery? The calibration was completed at the plant and should be require calibration during pre-delivery. It would be best to wait until the machine has 50-100 harvesting hours on it before doing a calibration. The feeder calibration should be performed If a harsh engagement or creeps is experienced.

FEEDER DRIVE OPERATIONS

FEEDER ENGAGEMENT

When the operator places the feeder control switch into the forward detented position, the feeder will be started by activating an acceleration mode to start and bring the feeder up to the requested RPM. The electrical system will activate the engine to ring clutch to start the feeder turning. The clutch will be modulated to provide a smooth engagement, bring the feeder speed up to the desired speed within 5 seconds. The electronics will monitor the actual feeder gear case output speed and make adjustments to the feeder pump as required to match the actual feeder speed to the requested feeder speed.

The feeder may be operated in one of two modes:

1. **Manual Operation**; the feeder speed will be set by the operator to a specific speed. The speed may vary due to engine speed.
2. **Auto Operation**; the feeder ratio to ground speed will be set by the operator to a specific ratio. Auto operation requires that a minimum and maximum feeder speed be configured and placing the feeder auto mode rocker switch in the "AUTO" position. The feeder speed will be at minimum until the ground speed exceeds the minimum preset, will then vary as a function of ground speed while below the maximum preset and will be at maximum should ground speed exceed the maximum limit. The feeder requested ratio to ground speed will be maintained, regardless of the engine speed. These settings are header sensitive.

The header drive operating range is between 222 - 698 RPM depending on engine speed. At high idle the range should be 456-698 RPM.

Reverse

Feeder reverse is activated when the feeder switch is placed and held in the momentary position. The feeder reverser permits the operator to rotate the feeder and header in reverse to free a stalled feeder chain or header. The feeder drive motor provides all driving force. The operator will hold the feeder engagement switch in the reverse position, (rearward momentary position). When the feeder is cleared the operator will release the switch, and the switch will return to the OFF position, (center detented position). At high engine idle (2100 RPM) the header drive shaft speed will be 130 RPM in the reverse direction. This speed is reduced in proportion to engine RPM.

Passive Deceleration

When the feeder is above 50 RPM and the feeder switch is placed into the "OFF" position, the ETR clutch is disengaged placing the feeder in the passive deceleration state. The RTF clutch will not engage to stop the feeder until the feeder speed is below 50 RPM.

SYSTEMS OPERATION

The entire feeder drive system consists of a PTO and feeder gear boxes, Power Plus drive, hydraulic pump, hydraulic motor, feeder engagement switch, AUTO/MANUAL switch, feeder speed/ratio potentiometer, speed sensor, and electronic controls.

Feeder status and fault warning data will be regularly conveyed to the operator by way of the Cab Display.

Feeder operation is controlled in four different modes; Disengaged (**OFF**), Engage (**ON**), Reverse and Calibration. Upon the feeder controller receiving a command speed via the CAN bus, the feeder will engaged by:

Engagement (ON), Manual Mode

1. The rear ladder must be in the home position (**UP**), the seat switch must be closed, separator and feeder switches **OFF** and the feeder at less then 50 RPM.
2. The operator will toggle the feeder **AUTO/MANUAL** switch so that the indicator lamp is **OFF** and places the separator switch into the **ON** position.
3. The operator places the feeder switch into the forward detented **ON** position.
4. The ETR clutch will engage to connect the engine gear drive to the Power Plus drive. The clutch solenoid will be activated using PWM to provide for a smooth engagement. The ETR clutch will provide the feeder with only ONE speed; it is a direct gear drive from the engine.
5. In manual mode, the operator will use the feeder speed control knob to select the desired operating speed.
6. If the feeder speed that is provided by the ETR clutch drive is not the desired speed, the controller will activate the feeder drive pump to provide for an above mid-range or below mid-range condition. The feeder's operating range will be between 222-698 RPM at the header drive shaft.
7. The feeder's actual speed should reach the desired speed within 5 seconds. The feeder speed may be changed "on the go", with the feeder speed control knob.



REMEMBER: If the separator and feeder are both engaged and the separator ONLY is disengaged, the feeder will also disengage. If the rotor is engaged with the feeder switch already in the engaged position the feeder will not reengage. The feeder switch must be engaged or recycled after the rotor is engaged.

The feeder may be engaged at any time once the separator switch has been moved to the **ON** position AND the feeder speed is BELOW 50 RPM.

SYSTEMS OPERATION

Engagement (ON), Auto Mode

1. The operator will use the display to select the MINIMUM and MAXMUM feeder speed, in terms of ground speed that will be used during harvesting and to define the header that is being used. This will automatically create the working range of the feeder drive in ratio to the ground speed. If ground speed falls out side of the previously selected range the feeder will be operated at its minimum or maximum speed respectively.

To define auto feeder mode maximum and minimum presets:

A) Enable parameter access by pressing: MAIN>TOOLBOX>FEEDER feed max adj.

B) Enable parameter access by pressing: MAIN> TOOLBOX>FEEDER feed min adj.

2. The operator will toggle the feeder AUTO/MANUAL switch so that the indicator lamp is ON and places the separator switch into the ON position.
3. The operator places the feeder switch into the ON position.
4. The ETR clutch will engage to connect the engine gear drive to the Power Plus drive. The clutch solenoid will be activated using PWM to provide for a smooth engagement. The ETR clutch will provide the feeder with only ONE speed; it is a direct gear drive from the engine.
5. If the feeder speed that is provided by the ETR clutch drive is not the desired speed the controller will activated the feeder drive pump to provide an over-speed or under-speed condition. The feeder's operating range will be between 222-698 RPM at the header drive shaft, depending on the engine setting and ground speed.

REVERSE

1. Places the feeder switch into the REVERSE position (rearward momentary position).
2. The RTF clutch will engage to permit the feeder motor to power the Power Plus drive.
3. The feeder pump (-) solenoid will be activated using PWM to provide for smooth engagement and speed control. The feeder will be operated with a range of 30-130 RPM proportional to engine speed.
4. When the feeder control switch is released it will automatically return to the **OFF** detent position.

AUTO FEEDER CUT OFF, (SHAFT SPEED MONITOR)

The CCM1 will detect any feeder clutch slippage, using the feeder speed sensor. If the feeder speed should drop below 80 RPM a message will be placed on the data bus for the CCM1 to dis-engage the feeder drive with in 2 seconds of detection. The feeder may be re-engaged by cycling the feeder switch.

SYSTEMS OPERATION

Engagement (ON), Auto Mode, con't

CALIBRATION

A feeder calibration process will let the controller learn the amount of current required to activate the RTF, ETR and pump solenoids. The process shall be automatically executed, once initiated from the Display by the operator.

Operation Sequence is:

1. Engine running at any idle speed, separator and feeder switches **OFF**.
2. Feeder at 0 RPM
3. Using the Display, select the :MAIN>CAL>CVT FEEDER
4. Press the START when prompted
5. Engaged feeder switch when prompted
6. Feeder pump (+), pump (-) and ETR clutch solenoids will be calibrated automatically (the feeder will be in motion during this process).
7. Display will prompt the operator when the process is completed, normally 2-3 minutes.

Feeder Drive Power Flow

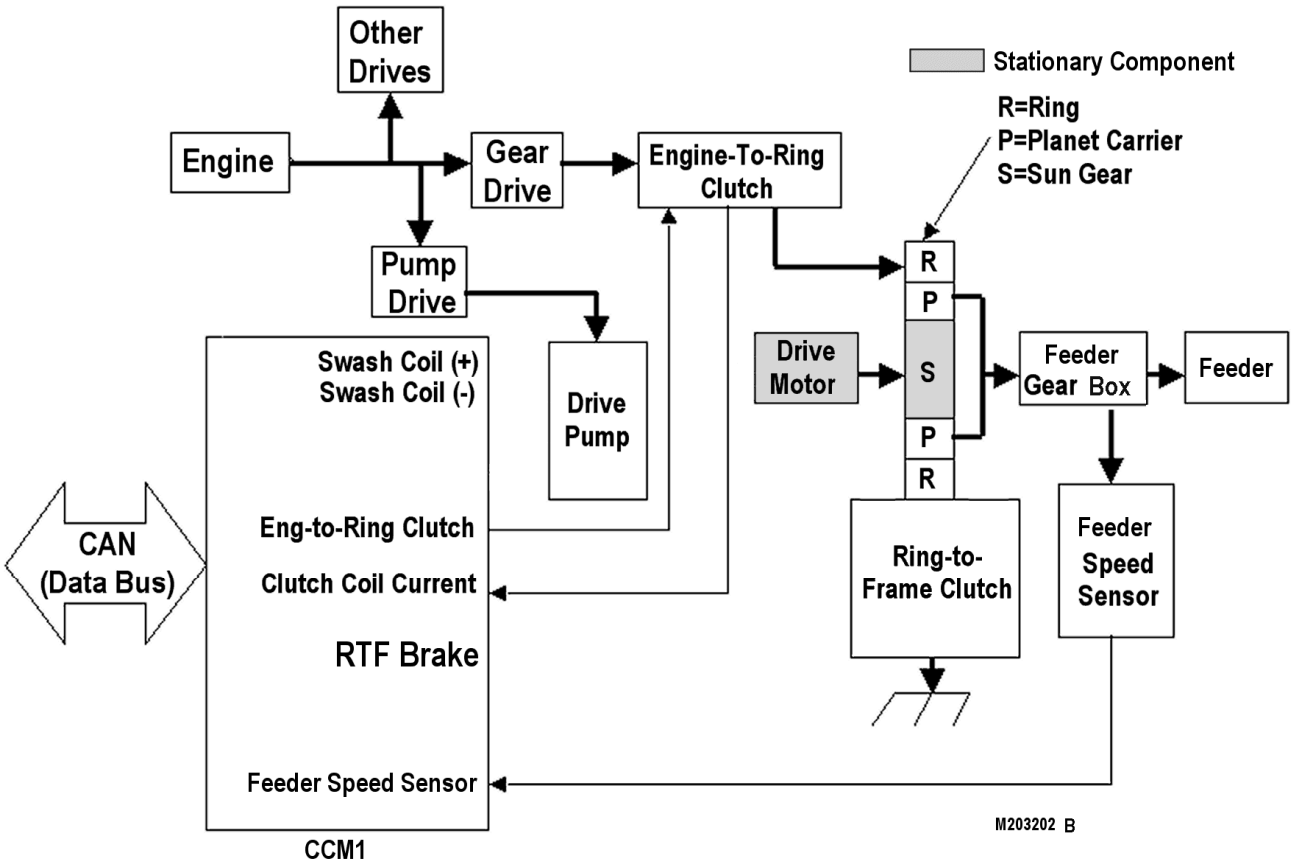
Power flow to the feeder may take one of two paths, or a combination of both.

- ✓ **Mechanical Power Flow, this would be normal operation**: Starting and running the feeder drive.

Hydro Power Flow

Combined Power Flow

Power from the engine is directed through the PTO gearbox to drive the engine clutch, ring, planetary carrier, feeder gear box and feeder.



FEEDER DRIVE POWER FLOW

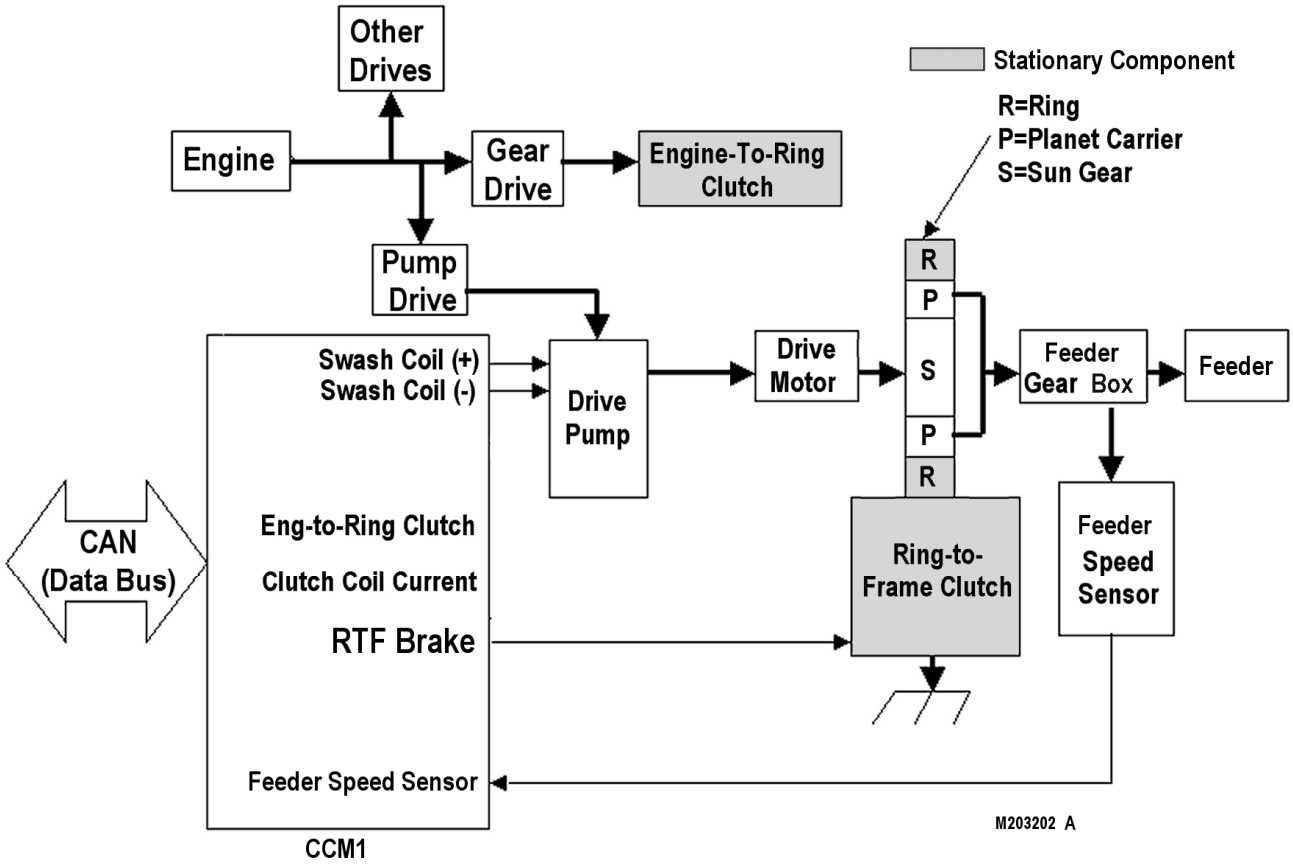
Power flow to the feeder may take one of two paths, or a combination of both.

Mechanical Power Flow

- ✓ **Hydro Power Flow, this would be for reversing the feeder chain**: Anti-Creep or Reversing the drive speed

Combined Power Flow

Power from the engine is directed through the PTO gear box to drive the feeder hydro pump, drive motor, sun gear, planetary carrier, feeder gear box and feeder.

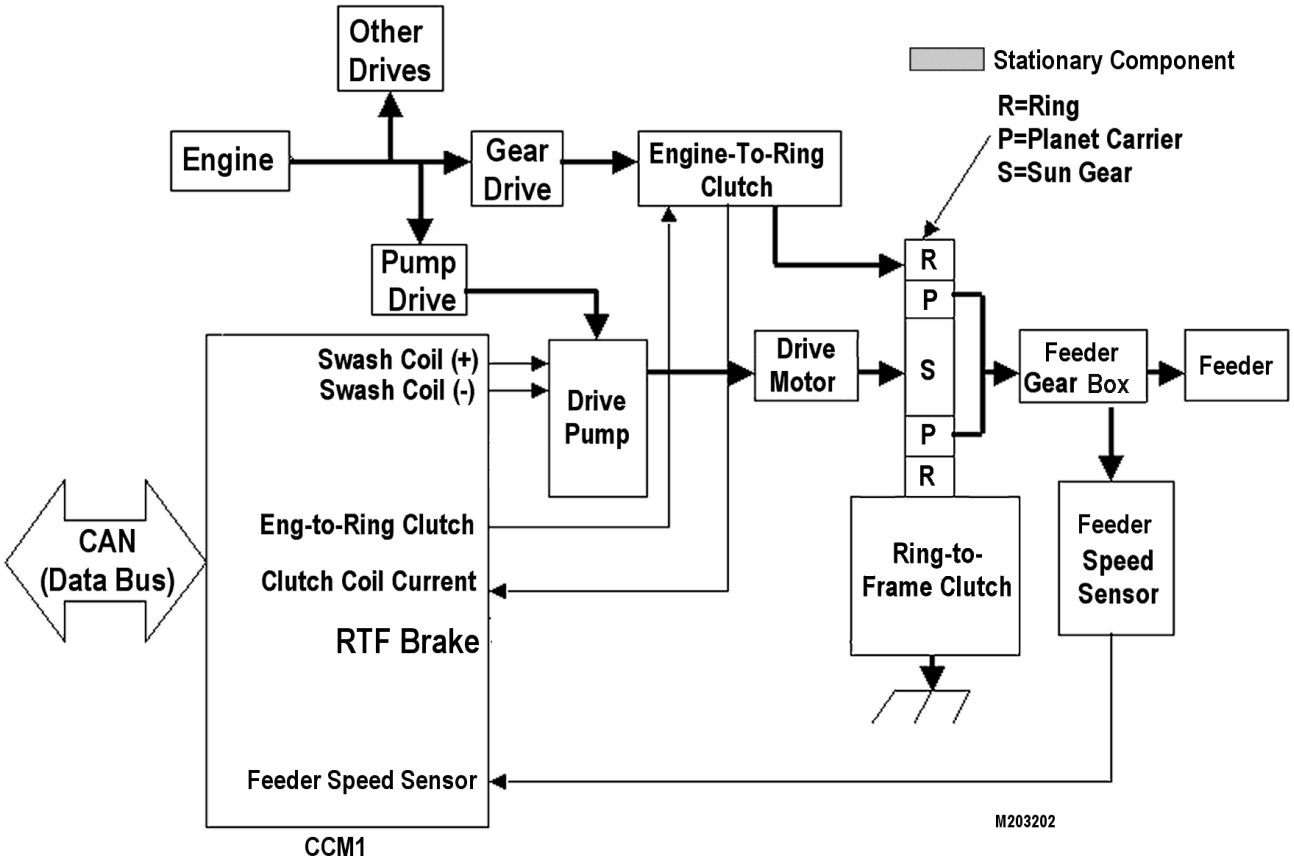


FEEDER DRIVE POWER FLOW

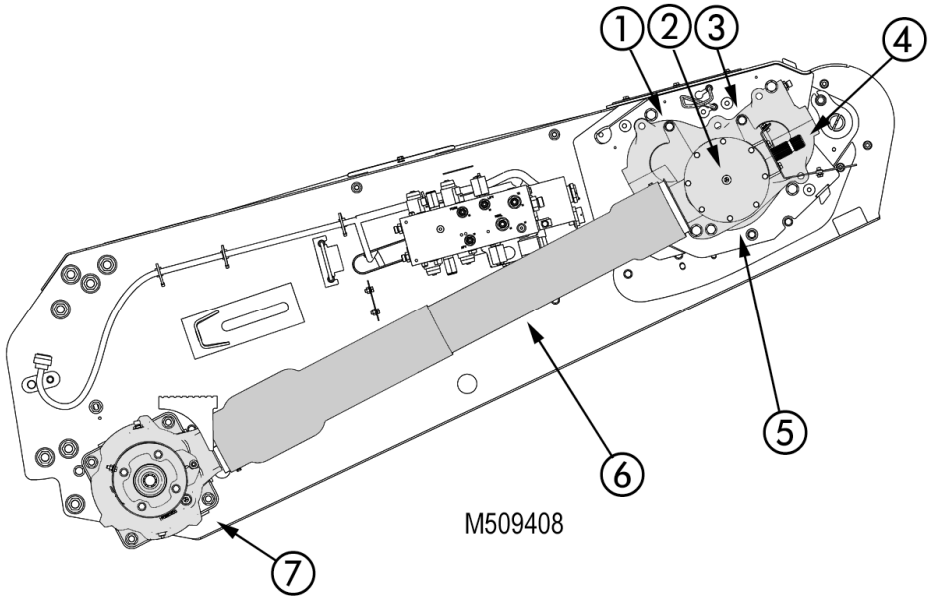
Power flow to the feeder may take one of two paths, or a combination of both.

Mechanical Power Flow
Hydro Power Flow
- ✓ **Combined Power Flow, this would be used to INCREASE/DECREASE the feeder speed under normal operation**: Modifying the drive speed.

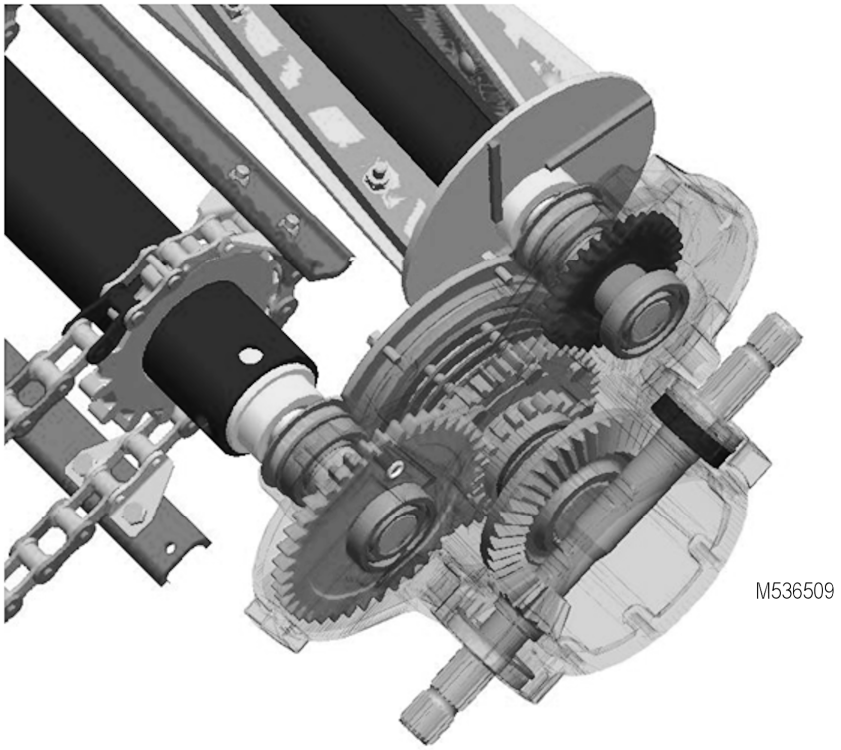
Power from the engine is directed through the PTO gearbox to drive the engine clutch, ring, planetary carrier, feeder gearbox and feeder. The hydro pump and motor will control the speed of the sun gear to change the speed at which the planetary carrier is walking around it. This provides for an Over-Speed or Under-Speed condition.



FEEDER GEARBOX



1.	RPM Sensor Location W/ Rock Trap	5.	Feeder Drive Gearbox
2.	Oil Level	6.	Header Drive Shaft
3.	RPM Sensor Location W/O Rock Trap	7.	Header Drive Gearbox
4.	Feeder & Header Input		



FEEDER GEARBOX

FEEDER DRIVE GEARBOX

The feeder drive gearbox drives the upper feeder shaft to power the feeder chains. If the unit is equipped with a rock trap the gearbox will have a second output shaft to operate the rock trap. The gearbox is equipped with the feeder slip clutch and speed sensor that will be used to control the speed of the feeder house, shaft speed monitor and provide a digital display on the Display.

The gearbox on the 20's combines provides a different operating speed for the rock trap beater then does the 10's combines. The gearboxes are NOT interchangeable because of the different feeder chain drive sprocket sizes.

		Clutch Gear set	Feeder Chain	Rock Trap	Rock Trap Speed	Gear Box Number
7010-9010	All	31T & 43T	44T	31T	700	
7120-9120	Y9G205101	21T & 49T	40T	25T	1000	87696851
7120-9120	Y9G205959	21T & 43T	40T	31T	700	84177487

Use gear set kit 84177488 to convert the earlier rock trap drive speed from 1000 RPM to 700 RPM.

The slip clutch should hold approximately 375 lbs ft torque when applied to the gearbox input shaft. There is a special spacer ring required to properly set the clutch when repairing or replacing. The clutch can be check by:

1. Blocking the feeder chain from moving
2. Removing the drive shaft (6) from the feeder gear box to the header drive gear box.
3. Placing an allen wrench into one of the gearbox input shaft splines
4. Placing a 1 5/16" 12 point socket over the shaft and allen wrench
5. Using a torque wrench of the proper capacity

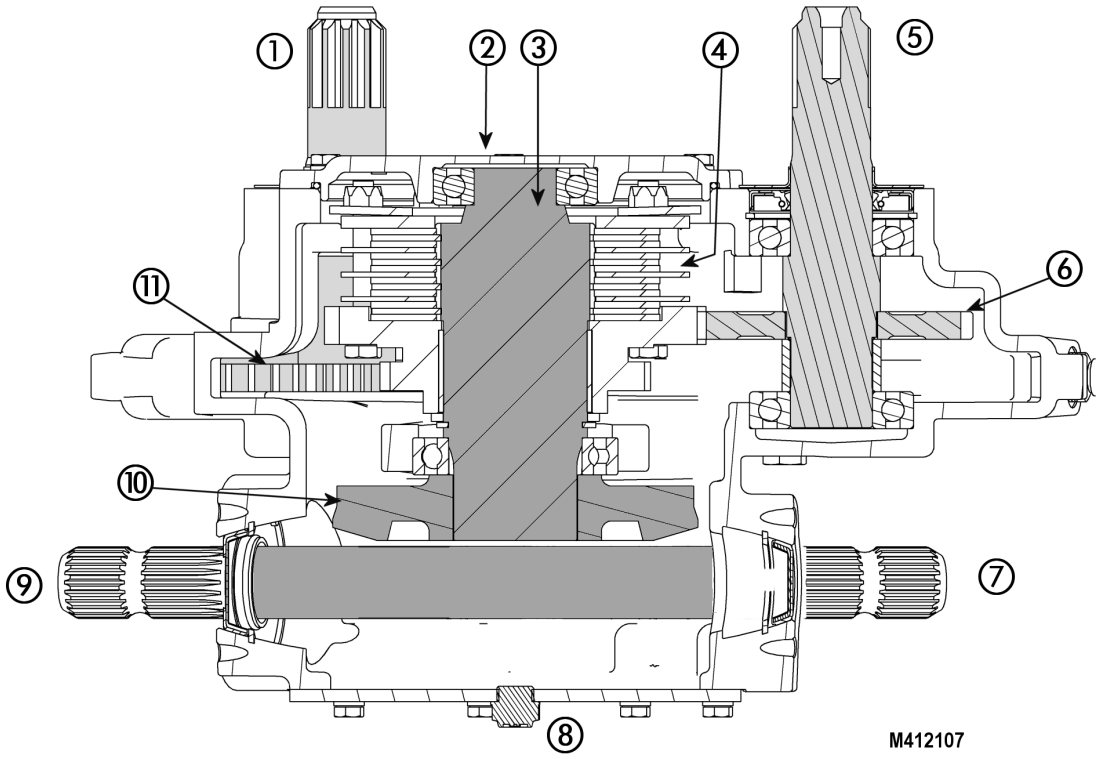
The unit is filled with 2.8 L of Hy-Tran Ultra and uses a sight gauge for oil level inspections. When checking the oil level the feeder should be lowered to the ground.



IMPORTANT: The feeder drive may be equipped with a radial pin slip clutch or starting with HAJ202000 a multi-disc slip clutch. When the disc slip clutch is install in earlier machines, the proper CCM software must be used to limit the slippage time before the "Automatic Feeder Cut Off" shuts **OFF** the feeder drive.

FEEDER GEARBOX

FEEDER DRIVE GEARBOX WITH STONE TRAP



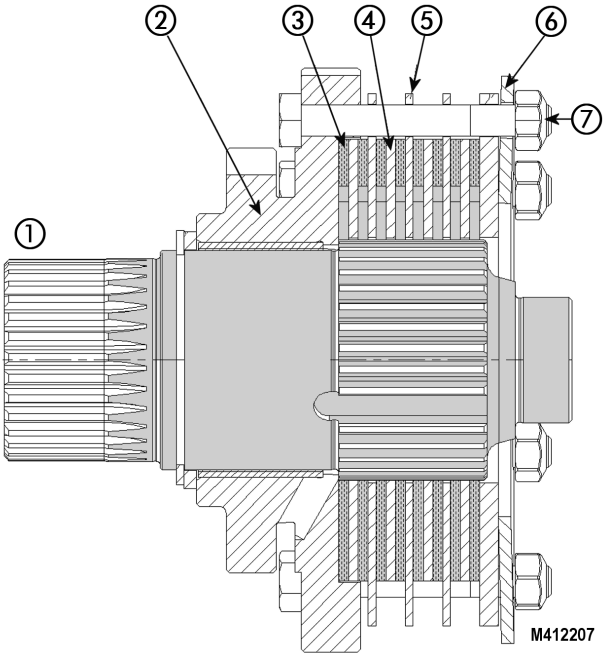
1.	Out Put Shaft to Feeder	7.	Input Shaft, Counter Clockwise
2.	End Cover	8.	Oil Level Sight Glass
3.	Drive Hub	9.	Out Put Shaft To Lower Gearbox
4.	Disc Clutch	10.	Bevel Gear Set
5.	Out Put Shaft to Stone Trap	11.	Feeder Driven Gear
6.	Stone Trap Driven Gear		

The unit is filled with 2.8 L of Hy-Tran Ultra and uses a sight gauge for oil level inspections. When checking the oil level the feeder should be lowered to the ground.

The oil change interval for this clutch is 600 hours, at which time the RPM sensor should also be cleaned as well as the magnetic drain plug.

FEEDER GEARBOX

FEEDER DRIVE GEARBOX



1.	Clutch Drive Hub
2.	Output Gear
3.	Drive Clutch Plates
4.	Internal Driven Clutch Plates
5.	External Driven Clutch Plates
6.	Clutch Belleville Spring
7.	Clutch Tie Bolts & Adjusters.

The torque setting on a new clutch may vary from specifications until it has been burnished in. The clutch should be set close to the specification, then burnished and a final torque setting checked.

A new disc clutch requires a break-in procedure. Slip 15-20 times manually (slow speed).

1. Block the feeder chain from moving
2. Run the engine at low idle. Engage the feeder REVERSER for approximately 2 seconds. This should be completed 15-20 times.
3. Do not let the oil in the gearbox become overheated.
4. The slip clutch should hold approximately 439-504 N-m (324-372 ft-lb) when applied to the gearbox input shaft. This setting should provide a feeder shaft torque of approximately 1350-1550 N-m.

The clutch can be checked by:

1. Blocking the feeder chain from moving
2. Removing the drive shaft (2) from the feeder gear box to the header drive gear box.
3. Placing an allen wrench into one of the gearbox input shaft splines
4. Placing a 1 5/16” 12 point socket over the shaft and allen wrench
5. Using a torque wrench of the proper capacity

FEEDER GEARBOX

FEEDER DRIVE GEARBOX

The AFC operation was changed at CCM1 software 32.6.2. to eliminate the disabling of the AFC and the shaft speed detection requirements. MY06 and earlier would require the latest 31.* software installed.

AUTO FEEDER CUTOFF "AFC"

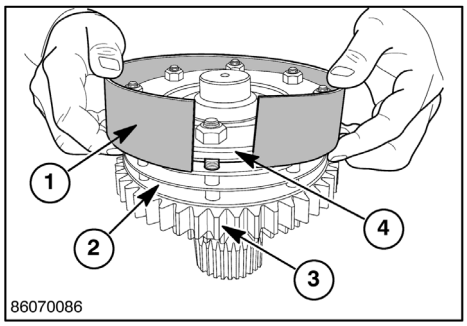
The feeder drive will be disabled any time the feeder output shaft speed drops below:

	3 Seconds	0.5 Second
Forward	80% Calculated Speed	50% Calculated Speed
Reverse	36 RPM	22 RPM

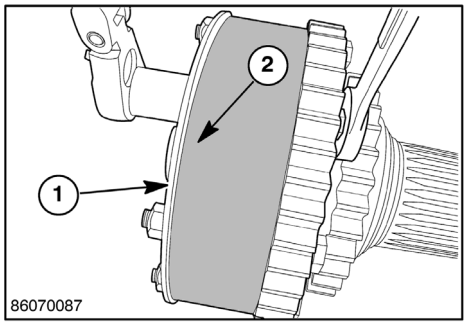
Feeder slip detection is not activated during the first 3 seconds in FORWARD or 2 seconds in REVERSE during engagement, (once power has been directed to the solenoid). This gives the system time to start up properly.

CLUTCH SETTING

When setting the clutch adjusting bolts a special spacer tool is installed around the plates. The bolts are then tighten down to the spacer height and backed OFF 90 deg. Remember to remove the spacer as it is a special tool.

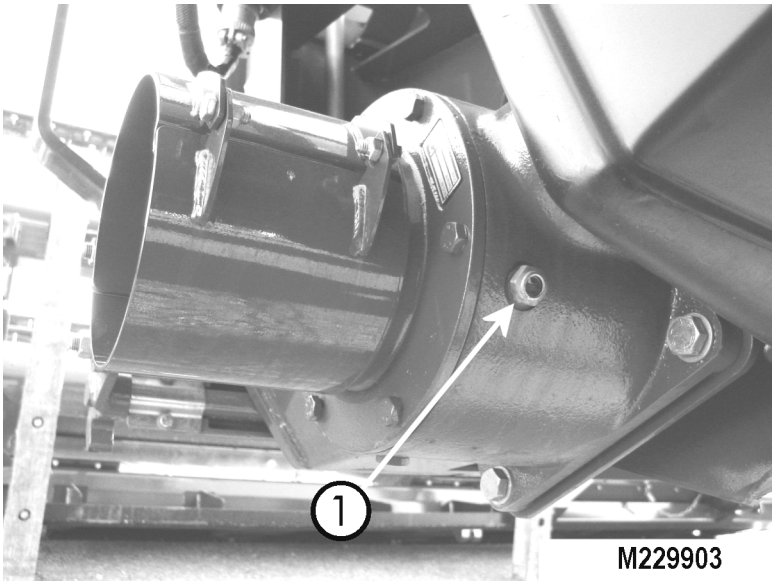


After installing the clutch be sure to burnish it in before checking the slip torque.



HEADER DRIVE GEARBOX

The header drive gearbox is used to power the lower shaft to provide driving power to the headers.

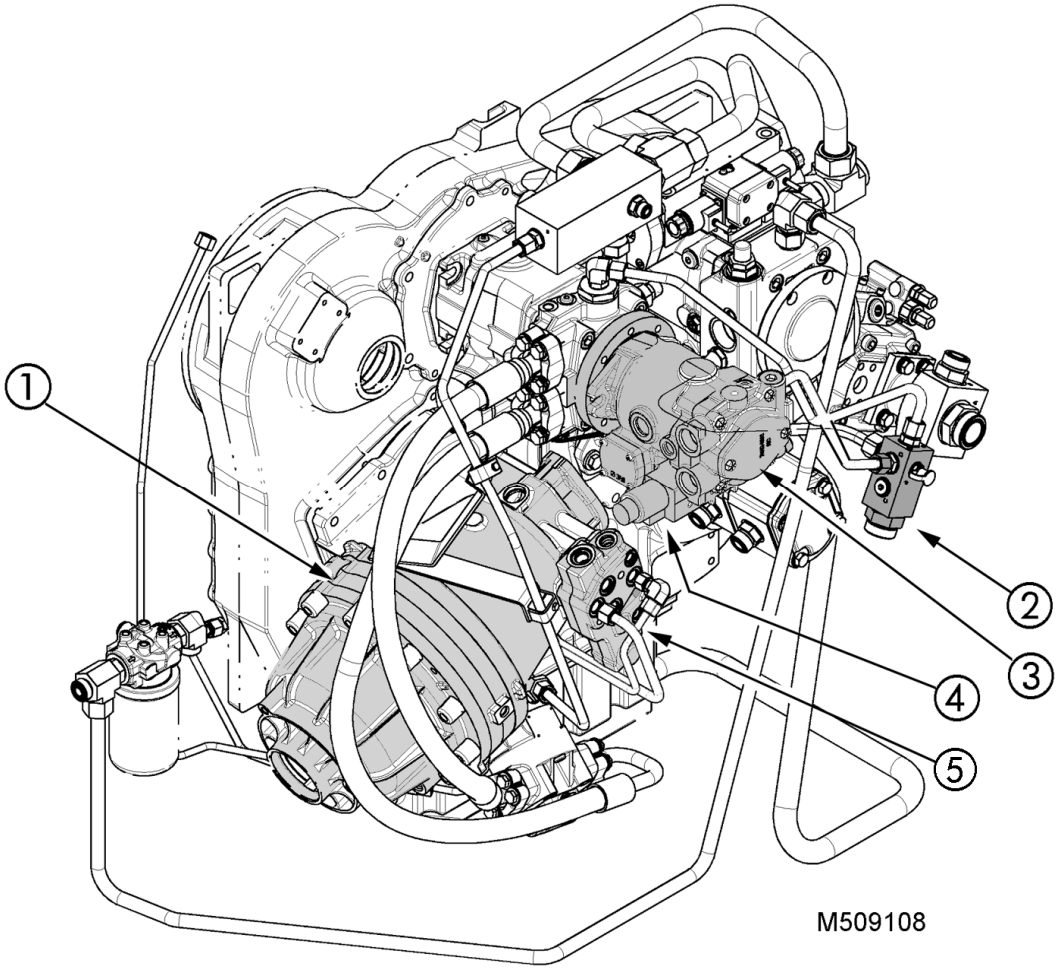


Oil Level Check Plug

When operating in a very high horse power crops it may be advisable to refill the gearbox with Synthetic Hytran Ultra oil instead of the regular Hytran Ultra oil.

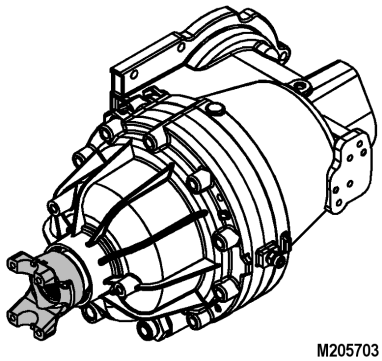
FEEDER DRIVE MECHANICAL

PTO GEARBOX

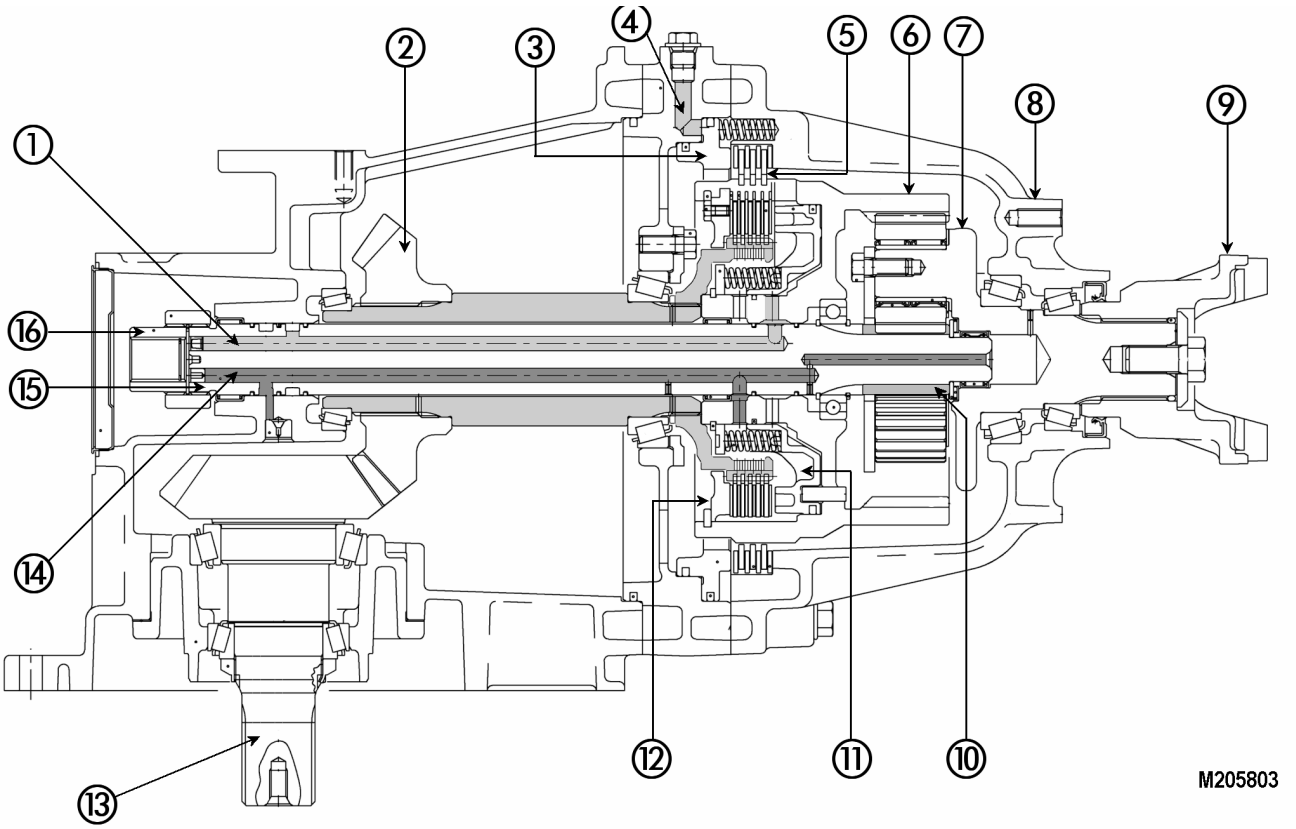


1.	Power Plus Feeder Drive	4.	Feeder Drive Motor
2.	Charge Pressure Distribution Manifold	5.	Feeder Control Valve
3.	Feeder Drive Pump		

FEEDER DRIVE MECHANICAL



M205703



M205803

1.	ETR Clutch Lock-Up Port	9.	Out-Put Shaft
2.	Engine Input Gear	10.	Sun Gear
3.	RTF Clutch Piston	11.	ETR Clutch Piston
4.	RTF Clutch Lock-Up Port	12.	ETR Clutch Plates
5.	RTF Clutch Plates	13.	PTO Gearbox Input Gear
6.	Ring	14.	Lubrication Oil
7.	Planetary Carrier	15.	Feeder Motor Input
8.	Frame	16.	Feeder Motor Coupler

FEEDER DRIVE MECHANICAL

MECHANICAL COMPONENTS

ETR Clutch Lock-Up Port, (1)

The ETR clutch lockup port is used to direct the lockup fluid to the piston, locking up the clutch plates. This clutch is used anytime the feeder in running in the FEEDING direction.

Located: In the Power Plus drive.

Engine Input Gear, (2)

The input gear transfers the engine power from the PTO gearbox through a bevel set of gears to the Power Plus outer shaft.

Located: In the Power Plus drive.

RTF Clutch Piston and Clutch Plates, (3 & 5)

The RTF clutch is used to lock the ring (7) stationary so the feeder drive motor can operate the feeder drive in reverse.

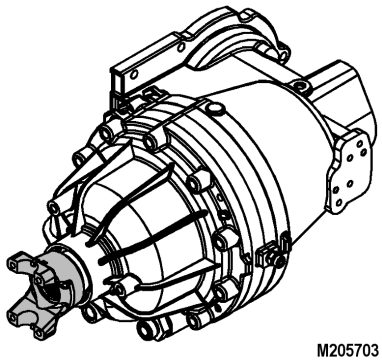
Located: In the Power Plus drive.

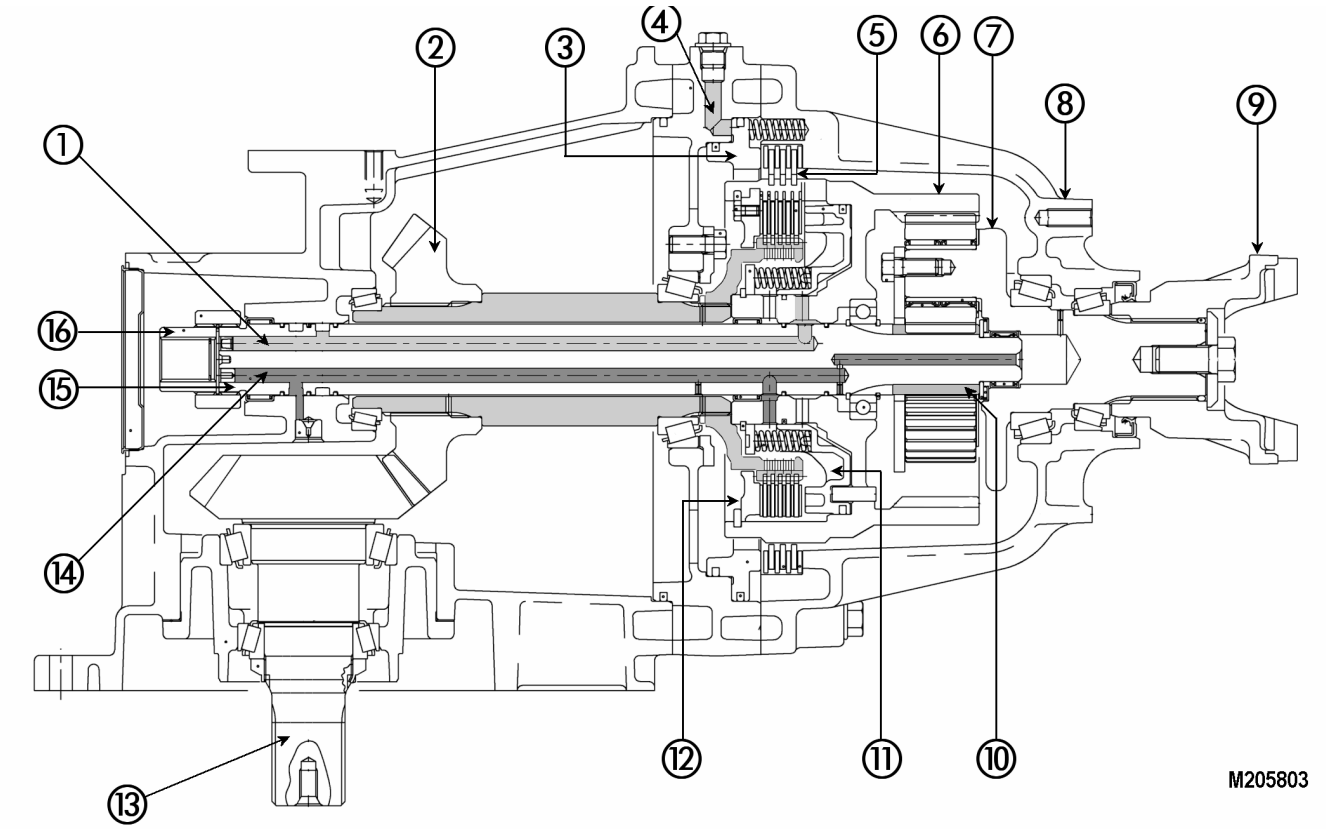
RTF Clutch Lock-Up, (4)

The RTF clutch port directs lock-up pressure to the RTF piston, locking up the RTF clutch plates. This clutch is only used during the REVERSE operating mode.

Located: In the Power Plus drive.

FEEDER DRIVE MECHANICAL





1.	ETR Clutch Lock-Up Port	9.	Out-Put Shaft
2.	Engine Input Gear	10.	Sun Gear
3.	RTF Clutch Piston	11.	ETR Clutch Piston
4.	RTF Clutch Lock-Up Port	12.	ETR Clutch Plates
5.	RTF Clutch Plates	13.	PTO Gearbox Input Gear
6.	Ring	14.	Lubrication Oil
7.	Planetary Carrier	15.	Feeder Motor Input
8.	Frame	16.	Feeder Motor Coupler

FEEDER DRIVE MECHANICAL

MECHANICAL COMPONENTS, CON'T

Ring, (6)

The planetary ring is used to transmit the engine power to the planetary unit when the ETR clutch is engaged or to provide the planetary a stationary outer gear for the planetary to walk around when the RTF clutch is engaged.

Located: In the Power Plus drive.

Planetary Carrier, (7)

The planetary provides a gear ratio change between the input and output shafts. This will enable operation in one of three modes:

- When the planetary is being driven by the ring (7) from the ETR clutch (11 & 12) and the sun gear (14) is being held stationary by the feeder drive motor (1). Output shaft (10) will be rotated at a fixed RPM in ratio to engine RPM.
- When the planetary is being driven by the sun gear (14) from the feeder drive motor and the ring is being held stationary by the RTF clutch. The output shaft (10) will be rotated at variable speed, (forward or reverse) determined by the feeder drive motor RPM and direction of rotation.
- When there is a combination of both of the above operations. The ETR clutch is engaged providing the ring gear a fixed drive and RPM, but the feeder motor operates the sun gear at variable RPM's and direction. The variability of the sun gear provide a variable rotation of the planetary carrier.

Located: In the Power Plus drive.

Frame, (8)

The frame is the outer housing that encloses the Power Plus drive unit.

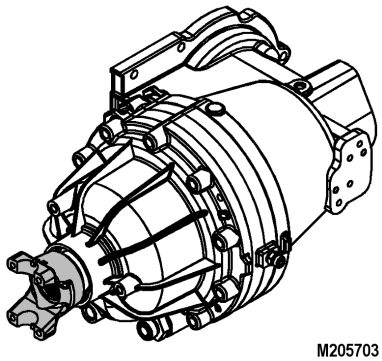
Located: In the Power Plus drive.

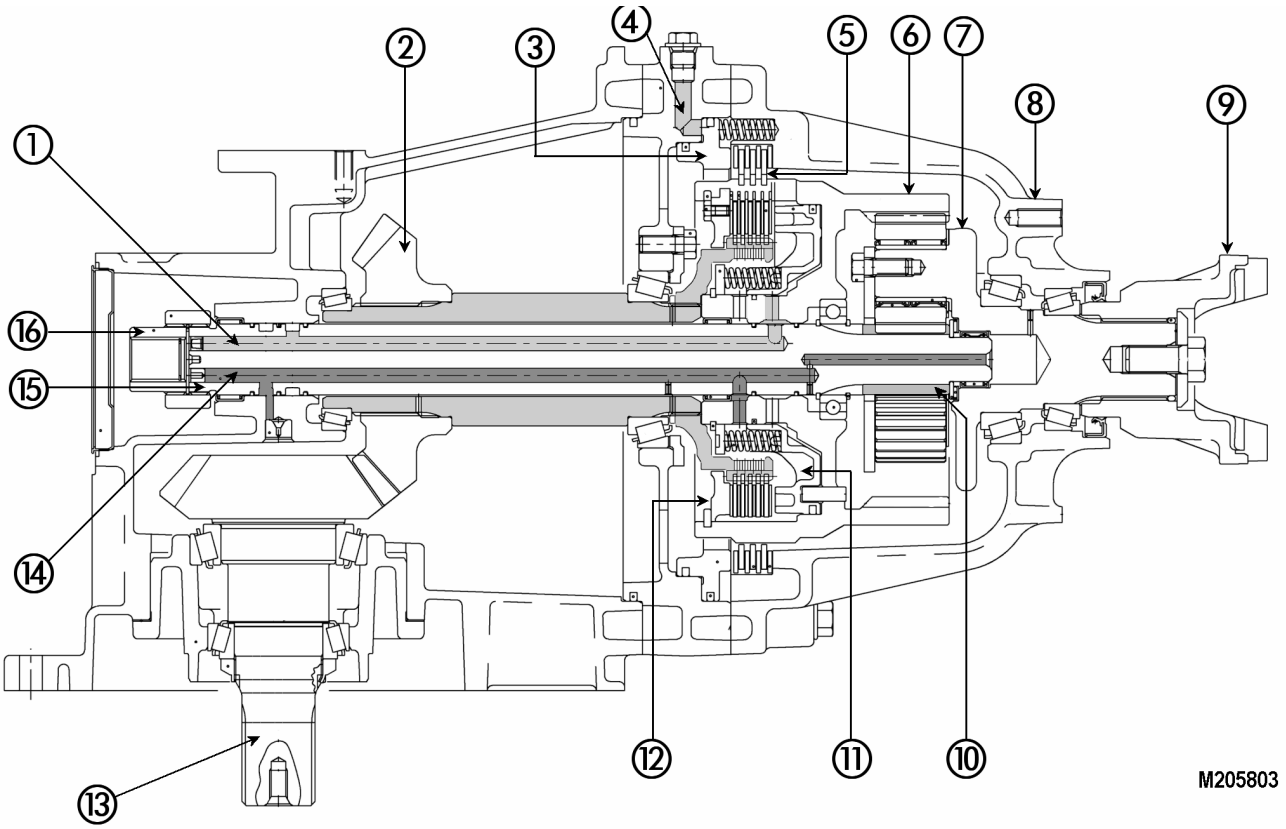
Output Shaft, (9)

The output shaft transmits the driving force to the feeder gear case.

Located: Front of the Power Plus drive unit.

FEEDER DRIVE MECHANICAL





1.	ETR Clutch Lock-Up Port	9.	Out-Put Shaft
2.	Engine Input Gear	10.	Sun Gear
3.	RTF Clutch Piston	11.	ETR Clutch Piston
4.	RTF Clutch Lock-Up Port	12.	ETR Clutch Plates
5.	RTF Clutch Plates	13.	PTO Gearbox Input Gear
6.	Ring	14.	Lubrication Oil
7.	Planetary Carrier	15.	Feeder Motor Input
8.	Frame	16.	Feeder Motor Coupler

FEEDER DRIVE MECHANICAL

MECHANICAL COMPONENTS, CON'T

Sun Gear, (10)

The sun gear transfers the feeder drive motor to the planetary. The gear will either be stationary, turning clockwise or turning counter clockwise.

Located: In the Power Plus drive.

ETR Clutch Plates and Piston, (11 & 12)

The ETR clutch is used to connect the engine input drive (3), to the ring gear (7) powering the ring gear. This operation drives the output shaft at one constant speed that is proportional to engine speed.

Located: In the Power Plus drive.

PTO Gearbox Input Shaft, (13)

The input shaft is splined into the drive gear inside the PTO gearbox to direct engine power to the Power Plus drive.

Located: In the Power Plus drive.

Lubrication Oil Port, (14)

The lubrication supply port directs lubrication oil to the center of the feeder motor input shaft to supply lubrication to the complete Power Plus drive unit.

Located: In the Power Plus drive.

Feeder Motor Input, (15)

The input shaft from the feeder drive motor connects to the shaft by way of a coupler. The motor provides forward (increase speed), reverse (decrease speed) or holding for the planetary sun gear.

Located: center shaft of the Power Plus drive unit.

Feeder Drive Motor Coupler, (16)

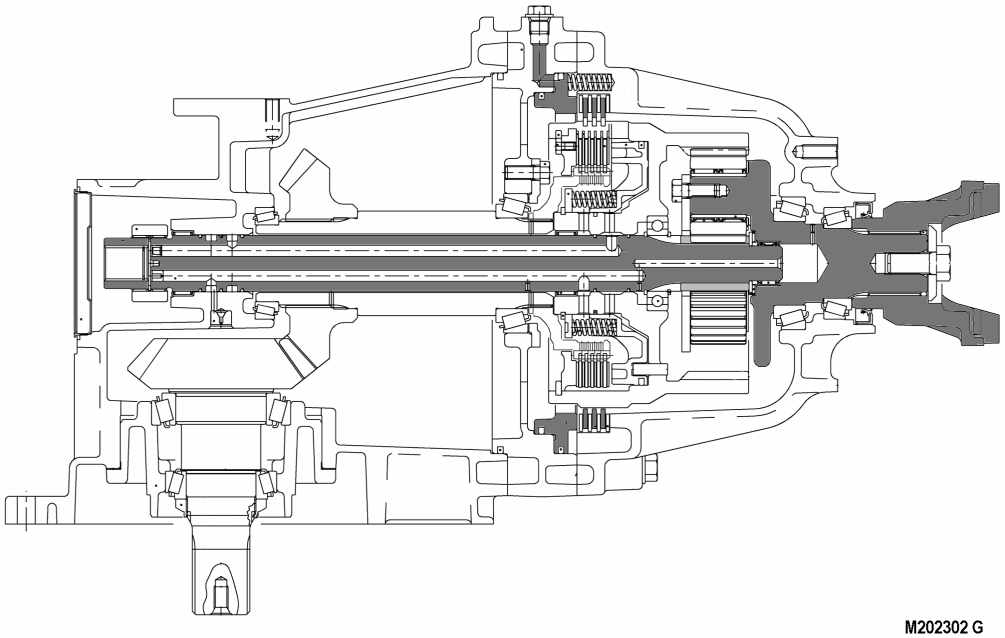
The motor coupler is used to connect the feeder drive motor to the motor input shaft.

Located: In the Power Plus drive.

MECHANICAL POWER FLOW

Feeder drive motor power flow

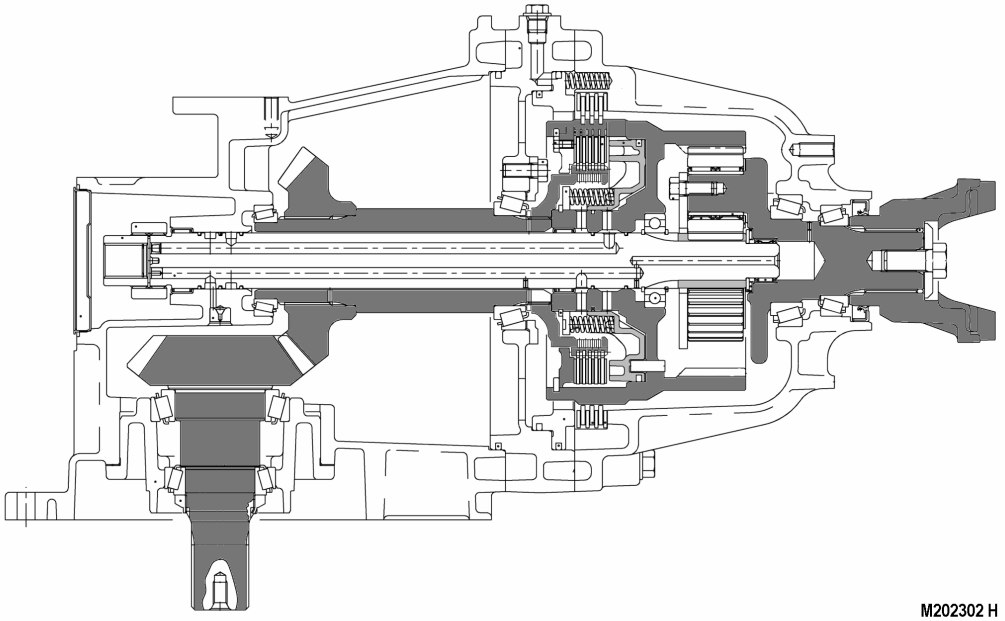
(Stationary Ring)



M202302 G

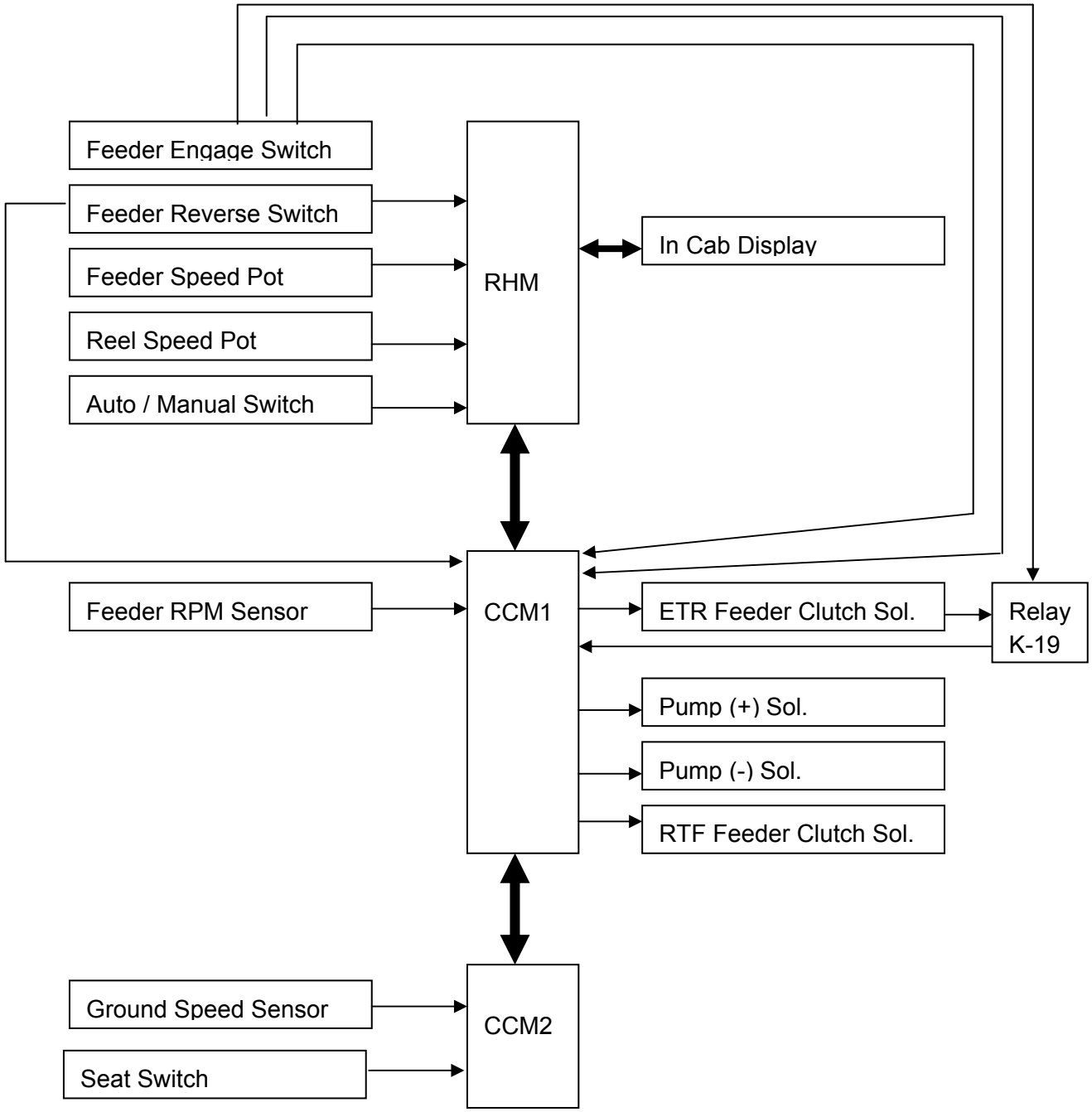
Engine power flow

(Stationary Sun Gear)



M202302 H

FEEDER DRIVE ELECTRICAL



FEEDER DRIVE ELECTRICAL

The entire feeder drive system consists of a PTO and feeder gear boxes, Power Plus drive, hydraulic pump, hydraulic motor, feeder engagement switch, AUTO/MANUAL switch, feeder speed/ratio potentiometer, speed sensor, and electronic controls.
The feeder electrical circuit include:

1) Ground speed signal
2) Feeder Speed Control
3) Auto/Manual Switch
4) Feeder RPM signal
5) Drive pump (+)/(-) coils (PWM) with feedback current
6) Engine to Ring (ETR) clutch coil (PWM) with feedback current
7) Engine to Ring feed back (ground) relay
8) Ring to Frame (RTF) clutch coil (ON/OFF)
9) Electronic controllers, CCM1, RHM, CCM2, Display
10) Operator controls
11) Seat switch
12) Resistor module
13) Diode module

Items that may influence the systems operation:

Engine RPM – must be above 1000 RPM
Rear Ladder – must be raised
Road Mode – indication lamp must NOT be lit
Header Type Sensor – feeder speed will be influenced by the header type
Ground Speed – Auto feeder to ground speed
Min/Max – Auto feeder to ground speed
Rotor RPM – rotor speed must be seen before the feeder will operate

FEEDER DRIVE ELECTRICAL

ELECTRICAL COMPONENTS

Feeder Switch, S-31

The feeder switch is used to send a signal to the RHM and CCM1 requesting the engagement of the feeder reverse operation. A second signal is also sent directly to the CCM1 controller and feeder engine to ring feedback relay to request normal operation.

Located: Right hand console

Header Speed Control, R-18

The feeder speed control provides the operator with a method of changing and controlling the desired feeder speed. The control is also used to set the feeder to ground speed ratio during AUTO feeder speed operation.

Located: Right hand console

CCM1 Controller

The CCM1 controller controls the feeder operation by receiving CAN bus signals from the RHM, display and sensors, and controlling solenoids.

Located: Under the instructor's seat

Seat Switch, S-05

The operator's seat switch is used to send a signal to the CCM2 controller when an operator is present. The CCM2 provides signal to the data bus.

Located: In the operator's seat

FEEDER DRIVE ELECTRICAL

ELECTRICAL COMPONENTS, CON'T

Feeder Pump Solenoid, L-48 and L-49

The pump solenoid incorporates two coils, one to provide a FORWARD rotation flow and one to provide REVESRE rotation flow to the feeder drive motor. The solenoids control the position of the pump swash plate in order to provide variable pump displacement and rotation direction. The pump swash plate is defaulted to the Neutral position when both solenoids are de-activated.

Located: Feeder pump mounted on the PTO gear box

Feeder RPM Sensor, B-14

The feeder RPM sensor is used by the CCM1 to calculate the feeder's accrual speed.

Located: Mounted on the upper feeder drive gearbox

RTF Solenoid, L-50

The ring-to-frame clutch is used when reversing the feeder.

Located: Mounted in the feeder control valve.

ETR Solenoid, L-47

The engine to ring clutch is used to connect the engine input to the Power Plus output shaft, permitting the feeder to be driven by the engine. This permits only one preset output speed from the Power Plus drive.

Located: Mounted in the feeder control valve.

Ground Speed Sensor, B-17

The ground speed sensor provides a speed signal that is used by the feeder drive when operating in the "AUTO" feeder to ground speed mode.

Located: Mounted in the ground drive transmission.

Auto/Manual Switch, S-69

The AUTO/MANUAL switch lets the operator select the desired mode operation.

Located: Mounted in the RHM.

FEEDER DRIVE ELECTRICAL

ELECTRICAL COMPONENTS, CON'T

Engine to Ring Solenoid Ground Relay, K-19

The ETR ground relay provides for a positive disconnect for the ETR solenoid ground.

Located: Mounted in the relay and fuse panel.

Resistor Module, R-20

The resistor module limits the operating voltage range for the feeder speed control potentiometer input to the CCM.

Located: Mounted in the Right Hand console.

Diode Pack, D-01

The diode pack provides a signal to the CCM1 terminal J1-17 that the feeder switch is NOT in the NEUTRAL position.

Located: Mounted in the Right Hand console.

FEEDER DRIVE ELECTRICAL

Feeder speed is controlled in four different modes; Neutral (OFF), Reverser, Engage (ON) and Calibration. Upon the feeder circuit receiving a command speed via the CAN bus, the feeder will accelerate by:

NEUTRAL (OFF)

When the engine is started or the feeder disengaged the RTF clutch will be engaged to permit the feeder motor to work as a brake to prevent the feeder from turning; feeder must be below 50 RPM.

REVERSE

The CCM1 controller will also provide a means for the operator to access a feeder "reverser" state, allowing the operator to run the feeder in a REVERSE direction from the cab until the slug condition has been removed. The system will remain in the reverser state until the feeder switch is placed back into the **OFF** position. The feeder RTF clutch, motor and pump will be used to operate the feeder during the reverse operation.

ENGAGED (ON)

1. Engaging the ETR clutch pack, which directs engine power to the Power Plus drive. The clutch is engaged by means of a PWM solenoid for modulation. The feeder will be operating at a ratio to the engine speed only.
2. Adjustments to feeder speed may be made "on the go", either manually with the feeder speed potentiometer or automatically if the "AUTO" mode is selected.
3. Engaging the ETR clutch to connect the engine gear drive to the Power Plus drive, completing the feeder acceleration to a steady state speed via the engine, ETR clutch, planetary and feeder gear case path.
4. Turning off the feeder switch will disengage the ETR clutch and RTF clutch, allowing the feeder to gradually return to zero RPM.

The feeder may be re-engaged at any time after the separator switch has been turned **ON**, as long as the feeder speed is below 50 RPM and will return to its previous set speed.

CALIBRATION

A feeder calibration process will let the controller learn the minimum amount of current required to activate the RTF, ETR and pump solenoids. The process will be automatically executed, once initiated from the display by the operator.

Feeder status data will be regularly conveyed to the operator by the display as well as fault warnings.

FEEDER DRIVE ELECTRICAL

REFERENCE MATERIAL

Electrical Schematic Frame: #12, #15, #27

KEY SYSTEM COMPONENTS

Feeder Engagement Switch S-31, Feeder Diode D-01, Feeder Auto/Manual SwitchS-69, Feeder (Header) Speed Control R-18, Seat Switch S-05, Ground Speed Sensor , Feeder Speed Sensor B-14, Relay K-19

POWER SUPPLY FUSES

F-38, Is supplying B+ power to the KEY switch terminal 6 whenever the switch is placed in the RUN position to provide power to each controller, CCM1, 2 and 3.

F-45, Is supplied power from the Cab Relay “K24” to provide power to the “A” terminals of the three speed sensors: Rotor speed, Rotor Drive Motor speed and Feeder speed.

F-47, Is supplied power from the Cab Power relay “K26” to provide power to the controllers, CCM 3.

F-48, Is supplied power from the Cab Power relay “K26” to provide power to the RHM, Separator switch terminal 2 and 5, Neutral Start switch, Feeder switch terminal 5, Feeder speed increase/decrease potentiometer terminal A.

F-49, Is supplied power from the Cab Power relay “K26” to provide power to the operator’s seat switch terminal A for the operator presents circuit.

GROUNDS

Controller CCM1, 2 and 3 are chassis grounded through the mounting bolts and cab ground strap
Controller RHM is chassis grounded
Ring to Frame Clutch solenoid is chassis grounded

MODES OF OPERATIONS

OFF

When the feeder switch is placed into the OFF position there is NO voltage signal directed to the CCM1 terminal J1-17. Lack of power at terminal J1-17 is telling the controller that the feeder is not requested. The CCM1 will direct PWM voltage out J3-15 to engage the RTF clutch and disable the feeder pump solenoids L-48 & 49.

FEEDER DRIVE ELECTRICAL

ELECTRICAL OPERATION, CON'T

ENGAGED

When the feeder switch is placed into the ENGAGED position, (forward detented position) a signal voltage is directed out of the feeder switch terminal 6 to the CCM1 terminal J1-17, requesting the feeder to be started.

The CCM1 will

1. Checks for the proper engine speed that is being transmitted over the data bus from the engine controller. The engine speed must be between 1000-2100 RPM.
2. Checks to see that the rear ladder is in the home position (UP), transmitted over the data bus.
3. Checks to see that the operator seat switch is closed, transmitted over the data bus.
4. Checks for rotor RPM, transmitted over the data bus.
5. Release the RTF clutch, by stopping the power output at terminal J3-15.
6. Use the power that is being received from the feeder switch at terminal J1-7 and directs it out terminal J2-30 to the ETR solenoid. This causes the ETR clutch to lock-up to permit engine drive for the feeder. The solenoid uses PWM for smooth engagement.
7. The feeder switch will direct power from terminal 3 to the ETR feedback relay K-19 terminal 1, activating the relay to provide a circuit from the ETR to the CCM1 terminal J2-40 for a ground.
8. Checks the actual speed of the feeder by monitoring the feeder speed sensor terminal B at CCM1 terminal J3-14.

The RHM will

1. Check to verify the position of the AUTO/MANUAL switch S-69 to determine the mode of operation desired. The front switch panel on the RHC is supplied 12V from F-48. When the switch is momentarily pressed a voltage signal is directs from connector X386 terminal 18 to the RHM connector X029 terminal 2. Each time this voltage is toggled the RHM will place a signal on the data buss to change modes. The RHM will direct a voltage signal out of connector X027 terminal 17 to illuminate the AUTO/MANUAL switches indicator LED. The mode of operation is transmitted on the data bus.
2. Directs a 5VDC power supply out connector X026 terminal 16 to the F terminal of the resistor module. The module provides a constant power supply to the header speed control, R-18, terminal A and the reel speed control.

FEEDER DRIVE ELECTRICAL

ELECTRICAL OPERATION, CON'T

3. Check the return voltage signal from the feeder control terminal B at the RHM connector X027 terminal 3. A desired speed signal is transmitted to the data bus.

The Display will

1. Will provide the required information for the feeder minimum and maximum feeder speed presets by way of the data bus.

If the speed is not the desired speed:

1. To increase the RPM. The CCM1 using the power that it receives at terminal J1-17, direct PWM power out terminal J3-31 to the feeder pump (+) solenoid terminal A. The solenoid will cause the pump's swash plate to tilt, causing the pump to increase flow, driving the feeder motor in a forward direction, increasing feeder speed. The solenoid is chassis grounded.

   To decrease the RPM. The CCM1 using the power that it receives at terminal J1-17, direct PWM power out terminal J3-21 to the feeder pump (-) solenoid terminal C. The solenoid will cause the pump's swash plate to tilt, causing the pump to increase flow, driving the feeder motor in a reverse direction, reduce the feeder speed.
2. The power being directed to the Feeder Pump (+)/(-) solenoids will be increased/decrease as required to bring the feeder to the desired speed.

FEEDER RE-ENGAGED

When re-engaging the feeder once it has been dis-engaged BUT has not come to a stop yet, the feeder will not be permitted to re-engaged until the feeder speed is below 50 RPM.

FEEDER DRIVE ELECTRICAL

ELECTRICAL OPERATION, CON'T

REVERSER

When the feeder switch is held in the REVERSE position (rearward momentary position) a signal voltage is directed out of the feeder switch terminal 1 to the RHM controller connector X029 terminal 5 and the diode module terminal C. The diode module directs power to the CCM1 terminal J1-17 to provide power for the CCM1 to use to power the pump's (-) solenoid. The RHM control will transmitted a message on the data bus for the CCM1 controller to operate the feeder drive in the reverser mode.

The CCM1 will

- Direct power, that is received at J3-11, out connector terminal J3-15 to the RTF solenoid, engaging the RTF clutch.
- Directs a PWM power, that is received at J3-17, out terminal J3-21 to the feeder pump (-) solenoid. The solenoid will cause the pump's swash plate to tilt, causing the pump to create flow.

CALIBRATION MODE

To enter the calibration mode the operator will make a selection from the MAIN>CALIBRATION screen on the display. The display will instruct the operator with the proper steps to follow. The display will place signals on the data bus for the CCM1 controller to operate the feeder drive while monitoring the feeder speed.

The CCM1 will

- Directs power out terminal J3-15 to engage the RTF clutch. Directs a modulated power supply out terminals J3-21 and J3-31 to learn the current flow required to create feeder rotation. After several cycles the readings are averaged and placed into the memory.
- Directs modulated power supply out terminal J2-30 to the ETR solenoid to learn the current flow required to create feeder rotation. After several cycles, the readings are averaged and placed into the memory.

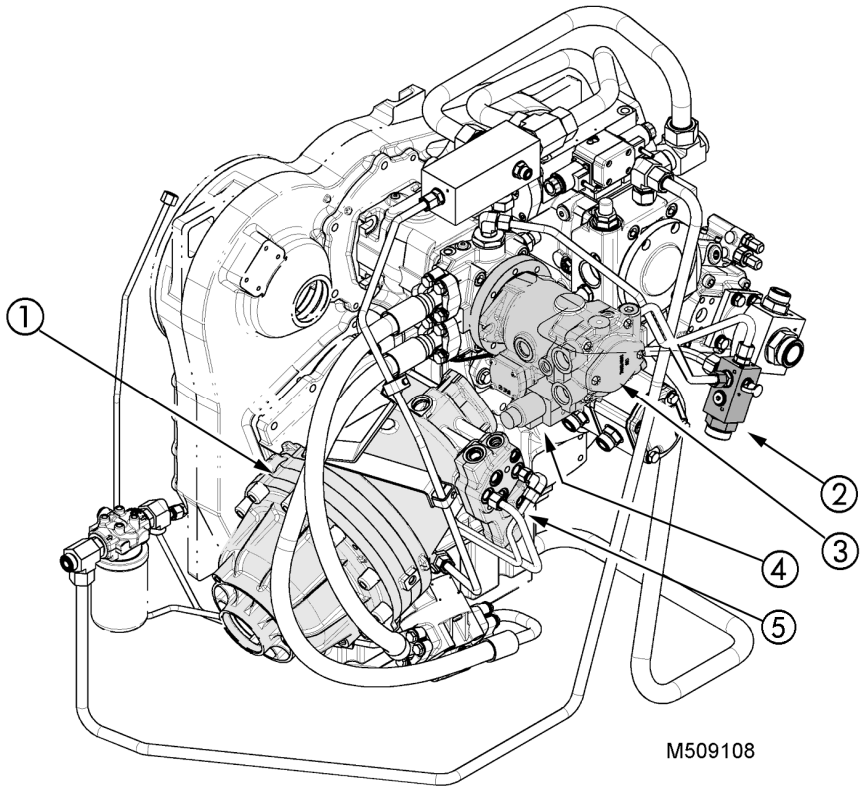
POWER PLUS HYDRAULIC CIRCUITS

The feeder drive system consists of a PTO, feeder upper and feeder lower gear boxes, Power Plus drive, hydraulic pump, hydraulic motor, feeder engagement switch, AUTO/MANUAL switch, feeder speed/ratio potentiometer, speed sensor, and electronic controls.
The feeder hydraulic circuit includes:

1. Feeder Control Valve Assembly
2. Feeder Drive Pump and Motor
3. Ring to Frame Clutch, (RTF)
4. Engine to Ring Clutch, (ETR)

The feeder control valve is used to control the RTF clutch and ETR clutches that are used to control the power input source that will be used to drive the feeder.

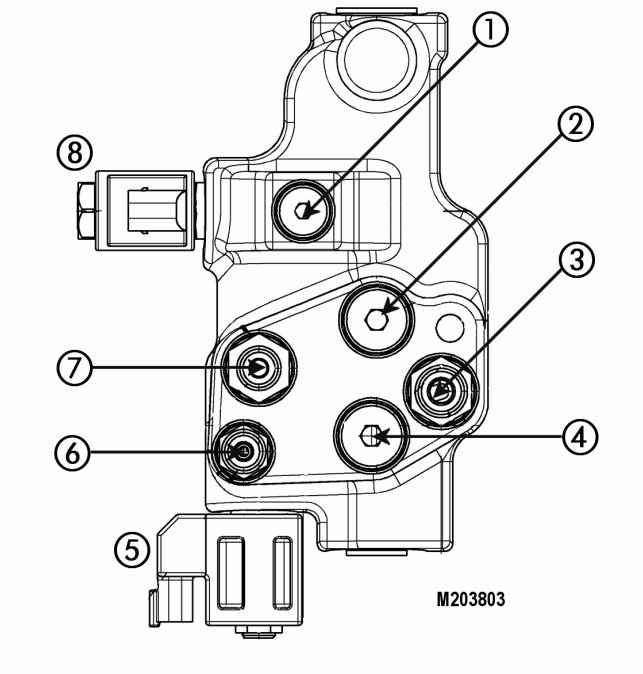
IMPORTANT: Refer to the “General Hydraulic” section for an explanation on how the charge pump, charge & control pressure, lube pump and lube circuits are controlled.

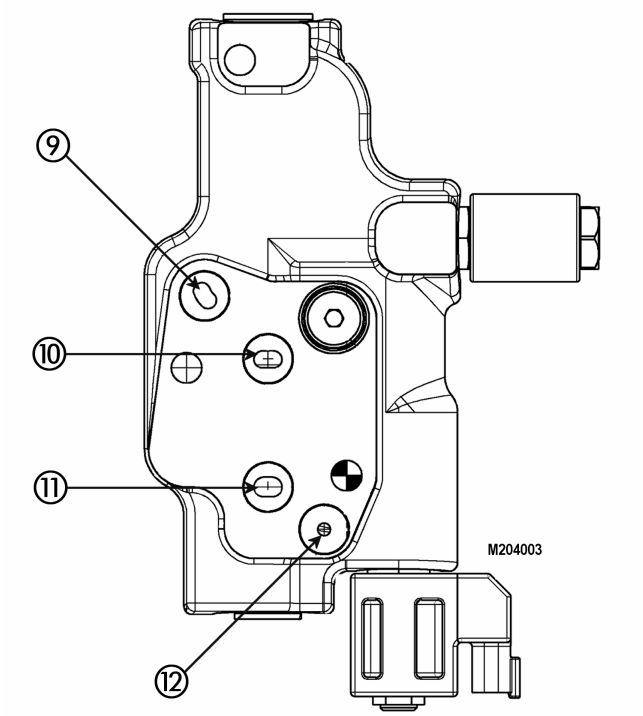


1.	Power Plus Feeder Drive	4.	Feeder Drive Motor
2.	Charge Pressure Distribution	5	Feeder Control Valve
3.	Feeder Drive Pump		

POWER PLUS HYDRAULIC CIRCUITS

CONTROL VALVE





Port Identification			
1.	Plugged	7.	Control Pressure Supply
2.	Plugged (ETR Test)	8.	Engine to Ring Solenoid
3.	Lube Supply	9.	Tank
4.	Plugged (Lube Test)	10.	Engine to Ring Clutch Port
5.	Ring to Frame Solenoid	11.	Clutch Lube
6.	Ring to Frame Clutch Port	12.	Plugged

The hydraulic control valve is supplied oil by external pipes from two sources,

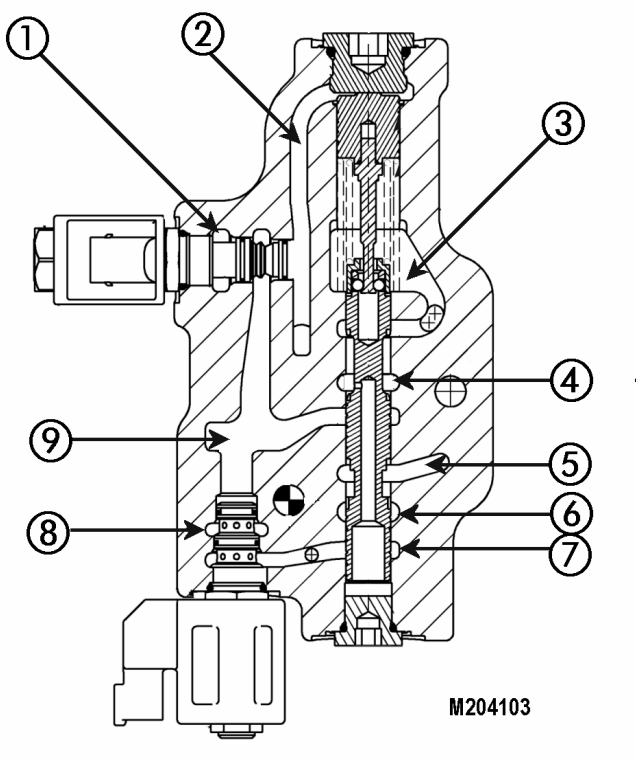
1. A constant 320 PSI (21 Bar) regulated “Control Pressure” from the charge pump. Port 7
2. Lube supply at a maximum pressure of 50 PSI (3.5 bar) from the lube supply pump. Port 3

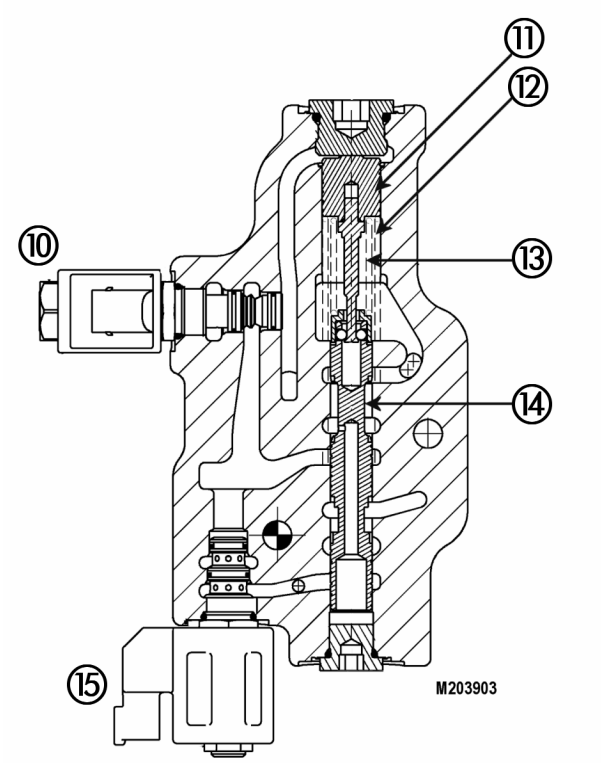
The valve directs oil to the following functions by external and internal pipes and ports,

1. Internal to the ETR clutch. Port 10
2. Internal to lube. Port 11
3. External to the RTF clutch. Port 6

POWER PLUS HYDRAULIC CIRCUITS

CONTROL VALVE

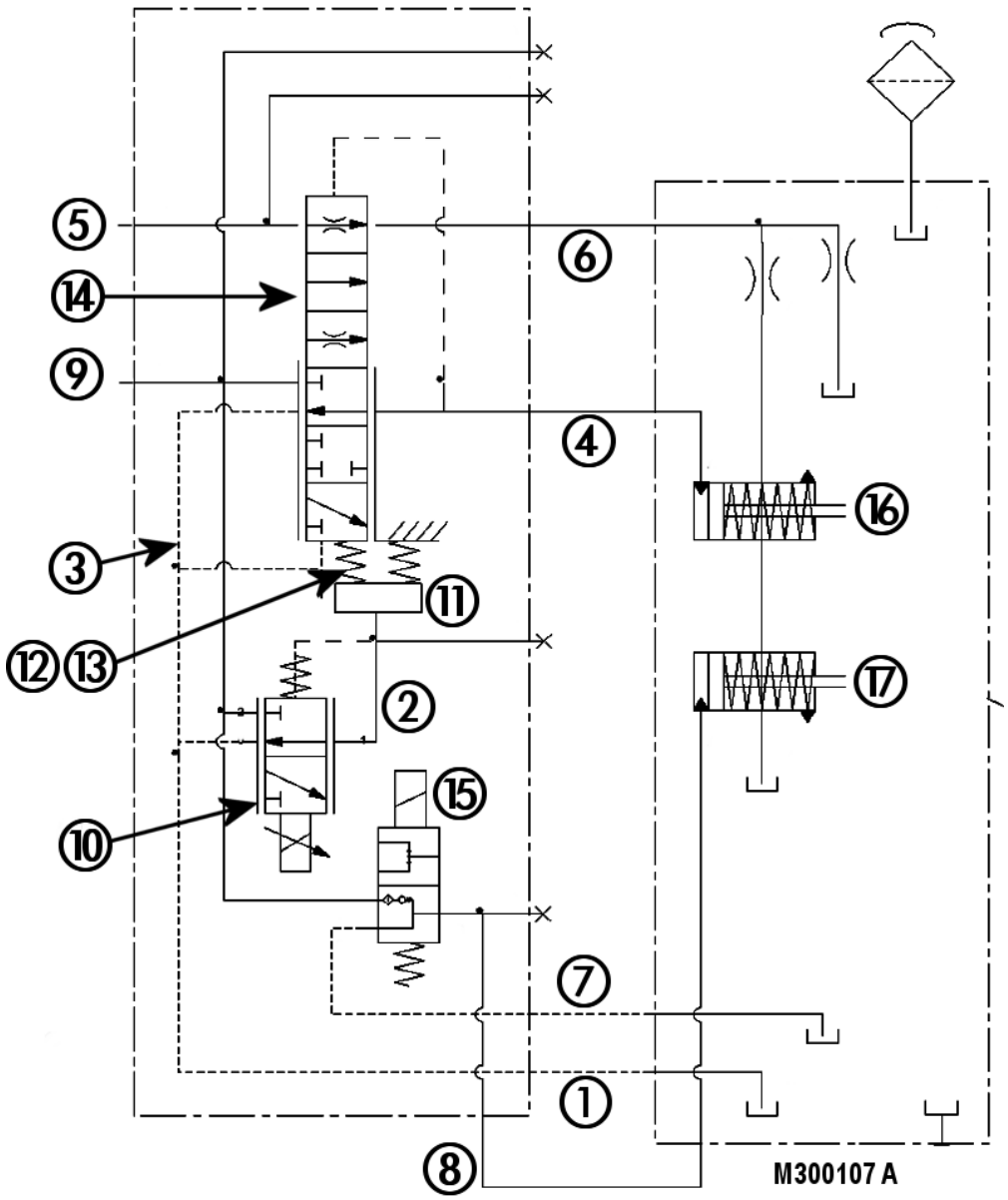




Component and Port Identification			
1.	Tank	9.	Valve Supply
2.	Modulation	10.	Engine to Ring Solenoid, (ETR)
3.	Tank	11.	Modulator Piston
4.	Engine to Ring Clutch, (ETR)	12.	Preload Spring (outer)
5.	Lube Supply	13.	Modulation Spring (inner)
6.	Lube Out	14.	Modulation Spool
7.	Tank	15.	Ring to Frame Solenoid (RTF)
8.	Ring to Frame Clutch (RTF)		

POWER PLUS HYDRAULIC CIRCUITS

CONTROL VALVE



Component and Port Identification			
1.	Tank	10.	Engine to Ring Solenoid
2.	Modulation	11.	Modulator Piston
3.	Tank	12.	Preload Spring (outer)
4.	To Engine to Ring Clutch	13.	Modulation Spring
5.	Lube Supply	14.	Modulation Spool
6.	Lube Out	15.	Ring to Frame Solenoid
7.	Tank	16.	Engine to Ring Clutch Pack
8.	To Ring to Frame Clutch	17.	Ring to Frame Clutch Pack
9.	Control Pressure Valve Supply		

POWER PLUS HYDRAULIC CIRCUITS

CONTROL VALVE OPERATIONS

Feeder Dis-Engaged

With the feeder control switch in the **OFF** position, the ETR solenoid (10) is NOT activated, causing the main spool (14) blocking the control pressure flow to the ETR clutch and the RTF solenoid (15) IS activated to direct control pressure to the RTF clutch.

1. Lube oil (5) is directed through the main spool to port 6 and out to the Power Plus unit to lubricate bearings, clutches and cooling. The spool lands and orifice passages in the PTO gearbox restrict the lube flow.
2. The ETR clutch is permitted to drain back to the tank at ports 1.

Feeder Engaged

When the feeder control switch is placed into the ENGAGED position (forward detented position) the RTF solenoid (15) will be de-activated and the ETR solenoid (10) will be activated by PWM. The solenoid will direct modulated supply pressure to the end of the modulation piston (11). As pressure builds, the piston moves against the force of both the inner and outer modulator springs (12 & 13). As the piston moves toward the spool, the inner spring causes the main spool (14) to shift. As the main spool moves, the lube port 6 is unrestricted to permit additional lube flow during clutch lockup.

The main spool will close OFF the ETR clutch drain port and begin directing control pressure to the clutch pack through port (4). As the pressure is directed to the clutch pack, it is also directed through an orifice hole in the side of the spool to the base of the spool, a signal port. As the pressure builds in the clutch pack the pressure also begins to move the main spool back up against the modulating springs, reducing the pressure on the clutch pack. This modulation takes place until the ETR solenoid has been fully powered and the main spool is held fully down.

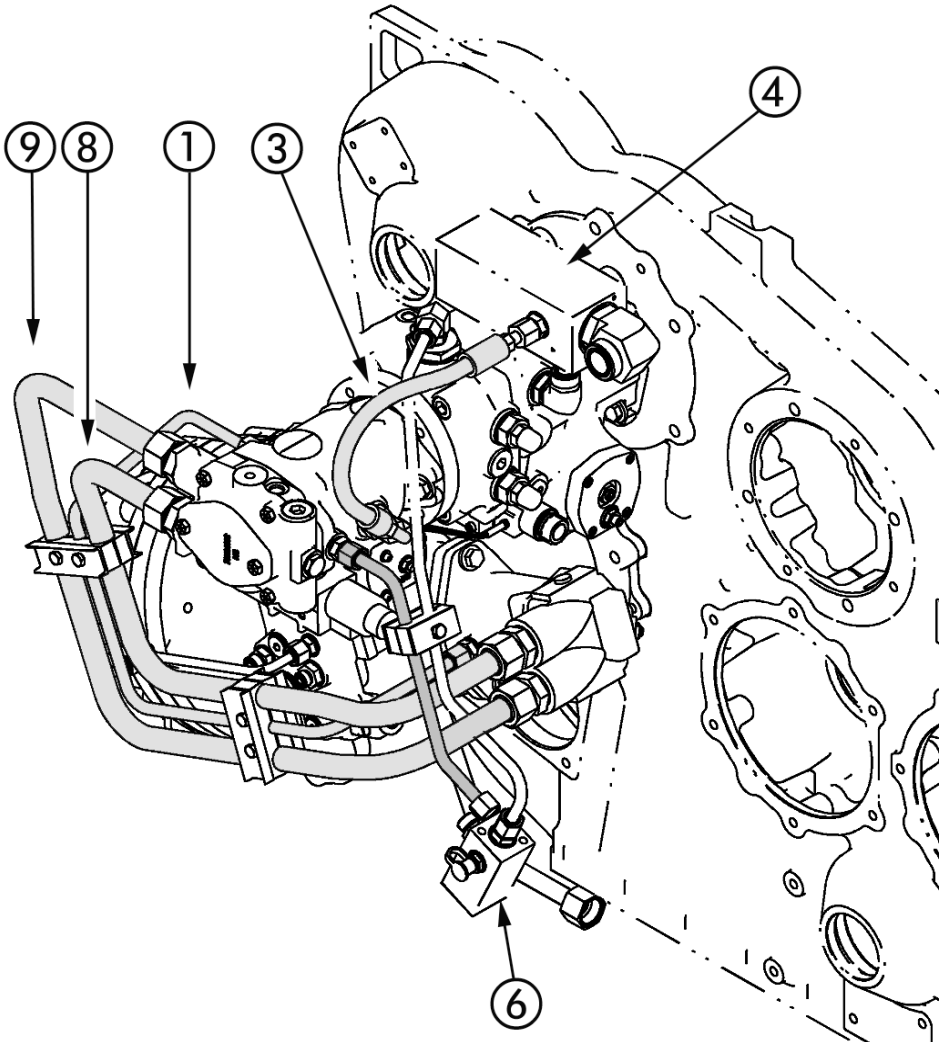
When the main spool is completely moved down, the lube passage again becomes restricted.

Reverser

The RTF solenoid (15) will be activated, directing pressure to the RTF clutch piston (17). The feeder drive pump and motor will rotate the feeder in a reverse direction.

POWER PLUS HYDRAULIC CIRCUITS

FEEDER DRIVE



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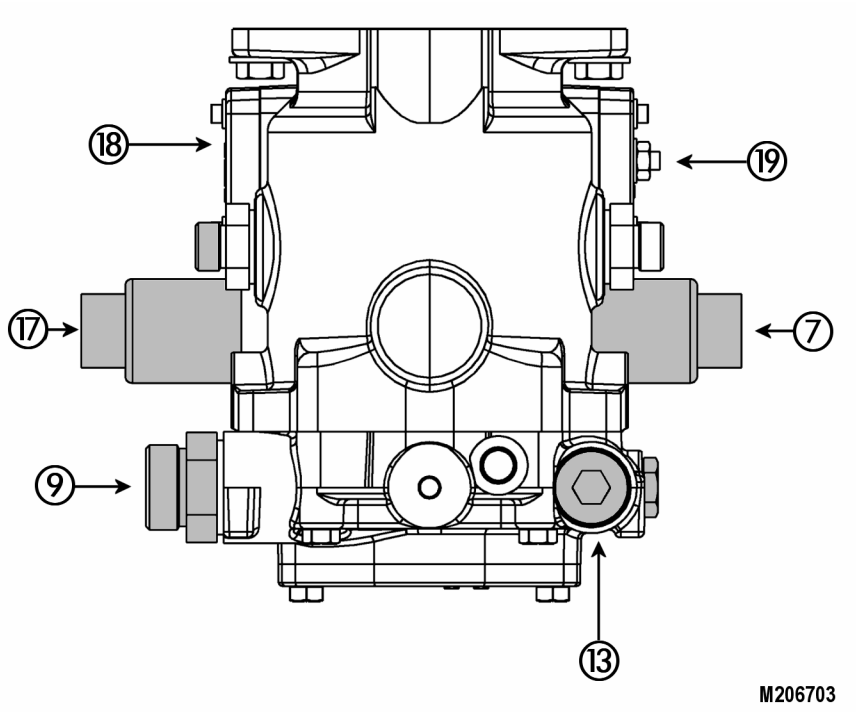
Reference Index For This Page and Next Page.

1.	Motor Case Drain Port	12.	Motor Rotating Assembly
3.	Pump Case Drain Port	13.	Multi-Function Valve (2)
4.	Return Manifold	14.	Drive Pressure Relief
6.	Charge Supply Manifold / Test Port	15.	Pump Rotating Assembly
7.	Control Solenoid (Reverse Drive)	16.	Servo Supply Orifice
8.	Pump Discharge Port	17.	Control Solenoid (Forward Drive)
9.	Pump Discharge Port	18.	Servo Piston
10.	Shuttle Pilot Operated Check Valves	19.	Servo Piston Centering Screw
11.	Shuttle Relief Valve		

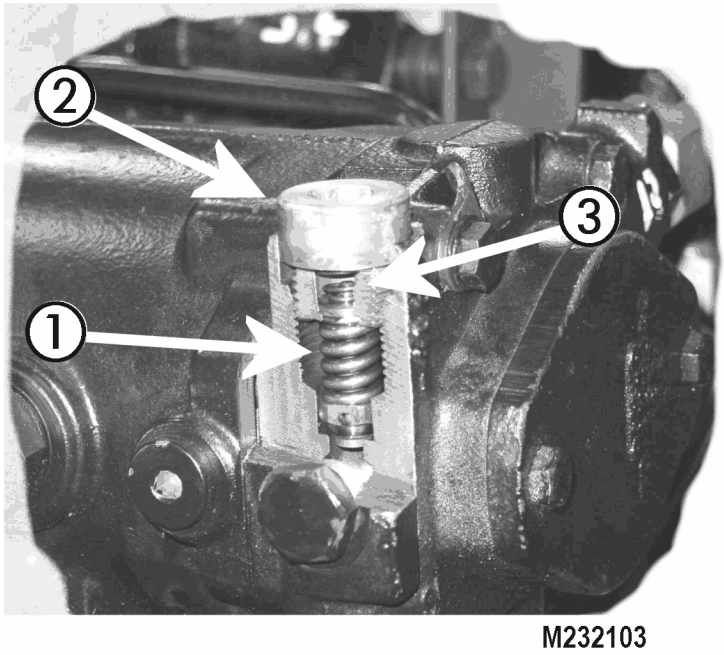
POWER PLUS HYDRAULIC CIRCUITS

FEEDER DRIVE

Drive Pump, (Top View)



Reference Index On Previous Page



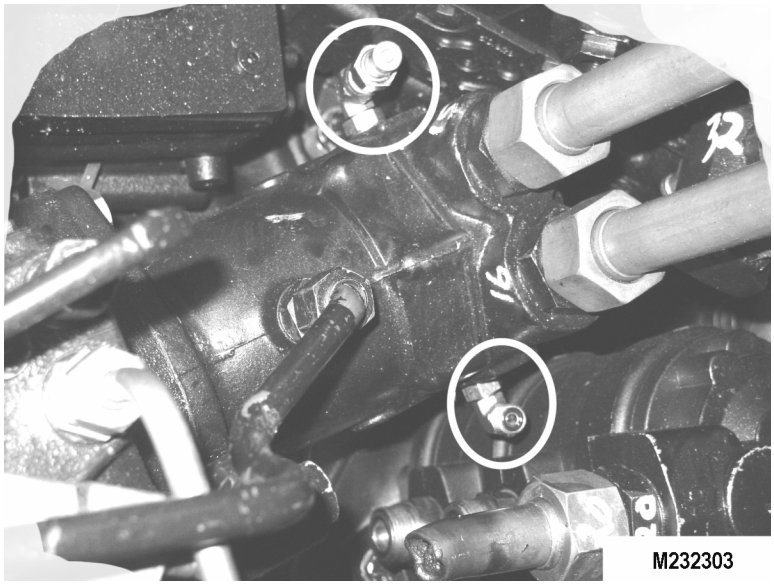
MULTI-FUNCTION VALVE ASSEMBLY

1.	High Pressure Spring
2.	Multi-Function Valve
3.	Charge Check Valve Spring

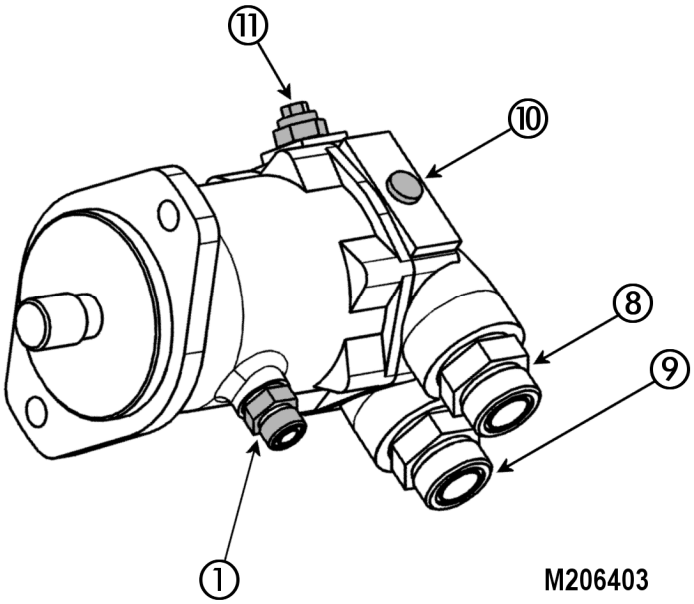
POWER PLUS HYDRAULIC CIRCUITS

HYDROSTATIC DRIVE

Feeder Drive Motor



Drive Pressure Test Ports



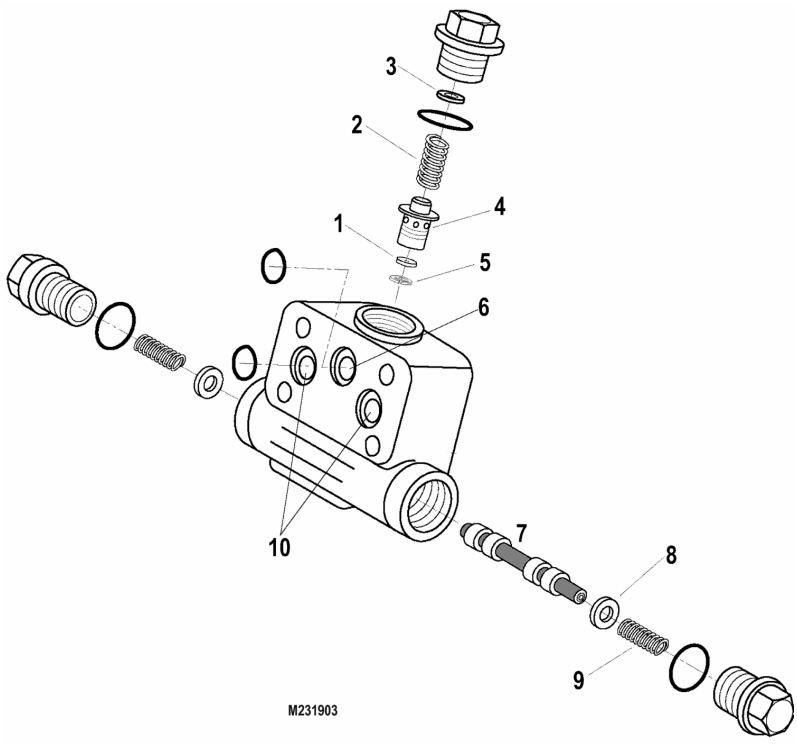
Feeder Drive Motor

1.	Case Drain
8.	Drive Port
9.	Drive Port
10.	Drive Pressure Test Port
11.	Shuttle Relief Valve

POWER PLUS HYDRAULIC CIRCUITS

HYDROSTATIC DRIVE

Feeder Drive Motor

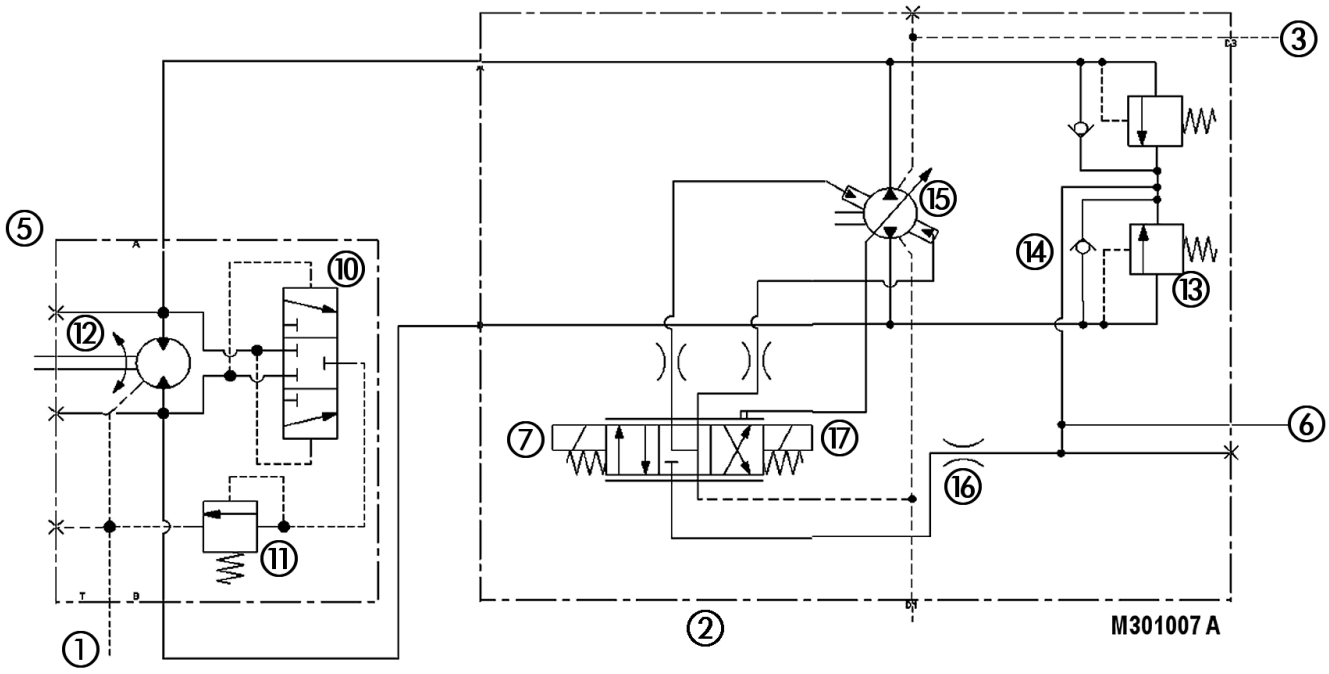


Motor Control Valve

1.	Flushing Orifice
2.	Shuttle Relief Spring
3.	Shuttle Relief Shims
4.	Shuttle Relief Poppet
5.	Snap Ring
6.	Flush Port
7.	Shuttle Spool
8.	Washer
9.	Spool Centering Spring
10.	Drive Pressure Ports

POWER PLUS HYDRAULIC CIRCUITS

FEEDER PUMP AND MOTOR DRIVE SCHEMATIC



1.	Motor Case Drain Port	10.	Shuttle Pilot Operated Check Valves (2)
2.	Feeder Drive Pump	11.	Shuttle Relief Valve
3.	Pump Case Drain Port	12.	Motor Rotating Assembly
4.	Return Manifold	13.	Drive Pressure Relief (2)
5.	Feeder Drive Motor	14.	Charge Check Valve (2)
6.	Charge Pressure Supply Manifold and Test Port	15.	Pump Rotating Assembly
7.	Control Solenoid	16.	Servo Supply Orifice
		17.	Control Solenoid

POWER PLUS HYDRAULIC CIRCUITS

FEEDER DRIVE

The pump and motor drive unit for the feeder operates on the same principles as the ground speed drive unit. The explanation here will be brief. For a more entailed description, review the ground drive circuit.

IMPORTANT: Refer to the "General Hydraulic" section for an explanation on how the charge pump, charge pressure, lube pump and lube circuits are controlled.

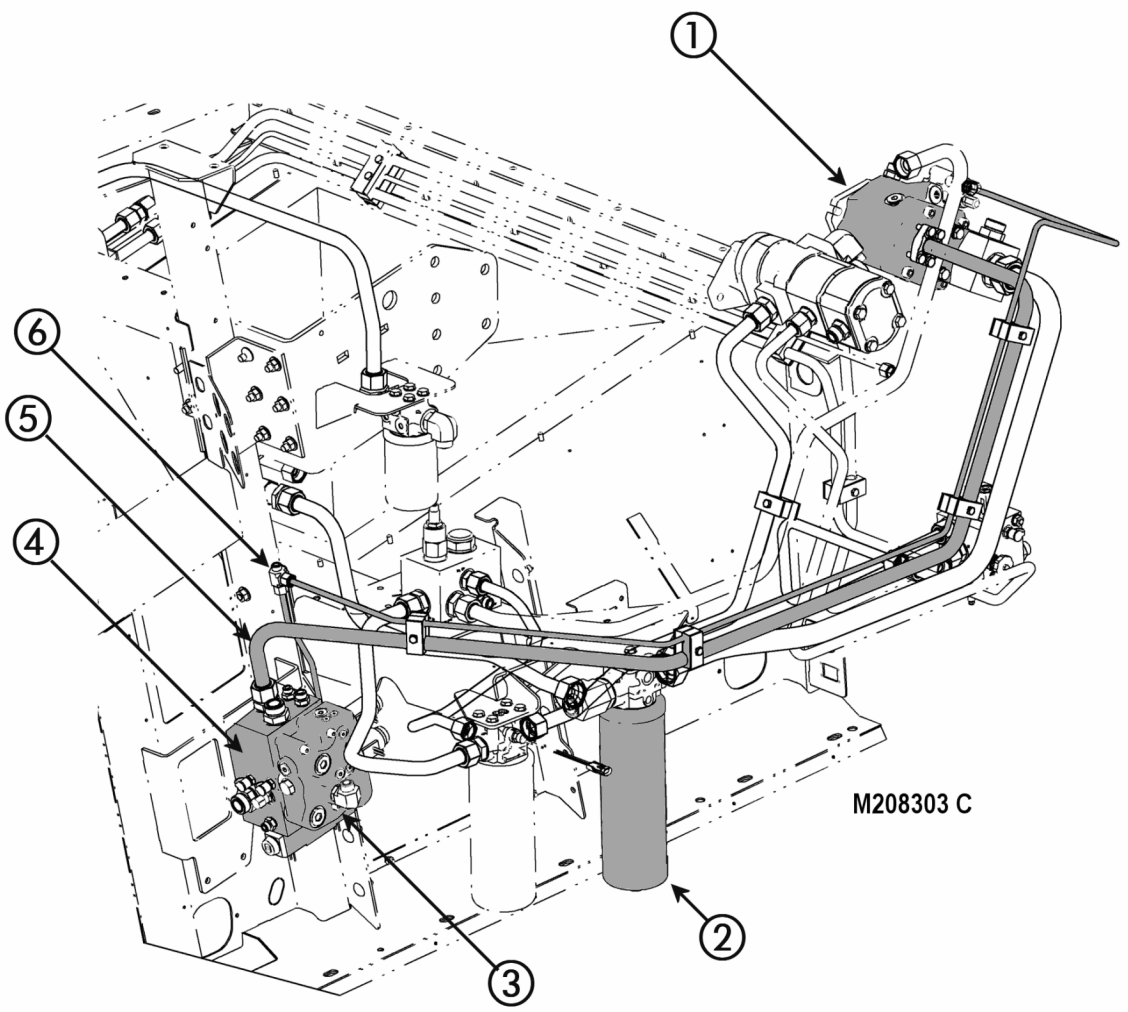
Feeder Disengaged

The feeder pump is supplied with a constant supply of charge pressure oil (charge oil) 425-PSI (30 bar) at port (6). The oil flow will force open the charge check valves (14) charging the closed loop circuit of the pump and motor. The pump does not receive a cooling and flushing oil flow when not operating.

Feeder Engaged, (example solenoid 17 is activated)

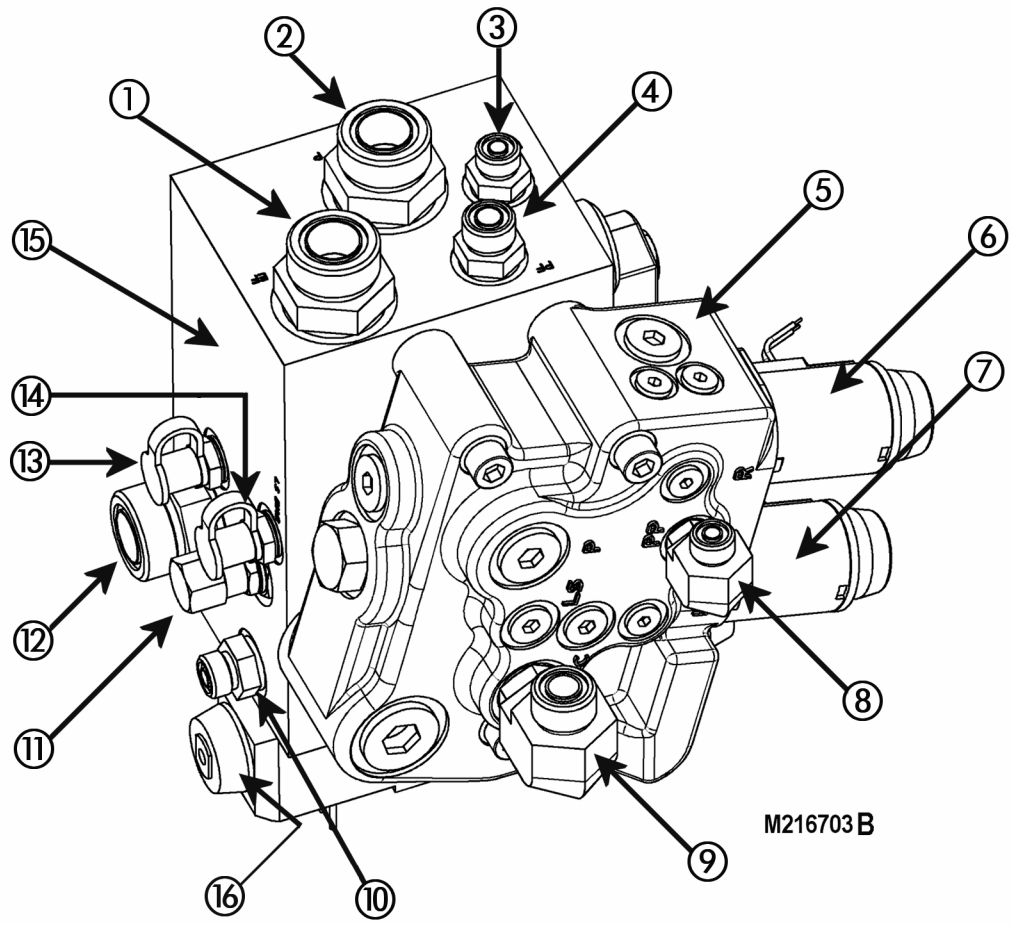
1. Directional control solenoid (17) is powered with PWM. The solenoid will work as a pressure reducing valve to provide variable pressure to the swash plate servo piston. The servo will tilt the swash plate, causing the pump to create a flow out to the motor. This drive pressure will hold the charge check valve (14) on its seat. The power that is being supplied to the solenoid will be modulated to provide for the proper motor RPM.
2. The pump's discharge is directed to the motor's rotating assembly (12) and to the shuttle check valve (10). Due to the drive pressure being higher then the charge supply pressure, the check valve on the low pressure side of the loop will be forced open permitting charge pressure to be exposed to the shuttle relief valve. The shuttle relief is set at a lower pressure setting approximately 230 PSI (16 bar) than the charge pressure so the relief is forced open. This provides the motor with lubrication, cooling and flushing. The motor case drains to the feeder pump to lubricate, cool and flush the pump.
3. If the feeder should become over-loaded, the drive pressure is monitored at the high-pressure relief valve (14). If the drive pressure exceeds 3000 PSI (207 bars) the pressure valve will open, directing the full pump flow back into the charge circuit.

Header Lift



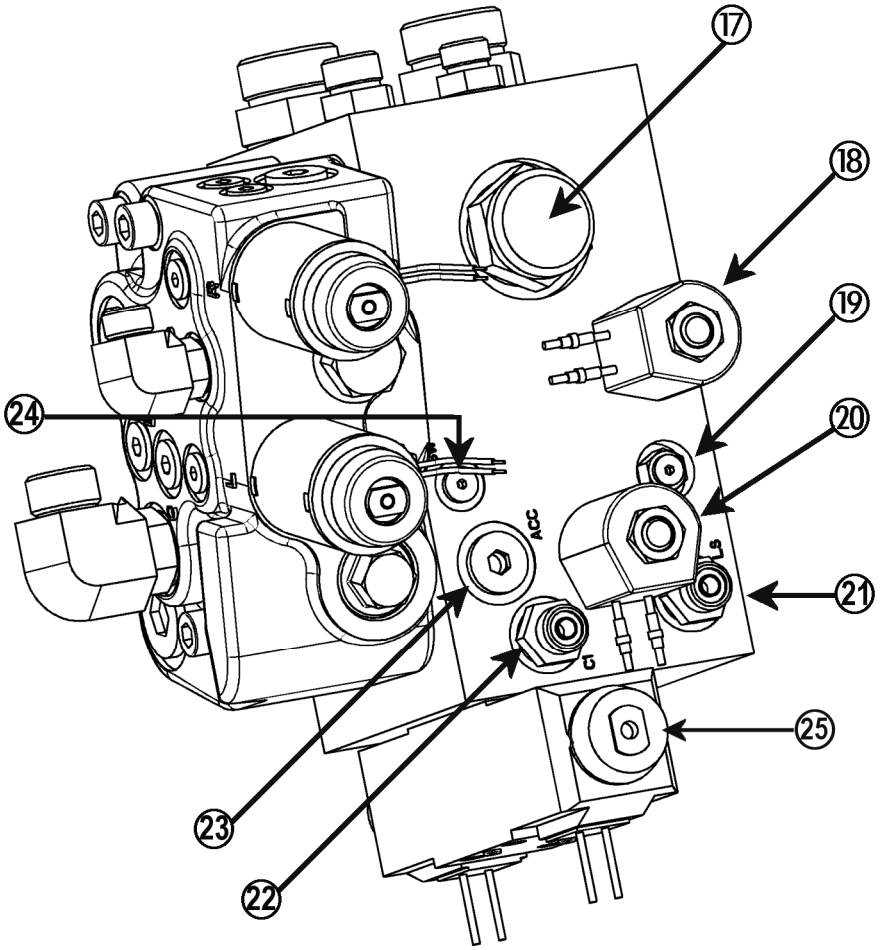
1.	PFC Pump and Compensator	4.	Main Valve Manifold
2.	Return Filter	5.	Main Supply
3.	Header Lift Valve	6.	Signal Line to PFC Pump

HEADER VALVE



1.	To Feeder Valve Supply	9.	To Header Lift Cylinders
2.	From PFC Pump	10.	Unloading Auger Retract
3.	From Steering Hand Pump Signal	11.	Thermal Relief Valve
4.	To Steering Hand Pump Supply	12.	Tank Port
5.	Header Valve	13.	Pump Pressure Test Port
6.	Header Raise Solenoid	14.	Signal Line Test Port
7.	Header Lower Solenoid	15.	Main Stack Manifold
8.	From Regulated Pressure Supply	16.	Unloading Auger Extend Solenoid

HEADER VALVE

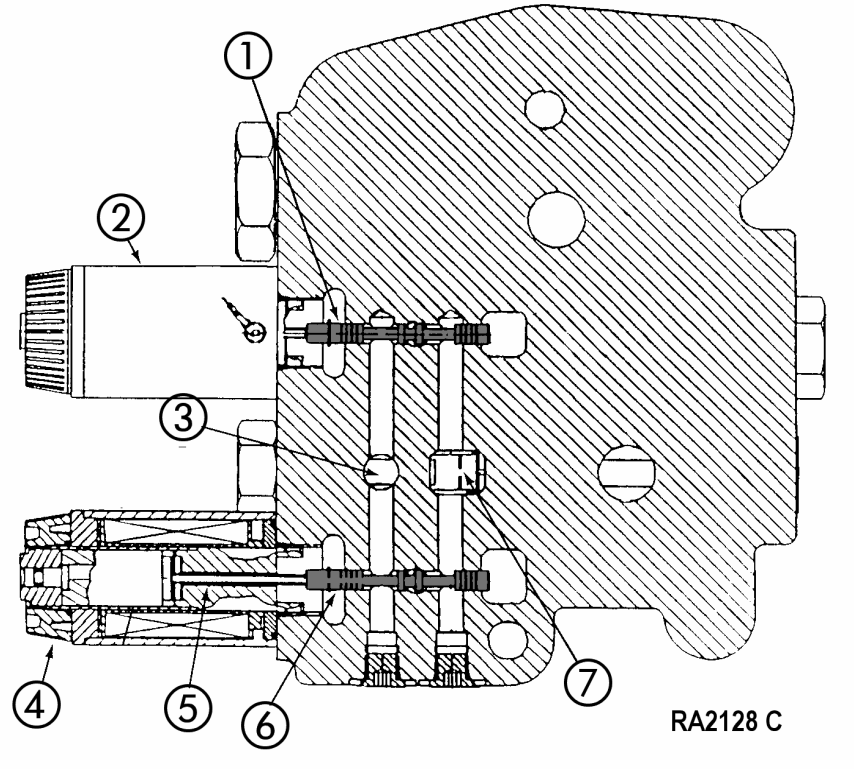


17.	Steering Priority Valve Cartridge	22.	Unloading Auger Extend
18.	Signal Valve	23.	To Accumulator
19.	Check Valve and Bleed Orifice	24.	Float Pressure Sensor
20.	Accumulator Solenoid	25.	Unloading Auger Retract Solenoid
21.	Signal To PFC Compensator		

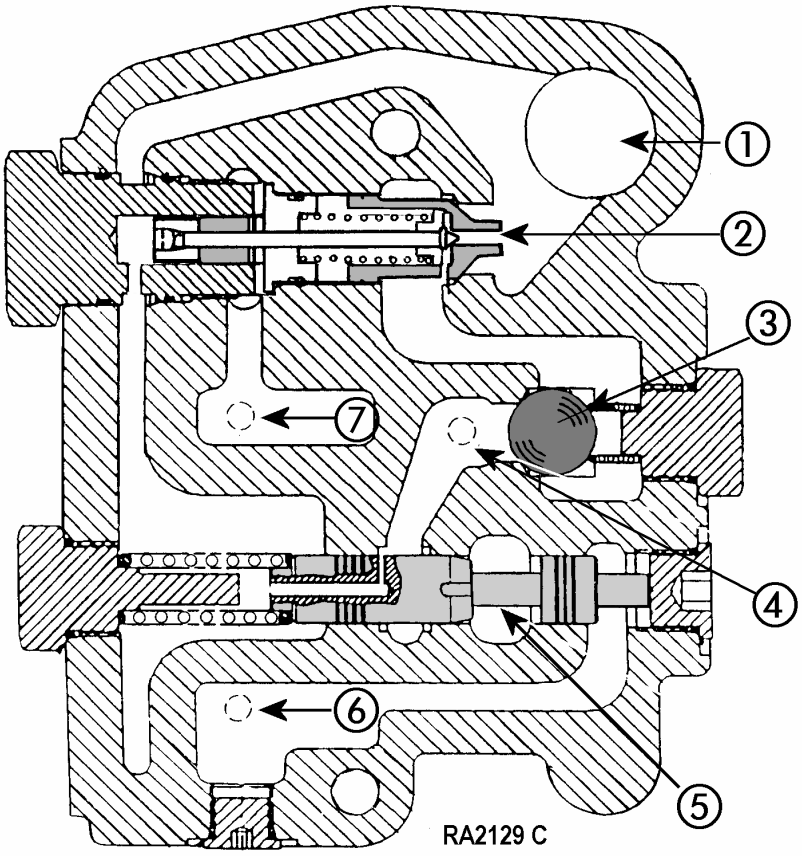
HEADER VALVE

"NEUTRAL"

1.	Lower Primary Spool
2.	Lower Sol.
3.	Regulated Pres. Inlet
4.	Raise Sol.
5.	Pin
6.	Raise Primary Spool
7.	Return Passage



1.	Return Passage
2.	Lower Secondary
3.	Lift Check
4.	Signal Passage, with Signal check
5.	Raise Secondary
6.	Raise Regulated Pressure Passage
7.	Lower Regulated Pressure Passage

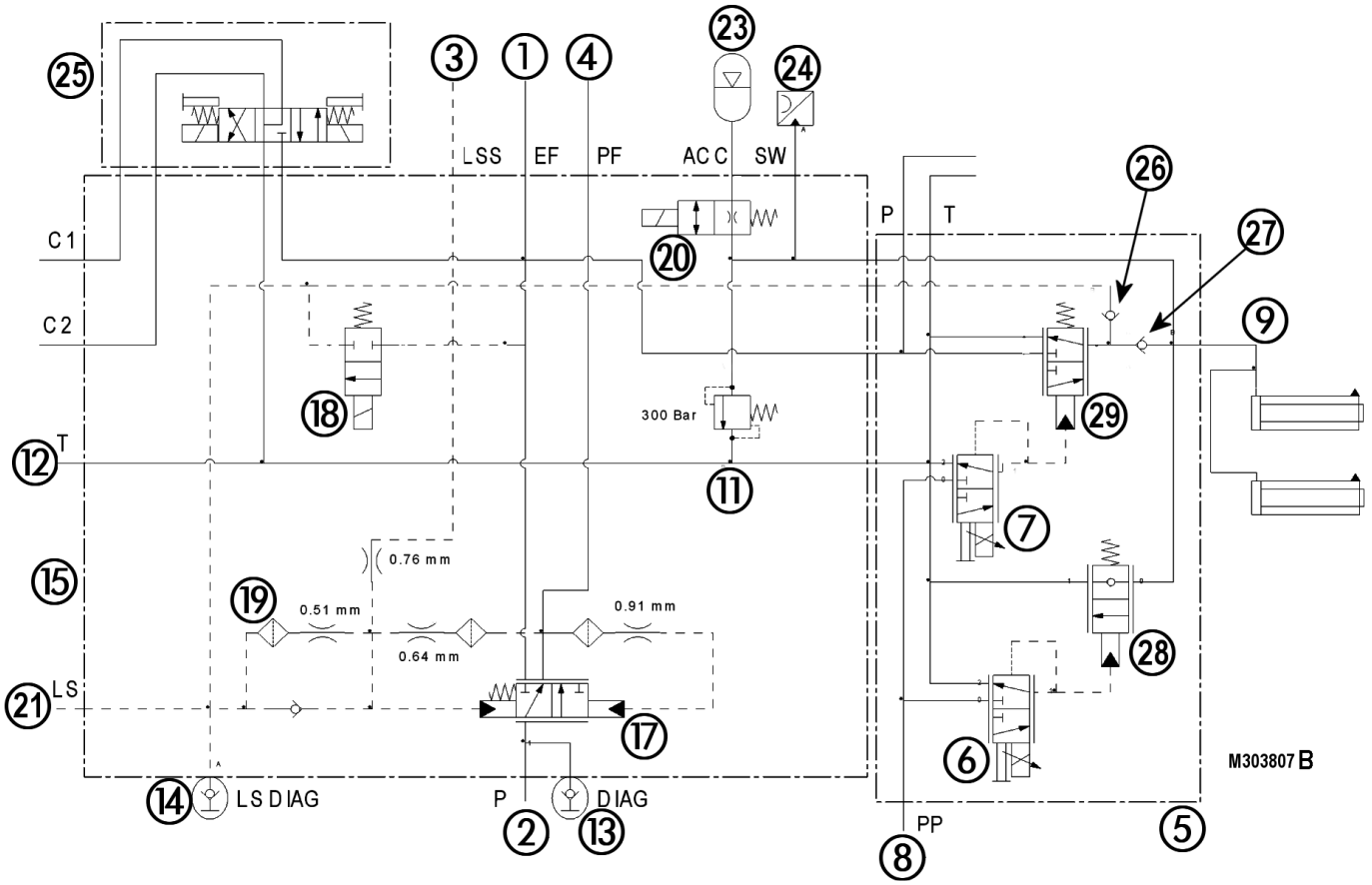


HEADER VALVE

The header valve is attached to the main manifold assembly. The header valve has two solenoids, one controls the raise primary spool the other controls the lower primary spool. The header valve also has a pilot-operated raise secondary spool, a pilot operated lower secondary spool, header lift-check ball and a signal-check ball. Oil is supplied to the valve from the PFC pump at two different pressure levels. Regulated pressure is supplied for pilot oil to shift the secondary spools. The main PFC pump is used to raise the header.

HEADER VALVE IN NEUTRAL

The header valve is a closed-center valve. In neutral there will be no oil flowing through the valve. The primary spools are blocking the supply oil from the regulated circuit. The raise secondary spool is blocking the supply oil from the PFC pump and is held in place by a spring. The lower secondary spool is blocking the return passage to reservoir. The lower secondary spool is held in place by a spring and oil pressure trapped behind the spool. Oil is trapped in the header raise cylinders by the internal lift-check ball and the lower secondary spool.



Use previous page identification tables plus these additional ones.

26.	Header Valve Signal Check	28.	Lower Secondary Spool
27.	Header Load Check	29.	Raise Secondary Spool

HEADER VALVE

FEEDER LIFT CYLINDERS

The feeder lift cylinders are a one way cylinders and do not incorporate any internal packing that would permit internal oil by-passing.

THERMAL RELIEF

When the header valve is in neutral position, the pressure in the lift cylinders may increase dramatically due to:

- The header bouncing during rough field or road operation
- Oil expansion due to ambient temperature increases when the lift cylinders are full extended

Located in the Main Valve assembly is a thermal relief. The thermal relief valve will relieve the pressure back to the return circuit if the pressure arises above 275-300 bar (3990-4350 PSI). See test procedures later in this section for adjustment procedures.



REMEMBER: A certain amount of header leak down is acceptable and corrective action should not be taken.

Referring to service bulletin NHE SB 032 98 the header should not leak down more then one inch of lift cylinder travel per hour. If leak down is excessive the following areas will have to be checked in order:

1. Check for any external leakage
2. Check the condition of the thermal relief valve for leakage. The valve will have to be tested on the work bench using a hand pump. It may drip a couple of drops a minute.
3. Check the condition of the load check ball, a leak here will normally provide a slow leak down.
4. Check the condition of the secondary poppet, a leak here can provide either a slow or extremely fast leak down.

HEADER VALVE

IMPORTANT: When replacing the load check ball or lower secondary poppet it is advisable to re-condition the seats.

Reconditioning the seats will be done with a hammer, brass punch and proper safety equipment:

1. Place a load check ball (or lower secondary poppet) into the seat, the load check ball must be in good condition, and using the brass punch and hammer give the ball two or three strikes.
2. Remove the ball, the seat should appear to have a continuous seat all the way around.
3. Clean the house of any possible chips and install a NEW load check ball.

HEADER VALVE

ACCUMULATOR

Ride Control Cartridge

The optional accumulator (23) is located on the left side of the machine between the engine and the grain tank. The accumulator is a shock absorber for the header raise and lower circuit when traveling on the road. The accumulator has an internal Bladder and a Schrader valve for recharging. The operator can turn the accumulator ON/OFF by placing a control on the one of the display's run screens.

The accumulator is connected to the header raise and lower circuit by a tee fitting. The internal bladder divides the accumulator into a gas side and an oil side. The gas side of the accumulator contains compressed nitrogen while the oil side is exposed to the header circuit hydraulic oil when the solenoid is open. As the hydraulic oil enters the accumulator, the bladder is pressed against the nitrogen gas, absorbing any shock loads. The accumulator is normally used for over the road transport; however, this option can be used when the operator chooses to. It should NOT be used when the header is being operated in ground sensing mode due to slower responses.

The accumulator is charged at the factory with 68.9 bar (1,000 psi) of nitrogen. The charge pressure may require modification depending on the header size to permit 1"-3" header drop, measured at the cutter bar or stalk rolls, when the circuit is active. The accumulator will have to be recharged should it lose its charge of nitrogen. This will require a tank of compressed nitrogen gas and charging kit P# 380001737 and adapter 380001168.



IMPORTANT Use extreme caution when handling the accumulator, do not expose to extreme heat, do not drop, use only nitrogen gas for recharging, and always use a regulator on the nitrogen supply tank to assure the accumulator does not get exposed to full supply pressure.

HEADER VALVE

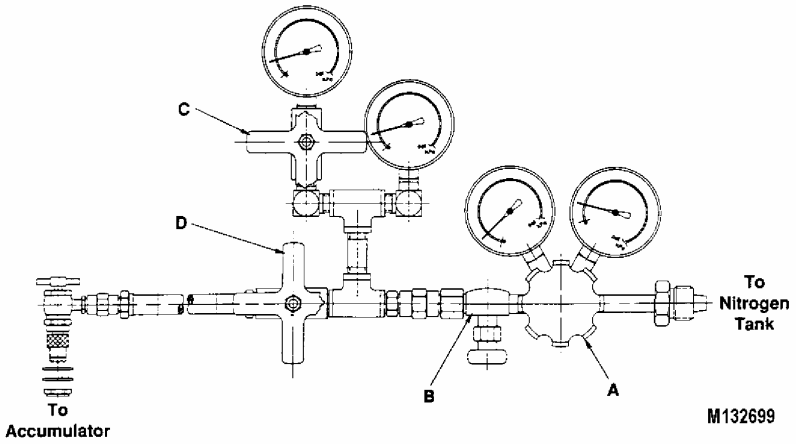
ACCUMULATOR CHARGING

The accumulator comes from the factory with a pre-charge of 69 bar (1000 PSI). This pre-charge should be checked and adjusted as required before the start of each season.

Due to different headers having different weight, a different accumulator pre-charge may be required to provide the proper cushioning of the header. When the accumulator is adjusted correctly, the header should have approx. a 1-3 inch drop when the accumulator is turned on.

TEST PROCEDURES

1. Turn **ON** the accumulator, solenoid using the cab display.
2. Lower the header completely and hold the DOWN switch for 5 seconds.
3. Turn **OFF** the accumulator, using the cab display.
4. **Raise** the header above the ground but not completely. Two feet should be good.
5. Measure the height of the header above the ground at the cutter bar or stalk rolls
6. Turn **ON** the accumulator, the header should drop
7. Measure the height of the header above the ground at the cutter bar or stalk rolls, it should be 1-3 inches lower. If the header lowers too much, add additional nitrogen, if the header does not lower enough release additional nitrogen.
8. Repeat steps 1-6 until the 1-3 inch drop is achieved



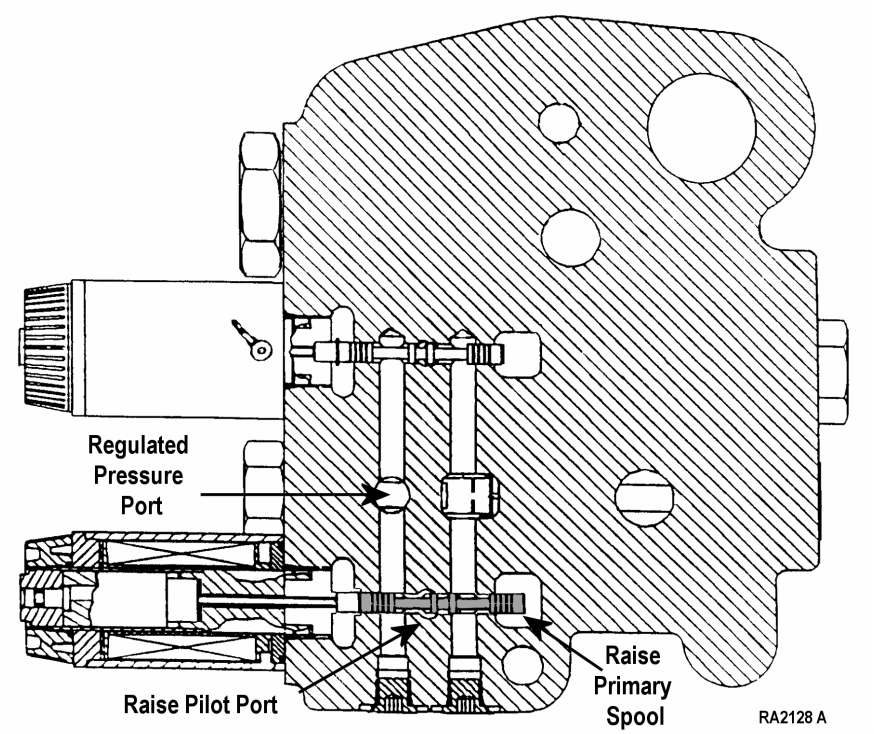
TEST TOOLS

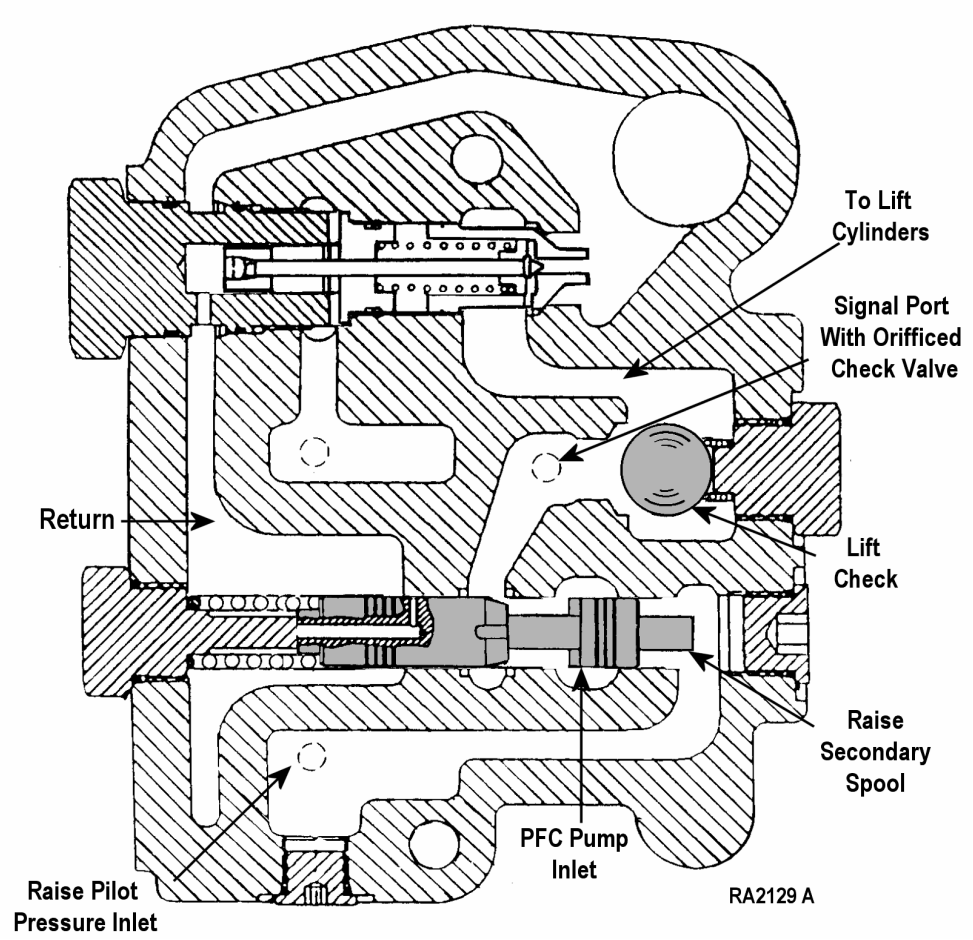
There are two different accumulators used, they will require different charging adapters.

CAS 10088-1	Without Regulator Valve
CAS 1975	Accumulator Pressure Test Gauge
380001737	Charging Kit - Magnum Tractors
380001168	Charging Adapter

HEADER VALVE

"RAISE"





HEADER VALVE

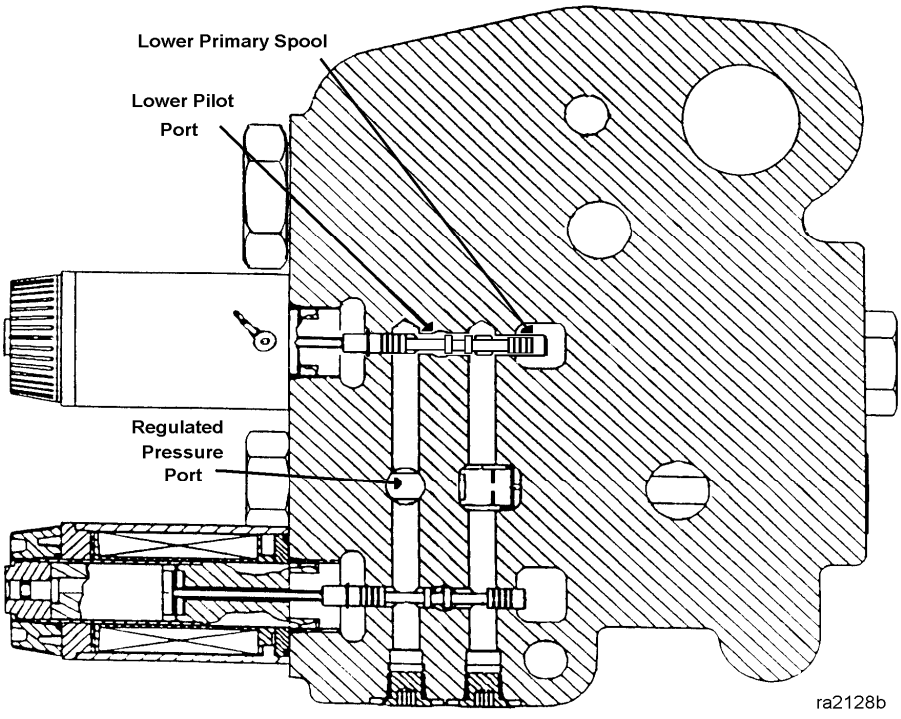
HEADER RAISE

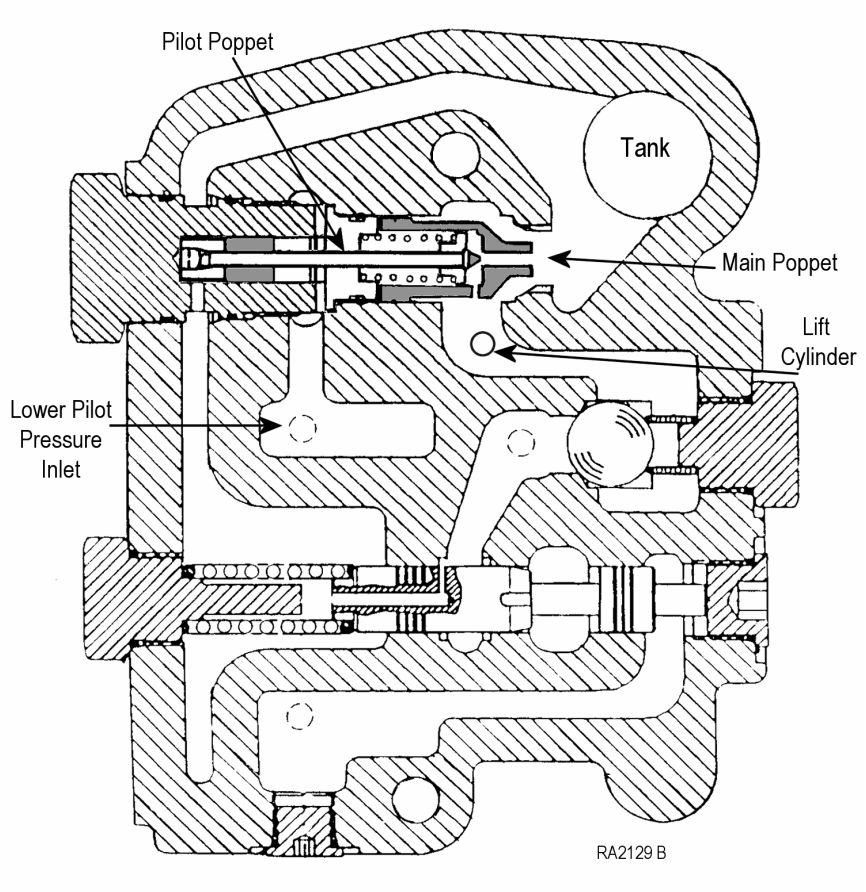
To raise the header, the number 4 (header raise) solenoid must be energized either manually by a switch on the propulsion lever, by the header controller in the automatic mode or by using the manual override. When the solenoid is energized, an internal pin will extend shifting the raise primary spool. The amount that the raise primary spool moves depends upon the current provided to the solenoid by the header controller. As the raise primary spool shifts, it meters regulated pressure to the raise secondary spool. The pilot pressure oil causes the raise secondary spool to shift against the spring, allowing oil from the PFC pump to flow to the header-lift check ball, signal-check ball, and header raise cylinders. The momentary drop in the PFC pump pressure line will allow the compensator to stroke the pump. The oil from the PFC pump will build enough pressure to unseat the lift check and then raise the head. At the same time, the signal-check ball will open to allow the work pressure back to the compensator through the signal line. The speed at which the header raises is controlled by how far the raise secondary spool is allowed to shift.

The header will stop moving when the solenoid is de-energized or the cylinders are fully extended. When the cylinders reach the end of their stroke, the system will go on high-pressure stand-by. When the solenoid is de-energized, oil pressure acting on the non-solenoid end of the raise primary spool will shift the spool, closing the supply of pilot oil to the raise secondary spool and opening a passage for oil to return to the reservoir. This loss of oil pressure causes the raise secondary spool to shift towards the non-spring end and block the inlet port from the PFC. The header will stop raising and the weight of the header will cause the lift check to seat. An orifice in the raise secondary spool will allow oil trapped between the lift check and the raise secondary spool to drain to reservoir. The oil pressure in the signal line will bleed to the reservoir through the steering priority valve and the steering hand pump.

HEADER VALVE

"LOWER"





HEADER VALVE

HEADER LOWER

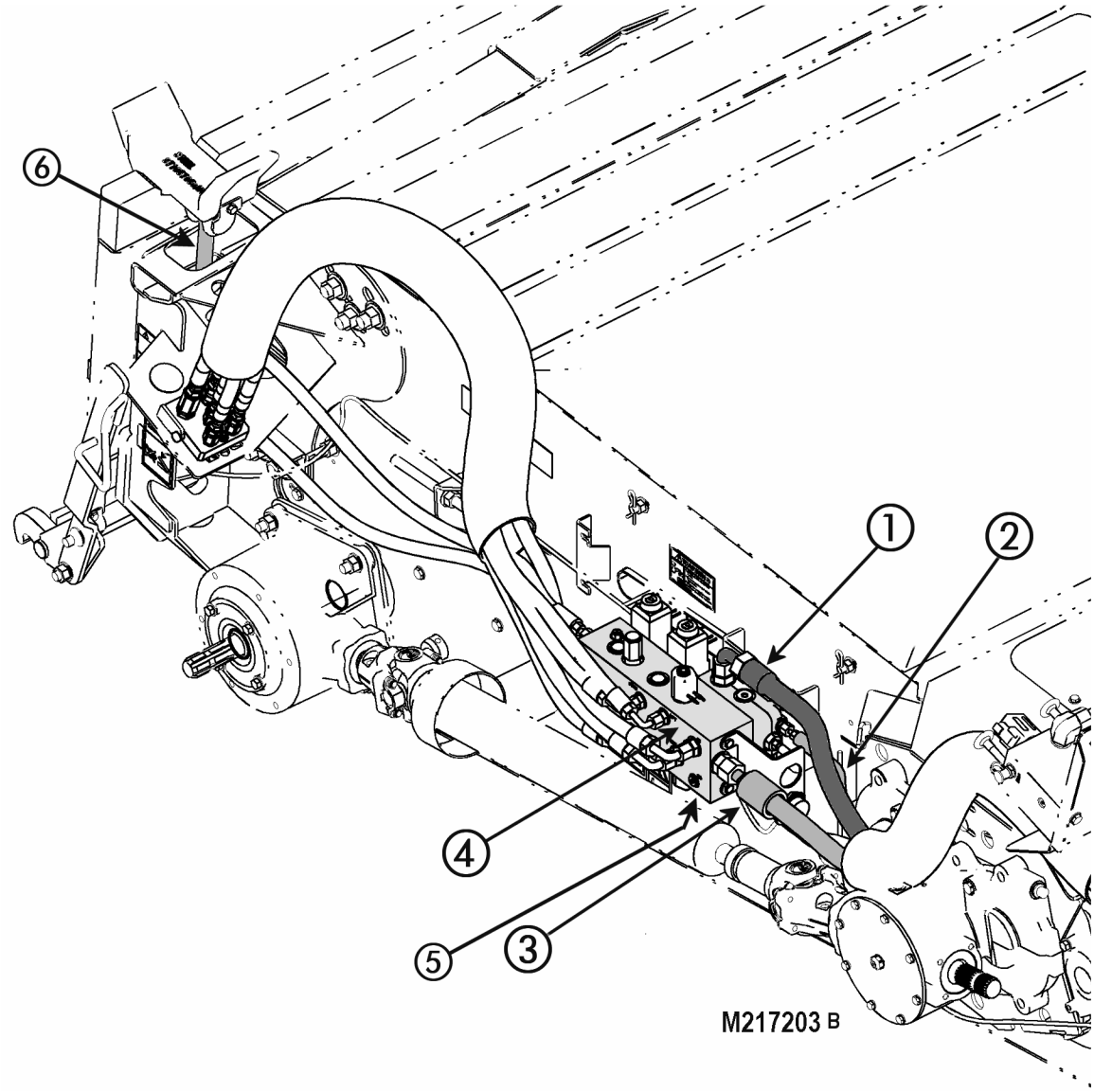
To lower the header, the number 2 (header lower) solenoid must be energized either manually by a switch on the propulsion lever, by the header controller in the automatic mode or by using the manual override. Oil pressure from the PFC pump is not required to lower the header. When this solenoid is energized an internal pin will extend shifting the lower primary spool. The amount that the lower primary spool moves depends upon the current provided to the solenoid by the header controller. As the lower primary spool shifts it meters regulated pressure to the lower secondary spool. The pilot oil causes a spring-loaded pilot poppet located in the center of the lower secondary spool to become unseated. This pilot poppet allows oil trapped in the center of the lower secondary spool to drain to the reservoir. At the same time, oil trapped in the raise cylinder flows through an orifice in the side of the lower secondary spool. As this oil flows through the orifice the pressure on the inside of the lower secondary spool will be less then the oil acting on the outside of the spool. This pressure differential will cause the lower secondary spool to shift and allow the oil from the raise cylinders to drain to the reservoir lowering the header. The speed at which the header lowers is controlled by how far the lower secondary spool is allowed to shift.

The header will stop lowering when the solenoid is de-energized. Oil pressure acting on the non-solenoid end of the lower primary spool will shift the spool, closing the supply of pilot oil to the lower secondary spool and opening a passage for oil to return to the reservoir. The spring-loaded pilot poppet in the center of the lower secondary spool is allowed to close. This stops the flow of oil through the orifice in the side of the lower secondary spool. The pressure inside the lower secondary spool will become equal to the pressure acting on the side of the spool. When the pressures become equal, the spring in the center of the lower secondary spool will shift the spool closed. The header will then stop lowering.

REMEMBER: A certain amount of header leak down is acceptable and corrective action should not be taken.

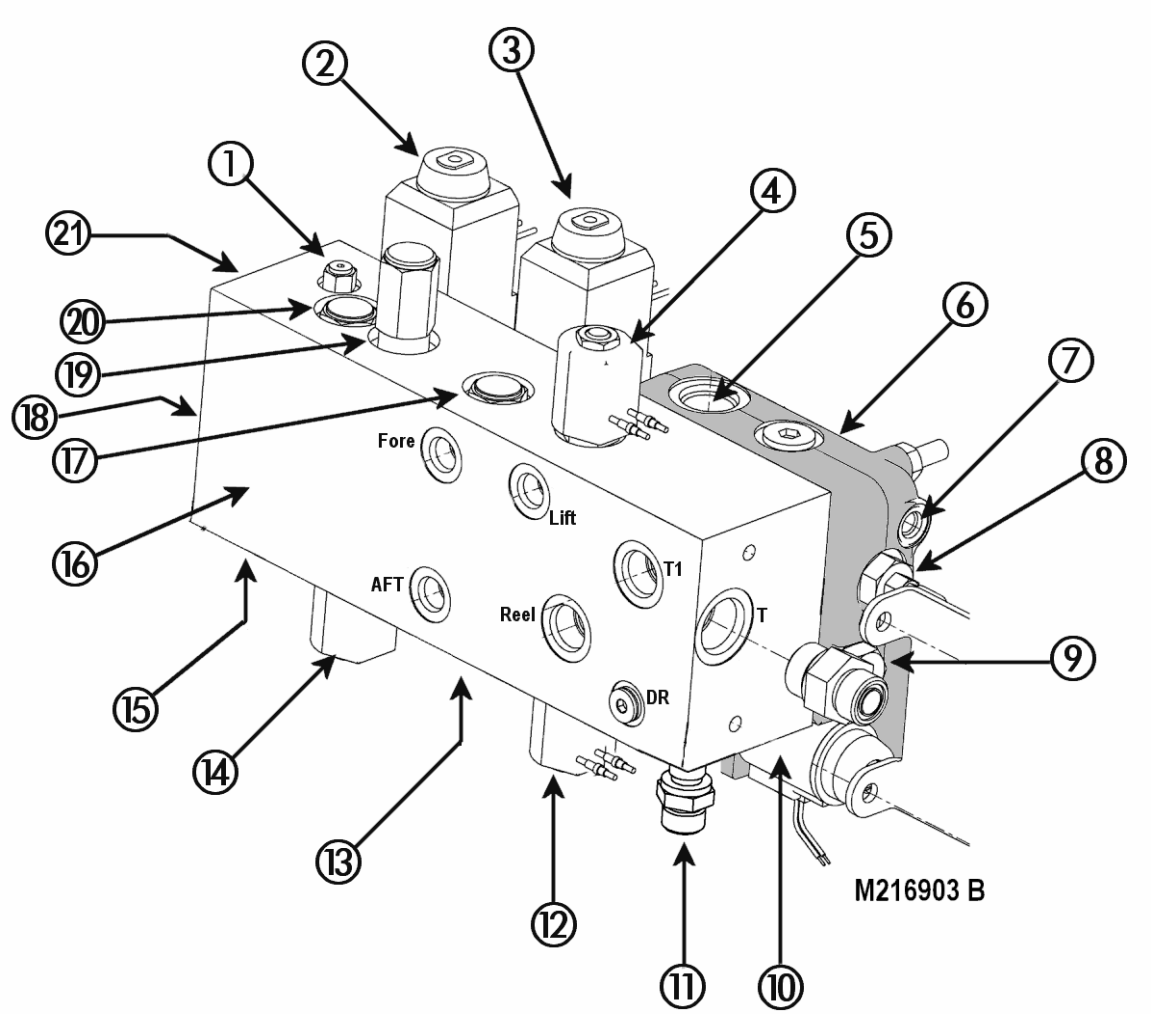
Header Tilt Hydraulics

FEEDER STACK VALVE



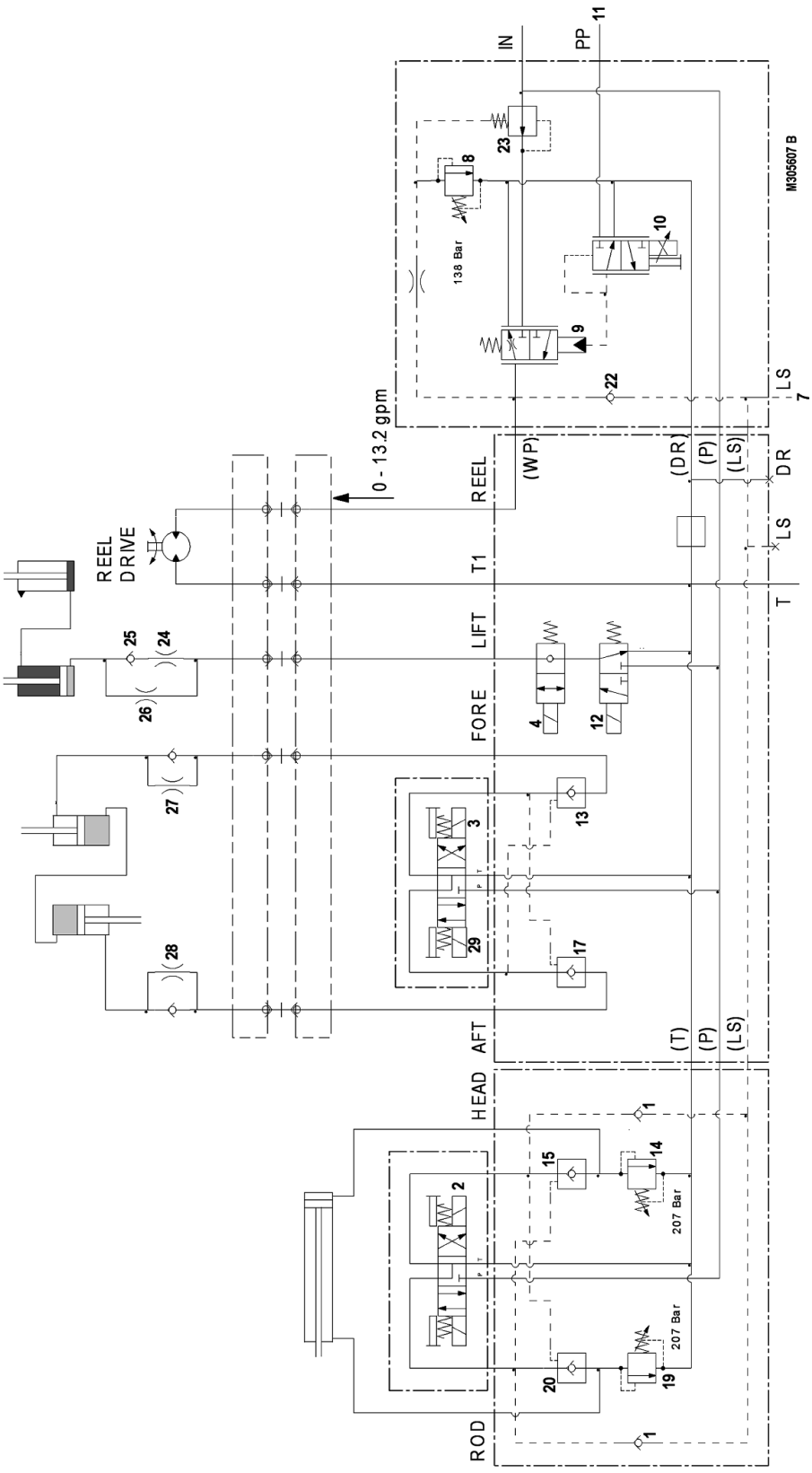
1.	Main Supply To Valve	4.	Feeder Stack Valve
2.	Signal Line To PFC Pump	5.	Regulated Pressure form Park Brake Valve
3.	Main Return to Return Filter	6.	Tilt Cylinder

HEADER TILT HYDRAULICS



1.	Tilt Signal Check Valve	15.	Pilot Checks, Tilt Base End
2.	Tilt Solenoid, CW	16.	Manifold Body
3.	Reel AFT Solenoid	17.	Pilot Checks, Fore
4.	Reel Lower Solenoid	18.	Tilt Port, CW
5.	Main Supply Port for Stack Valve	19.	Port Relief Valve, Tilt Rod End
6.	Reel Drive Valve	20.	Pilot Checks, Tilt Rod End
7.	Signal Port To PFC Pump	21.	Tilt Port, CCW
8.	Reel Drive Relief Valve	Fore	Reel Fore Port
9.	Reel Drive Secondary Spool	Aft	Reel Aft Port
10.	Reel Drive Solenoid	Lift	Reel Lift Port
11.	Regulated Pressure Supply	Reel	To Reel Drive Motor
12.	Reel Raise Solenoid	T1	From Reel Drive Motor
13.	Pilot Checks, Aft	T	To Return Filter
14.	Port Relief Valve, Tilt Base End	DR	Not Used

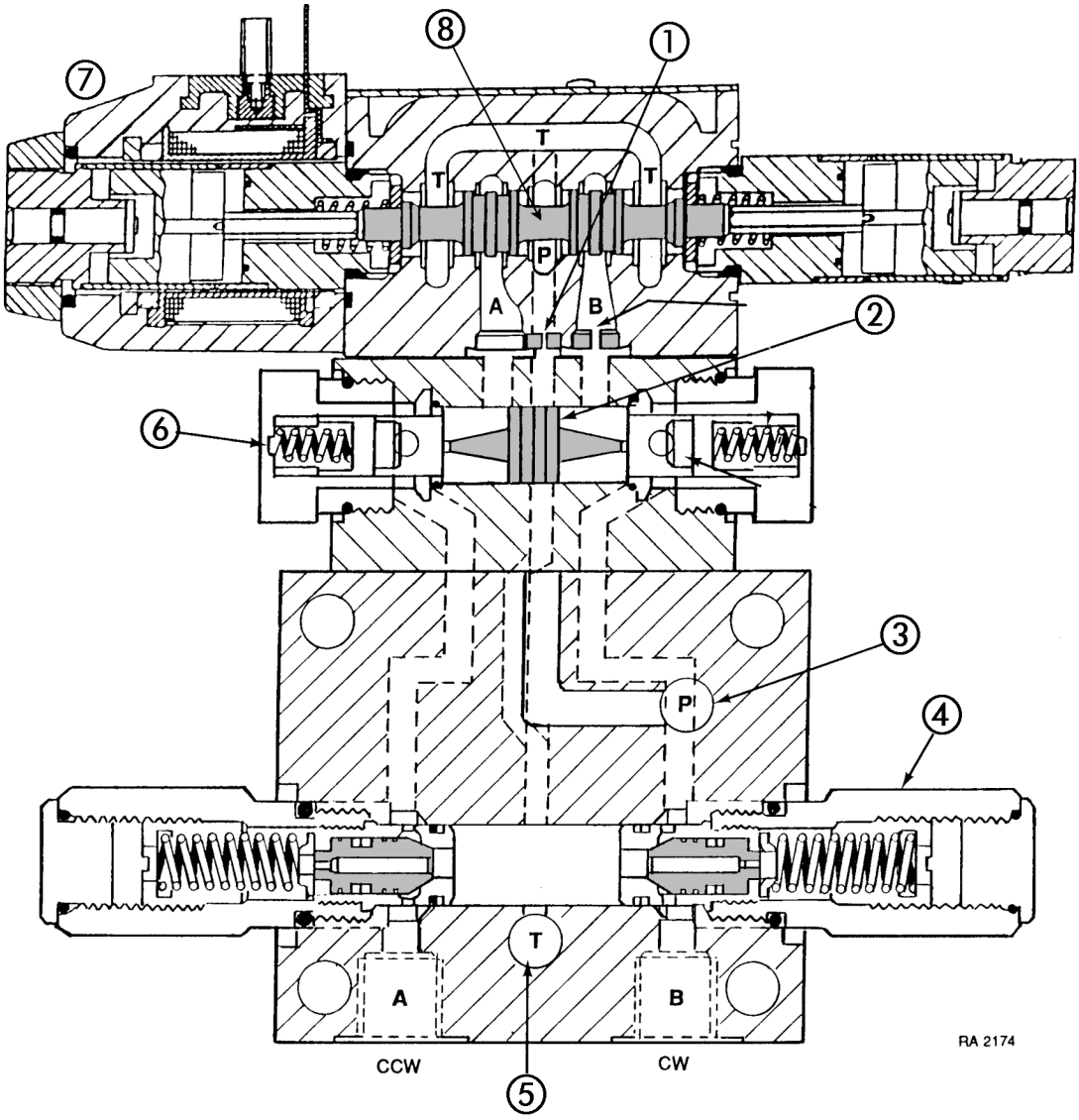
HEADER TILT HYDRAULICS



Use previous page identification tables plus these additional ones.

22.	Reel Drive Signal Check Valve
23.	Pressure Compensator Spool
27.	Orifice check
28.	Orifice check

HEADER TILT HYDRAULICS



1.	Supply Orifice	5.	Tank Return Port
2.	Alternating Poppet	6.	Pilot Check Valves
3.	PFC Pump Supply	7.	Solenoid
4.	Counterbalance Valve	8.	Main Spool

Note: This is a representation of the valve.

IMPORTANT: On occasions the Terrain Tracker may tilt to the right and not return. This can normally be fixed by installing an o'ring and backup rings on the alternating poppet (2). Part 86508168

HEADER TILT HYDRAULICS

The Terrain Tracker valve contains two solenoids, a spring-centered spool, two controlling orifices, two alternating check valves, and two port relief valves. This valve uses direct acting solenoids to shift a spring-centered spool to control the direction of oil flow. The Terrain Tracker valve is an optional attachment and uses a different stack valve assembly then a machine with out header tilt.

NEUTRAL POSITION

When in neutral, the springs on each end of the spool (8) will center the spool in the valve. This blocks flow from the supply passage (1) to prevent accidental activation of Terrain Tracker should another main valve assembly function be energized. Oil is trapped in the cylinder by the pilot check (6) and counterbalance (4) valves. The pilot check valves are used to prevent the Terrain Tracker from drifting.

HEADER TILT HYDRAULICS

NOTE: This explanation reference the tilt schematic on the previous page, and not the valve cutaway drawing.

RIGHT TILT, CW

To make the head tilt CW (right) the solenoid (2) must be energized. In manual mode, a switch located on the propulsion lever is used to energize the solenoids. In automatic mode, the CCM1 Controller will energize the solenoids.

When the head is tilted to the CCW, the solenoid is energized creating a magnetic field in the coil, which pushes the armature. The armature pushes the pin located inside the solenoid. This pin contacts the spool and causes the spool to shift compressing one of the centering springs. This opens a path for oil to flow from the PFC pump to the cylinder. The oil will flow from the PFC pump through a 0.89 mm (0.035 in) orifice, across the spool, out the work port. This flow opens the return side pilot check valve (19) and the signal port check valve (1), flow continues through the 1.09 mm (0.043 in) orifice, opening the pilot check valve (15) and out to the base end of the tilt cylinder extending it. The circuit working pressure is exposed to the signal check valve (1) and directed to the PFC pump compensator to signal the pump to create flow.

The Terrain Tracker valve contains two orifices. A 0.89 mm (0.035 in) orifice is located in the supply port. A 1.09 mm (0.043 in) orifice is located in the extend work port. The orifices work together controlling the speed of header movement.

LEFT TILT, CCW

To make the head tilt left (CW) left tilt solenoid must be energized. In manual mode, a switch located on the propulsion lever is used to energize the solenoids. In automatic mode the header tilt module will energize the solenoids.

When the head is tilted to the left, the Terrain Tracker valve function is the same as when tilted to the left. The only difference is the spool will shift in the opposite direction and return oil will flow through the “A” port of the Terrain Tracker valve.

NOTE: When Terrain Tracker is tilted left or right, the PFC pump will produce the required pressure and flow to complete the operation.

HEADER TILT HYDRAULICS

PORT RELIEF VALVE

Attached to the Terrain Tracker valve are two adjustable simple port relief valves. Which act as circuit cushion and/or thermal reliefs. They limit the amount of pressure trapped between the cylinder and Terrain Tracker valve. The relief valves are set at 206.7 bar (3000 psi). If pressure in the system exceeds this, the valves will open to stabilize the circuit preventing damage to the header should it contact the ground.

OPERATION

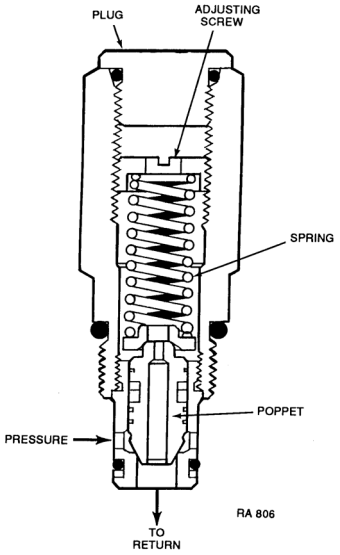
The Terrain Tracker port relief valves are an adjustable simple relief. They contain a hollow poppet, a spring with a ball guide, an adjusting plug, and outer sleeve. The outer sleeve and the poppet have an O-ring and back-up washer to prevent oil from leaking from one port to another.

In the neutral position circuit pressure is directed to the side port of the valve. The poppet isolates the ports from one another. Return circuit oil pressure is directed to the top of the poppet through the hollow center in the poppet. The poppet will remain seated as long as the side pressure does not increase higher than the spring and return circuit back-pressure holding the poppet seated.

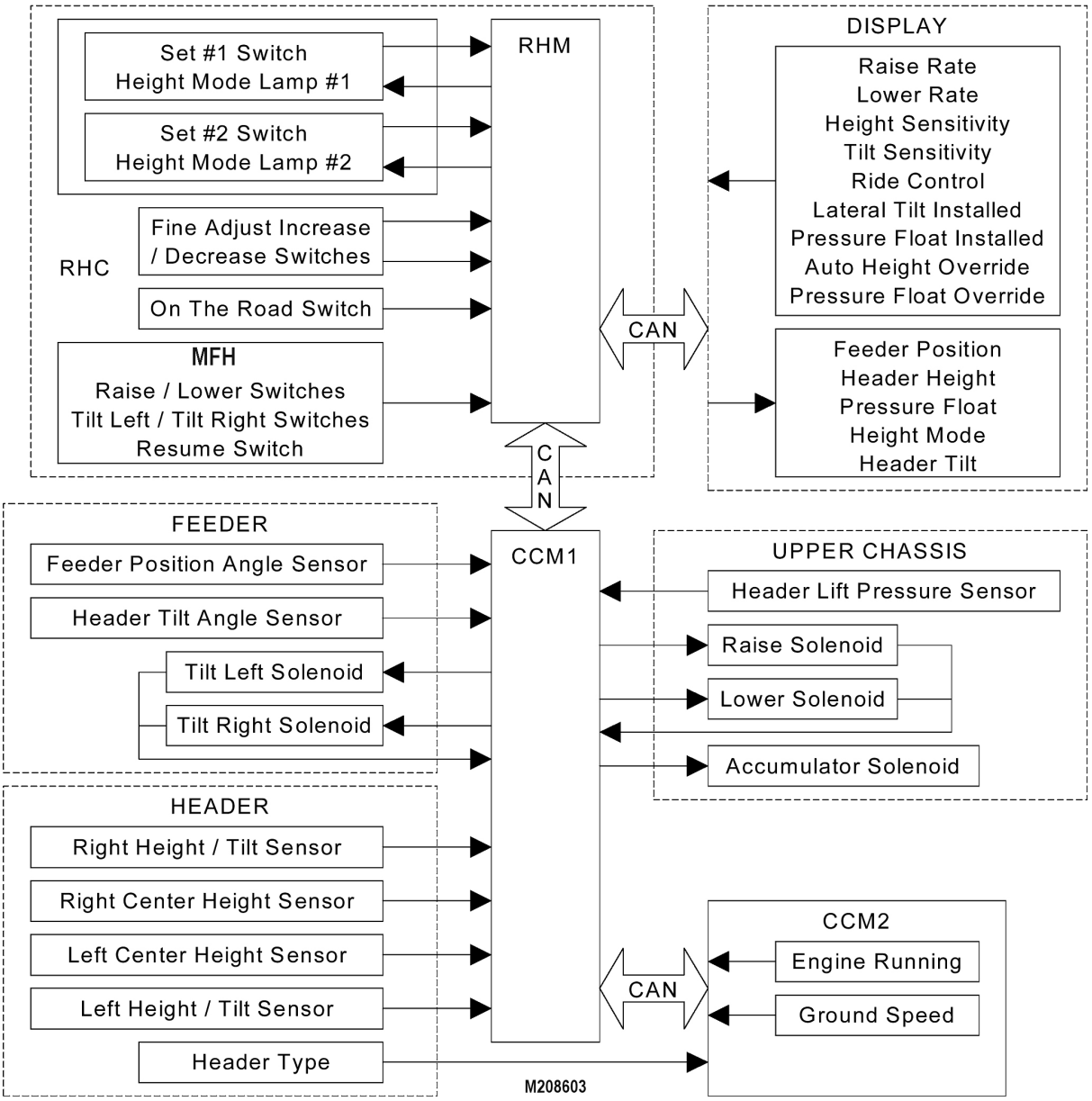
RELIEF OPEN

When the circuit pressure on the side port reaches the relief valve setting 206.7 bar (3000 psi) the valve will open. The oil pressure will cause the poppet to shift against the spring and displace the oil located on the top of the poppet through the hollow center. Oil will be able to flow from the side port, out the bottom, and then to the reservoir. The relief valve will close when the side pressure drops below the spring setting and the return circuit back-pressure.

The relief valves are set from the factory at 206.7 bar (3000 psi). If adjustment of the relief valve opening pressure is needed refer to the testing section.

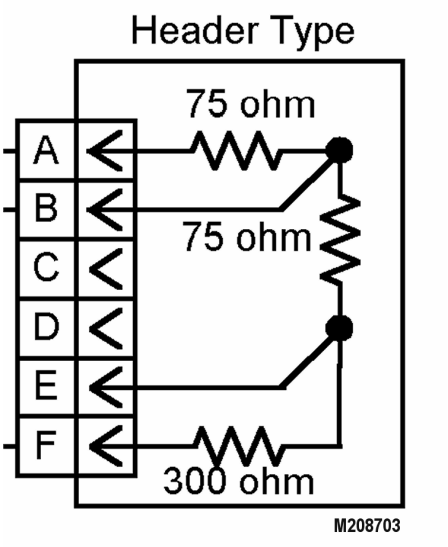


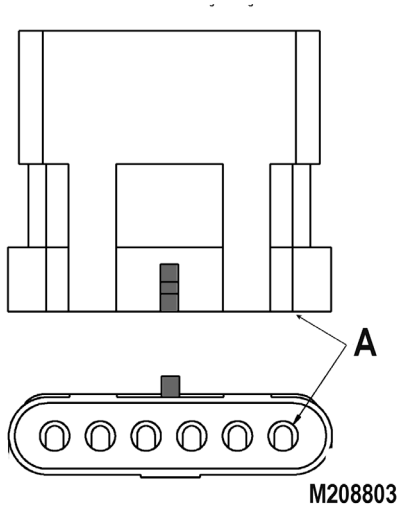
Flow of Information



FLOW OF INFORMATION

HEADER RECOGNITION





The header type sensor is used to recognize the type of header install on the combine. The sensor is wired per machine so that at different volt signal is sent to the CCM2 for identification. The type sensor is housed in a six pin Packard connector body. Mounted on the header close to the main header connector.

HEADER TYPE

	WIRE	Corn	Grain	Draper	Pick-Up	Default	NO Header
PK	5 Volt Supply	A	A	A	F	F	
YE	Signal Wire	B	E	B	E	B	
BK	Ground	F	F	E	A	A	
	Signal Voltage	3.7-4.7V	2.9-3.7V	2.0-2.9V	1.2-2.0V	0.3-1.2V	0.0-0.3V

REMEMBER: Refer to a previous page in this section under “Cab Display>”Items to be Configured” for items the header recognition system handles, plus the following items:

- Feeder Ground Calibration
- Feeder allowable speed range, the actual operating speed for the feeder and reel are saved in the “Harvest Presets”

Header Electrical Operation

REFERENCE

Electrical Schematic Frames: 14, 11

KEY COMPONENTS

RHM, CCM1, DISPLAY, Raise/Lower Solenoids L-11 & 12, Header Position Switch S-70, Feeder Angle Sensor R-03, Relays and Fuses.

GENERAL INFORMATION

The CCM2 and the header lift valve control the Raising and Lowering of the feeder. Feeder lift hydraulics will control the position of the header in relationship to the front axle not to the ground.

The electrical circuits are supplied power from fuses F-38, F-39, F-44, F-45, F-47, F-48 and F-49, and wire CM-096-OR-18, and each controller is chassis grounded.

POWER SUPPLY FUSES

1. F-38, Is supplying power to the CCM1, CCM2, and CCM3 for power.
2. F-39, Is supplying power to from B+ Unswitched power to provide power to the CCM1 terminal J1-1 and the RHM terminal J6-13.
3. F-42, Is supplied power from fuse 38 and supplies power to the RHC controls: On The Road switch, Set #1 / #2 switch and Header Height Increase/Decease switches.
4. F-43, Is supplied power from relay “K24” terminal 5 to provide power to the CCM1 terminal J2-2.
5. F-44, Is supplied power from relay “K24” terminal 5 to provide power to the CCM1 terminal J3-11.
6. F-45, Is supplying power to the Feeder, Rotor, and Rotor Motor speed sensors terminals “A”.
7. F-48, Is supplied power from relay “K26” terminal 5 to provide power to the RHM terminal J6-4, feeder control, separator control, rotor controls and J6-5.

ELECTRICAL OPERATION

GROUNDS

1. Controller CCM1 is chassis grounded through terminal J1-8, J2-18, J2-12 and the mounting hardware.
2. Controller RHM is chassis grounded
3. Switch indicator lamps on the RHC are chassis grounded from terminal 2.
4. The accumulator solenoid is chassis ground through wire 760 BL.

ELECTRICAL OPERATION

MODES OF OPERATIONS

HEADER RECOGNITION, R-20

When the system is powered up the combine needs to recognize the header that is attached to the machine. The information is placed on the data bus for the other controllers to access.

- The CCM2 terminal J3-26 supplies 5 volts to the header connector C032 terminal 12. From the connector C032 the voltage is directed to the “Header Type Sensor”, BUT depending on which header is attached may be directed to different terminals of the sensor, refer to the earlier explanation for “Header Recognition” in this section for proper terminal call outs.
- The sensor is provided a return at connector C032 terminal 13 to the CCM2 terminal J3-18.
- The sensor directs a signal voltage to connector C032 terminal 27 to the CCM2 terminal J3-24.

NEUTRAL, (NO HEADER MOVEMENT)

When there are no commands being given by the operator, information is still flowing to and from system sensor. The controller needs to know the mode of operation that is desired from the operator, so it is looking for information from the header RAISE/LOWER, RESUME, ON The Road and Set switches. It also needs to know where the header currently is within it’s operating range.

The RHM is looking for signals from the MFH:

1. The header RAISE button is supplied power from the RHM terminal J7-B10 and a return to the controller at terminal J7-B6. Since there is no CURRENT flowing the switch must be open.
2. The header LOWER button is supplied power from the RHM terminal J7-B11 and a return to the controller at terminal J7-B6. Since there is no CURRENT flowing the switch must be open.
3. The header RESUME button is supplied power from the RHM terminal J7-B9 and a return to the controller at terminal J7-B6. Since there is no CURRENT flowing the switch must be open.
4. The header tilt RIGHT button is supplied power from the RHM terminal J7-B2 and a return to the controller at terminal J7-B6. Since there is no CURRENT flowing the switch must be open.
5. The header tilt LEFT button is supplied power from the RHM terminal J7-B5 and a return to the controller at terminal J7-B6. Since there is no CURRENT flowing the switch must be open.

ELECTRICAL OPERATION

MODES OF OPERATIONS, CON'T

NEUTRAL, (NO HEADER MOVEMENT), CON'T

The RHM is looking for signals from the RHC

1. The "On The Road" switch is supplied power from fuse F-42 and a return wire to the controller terminal J8-A16. This switch is a momentary switch so the RHM remembers the desired setting the last time the switch was toggled.

The CCM1 is looking for signals from the Sensors.

The CCM1 needs to know where the feeder house is located with in its travel.

1. The CCM1 directs voltage from terminal J2-31 to the "Feeder Position Sensor" terminal 1. The sensor is provided a return from terminal 3 to the CCM1 terminal J2-14 for testing the system. Terminal 2 from the sensor provide a variable voltage to the CCM1 terminal J2-22 as a signal for its current position.
2. The CCM1 directs voltage from terminal J3-26 to the "Header Tilt Position Sensor" terminal 1. The sensor is provided a return from terminal 3 to the CCM1 terminal J3-18 for testing the system. Terminal 2 from the sensor provide a variable voltage to the CCM1 terminal J3-17 as a signal for its current position.
3. The CCM1 directs voltage from terminal J3-25 to the "Pressure Float Sensor" terminal B. The sensor is provided a return from terminal A to the CCM1 terminal J2-14 for testing the system. Terminal C from the sensor provide a variable voltage to the CCM1 terminal J3-25 as a signal for its current position.

The CCM1 Checks the Activation Solenoids.

There should be NO voltage at the solenoids, (header raise / lower, tilt right / left and accumulator) at this time so the CCM1 checks for voltage at the following terminals, J3-1, J3-2, J3-4, J2-4, J2-5, J2-10 and J2-20.

ELECTRICAL OPERATION

MODES OF OPERATIONS, CON'T

HEADER RAISED/LOWERED MANUALLY

Example is for LOWERING the header to establish the working mode of operation with a 2020 flex header.

When the operator installed the header and recognized by the combine, its working parameters were entered. The operator will manually lower the header using the header LOWER command button until the header is at the position the operator desires it to operate at. Feeder must be engaged.

CCM2 will

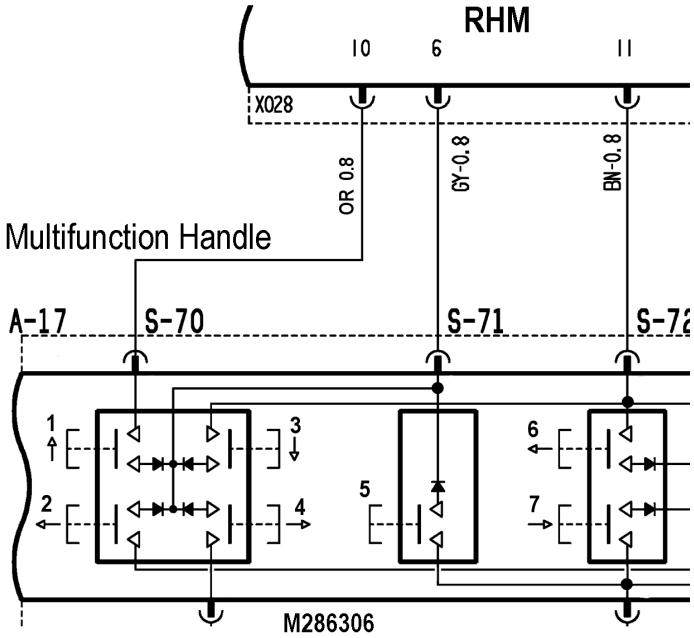
The CCM2 terminal J3-24 will recognize the voltage signal received from the header Type Sensor and place a message on the data bus.

Display will

The Display will place a message on the data bus as to the desired RAISE / LOWER rate.

MFH will

The header position switch S-70 has four sets of contacts to control the header RASIE (1), LOWER (3), TILT LH (2) and TILT RH (4). From the RHM module 12V is supplied out terminals 10 and 11, with a return at terminal 6.



S-70	Header Position Switch
1	Header Raise
2	Tilt Left
3	Header Lower
4	Tilt Right

When the header LOWER switch S-70 is closed, closing the contact at (3) the RHM senses a voltage change at pins 11 and 6. The RHM will transmit a signal on the data bus to lower the header.

ELECTRICAL OPERATION

MODES OF OPERATIONS, CON'T

HEADER RAISED/LOWERED MANUALLY

CCM1 will

The CCM1 determines the direction the header should move and at what speed and directs a PWM power supply to the header LOWER solenoid from terminal J2-5. The CCM1 creates a PWM voltage to vary the lower speed, but as the coil gets hot its internal resistance increases, causing less current to flow, which will change the raise speed. The CCM1 monitors the return wire for current flow, changing the PWM voltage to maintain the same current flow, which should maintain the same magnetic strength of the solenoid.

The CCM1 will monitor the feeder angle sensor R-03 to determine it present location and to provide the operator with location information. The sensor is supplied a 5V supply from CCM1 terminal J2-31 to terminal 3, a return ground from terminal 1 to the CCM1 terminal J3-18. The signal wire from terminal 2 is directed to the CCM1 terminal J2-22.

RHM will

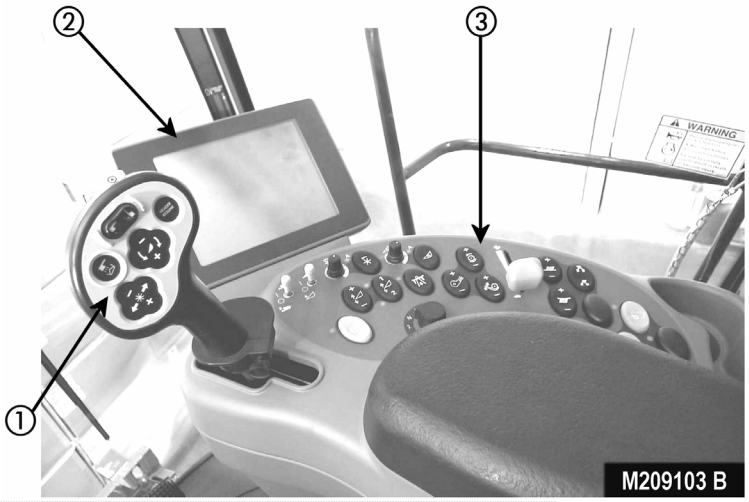
Once the operator has placed the header at the desired operating position, he will release the LOWER button. The operator will signal the system by pressing the SET# 1 switch S-04 on the RHC. The SET# 1 switch will direct a voltage signal to the RHM terminal connector X029 terminal 3, the RHM will place a message on the data bus to log this position.

CCM1

As the header is lowering the module is monitoring the return signals from the Feeder Position sensor at terminal J-22, the Auto Header Height sensors at terminal J3-22 and J3-24 and the Float Pressure sensor at terminal J3-25. If **ONLY** the **Feeder Position** sensor changes the system will operate in RTC mode. If the **Auto Height** sensor(s) records a movement the system will operate in **AUTO Header Height** mode. If the **Float Pressure** sensor record ZERO pressure the system will operate in **Header Float** mode. The CCM1 will record the current position of sensors to determine where to return the header to when the RESUME button is pressed.

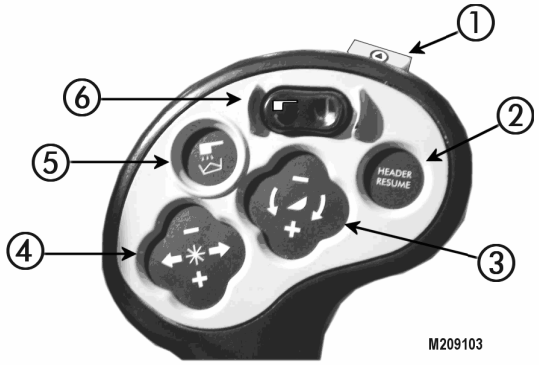
REMEMBER: The operate can then place the header at a different operating position and press the SET# 2 switch for its operating location. The operator can then toggle between the two operating locations.

Reel Operation



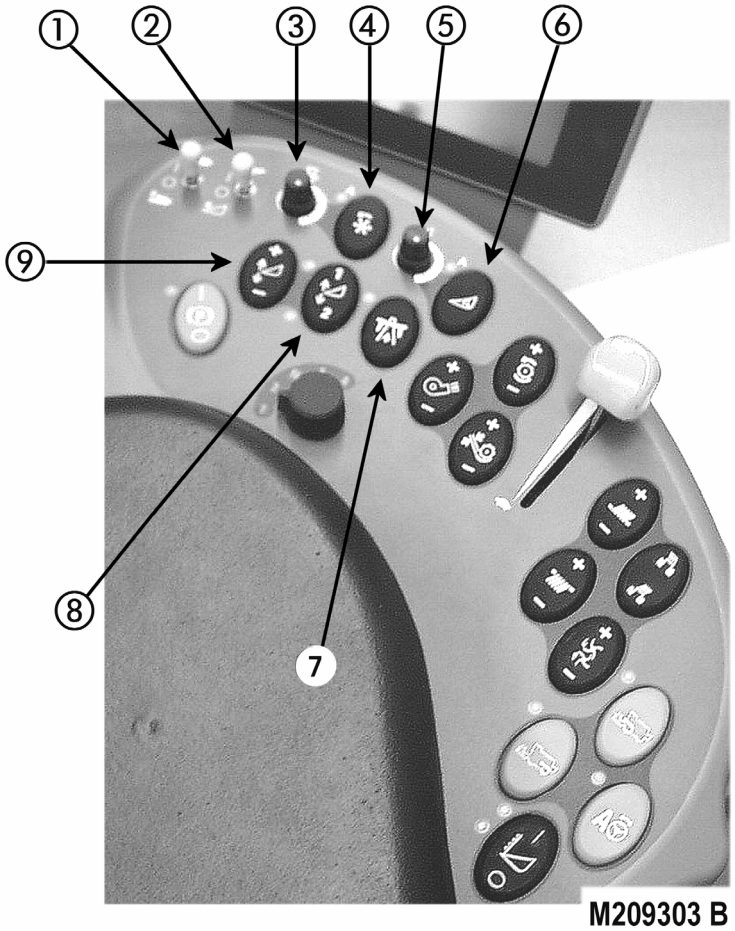
OPERATOR CONTROL CENTER

1.	Mulit-Function Handle, MFH
2.	Cab Display
3.	Right Hand Console, RHC



MULTI-FUNCTION HANDLE

1.	Feeder Stop
2.	Resume
3.	Header Raise/Lower Tilt Right/Left
4.	Reel Raise/Lower, Fore/Aft
5.	Unloader Engagement
6.	Unloader Swing



RIGHT HAND CONSOLE

(RHC)

1.	Separator Engagement
2.	Feeder Engagement
3.	Reel Speed Control
4.	Auto Reel Speed Control
5.	Feeder Speed Control
6.	Auto Feeder Control
7.	Road Switch
8.	Set Switch
9.	Header Position INCREASE/DECREASE Switch

REEL OPERATION

REEL SPEED CONTROL

Reel Speed Control may be operated in Manual or Automatic speed control.

- The Reel Speed Selector switch is used to select the mode of reel operation.
- The Reel Speed Control is used to select the reel speed Manual mode or the reel off-set in Automatic mode.

MANUAL MODE

In the Manual mode, by rotating the Reel Speed Control, the CCM2 uses PWM to power the reel drive solenoid on the reel drive control valve. The greater the PWM allowed for the reel drive control valve, the stronger the magnetic field created by the solenoid. This magnetic field shifts the primary spool in the reel drive control valve. The selected speed will remain constant and will not vary with combine ground speed. The reel should normally be operating approximately 8 RPM for each 1 MPH, or appear to be synchronized with the ground speed. On most machines the reel will probably be able to be slowed down almost enough to stop it.

AUTOMATIC SPEED CONTROL

The Automatic Reel Speed Control function is to change the speed of the reel proportionately to changes in combine ground speed. A reel that is rotating too slow or fast is inefficient and tends to cause excessive shatter loss. The automatic mode also incorporates a minimum reel speed feature to permit the reel to turn when the combine is not moving. This feature allows the reel to feed material into the header without requiring the operator to move the Reel Speed Selector switch to Manual.

In the automatic mode the Reel Speed Control is not used to control the speed of the reel as in manual mode, but is instead used to set the offset of the reel speed. No offset would be a setting at the mid-point of the control. At the mid-point setting, the reel would ideally be rotating 10% faster than the ground speed. Offset is increased as the control is adjusted above the mid-point setting and is reduced as the control is adjusted below the mid-point setting. When setting the offset control the reel should appear to be running a little faster then the ground speed.

When operating in the Auto Reel speed mode and the header is raised above the set point, (the height that the acre counter is turned OFF or ON), the reel speed will remain constant. The reel speed will remain at the speed it was operating at when the header was raised, regardless of the ground speed. When the header is lower below the set point the reel speed will return to Auto Reel speed operation.

When in AUTO mode and ground speed 0 MPH, reel MINUMM speed control set to 0 MPH, the reel will remain turning at approximately 10 RPM ± 10 RPM.

REEL OPERATION

REEL SPEED CONTROL, CON'T

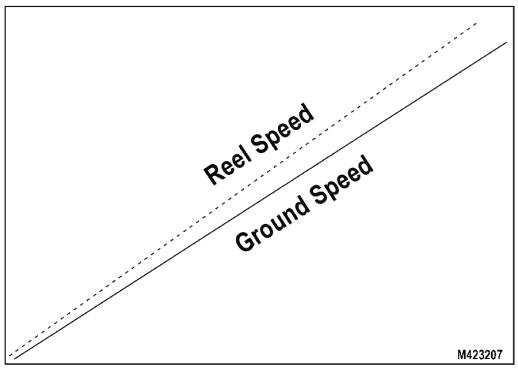
CONFIGURING THE AUTO REEL CONTROL

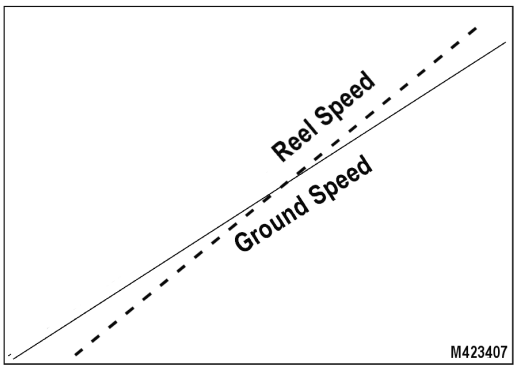
The reel speed may be controlled in an automatic speed control mode where reel speed will vary as a function of ground speed.

To use the reel auto mode, the operator needs to be familiar with several terms:

1) **Minimum Reel Speed** – Is the slowest speed the reel will turn at while in auto mode. The reel will turn at this speed even when standing still. The speed is set on the display and is a MPH. A suggested speed would to be to start with a setting that would be approximately 1-1.5 MPH less then the slowest cutting speed. If the speed is set too slow it will take longer to reach operating speed when starting forward motion. To make an adjustment, using the cab display navigate using MAIN>TOOLBOX>HEAD 2.
2) **Reel Speed Slope** – The reel speed slope sets the ratio between ground speed and reel RPM. Due to different types of headers, different reel drive motors and different reel drive valves; the ratio may not always be correct. In theory if the reel is operating at a ratio of 1.3 to the ground speed it should be the same at slow ground speed and fast ground speed, but this may not happen. The reel slope range is from 100 which equates to 1:1 ratio to 190 which equates to 1.9:1. To make an adjustment, using the cab display navigate using BACK>TOOLBOX>HEAD 2.

INCORRECT REEL SPEED SLOPE, (RATIO)





TYPICAL STARTING POINTS

HEADER TYPE	SETTING	EQUALS
Corn	100	1.0:1
Grain	120	1.2:1
Pickup	120	1.2:1
Draper	160	1.6:1

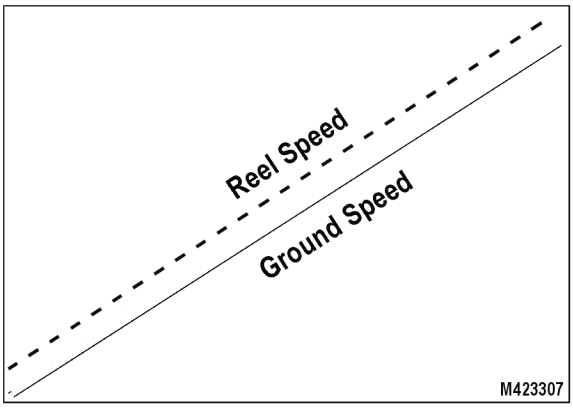
These settings are recalled by the type sensor signal.

REEL OPERATION

REEL SPEED CONTROL, CON'T

CONFIGURING THE AUTO REEL CONTROL

3) **Reel OFF-Set** - Sets the amount of Over Speed the reel will operate at. A constant value that is added or subtracted (based on the control setting) from the current reel speed in auto reel mode. This constant is adjusted through the reel speed potentiometer during auto reel mode and the offset is ZERO when the control is set mid-point. Settings above or below the mid-point increase or respectively decrease the reel speed above or below the corresponding ground speed ratio. To make an adjustment, use the reel offset knob on the right hand console.



REEL OPERATION

REEL SPEED CONTROL, CON'T

The control sequence used to engage the reel auto mode is:

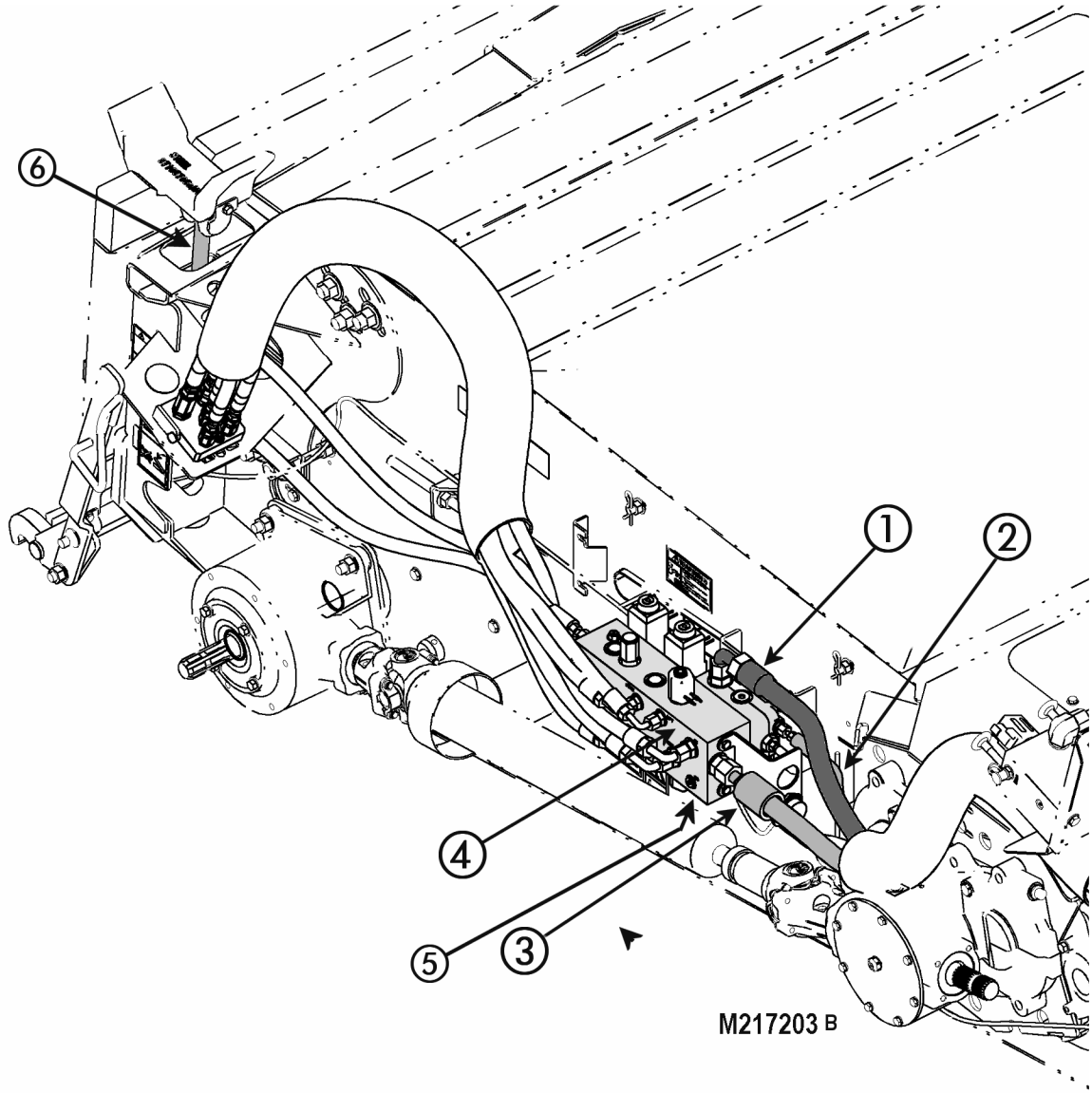
1) Combine stopped, ground speed Zero
2) Disable reel auto mode by toggling the Reel Control Switch so that the LED indicator is NOT illuminated.
3) If the header that is installed is equipped with a HEADER TYPE sensor verify that the HYDRAULIC reel is selected or manually DEFINE the header. This setting is made on the display under: MAIN>TOOLBOX>HEADER1.
4) Set the minimum reel speed. To make this setting the operator will have to navigate to MAIN>TOOLBOX>HEADER2. As a preliminary setting, start with the MINIMUM speed set for approximately 1-1.5 MPH less then the normal cutting speed.
5) Engage separator, feeder.
6) Select ground speed range, engine high idle, park brake off, handle forward
7) Set the reel speed control knob FULLY CCW and fine tune the speed as cutting begins. The reel should appear to be synchronized with the ground speed.
8) Engage reel auto mode by toggling the reel control switch so that the LED is illuminated. When the switch is toggled there MAY be a reel speed change because the reel speed knob no longer control the reel speed, but the OFF set.

Note: Reel will turn at minimum reel speed until ground speed has reached minimum set speed PLUS reel offset speed.

REEL OPERATION

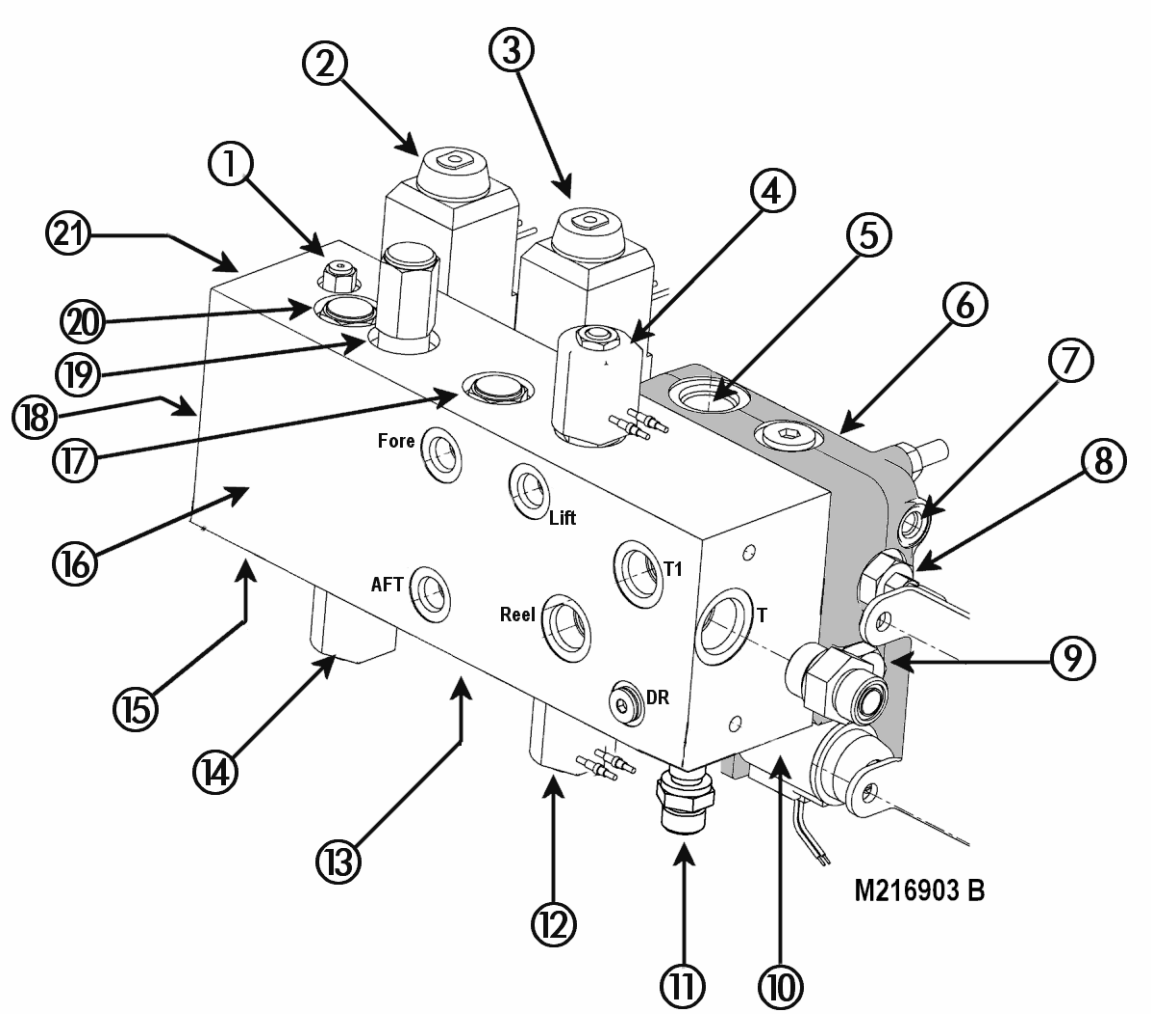
REEL DRIVE OPERATION

FEEDER STACK VALVE



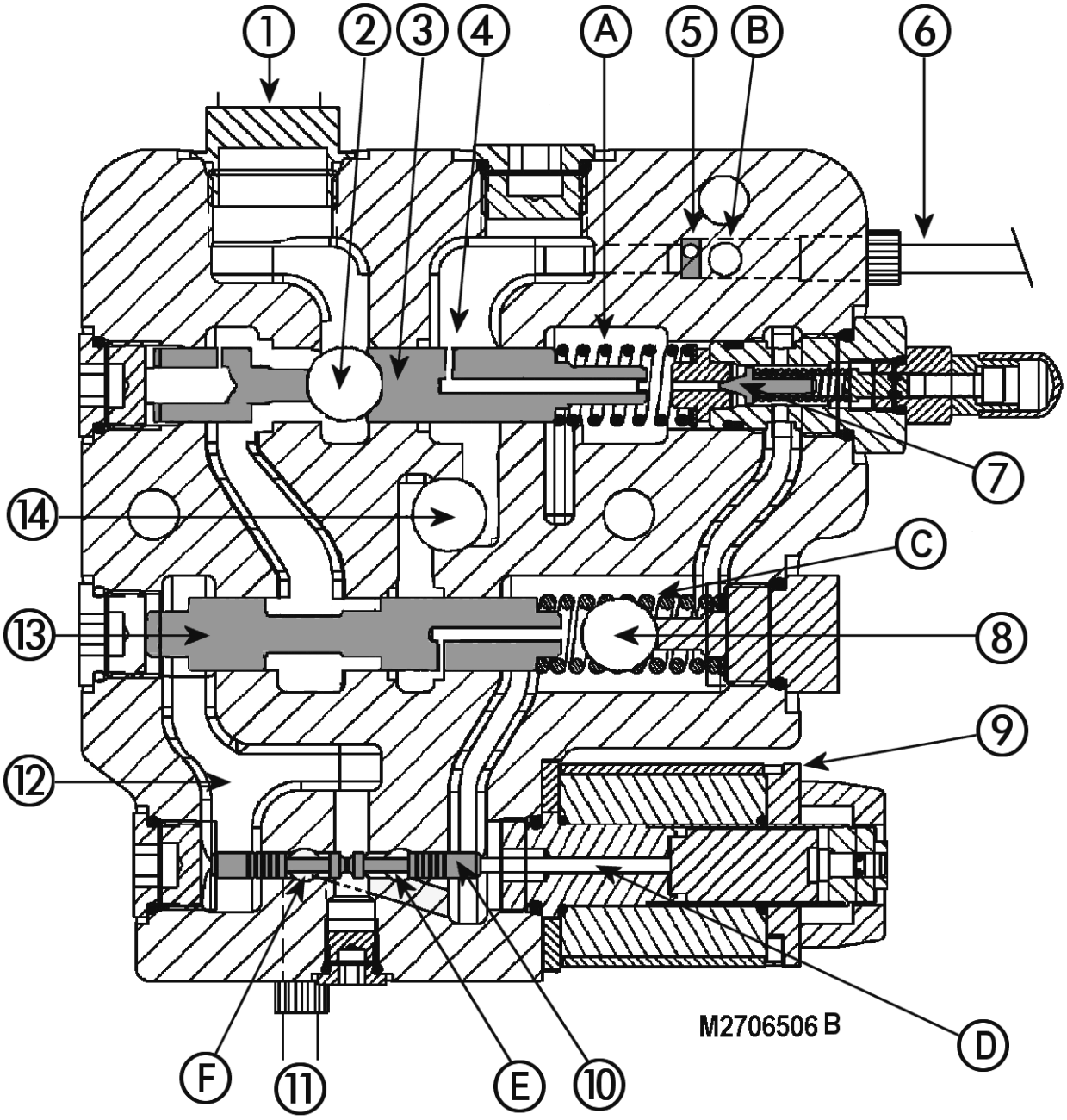
1.	Main Supply To Valve	4.	Feeder Stack Valve
2.	Signal Line To PFC Pump	5.	Regulated Pressure form Park Brake Valve
3.	Main Return to Return Filter	6.	Tilt Cylinder

REEL OPERATION



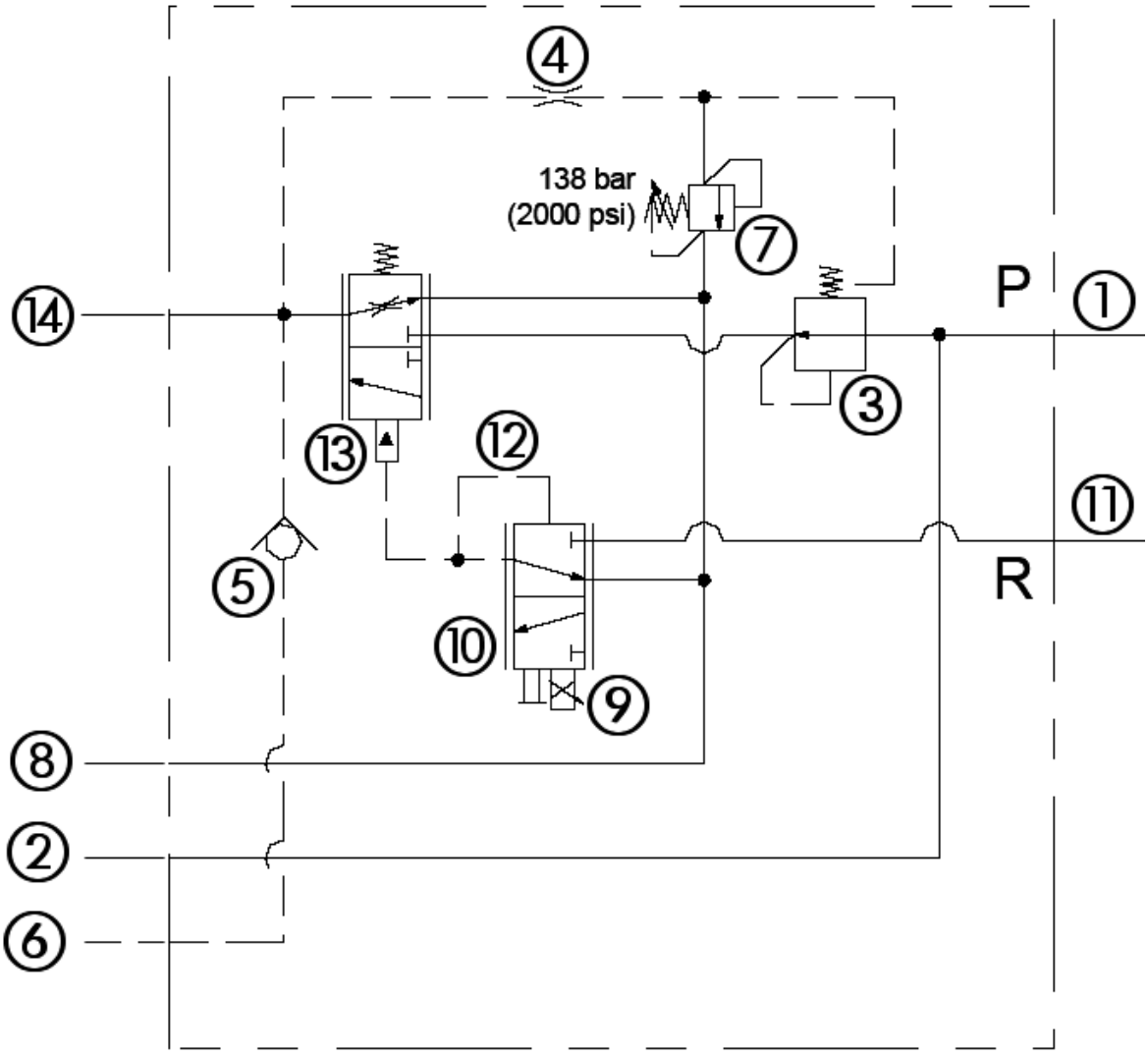
1.	Tilt Signal Check Valve	15.	Pilot Checks, Tilt Base End
2.	Tilt Solenoid, CW	16.	Manifold Body
3.	Reel AFT Solenoid	17.	Pilot Checks, Fore
4.	Reel Lower Solenoid	18.	Tilt Port, CW
5.	Main Supply Port for Stack Valve	19.	Port Relief Valve, Tilt Rod End
6.	Reel Drive Valve	20.	Pilot Checks, Tilt Rod End
7.	Signal Port To PFC Pump	21.	Tilt Port, CCW
8.	Reel Drive Relief Valve	Fore	Reel Fore Port
9.	Reel Drive Secondary Spool	Aft	Reel Aft Port
10.	Reel Drive Solenoid	Lift	Reel Lift Port
11.	Regulated Pressure Supply	Reel	To Reel Drive Motor
12.	Reel Raise Solenoid	T1	From Reel Drive Motor
13.	Pilot Checks, Aft	T	To Return Filter
14.	Port Relief Valve, Tilt Base End	DR	Not Used

REEL OPERATION



1.	PFC Pump Supply	8.	Valve Drain	A.	Spring
2.	Flow to Header Valve	9.	Solenoid	B.	Tilt Valve Signal Port
3.	Pressure-Compensating Spool	10.	Pilot Spool	C.	Spring
4.	Orifice to Relief Valve	11.	Regulated Oil Supply	D.	Pin
5.	Signal Check Valve	12.	Pilot Passage	E.	Regulated Oil Port
6.	Signal Line	13.	Main Spool	F.	Pilot Port Drain
7.	Relief Poppet	14.	Motor Work Port		

REEL OPERATION



M2706606

1.	PFC Pump Supply	8.	Valve Drain
2.	Flow to Header Valve	9.	Solenoid
3.	Pressure-Compensating Spool	10.	Pilot Spool
4.	Orifice to Relief Valve	11.	Regulated Oil Supply
5.	Signal Check Valve	12.	Pilot Passage
6.	Signal Line	13.	Main Spool
7.	Relief Poppet	14.	Motor Work Port

REEL OPERATION

REEL DRIVE HYDRAULICS

REFERENCE MATERIAL:

General Hydraulic Section for “PFC Pump Operation” and “Regulated Pressure” Hydraulic Schematics

KEY COMPONENTS:

Reel Drive Valve, Signal Check Valve, PFC Pump

GENERAL INFORMATION

The reel drive valve is a closed-center pressure-compensated valve located on the left-hand side of the feeder, assembled to the inward side of the feeder valve stack. The reel drive valve contains three spools: a pressure-compensating spool (3), a pilot spool (10), and main spool (13). The reel valve receives oil from the PFC pump in two forms: regulated pressure (11) (that is maintained by the park brake valve) to control valve and PFC pump flow (1) to operate the reel motor. The valve achieves pressure compensation through the use of a pressure-compensation spool. The pressure-compensation spool maintains a constant pressure drop across the main spool (center) by sensing inlet pressure (PFC pump pressure) and reel drive pressure (work pressure) of the main spool and is set by the compensator spring (A). The reel valve also has an external adjustable relief (7). Located in the end of the solenoid (9) is a manual override button for use as a diagnostic tool, not to run the reel when the solenoid coil has failed. As the button moves, it shifts the primary spool inside the valve to activate the reel drive motor.

The operator selects Manual or Automatic Speed Control mode to control reel speed. The CCM2 uses Pulse-Width Modulation (PWM) to power the reel drive solenoid on the reel drive control valve. The greater the PWM allowed for the control valve the stronger the magnetic field created by the solenoid. The magnetic field shifts the pilot spool allowing pilot pressure to hold the main spool at a constant setting in the Manual mode or to adjust proportionally to ground speed in the Automatic Speed Control mode.

REEL OPERATION

Reel Drive Hydraulics, con't

OPERATION

NEUTRAL (SOLENOID DE-ENERGIZED)

Before the combine is started, the pressure-compensating spool (3) is spring biased (A) to direct total flow to the main spool. The main spool (13) are spring biased (C) to prevent any flow reaching the motor work port. When the combine is started, oil from the PFC pump (1) flows to the reel drive valve. The flow is directed around the pressure-compensating spool and dead headed at the reel drive main spool. Pressure will start to build in the system. The pressure-compensating spool has a cross drilling on the non-spring end. This drilling will allow a build- up of pressure on the backside of the spool to shift it against the spring. The pressure compensating spool spring is a 20 bar (300 psi) spring. This means the spool will not shift until there is at least 20 bar (300 psi) of pressure on the non-spring end of the pressure-compensating spool. When the pressure-compensating spool shifts against the spring, the flow of oil to the main spool is blocked.

SOLENOID ENERGIZED

When the feeder is engaged and the header configuration call for a reel drive, the CCM2, (using PWM) controller will activated the reel drive solenoid (9). As current is sent to the solenoid, a magnetic field is created causing the pin (D) in the solenoid to push the pilot spool (10). Regulated oil (E) from the pilot spool is directed to the non-spring end of the main spool (13). The build-up of oil will cause the main spool to shift against the spring (C). As the main spool shifts, it opens the port (14) to the reel drive motor. As PFC flow is directed to the reel drive motor it is also exposed to the signal check valve (5). The same work pressure that is required to operate the reel drive motor is also directed back the PFC pump compensator (6) to command the PFC pump. When the port is open, there is a momentary drop in pressure on the non-spring end of the pressure-compensating spool (3). This allows the spring (A) to shift the spool to the left and send oil to the reel drive motor. Oil is also directed through the signal channel (4) to the spring-end of the pressure compensation spool. A 0.64 mm (0.25 in) orifice is located within the signal channel. When the reel drive motor demand is satisfied the pressure will start to build on the non-spring end of the pressure-compensating spool. This pressure will build until it is 20 bar (300 psi) greater than the demand required by the reel drive motor. When the pressure reaches this point the pressure-compensating spool will shift against the spring and the work pressure on the spring side of the spool. The pressure-compensating spool will restrict the inlet flow to the main spool.

REEL OPERATION

Reel Drive Hydraulics, con't

RELIEF VALVE

The reel drive valve has an adjustable pilot operated relief (7) located within the valve. This relief valve should be set at approximately 147 bar (2100 psi) (it may be set between 62-147 bar (900-2100 psi)) and will protect the reel drive circuit from over pressurization. When the reel is in operation, the oil pressure sent to the reel drive motor is also sent through the signal channel (4) to the relief valve. If the system pressure exceeds the relief valve setting the pilot poppet of the relief will become unseated. Oil from the spring end of the pressure-compensating spool (3) will drain to the reservoir (8). This drop in pressure on the spring-end of the spool will allow the spool to shift against the spring and stopping the flow of oil through the pressure-compensating spool to the main spool. The 0.64 mm (0.25 in) orifice located in the signal channel is used to provide the pressure differential needed between the non-spring end and spring-end of the pressure-compensating spool when the system is on relief.

SHUT-DOWN (SOLENOID DE-ENERGIZED)

When the solenoid (9) is de-energized, the pilot spool (10) shifts, blocking the supply of regulated oil (E) to the pilot channel (12). At the same time it opens the pilot channel passage for oil on the non-spring end of the main spool to return to the reservoir (F). The spring (C) on the main spool will shift the spool closing the supply of oil to the reel drive motor. When the main spool shifts completely, an orifice located in the spool is exposed. This orifice allows oil from the spring-end of the pressure-compensating spool to bleed to reservoir. The orifice also allows the oil pressure in the reel drive motor circuit to bleed to the reservoir. This will allow for easier operation of the quick couplers and prevent reel creep if oil leaks by the main spool.

REMEMBER: If the steering system is sluggish or hard, inspect the reel drive signal check valve (5) for leakage. This has been know to leak which causes the steering signal to be leaked to the reel drive system.

REMEMBER: If checking for reel operation, the valve should be able to deliver approximately 13gpm at the fastest RPM setting.

REEL OPERATION

REEL DRIVE ELECTRICAL

REFERENCE MATERIAL:

Electrical Frames: #12, #11, #25, #09

KEY COMPONENTS:

Reel Selector Switch S-08, Reel Speed Control R-22, RHM, CCM2, DISPLAY, Resistor Module R-23, Ground Speed Sensor B-17

REMEMBER: The reel will NOT operate with out the feeder being engaged.

REEL SPEED MANUAL MODE

When the operator toggles the reel selector switch so that the indicator lamp is NOT illuminated the reel speed will be totally controlled by the reel speed control. The RHM will determine that the operator wants to operate the reel speed manually, and monitors the position of the reel speed control for the desired speed.

The RHM connector X026 terminal 16 supplies 5V to the resistor module terminal F. The module provides power to the reel and feeder speed potentiometers. The module is used to provide a voltage change at the potentiometer with having an excessive amount of current flowing. The resistor module directs the 5V out terminal E to the speed control potentiometer terminal A. The potentiometer is provided a return through terminal C back to the resistor module, out terminal A to the RHM connector X027 terminal 6. The signal wire from the speed potentiometer terminal B is directed to the RHM connector X027 terminal 9. As the voltage changes at terminal 9 the RHM places a message on the data bus for the desired speed.

The CCM2 will pickup the message and direct a PWM voltage out connector X017 terminal J3-2 to the main feeder stack valve connector X021 terminal E for the reel drive solenoid. The solenoid is provided a chassis ground out terminal F to the front grounding point (2).

REEL OPERATION

REEL DRIVE ELECTRICAL, CON'T

REEL SPEED AUTO MODE

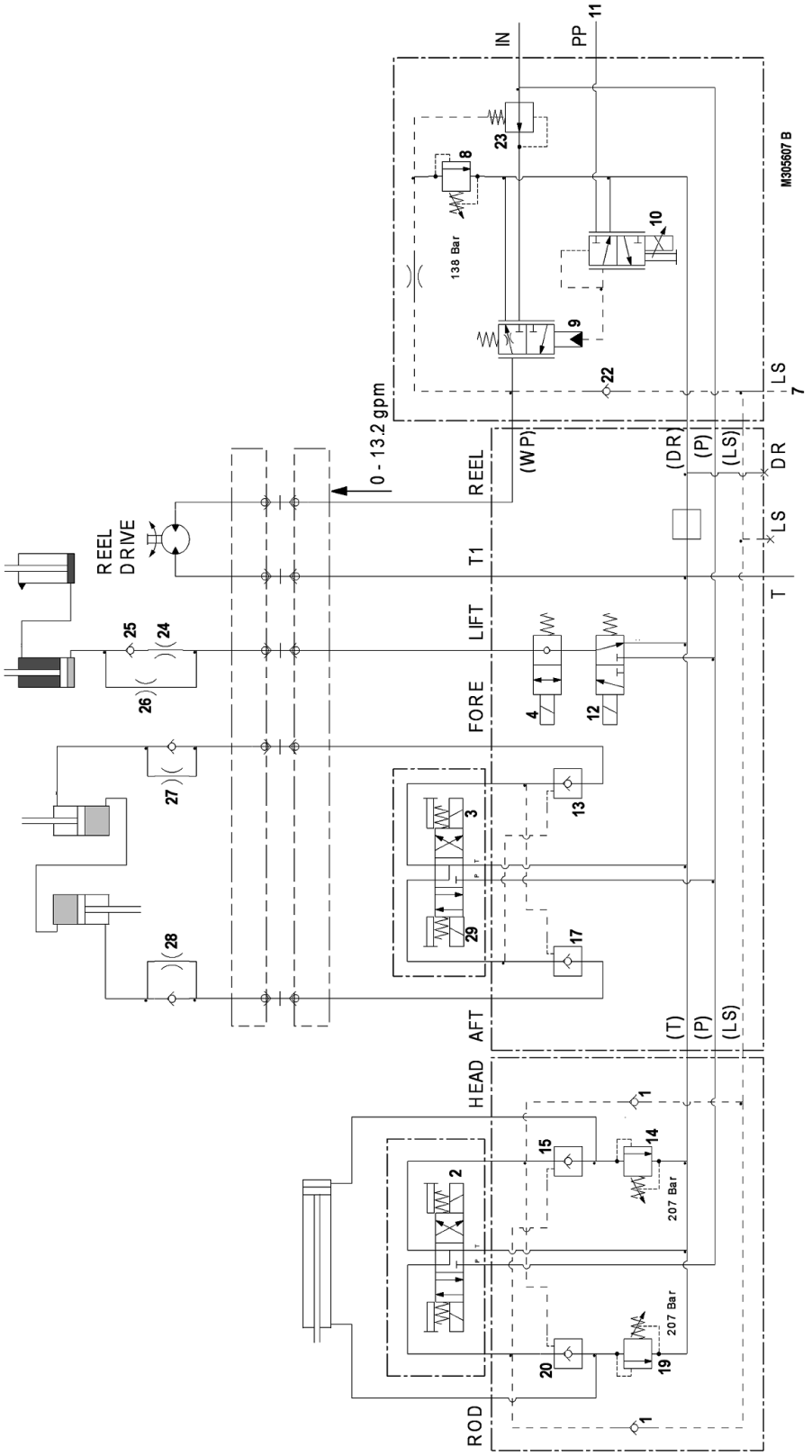
When the operator toggles the reel selector switch so that the indicator lamp IS illuminated the reel speed will be totally controlled by the RHM and CCM2. The RHM will determine that the operator wants to let the combine control the reel speed automatically, and monitors the position of the reel speed control for the desired amount of OVER or UNDER speed.

The reel selector switch is supplied 12V from the RHM, when the operator momentarily presses the switch a voltage signal is directed to the RHM connector X029 terminal 10. When the RHM senses this momentary voltage it will provide a ground from connector X027 terminal 15 for the indicator lamp so that it will illuminate. The RHM will then determine the position of the reel speed control, recognizing that the control is now providing information on the amount of reel drive OVER or UNDER speed desired. The RHM places the message on the data bus.

The CCM2 will pickup the desired reel speed message and comparing it against the ground speed that it is receiving from the ground speed sensor at connector X017 terminal J3-14. The CCM2 will direct a PWM voltage out connector X017 terminal J3-2 to the main feeder stack valve connector X021 terminal E for the reel drive solenoid. The solenoid is provided a chassis ground out terminal F to the front grounding point (2).

REEL OPERATION

REEL POSITION OPERATION



Use previous page identification tables plus these additional ones.

3.	Reel FORE Solenoid
4.	Reel Lower Solenoid
12.	Reel Raise Solenoid
13.	Pilot Checks, Aft
17.	Pilot Checks, Fore
22.	Reel Drive Signal Check Valve
23.	Pressure Compensator Spool
24.	Reel Lower Orifice
25.	Check Valve
26.	Reel Raise Orifice
27.	Reel Fore Speed Control Orifice
28.	Reel Aft Speed Control Orifice
29.	Reel AFT Solenoid
Aft	Reel Aft Port
Fore	Reel Fore Port
Lift	Reel Lift Port
P	PFC Supply Port
T	To Return Filter

REEL OPERATION

REEL POSITION HYDRAULICS

REFERENCE MATERIAL:

General Hydraulic Section for “PFC Pump Operation”
Hydraulic Schematics

KEY COMPONENTS:

Reel Drive Valve, Reel Raise and Lower Valve, Reel Fore/Aft Valve, Signal Valve, PFC Pump

REEL RAISE

When the operator press the reel position switch to RAISE the reel the CCM2 will activated:

- the signal valve to place the PFC pump on HIGH pressure stand-by
- the reel RAISE solenoid to give the oil some where to go

When the reel raise solenoid (12) is activated the valve will shuttle against the return spring and direct full PFC pump flow to the reel lift cylinders. The reel raise speed is controlled by orifice (26) located at the reel MASTER lift cylinder. When raising the flow will hold the check valve (25) on its seat, forcing the flow to go through the orifice plate.

REEL LOWER

When the operator press the reel position switch to LOWER the reel the CCM2 will activated ONLY the reel LOWER solenoid, the reel is lower by its own weight.

When the reel lower solenoid (4) is activated the valve will shuttle against the return spring, opening the reel MASTER cylinder to the tank port (T). The reel LOWRE speed is controlled by orifice (24 and 26) located at the reel MASTER lift cylinder.

Location: Orifices are located at the header

REEL OPERATION

REEL POSITION HYDRAULICS, CON'T

Reel Fore/Aft Neutral

When the Fore/Aft is not being activated the reel is held in place by two load check valves, (17 and 13). If either of the valve should leak the reel could drift Fore or Aft.

REEL FORE

When the operator press the reel position switch to move the reel FORE, the CCM2 will activated:

- the signal valve to place the PFC pump on HIGH pressure stand-by
- the reel FORE solenoid to give the oil some where to go

When the reel FORE solenoid (3) is activated the valve will shuttle against the return spring and direct full PFC pump flow through the load check valve (13) and also through a pilot line to mechanically open the return load check valve (17). The flow continues to the Fore/AFT cylinders. The movement speed is controlled by orifice (26) located at the reel right hand cylinder. The return flow will hold the check valve (28) on its seat.

REEL AFT

When the operator press the reel position switch to move the reel AFT, the CCM2 will activated:

- the signal valve to place the PFC pump on HIGH pressure stand-by
- the reel AFT solenoid to give the oil some where to go

When the reel FORE solenoid (29) is activated the valve will shuttle against the return spring and direct full PFC pump flow through the load check valve (17) and also through a pilot line to mechanically open the return load check valve (13). The flow continues to the Fore/AFT cylinders. The movement speed is controlled by orifice (18) located at the reel left hand cylinder. The return flow will hold the check valve (26) on its seat.

Location: Orifices are located at the header

REEL OPERATION

REEL POSITION ELECTRICAL

REFERENCE MATERIAL:

Electrical Frames: #12, #11, #25, #09
Refer to the Electrical Section to understand the operations of the MFH switch.

KEY COMPONENTS:

Reel Position Switch S-74, Position Solenoids L-13-L16, MFH, RHM, CCM2, Header Type Sensor R-20, DISPLAY, Signal Valve L-43

GENERAL OPERATION

The reel may be moved in any one of four directions, UP/DOWN/FORE/AFT, to promote crop feeding into the header. The Fore/Aft function can be reassigned, through the display, when using a Draper header to control the header angle and on a Corn header to control the stripper plate adjustment.

REEL RAISE

When the operator momentarily presses or holds the reel position switch to RAISE the reel the RHM will place a message on the data bus for as long as the switch is held. The reel will raise at a speed that is controlled by the orifice in the valve body. The RAISE button is the “+” sign.

The RHM will direct voltage from connector X028 terminal 4 to the MFH switch S-74 terminal 9, the switch is also supplied a common return wire back to the RHM connector X028 terminal 7. When the operator press the RAISE portion of the switch the RHM senses the voltage change on terminals 4 and 7 at connector X028. The RHM places a message on the data bus.

The CCM2 take the message and directs a 12V power out connector X017 terminal J3-12 to the main stack valve connector X022 terminal 1 to activated the signal valve. The signal valve is used to command the PFC pump to high pressure stand-by. The CCM2 also directs 12V power to the feeder stack valve connector X021 terminal R to activate the reel RAISE solenoid. The RAISE solenoid is provided a return to the chassis ground point (2) from the terminal S.

REEL LOWER, FORE, AFT

The operations for the other reel positions is the same as the reel raise, just different solenoids are used. Reel Lower does not use the signal valve, it drops by the weight of the reel only. The LOWER button is the “-“, FORE is the “<” and the AFT is the “>” signs.

REEL OPERATION

REEL POSITION ELECTRICAL, CON'T

HEADER TYPE SENSOR

When the CCM2 recognizes a header with a Type Sensor installed may reassign the reel Fore/Aft control to different functions. To the operation of the hydraulic and electrical function there is no change, just the function that the operator is attempting to accomplish.

Corn Head

When a corn head is attached that has been configured with movable stripper plates, the Fore/Aft will be used to move the stripper plates. If the head is configured with out moveable stripper plates the control switch will NOT function.

Draper Head

When a draper head is attached that is configured with hydraulic adjusting header angle (guard angle) the Fore/Aft will ALSO be used to change the header angle. The operator will use the MFH shift switch to change the mode from Fore/Aft to Header Angle.

Reel Vertical/Horizontal Position Sensor

REFERENCE MATERIAL:

Electrical Frames: #13

KEY COMPONENTS:

Reel Vertical Position Switch R-25 and Horizontal Position Sensor R-24

GENERAL OPERATION

The reel may be equipped with a vertical and horizontal position sensors, which would be used with the “Headland Mode” in EUR. When set correctly the reel will automatically move to a preset position while in Headland mode, this is used for cleaning the head of loose material.

OPERATION:

Vertical

The CCM2 will direct 5V out connector X017 terminal J3-26 to the vertical position sensor R-25 terminal X436 terminal A. The sensor is supplied a return from terminal B. The sensor’s signal wire, terminal C is directed to the CCM2 connector X017 terminal J3-25. The sensor will provide a variable voltage as the reel is moved.

Horizontal

The CCM2 will direct 5V out connector X017 terminal J3-26 to the horizontal position sensor R-24 terminal X437 terminal A. The sensor is supplied a return from terminal B. The sensor’s signal wire, terminal C is directed to the CCM2 connector X017 terminal J3-32. The sensor will provide a variable voltage as the reel is moved.

Trouble Shooting



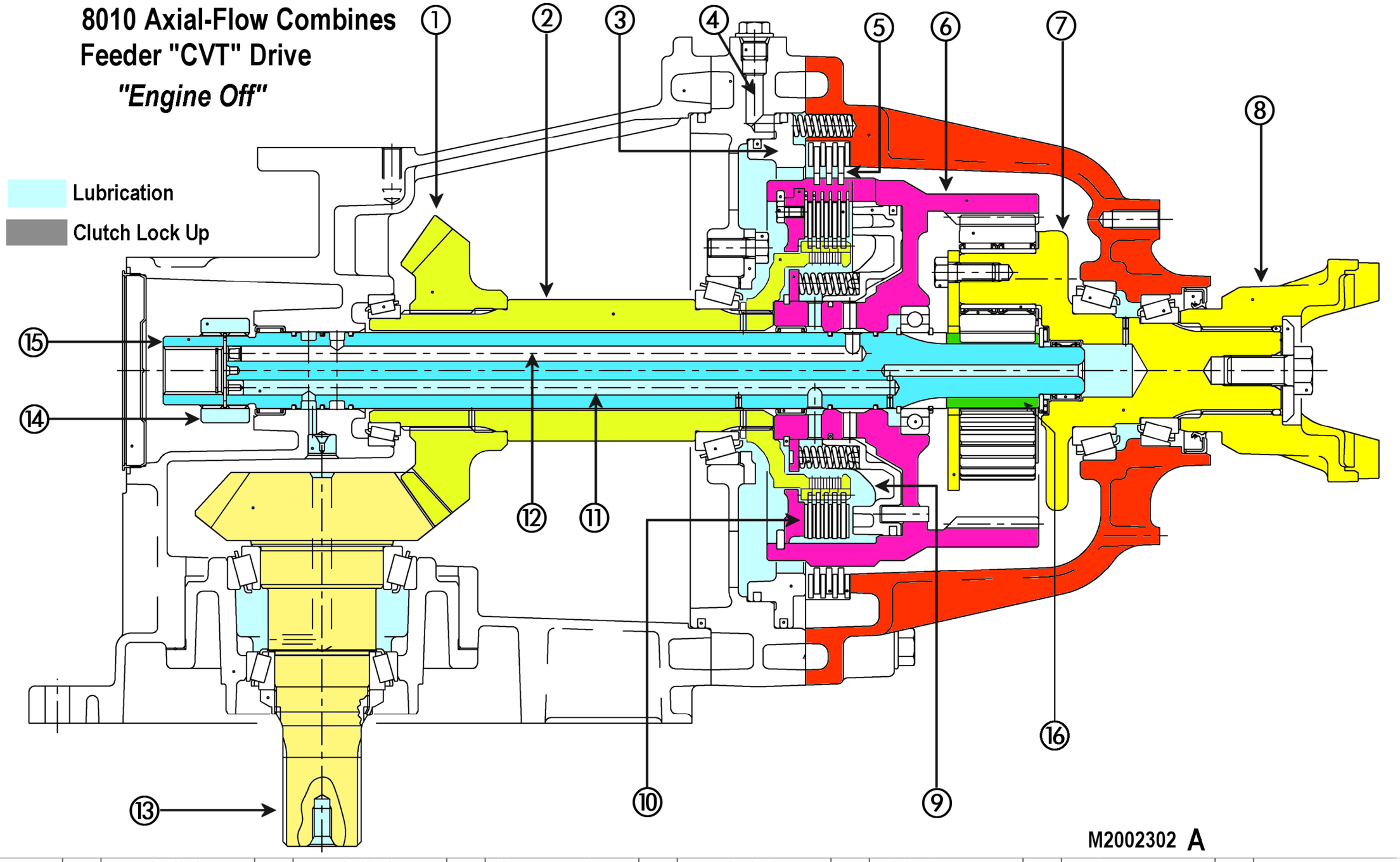
Wait a Minute... Wait a minute, how can I trouble shoot a system that incorporates mechanical drives, electrical circuits and hydraulic circuits?

The most challenging part of repairing any operation is determining which part of the operation has failed as quickly as possible, but without overlooking any possibilities. Your first test must be able to verify whether the problem is in the electrical circuit, hydraulic circuit or the mechanical components.

First verify if a fault code is being displayed. If so, follow the explanation associated with the fault code. If not, make your first test with a voltmeter where electrical power controls mechanical power, "The Solenoid", to verify voltage is being supplied and a ground provided.

- ✓ If voltage and ground is supplied, the electrical circuit is not the main problem. Look at the hydraulic or mechanical circuit.
- ✓ If voltage and/or ground is not being supplied, then you must correct the electrical circuit first before moving on to the hydraulic and/or mechanical circuits.
- ✓ What other components are supplied the same hydraulic supply that is supplying the feeder drive circuits? Are they working? Check regulated pressure.
- ✓ Check for stuck control spools, plugged orifices, open relief valves, etc.

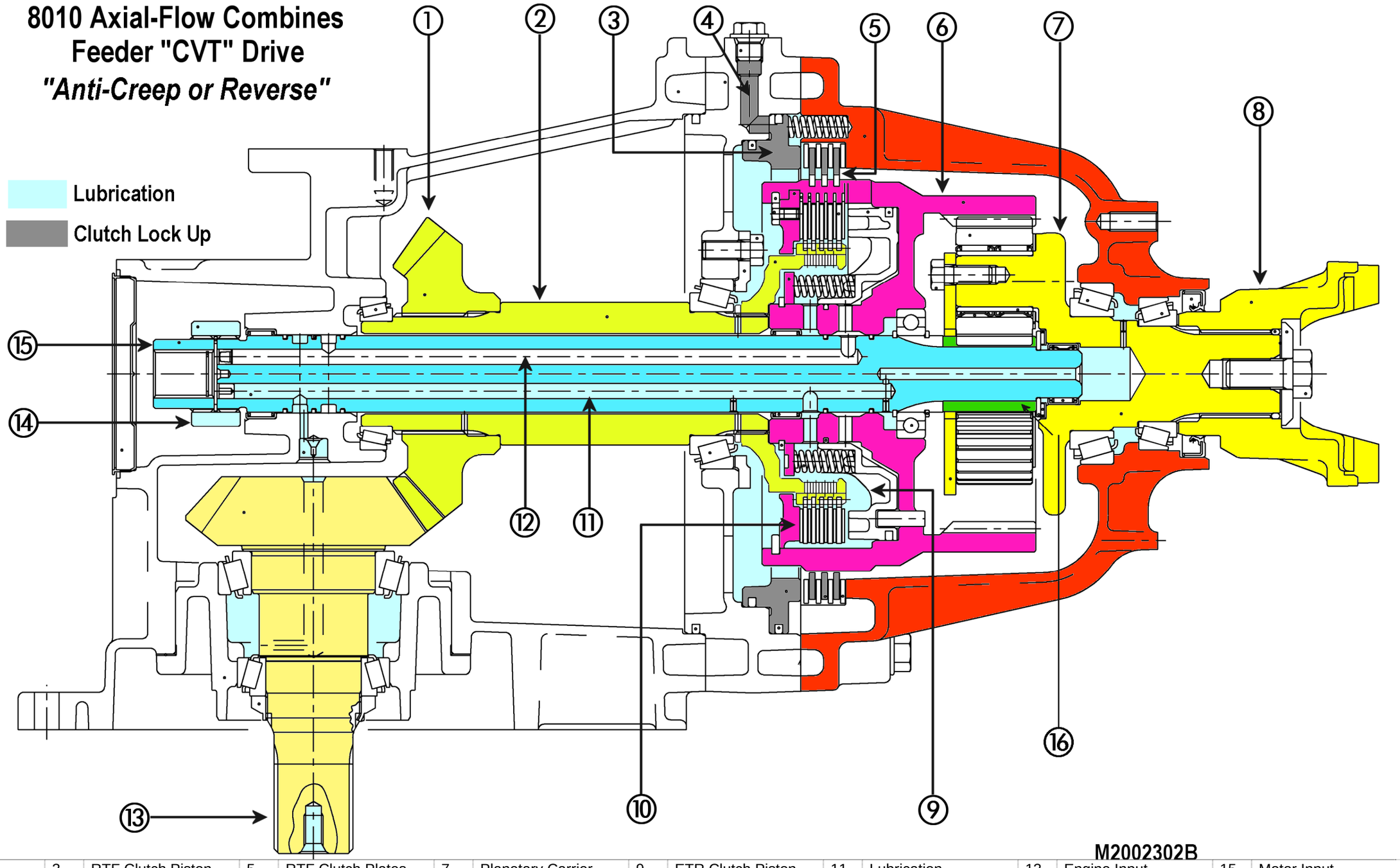
8010 Axial-Flow Combines
Feeder "CVT" Drive
"Engine Off"



M2002302 A

1.	Gear Set	3.	RTF Clutch Piston	5.	RTF Clutch Plates	7.	Planetary Carrier	9.	ETR Clutch Piston	11.	Lubrication	13.	Engine Input	15.	Motor Input
2.	Drive Shaft	4.	Lock-Up RTF Clutch	6.	Ring	8.	Out Put Yoke	10.	ETR Clutch Plates	12.	Lock-Up ETR Clutch	14.	Coupler	16.	Sun Gear

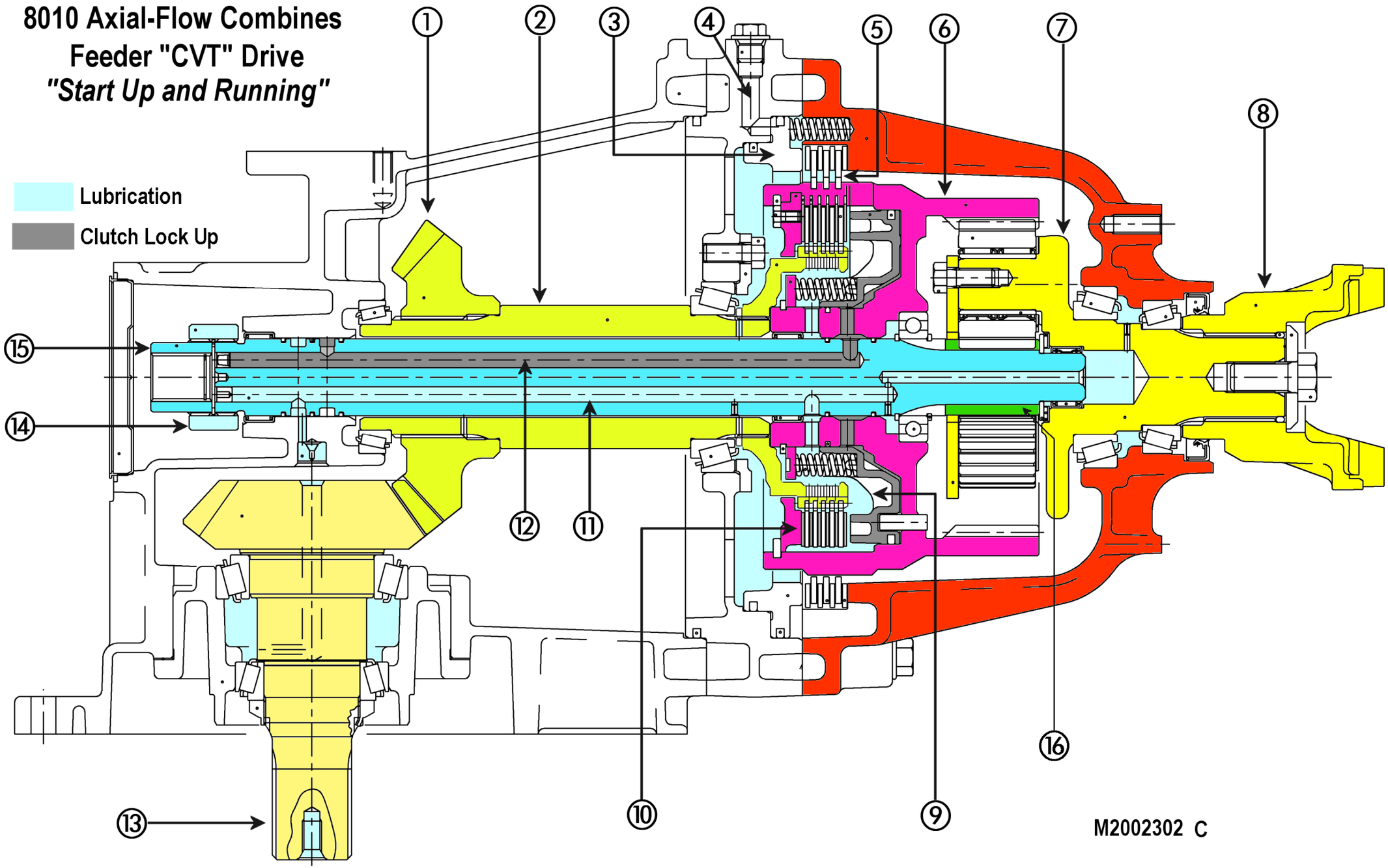
8010 Axial-Flow Combines
Feeder "CVT" Drive
"Anti-Creep or Reverse"



M2002302B

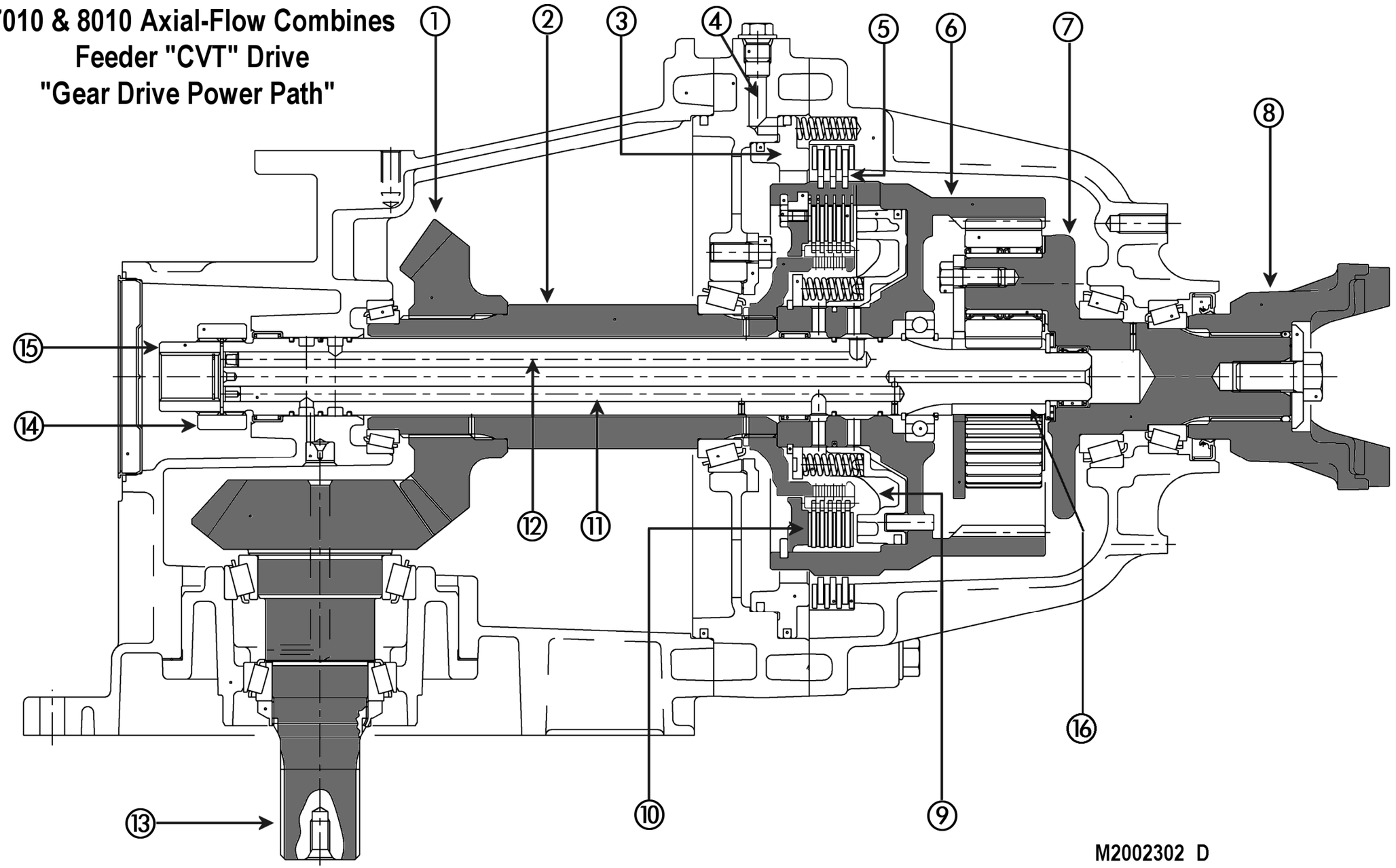
1.	Gear Set	3.	RTF Clutch Piston	5.	RTF Clutch Plates	7.	Planetary Carrier	9.	ETR Clutch Piston	11.	Lubrication	13.	Engine Input	15.	Motor Input
2.	Drive Shaft	4.	Lock-Up RTF Clutch	6.	Ring	8.	Out Put Yoke	10.	ETR Clutch Plates	12.	Lock-Up ETR Clutch	14.	Coupler	16.	Sun Gear

8010 Axial-Flow Combines
Feeder "CVT" Drive
"Start Up and Running"



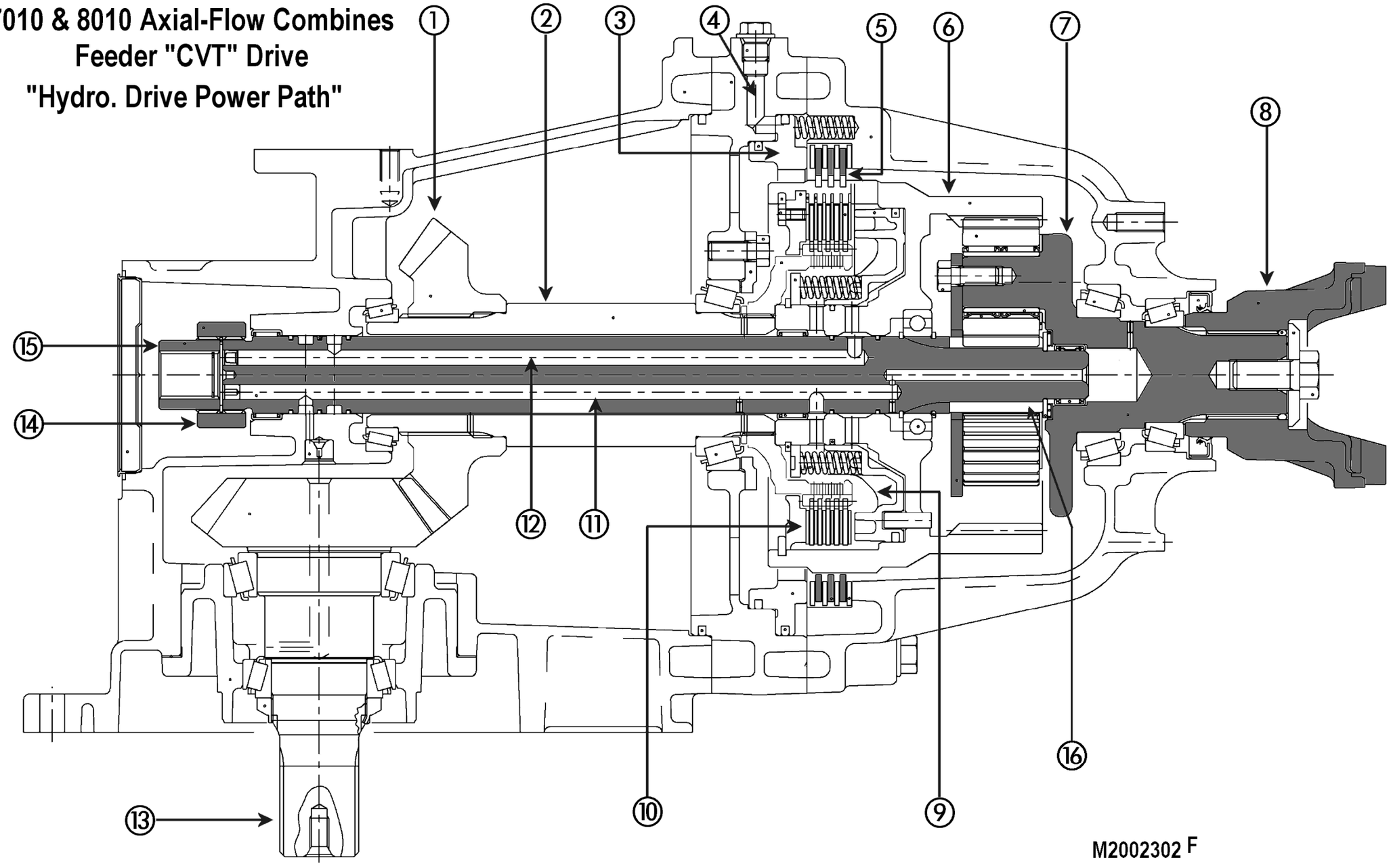
1.	Gear Set	3.	RTF Clutch Piston	5.	RTF Clutch Plates	7.	Planetary Carrier	9.	ETR Clutch Piston	11.	Lubrication	13.	Engine Input	15.	Motor Input
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7010 & 8010 Axial-Flow Combines
Feeder "CVT" Drive
"Gear Drive Power Path"



1.	Gear Set	3.	RTF Clutch Piston	5.	RTF Clutch Plates	7.	Planetary Carrier	9.	ETR Clutch Piston	11.	Lubrication	13.	Engine Input	15.	Motor Input
2.	Drive Shaft	4.	Lock-Up RTF Clutch	6.	Ring	8.	Out Put Yoke	10.	ETR Clutch Plates	12.	Lock-Up ETR Clutch	14.	Coupler	16.	Sun Gear

7010 & 8010 Axial-Flow Combines
Feeder "CVT" Drive
"Hydro. Drive Power Path"



1.	Gear Set	3.	RTF Clutch Piston	5.	RTF Clutch Plates	7.	Planetary Carrier	9.	ETR Clutch Piston	11.	Lubrication	13.	Engine Input	15.	Motor Input
2.	Drive Shaft	4.	Lock-Up RTF Clutch	6.	Ring	8.	Out Put Yoke	10.	ETR Clutch Plates	12.	Lock-Up ETR Clutch	14.	Coupler	16.	Sun Gear

CASE IH

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 – 9120 SERIES AXIAL-FLOW COMBINE



SECTION 63 FIXED FEEDER DRIVE OPERATION

Form 5175 1/2010

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RACINE, WI 53404
U.S.A.

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Feeder Gearbox ---- 15
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Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

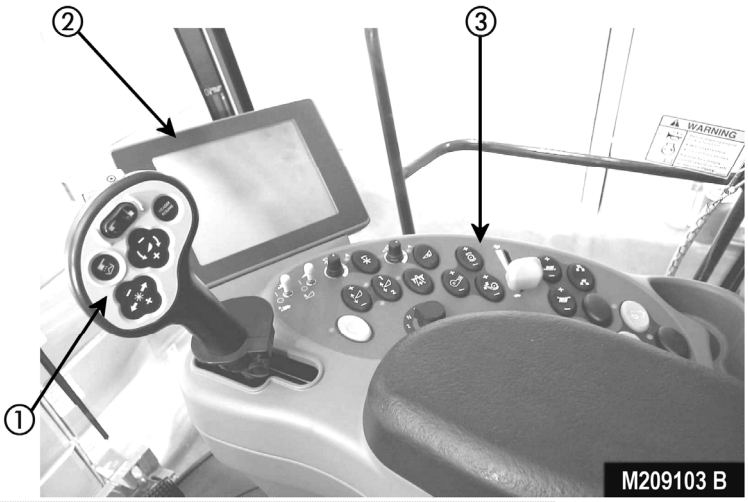
SPECIFICATION

ID#	COMPONENT			RESISTANCE: OHMS AT 70°F (25°C)
Feeder drive speed as listed at the Header Drive shaft				
	Forward	570 PRM		
	Reverse	80 PRM		
Relief Valve Setting				
	Reverser Relief Valve	3200-3350 PSI	220-230 bar	
Solenoid Specification				
	Forward Clutch			6.4 ohms
	Reverse Clutch			9.2 ohms
	Reverser Motor			6.4 ohms

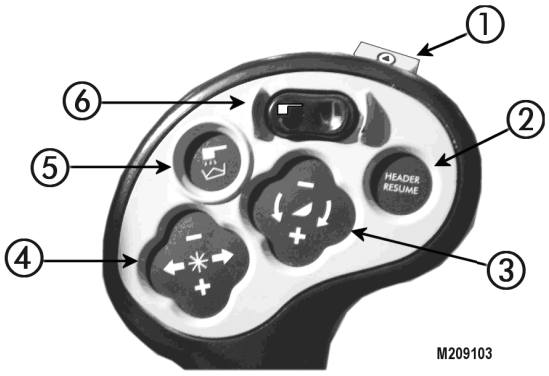
General Information

The AFX combine may be equipped with a fixed speed feeder/header drive unit, the fixed speed unit may be more cost efficient where corn is not a primary crop. The fixed speed unit will provide for a constant header speed of 570 RPM and a Reversing operation that is similar to the unit used on the 2300's combines.

Operator's Controls

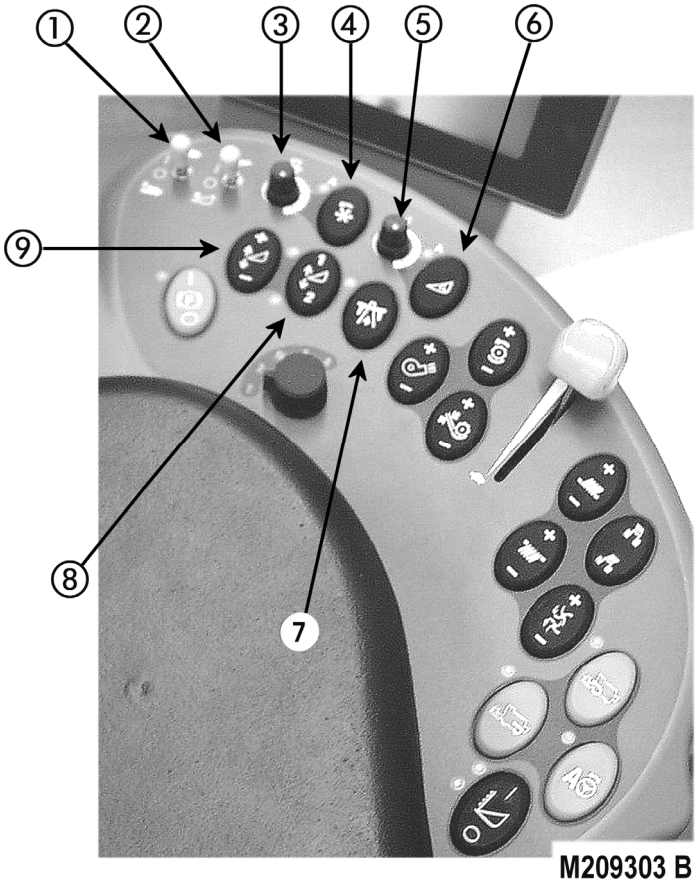


OPERATOR CONTROL CENTER	
1.	Mulit-Function Handle, MFH
2.	Cab display
3.	Right Hand Console, RHC



MULTI-FUNCTION HANDLE

1.	Feeder Stop
2.	Resume
3.	Header Raise/Lower Tilt Right/Left
4.	Reel Raise/Lower, Fore/Aft
5.	Unloader Engagement
6.	Unloader Swing



RIGHT HAND CONSOLE

(RHC)

1.	Separator Engagement
2.	Feeder Engagement

OPERATOR'S CONTROLS

Universal Display

The cab display will be used for providing feeder operational information to the operator.

Feeder Stop

The Emergence Stop (yellow) provides the operator a means to disengage the feeder drive with out removing their hand form the multi-function handle.

Feeder Engagement

The Feeder engagement switch provides the operator a means to engaged, disengage and reverse the feeder drive.

FEEDER DRIVE OPERATIONS

HOW SHOULD THE FEEDER DRIVE SYSTEM OPERATE?

The feeder drive has very specific operating requirements and must operate in one of five modes at all times. The system is in control of all feeder operations, maintaining RPM, monitoring, troubleshooting and warnings.

MODES OF OPERATION

IDLE

- Immediately after the operator has started the engine, electrical power is applied to the CCM1 controller and the feeder should be at rest. The Forward clutch is disengaged but the REVERSE clutch is engaged (if feeder speed is below 50 RPM) to assure the feeder is at zero speed and the feeder switch is in the "**OFF**" position.
- The operator will have placed the feeder control switch into the **OFF** (center-detented) position the feeder should not be powered and must not creep.

Calibration

The calibration mode provides the ability for the electronics to learn clutch fill times and current required to activate the Forward clutch solenoid. The calibration mode is activated through the display unit. These values are stored in non-volatile memory. Calibration should be done at least once every harvest season and upon pump or clutch replacement.

Forward

When the operator places the feeder control switch into the forward detented position, the feeder will be started by activating an acceleration mode to start and bring the feeder up to RPM, assuming all constraints have been met. The electrical system will activate the Forward clutch to start the feeder turning. The clutch will be modulated to provide a smooth engagement, bring the feeder up to a direct gear drive speed of 570 RPM at 2100 engine RPM within 2 seconds. The electronics will monitor the actual feeder chain speed and recalculate for the cab display to display header speed.

Reverse

The feeder reverser permits the operator to rotate the feeder and header in reverse to free a stalled feeder chain or header. The REVERSE drive motor provides all driving force. The operator will hold the feeder engagement switch in the reverse position, (rearward momentary position). The reverse drive speed will be maintained at 80 RPM by a flow control orifice in the motor circuit. When the feeder is cleared the operator will release the switch, and the switch will return to the **OFF** position, (center detented position).

Passive Deceleration

When the feeder is above 50 RPM and the feeder switch is placed into the "OFF" position, the Forward clutch is disengaged placing the feeder in the passive deceleration state.

SYSTEMS OPERATION

The entire feeder drive system consists of a PTO, Forward clutch and Feeder gearboxes, Hydraulic Motor, feeder engagement switch, Feeder speed sensor, and electronic controls.

Feeder status and fault warning data will be regularly conveyed to the operator by way of the In Cab Display Unit.

Feeder operation is controlled in four different modes; Disengaged (**OFF**), Engage (**ON**), Reverse and Calibration. When the feeder engagement command is given by the operator the feeder will engaged by:

Engagement (ON)

1. The rear ladder must be in the home position (**UP**), the seat switch must be closed, separator and feeder switches **OFF** and the feeder at less then 50 RPM.
2. The operator will place the separator switch into the **ON** position.
3. The operator places the feeder switch into the forward detented **ON** position.
4. The Reverse clutch will disengage, releasing the unit to freely rotate.
5. The Forward clutch will engage to connect the engine gear drive to the drive gearbox output shaft. The clutch solenoid will be activated using PWM to provide for a smooth engagement. The Forward clutch will provide the feeder direct gear drive from the engine.

REMEMBER If the separator and feeder are both engaged and the separator ONLY is disengaged, the feeder will also disengage. If the rotor is engaged with the feeder switch already in the engaged position the feeder will not reengage. The feeder switch must be engaged or recycled after the rotor is engaged.

The feeder may be engaged at any time once the separator switch has been moved to the **ON** position AND the feeder speed is BELOW 50 RPM.

SYSTEMS OPERATION

REVERSE

1. Places the feeder switch into the REVERSE position (rearward momentary position).
2. The REVERSE clutch was engaged at the time the feeder was turned **OFF** to permit the feeder motor to power the output shaft.
3. The signal valve will be activated by the CCM2 to place the PFC pump on high pressure standby.
4. The CCM1 will activate the reverser MOTOR solenoid to start the motor rotation. The reverser motor will power the output shaft and is limited by a flow control orifice to at speed of 80 RPM.
5. When the feeder control switch is released it will automatically return to the **OFF** detent position.

AUTO FEEDER CUT OFF, (SHAFT SPEED MONITOR)

The CCM1 will detect any feeder clutch slippage, using the feeder speed sensor. If the feeder speed should drop below 80 RPM a message will be placed on the data bus for the CCM1 to dis-engage the feeder drive with in 2 seconds of detection. The feeder may be re-engaged by cycling the feeder switch.

CALIBRATION

A feeder calibration process will let the controller learn the amount of current required to activate the Forward clutch solenoid. The process shall be automatically executed, once initiated from the display by the operator. Using the display, select the feeder calibration procedure.

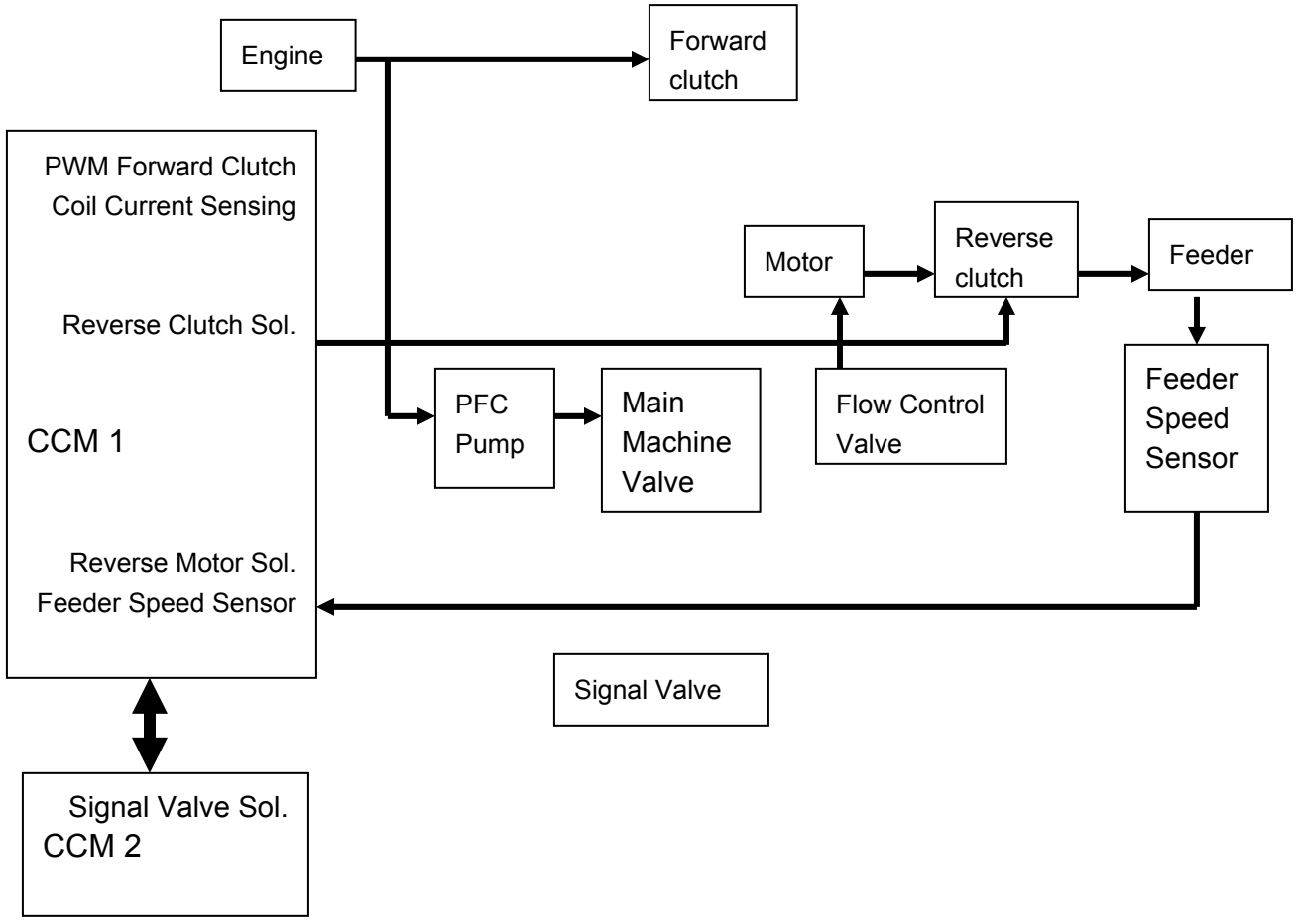
FEEDER DRIVE POWER FLOW

Power flow to the feeder may take one of two paths.

- ✓ **Braking Action:** Anti-Creep
  Forward: Mechanical Power Flow
  Reverse: Hydraulic Power Flow

To prevent the feeder from creeping the Reverse clutch is engaged and the reverser motor is used to prevent the system from creeping.

.



Feeder Drive Power Flow

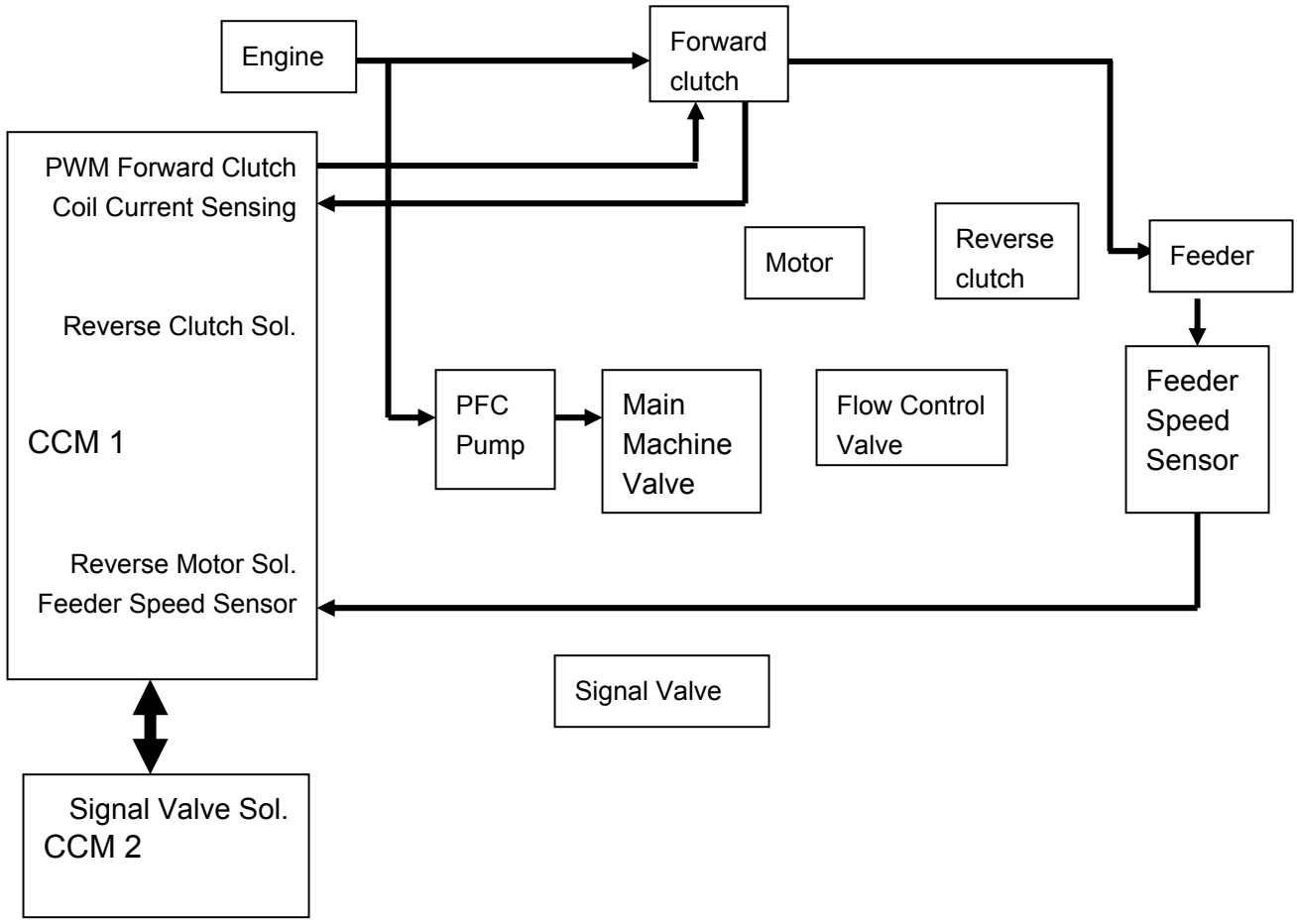
Power flow to the feeder may take one of two paths.

Braking Action**:** Anti-Creep

- ✓ **Forward:** Mechanical Power Flow, this would be normal operation, Starting and running the feeder drive.

Reverse: Hydraulic Power Flow

Power from the engine is directed through the PTO gearbox to the Forward clutch and feeder.

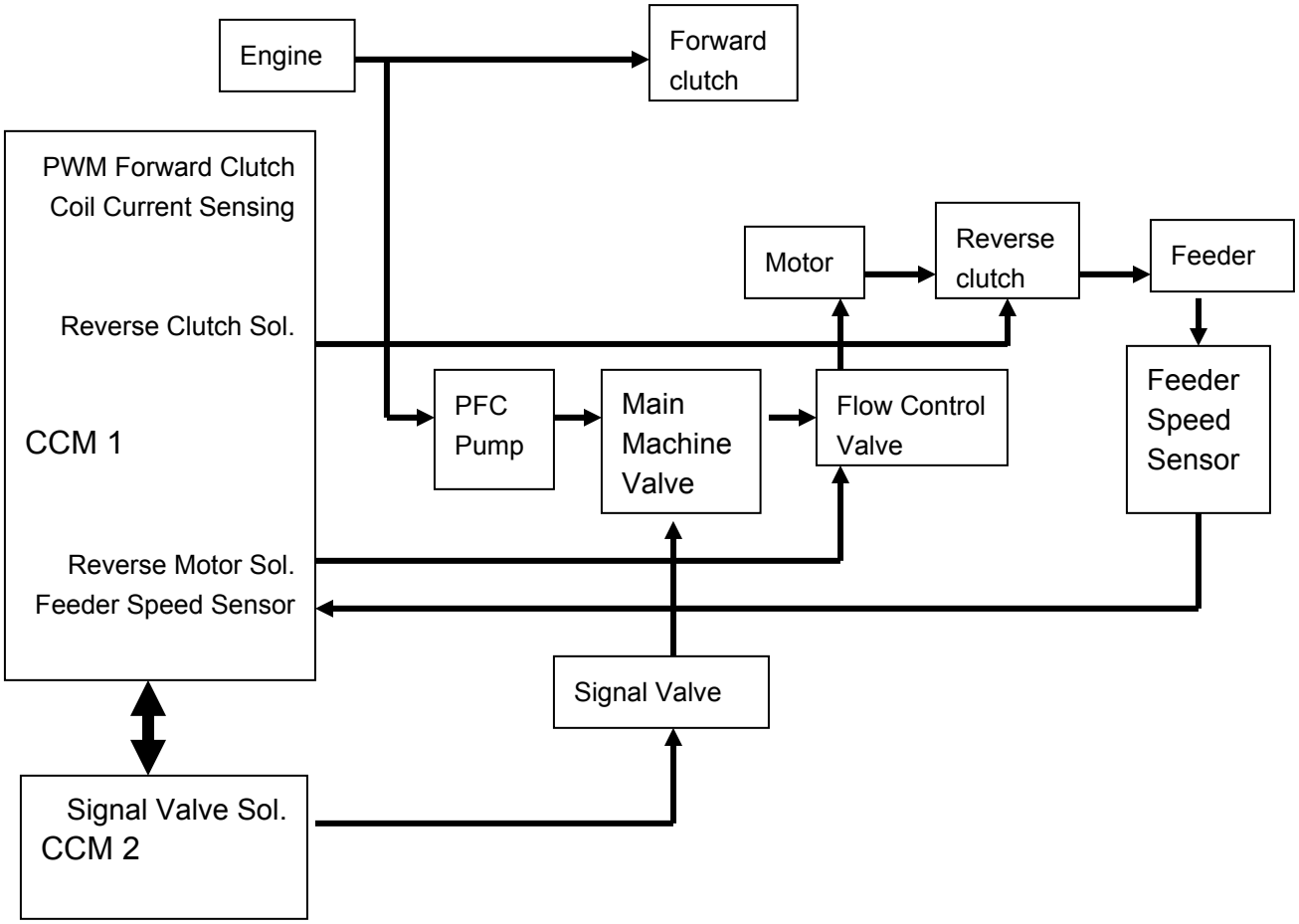


FEEDER DRIVE POWER FLOW

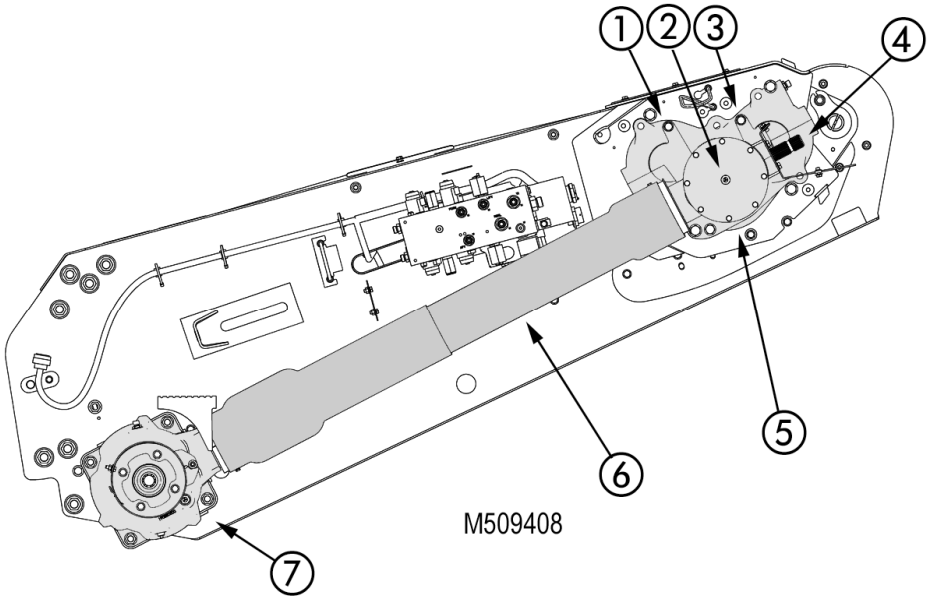
Power flow to the feeder may take one of two paths.

Braking Action**:** Anti-Creep
Mechanical Power Flow
- ✓ **Reverse:** Hydraulic Power Flow, Reversing the feeder drive

Power from the engine is directed through the PTO gear box to drive the main PFC pump, reverser motor, reverse clutch and feeder.



FEEDER GEARBOX



1.	RPM Sensor Location W/ Rock Trap	5.	Feeder Drive Gearbox
2.	Oil Level	6.	Header Drive Shaft
3.	RPM Sensor Location W/O Rock Trap	7.	Header Drive Gearbox
4.	Feeder & Header Input		

FEEDER DRIVE GEARBOX

The feeder drive gearbox drives the upper feeder shaft to power the feeder chains. If the unit is equipped with a rock trap the gearbox will have a second output shaft to operate the rock trap. The gearbox is equipped with the feeder slip clutch and speed sensor that will be used to control the speed of the feeder house, shaft speed monitor and provide a digital display on the Display.

The gearbox on the 20's combines provides a different operating speed for the rock trap beater then does the 10's combines. The gearboxes are NOT interchangeable because of the different feeder chain drive sprocket sizes.

	Bevel Set	Clutch Gear set	Feeder Chain	Rock Trap
7010-9010	Same	31T & 43T	44T	31T
7120-9120		21T & 49T	40T	25T

FEEDER GEARBOX

The slip clutch should hold approximately 375 lbs ft torque when applied to the gearbox input shaft. There is a special spacer ring required to properly set the clutch when repairing or replacing. The clutch can be check by:

1. Blocking the feeder chain from moving
2. Removing the drive shaft (2) from the feeder gear box to the header drive gear box.
3. Placing an allen wrench into one of the gearbox input shaft splines
4. Placing a 1 5/16" 12 point socket over the shaft and allen wrench
5. Using a torque wrench of the proper capacity

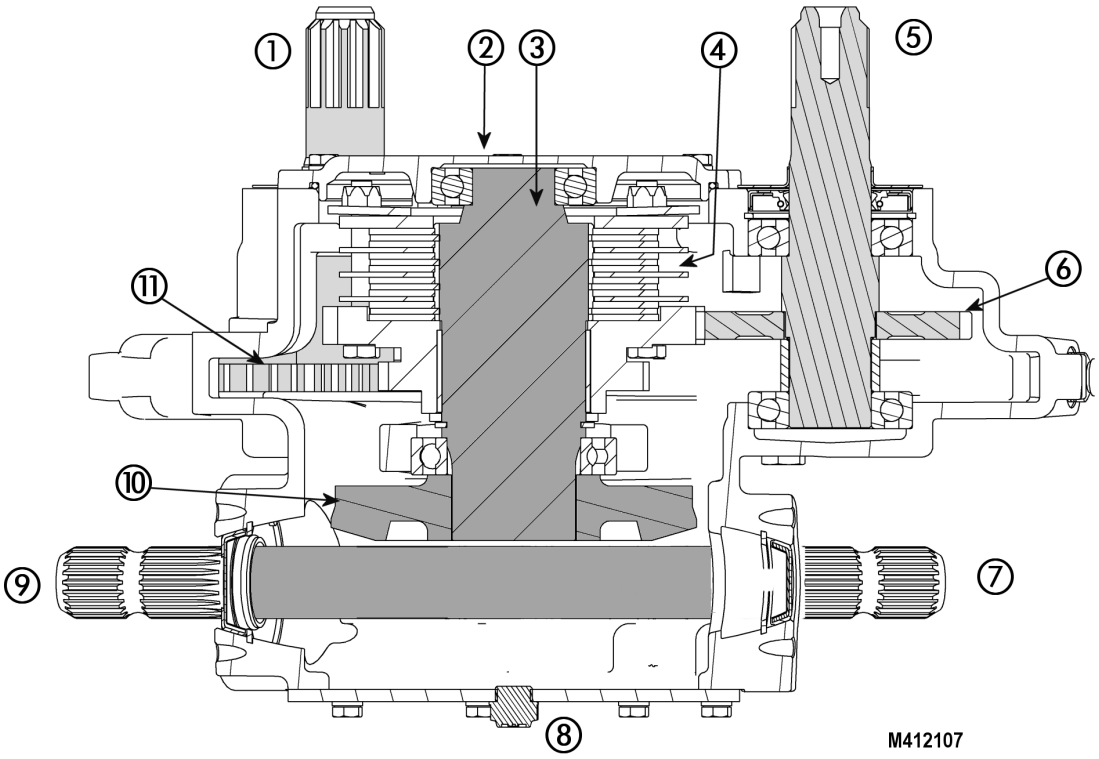
The unit is filled with 2.8 L of Hy-Tran Ultra and uses a sight gauge for oil level inspections. When checking the oil level the feeder should be lowered to the ground.



IMPORTANT: The feeder drive may be equipped with a radial pin slip clutch or starting with HAJ202000 a multi-disc slip clutch. When the disc slip clutch is install in earlier machines, the proper CCM software must be used to limit the slippage time before the "Automatic Feeder Cut Off" shuts **OFF** the feeder drive.

FEEDER GEARBOX

FEEDER DRIVE GEARBOX, WITH DISC CLUTCH & WITH STONE TRAP



1.	Out Put Shaft to Feeder	7.	Input Shaft, Counter Clockwise
2.	End Cover	8.	Oil Level Sight Glass
3.	Drive Hub	9.	Out Put Shaft To Lower Gearbox
4.	Disc Clutch	10.	Bevel Gear Set
5.	Out Put Shaft to Stone Trap	11.	Feeder Driven Gear
6.	Stone Trap Driven Gear		

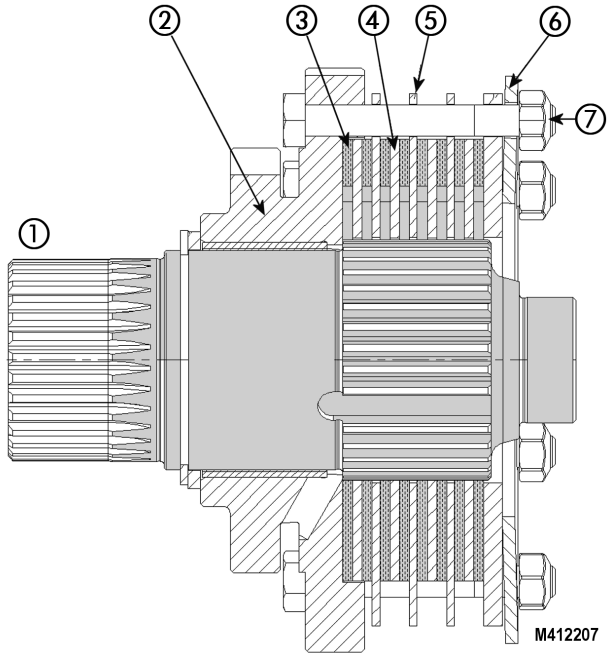
The unit is filled with 2.8 L of Hy-Tran Ultra and uses a sight gauge for oil level inspections. When checking the oil level the feeder should be lowered to the ground.

The oil change interval for this clutch is 600 hours, at which time the RPM sensor should also be cleaned as well as the magnetic drain plug.

IMPORTANT When the disc slip clutch is install in earlier machines, the proper CCM software must be used to limit the slippage time before the “Automatic Feeder Cut Off” shuts **OFF** the feeder drive.

FEEDER GEARBOX

FEEDER DRIVE GEARBOX, WITH DISC CLUTCH & WITH STONE TRAP



1.	Clutch Drive Hub
2.	Output Gear
3.	Drive Clutch Plates
4.	Internal Driven Clutch Plates
5.	External Driven Clutch Plates
6.	Clutch Belleville Spring
7.	Clutch Tie Bolts & Adjusters.

The torque setting on a new clutch may vary from specifications until it has been burnished in. The clutch should be set close to the specification, then burnished and a final torque setting checked.

A new disc clutch requires a break-in procedure. Slip 15-20 times manually (slow speed).

1. Block the feeder chain from moving
2. Run the engine at low idle. Engage the feeder REVERSER for approximately 2 seconds. This should be completed 15-20 times.
3. Do not let the oil in the gearbox become overheated.
4. The slip clutch should hold approximately 439-504 N-m (324-372 ft-lb) when applied to the gearbox input shaft. This setting should provide a feeder shaft torque of approximately 1350-1550 N-m.

The clutch can be check by:

1. Blocking the feeder chain from moving
2. Removing the drive shaft (2) from the feeder gear box to the header drive gear box.
3. Placing an allen wrench into one of the gearbox input shaft splines
4. Placing a 1 5/16” 12 point socket over the shaft and allen wrench
5. Using a torque wrench of the proper capacity

FEEDER GEARBOX

FEEDER DRIVE GEARBOX, WITH DISC CLUTCH & WITH STONE TRAP

The AFC operation was changed at CCM1 software 32.6.2. to eliminate the disabling of the AFC and the shaft speed detection requirements. MY06 and earlier would require the latest 31.* software installed.

AUTO FEEDER CUTOFF "AFC"

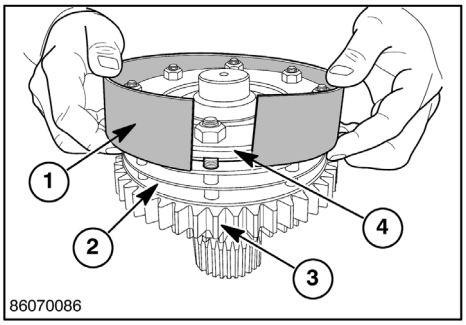
The feeder drive will be disabled any time the feeder output shaft speed drops below:

	3 Seconds	0.5 Second
Forward	80% Calculated Speed	50% Calculated Speed
Reverse	36 RPM	22 RPM

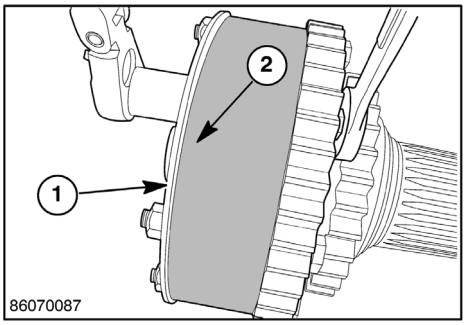
Feeder slip detection is not activated during the first 3 seconds in FORWARD or 2 seconds in REVERSE during engagement, (once power has been directed to the solenoid). This gives the system time to start up properly.

CLUTCH SETTING

When setting the clutch adjusting bolts a special spacer tool is installed around the plates. The bolts are then tighten down to the spacer height and backed OFF 90 deg. Remember to remove the spacer as it is a special tool.

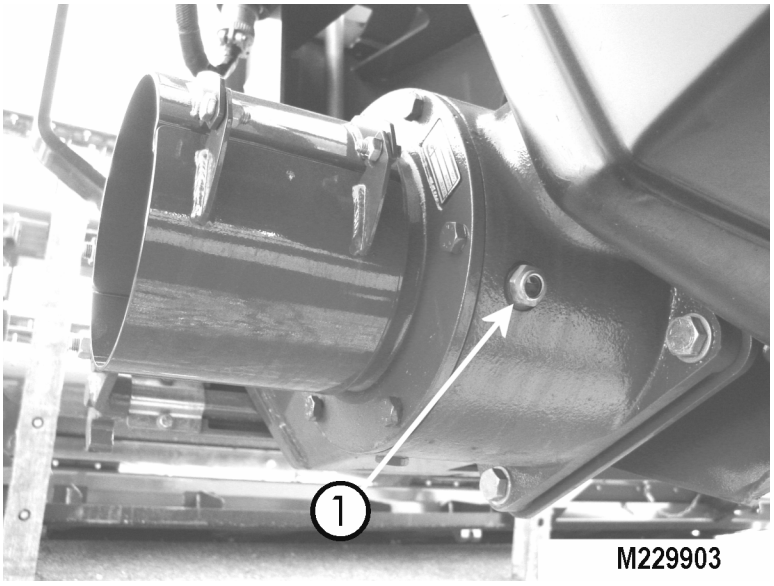


After installing the clutch be sure to burnish it in before checking the slip torque.



HEADER DRIVE GEARBOX

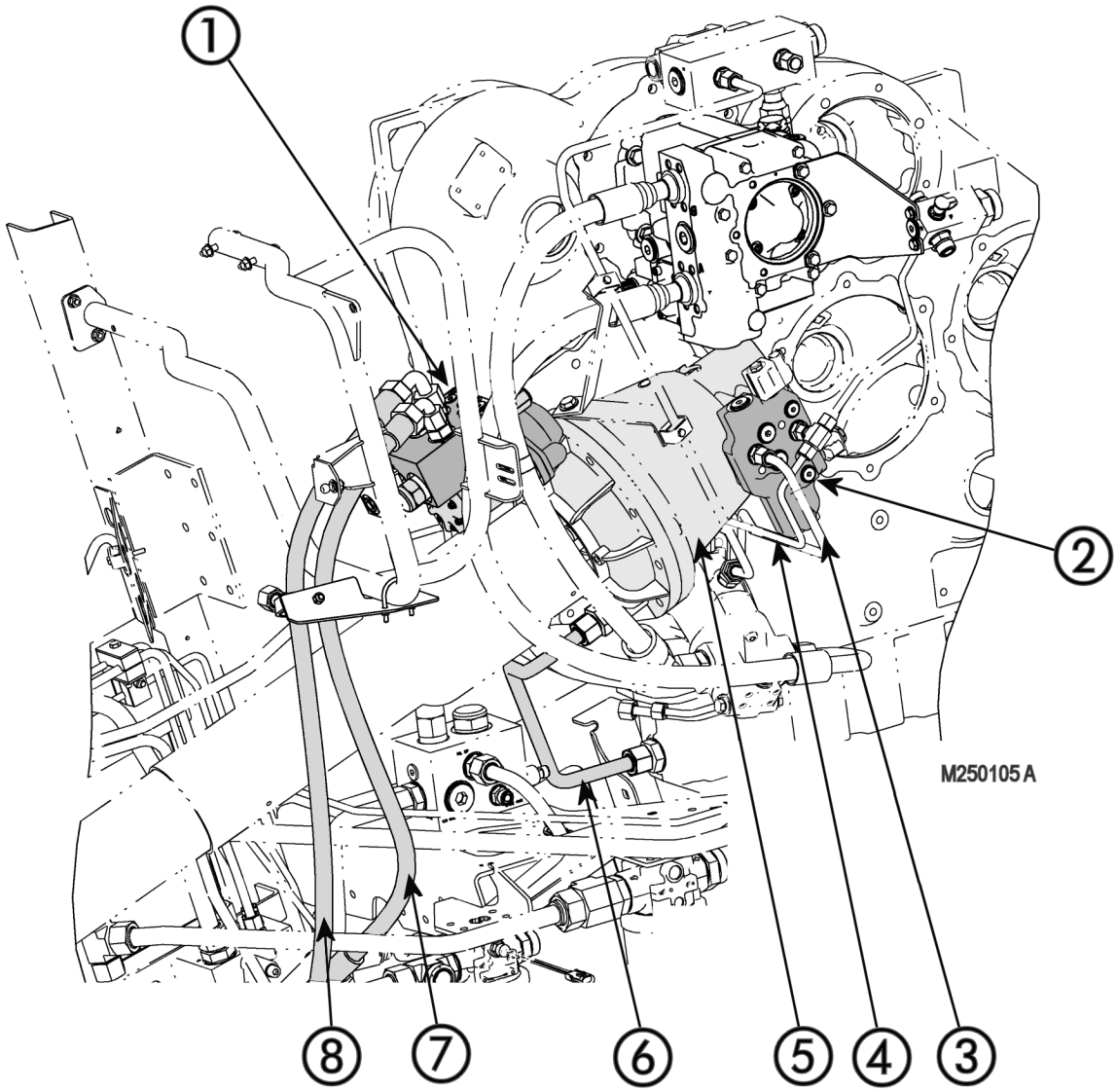
The header drive gearbox is used to power the lower shaft to provide driving power to the headers.



Oil Level Check Plug

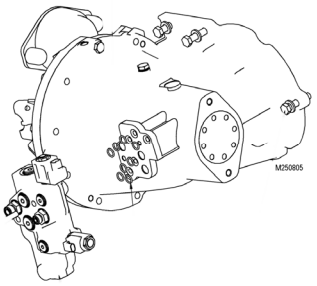
FEEDER DRIVE MECHANICAL

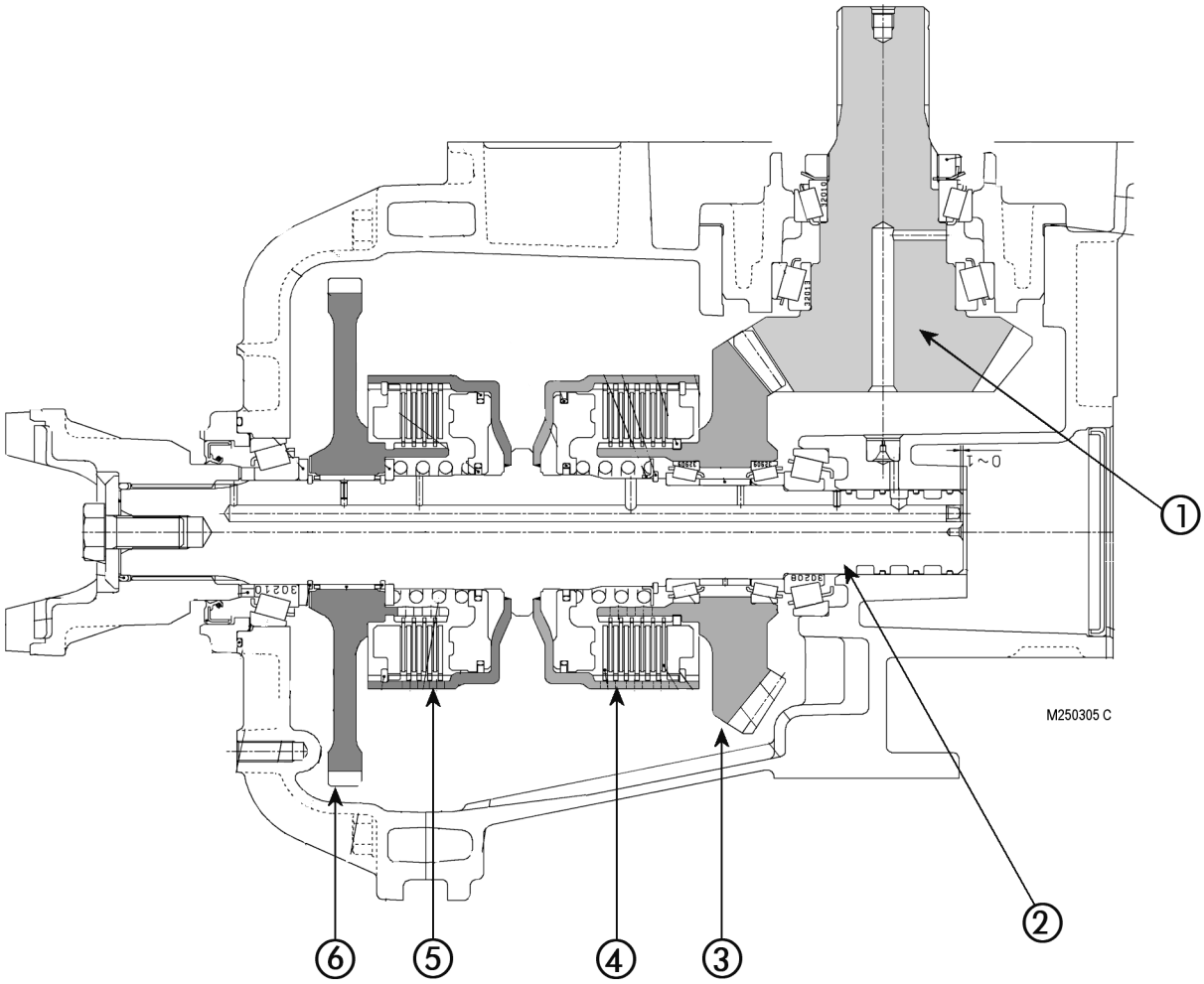
PTO GEARBOX



1.	Reverse Drive Motor	5.	Feeder Drive Gear Box
2.	Feeder Control Valve	6.	Gear Box Drain Line
3.	System Lube Supply	7.	Reverse Supply
4.	Control Pressure Supply	8.	Reverser Return

FEEDER DRIVE MECHANICAL





1.	Engine Input Gear	4.	Engine Clutch
2.	Main Shaft	5.	Reverse Clutch
3.	Engine Driven Gear	6.	Reverse Driven Gear

FEEDER DRIVE MECHANICAL

MECHANICAL COMPONENTS

Engine Input Gear, (1 & 3)

The input gear transfers the engine power from the PTO gearbox through a bevel set of gears to the Power Plus outer shaft.

Located: In the Feeder Drive.

Out put Shaft, (2)

The output shaft is used to transfer the driving force from the DRIVE and REVERSE clutches.

Location: in the Feeder Drive

Forward Clutch Assembly, (4)

The Forward clutch is used to transfer engine power to the output shaft for normal forward operation. It is a multi-disc wet clutch.

Located: In the Feeder Drive.

Reverse Clutch Assembly, (5)

The reverse clutch is used to transfer the reverser drive motor power to the output shaft for driving the feeder and header in a reverse operation. It is a multi-disc wet clutch. This clutch is used during reverse and anti-creep operations.

Located: In the Feeder Drive.

Reverse Motor Input Gear, (6)

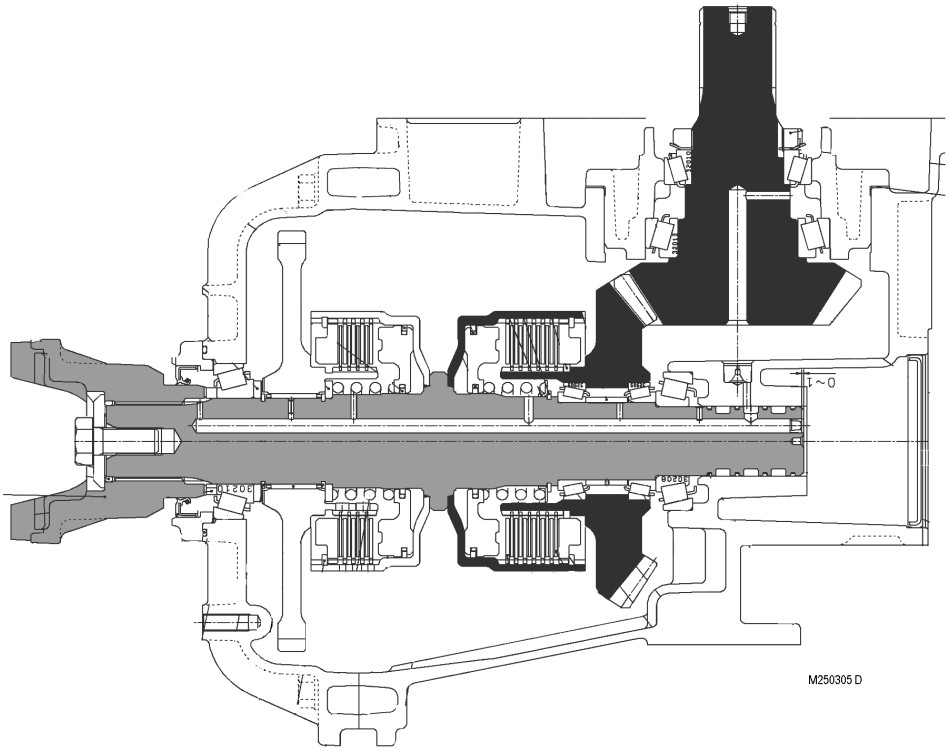
The reverse input gear is used to transfer the reverser drive motor power to the reverse clutch for driving the feeder and header in a reverse operation. This is used during reverse and anti-creep operations.

Located: In the Feeder Drive.

MECHANICAL POWER FLOW

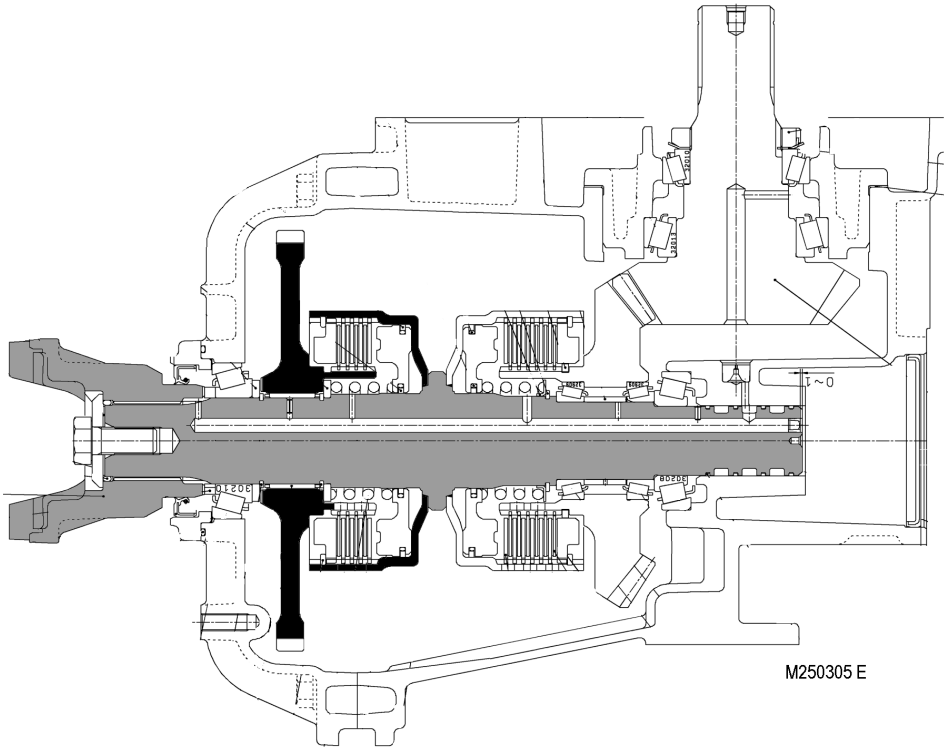
Feeder in Drive Mode

(Engine Power)

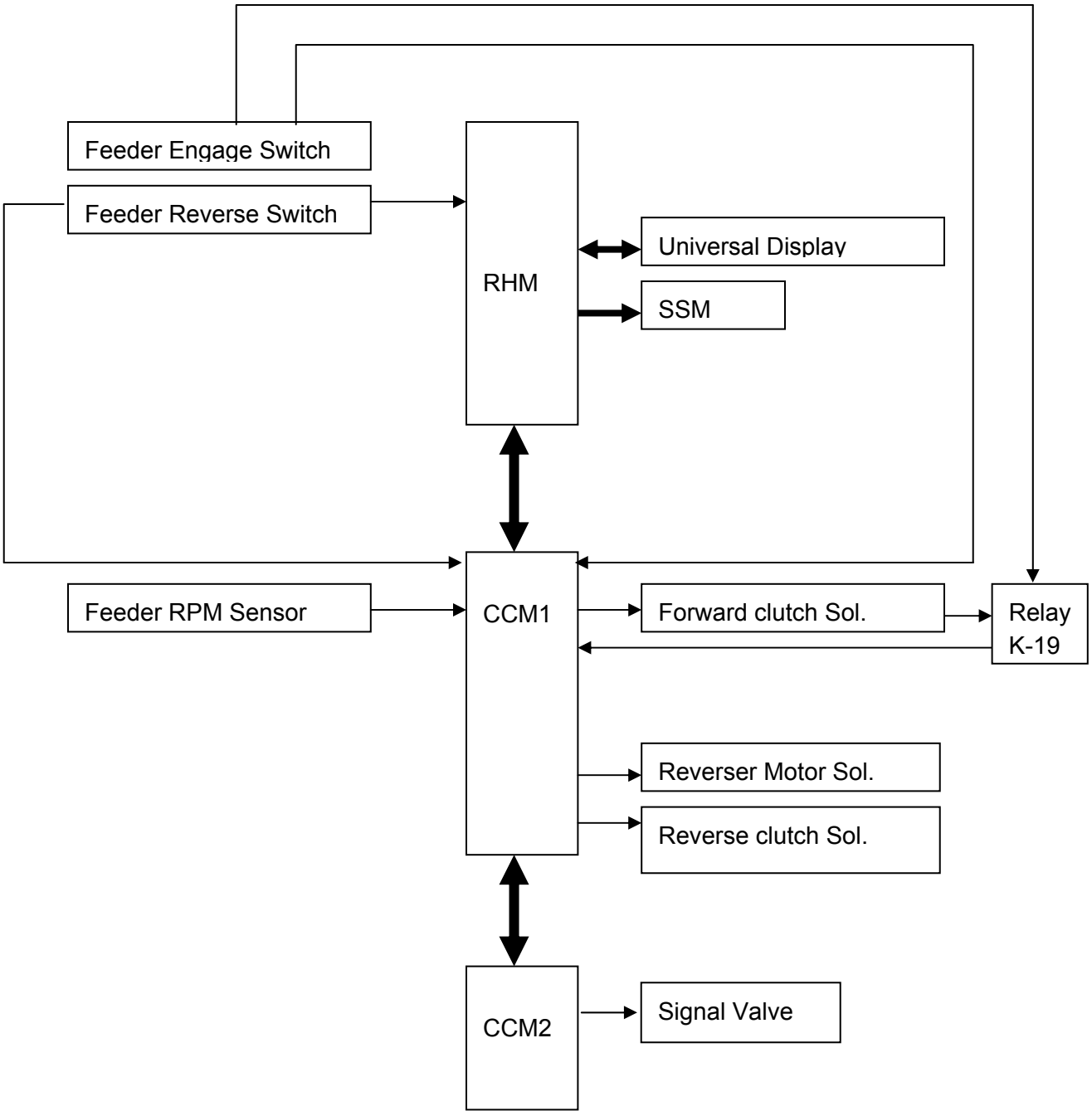


Feeder in Reverse Mode

(Reverser Operation)



Feeder Drive Electrical



FEEDER DRIVE ELECTRICAL

The entire feeder drive system consists of a PTO, Forward clutch and Feeder gearboxes, Hydraulic Motor, feeder engagement switch, Feeder speed sensor, and electronic controls.

.

The feeder electrical circuit include:

1) Feeder RPM signal
2) Forward clutch solenoid, (PWM)
3) Forward clutch feed back (ground) relay
4) Reverse clutch solenoid (ON/OFF)
5) Signal solenoid
6) Reverser motor solenoid
7) Electronic controllers, CCM1, RHM, CCM2, cab display
8) Operator controls
9) Seat switch
10) Resistor module
11) Diode module
12) Adapter Harness

Items that may influence the systems operation:

Engine RPM – must be above 1000 RPM
Rear Ladder – must be raised
Road Mode – indication lamp must NOT be lit
Rotor RPM

FEEDER DRIVE ELECTRICAL

ELECTRICAL COMPONENTS

CCM1 Controller

The CCM1 controller controls the feeder operation by receiving CAN bus signals from the RHM, display and sensors, and controlling solenoids.

Located: Under the instructor's seat

Feeder Switch, S-31

The feeder switch is used to send a signal to the RHM and CCM1 requesting the engagement of the feeder reverse operation. A second signal is also sent directly to the CCM1 controller and feeder engine to ring feedback relay to request normal operation.

Located: Right hand console

Seat Switch, S-05

The operator's seat switch is used to send a signal to the CCM2 controller when an operator is present. The CCM2 provides signal to the data bus.

Located: In the operator's seat

Forward Clutch Solenoid, L-47

The forward clutch solenoid is used to engaged/disengage the forward drive clutch pack.

Located: In the feeder control valve

Forward Clutch Solenoid Ground Relay, K-19

The Forward clutch ground relay provides for a positive disconnect for the solenoid ground.

Located: Mounted in the relay and fuse panel.

Resistor Module, R-20

The resistor module limits the operating voltage range for the feeder speed sensor input to the CCM.

Located: Mounted in the feeder wiring harness.

Diode Pack, D-01

The diode pack provides a signal to the CCM1 terminal J1-17 that the feeder switch is NOT in the NEUTRAL position.

Located: Mounted in the feeder wiring harness.

FEEDER DRIVE ELECTRICAL

ELECTRICAL COMPONENTS, CON'T

Feeder RPM Sensor, B-14

The feeder RPM sensor is used by the CCM1 to calculate the feeder's accrual speed, but is calculated and displayed as header speed.

Located: Mounted on the upper feeder drive gearbox

Reverser Motor Solenoid, L-63

The reverser motor solenoid is used direct PFC pump flow to the reverser motor.

Located: Mounted in the reverser control valve.

Reverser Clutch Solenoid, L-50

The reverse clutch is used to connect the reverser motor input to the output shaft, permitting the feeder to be driven by the motor, and to prevent creepage.

Located: Mounted in the feeder control valve.

Ground Speed Sensor

The ground speed sensor provides a speed signal that is used by the feeder drive when operating in the "AUTO" feeder to ground speed mode.

Located: Mounted in the ground drive transmission.

Signal Solenoid, L-43

The signal solenoid is used to activate the PFC pump, which provides the fluid supply for the reverser motor operation.

Location: In the main machine valve assembly

Adapter Harness

An adapter harness is used to make a connection at connector X402, the feeder Power Plus solenoid connector terminals C and D to the reverser motor solenoid. This permits the CCM1 to control the motor solenoid.

FEEDER DRIVE ELECTRICAL

REFERENCE MATERIAL

Electrical Schematic Frame: #12, #15, #27

KEY SYSTEM COMPONENTS

Feeder Engagement Switch S-31, Feeder Diode D-01, Seat Switch S-05, Ground Speed Sensor, Feeder Speed Sensor B-14, Relay K-19, Forward L-47, Reverse L-50, Motor L-63 and Signal L-43 solenoids.

POWER SUPPLY FUSES

F-38, Is supplied power from the KEY switch terminal 6 whenever the switch is placed in the RUN position to provide power to each controller, CCM1, 2 and 3.

F-39, Is supplying B+ Unswitched power to the CCM1 terminal J1-1 and the RHM terminal J6-13.

F-45, Is supplied power from the Cab Relay “K24” to provide power to the “A” terminals of the three speed sensors: Rotor speed, Rotor Drive Motor speed and Feeder speed.

F-47, Is supplied power from the Cab Power relay “K26” to provide power to the controllers, CCM 3.

F-48, Is supplied power from the Cab Power relay “K26” to provide power to the RHM, Separator switch terminal 2 and 5, Neutral Start switch, Feeder switch terminal 5, Feeder speed increase/decrease potentiometer terminal A.

F-49, Is supplied power from the Cab Power relay “K26” to provide power to the operator’s seat switch terminal A for the operator presents circuit.

GROUNDS

Controller CCM1, 2 and 3 are chassis grounded through the mounting bolts and cab ground strap
Controller RHM is chassis grounded
Reverse clutch solenoid is chassis grounded

FEEDER DRIVE ELECTRICAL

ELECTRICAL OPERATION, CON'T

MODES OF OPERATIONS

OFF

When the feeder switch is placed into the **OFF** position there is NO voltage signal directed to the CCM1 connector terminal 7. Lack of power at connector X018 terminal 7 is telling the controller that the feeder is not requested.

ENGAGED

When the feeder switch is placed into the ENGAGED position, (forward detented position) a signal voltage is directed out of the feeder switch terminal 6 to the CCM1 connector X018 terminal 7, requesting the feeder to be started.

The CCM1 will

1. Check for the proper engine speed that is being transmitted over the data bus from the engine controller. The engine speed must be between 1000-2100 RPM.
2. Check to see that the rear ladder is in the home position (UP), transmitted over the data bus.
3. Check to see that the operator seat switch is closed, transmitted over the data bus.
4. Release the Reverse clutch.
5. Use the power that is being received from the feeder switch at connector X018 terminal 17 and direct it out connector X019 terminal 30 to the Forward clutch solenoid. This causes the forward clutch to lock-up to permit engine drive for the feeder. The solenoid will be controlled by PWM for smooth engagement.
6. The feeder switch will direct power from terminal 3 to the forward feedback relay terminal 1, activating the relay to provide a ground for the forward solenoid at the CCM1 X019 terminal 40.
7. Checks the actual speed of the feeder by monitoring the feeder speed sensor terminal B at CCM1 connector X020 terminal J3-14. If the speed should fall below 80 RPM, the CCM1 will disengage the forward clutch.

The display will

1. Will display the required information for the feeder operations.

FEEDER RE-ENGAGED

When re-engaging the feeder once it has been dis-engaged BUT has not come to a stop yet, the feeder will not be permitted to re-engaged until the feeder speed is below 50 RPM.

FEEDER DRIVE ELECTRICAL

ELECTRICAL OPERATION, CON'T

REVERSER

When the feeder switch is held in the REVERSE position (rearward momentary position) a signal voltage is directed out of the feeder switch terminal 1 to the RHM controller connector X027 terminal 5 and the diode module terminal C. The diode module directs power to the CCM1 connector X018 terminal 17 to provide power for the CCM1 to use to power the Reverse Motor solenoid.

The RHM will

- The RHM will place a message on the data bus for the CCM1 controller to operate the feeder drive in the reverser mode.
- The RHM will place a message on the data bus for the CCM2 to activate the signal valve, engaging the PFC pump.

The CCM1 will

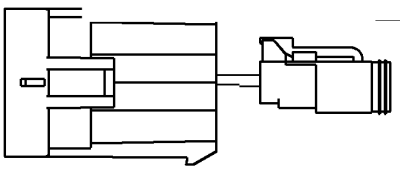
- Direct power out connector X020 terminal 15 to the Reverse solenoid, engaging the reverse clutch.
- Directs a PWM power out connector X020 terminal 21 to the reverse motor solenoid. The solenoid will permit PFC pump flow to the motor inlet port, causing the pump to rotate.

Adapter Harness, Connector X402

CONNECTOR: PAC#12186271
CABLE SEAL: PAC#12186769
TERMINAL: PAC#12045773

CAVITY	CIRCUIT ID	DESCRIPTION
A	N/A	OPEN
B	N/A	OPEN
C	1051	FDR REV FLW VLV +
D	1058	FDR REV FLW VLV +

CONNECT TO GEAR BOX HARNESS BREAKOUT "F"



CONNECTOR: 225316C1

CAVITY	CIRCUIT ID	DESCRIPTION
A	1051	SIG
B	1058	RET

M251405

CALIBRATION MODE

To enter the calibration mode the operator will make a selection from the "CALIBRATION" screen on the display. The display will place signals on the data bus for the CCM1 controller to operate the feeder drive while monitoring the feeder speed.

The CCM1 will

Directs modulated power supply out connector X019 terminal 30 to the Forward solenoid to learn the current flow required to create feeder rotation. After three cycles the readings are averaged and placed into the memory.

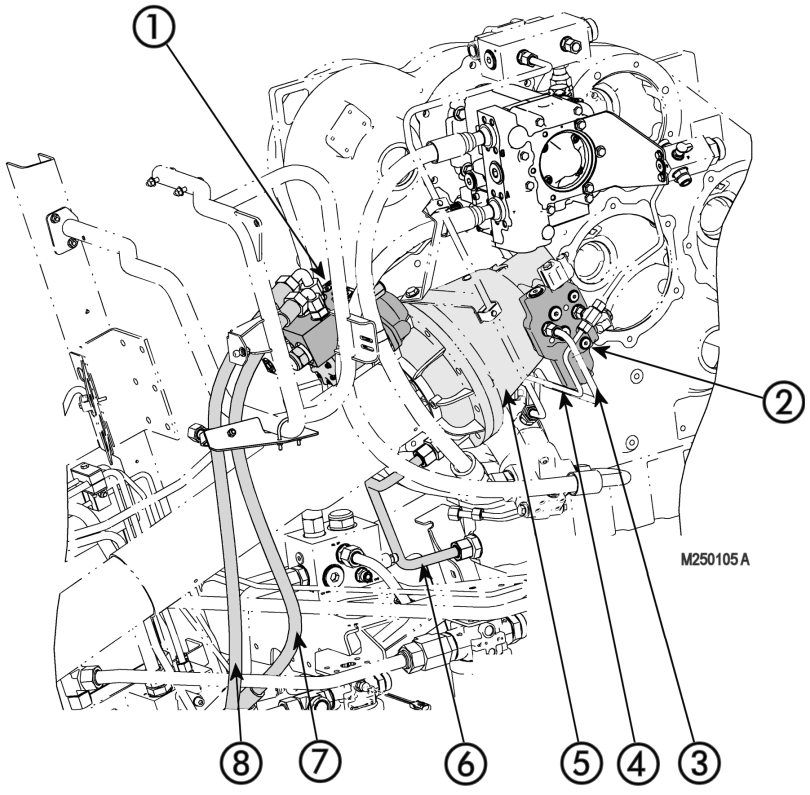
FIX SPEED FEEDER HYDRAULIC CIRCUITS

The feeder drive system consists of a PTO, Feeder drive, feeder upper and feeder lower gear boxes, hydraulic motor, feeder engagement switch, speed sensor, and electronic controls.
The feeder hydraulic circuit includes:

1. Feeder Drive Control Valve Assembly
2. Reverser Motor and Valve Assembly
3. Forward clutch
4. Reverse clutch

The feeder drive control valve is used to control the drive and reverser clutches that are used to control the power input source that will be used to drive the feeder.

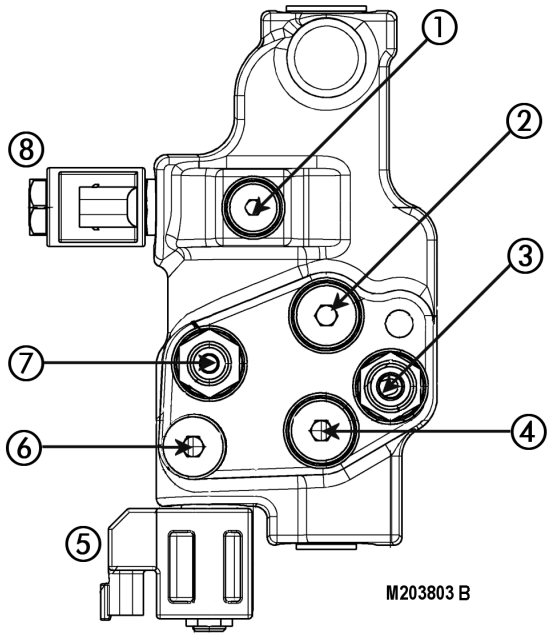
IMPORTANT: Refer to the "General Hydraulic" section for an explanation on how the PFC pump, signal valve, control pump, control pressure, lube pump and lube circuits are controlled.

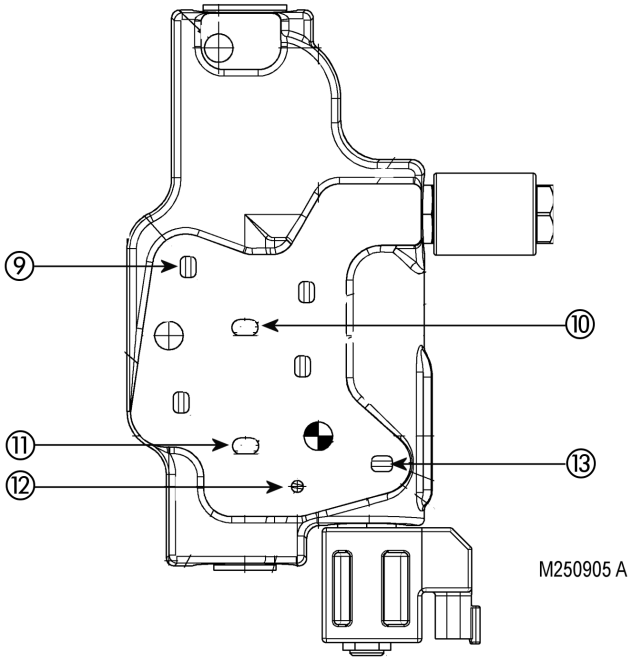


1.	Reverse Drive Motor	5.	Feeder Drive Gear Box
2.	Feeder Control Valve	6.	Gear Box Drain Line
3.	System Lube Supply	7.	Reverse Supply
4.	Control Pressure Supply	8.	Reverser Return

FIX SPEED FEEDER HYDRAULIC CIRCUITS

CONTROL VALVE





Port Identification			
1.	Plugged	8.	Forward Clutch Solenoid
2.	Plugged (FORWARD Test)	9.	Tank
3.	Lube Supply	10.	Forward Clutch Port
4.	Plugged (Lube Test)	11.	Gearbox Lube
5.	Reverser Clutch Solenoid	12.	Tank
6.	Plugged (Reverser Clutch Port)	13.	Reverse Clutch Port
7.	Control Pressure Supply		

The hydraulic control valve is supplied oil by external pipes from two sources,

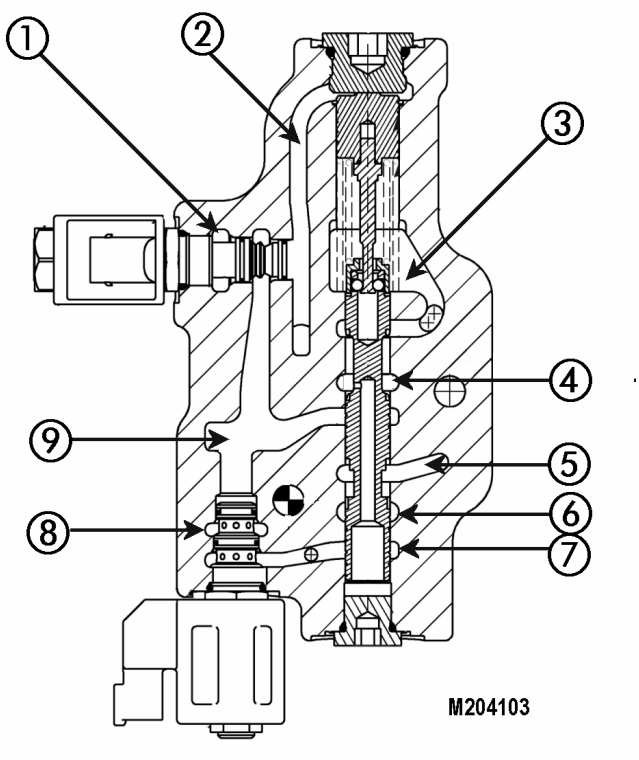
1. A constant 290-320 PSI (20-22 Bar) regulated “Control Pressure” from the Control pump. Port 7
2. Lube supply at a maximum pressure of 50 PSI (3.5 bar) from the lube supply pump. Port 3

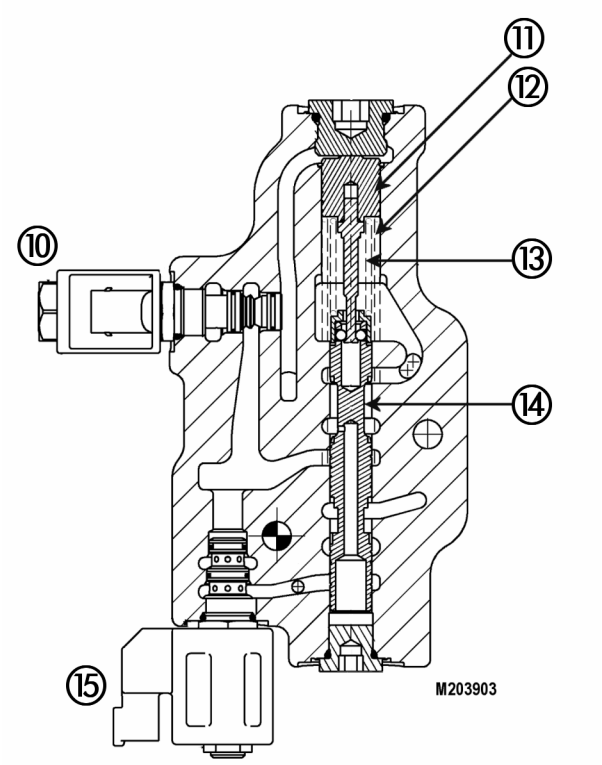
The valve directs oil to the following functions by internal ports,

1. to the Forward clutch. Port 10
2. to the lube. Port 11
3. to the reverse clutch. Port 6

FIX SPEED FEEDER HYDRAULIC CIRCUITS

CONTROL VALVE

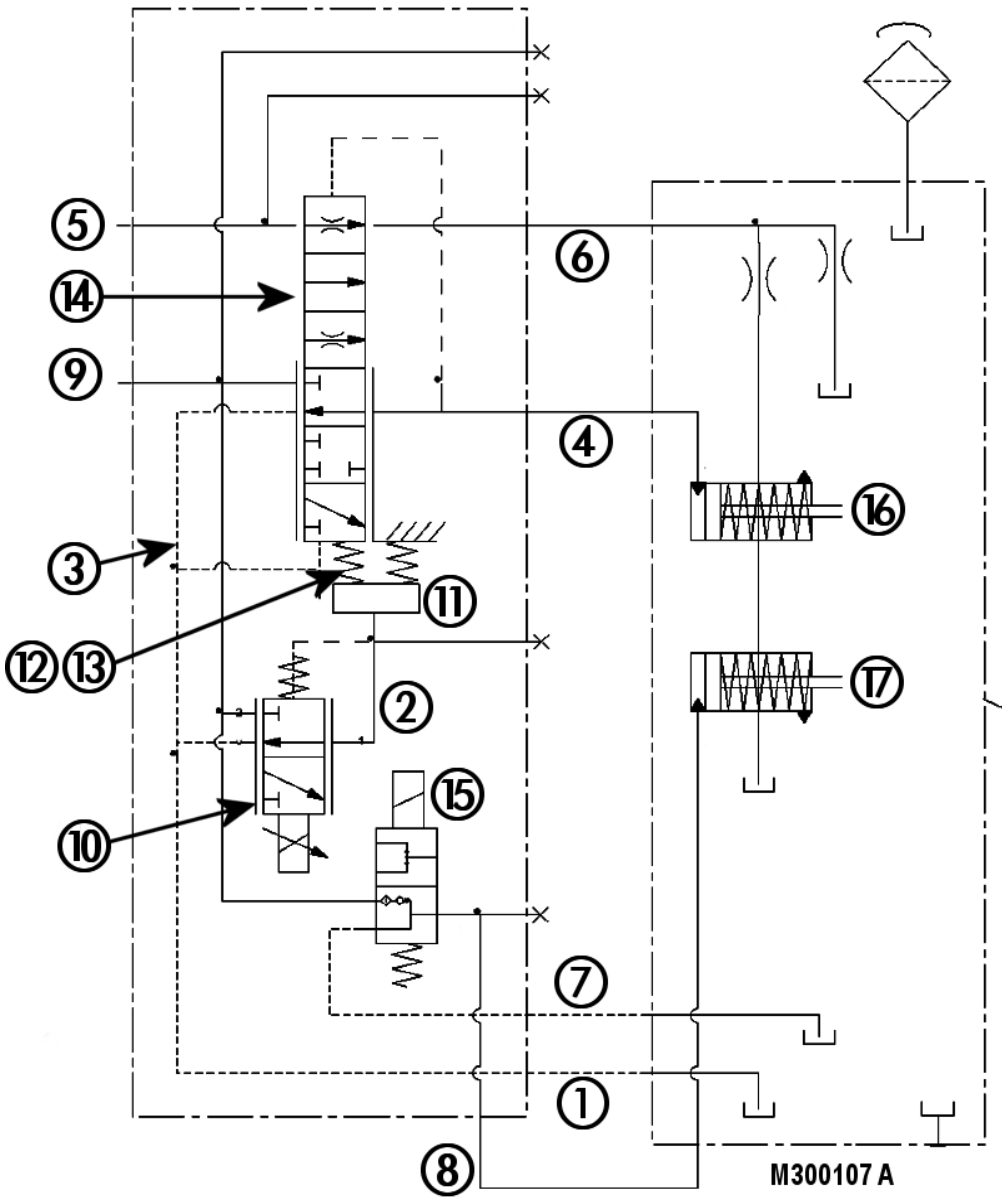




Component and Port Identification			
1.	Tank	9.	Control Pressure Supply
2.	Modulation Passage	10.	Forward Clutch Solenoid
3.	Tank	11.	Modulator Piston
4.	Forward Clutch Port	12.	Preload Spring (outer)
5.	Lube Supply Port	13.	Modulation Spring (inner)
6.	Lube Out	14.	Modulation Spool
7.	Tank	15.	Reverse Clutch Solenoid
8.	Reverse Clutch Port		

FIX SPEED FEEDER HYDRAULIC CIRCUITS

CONTROL VALVE



Component and Port Identification			
1.	Tank	10.	Forward Clutch Solenoid
2.	Modulation Passage	11.	Modulator Piston
3.	Tank	12.	Preload Spring (outer)
4.	To Forward Clutch Port	13.	Modulation Spring
5.	Lube Supply	14.	Modulation Spool
6.	Lube Out	15.	Reverse Clutch Solenoid
7.	Tank	16.	Forward Clutch Pack
8.	To Reverse Clutch Port	17.	Reverse Clutch Pack
9.	Control Pressure Valve Supply		

FIX SPEED FEEDER HYDRAULIC CIRCUITS

CONTROL VALVE OPERATIONS

Feeder Dis-Engaged

With the feeder control switch in the **OFF** position, the Forward clutch solenoid (10) is NOT activated, causing the main spool (14) to block the control pressure flow to the clutch and the reverse solenoid (15) IS activated to direct control pressure to the reverse clutch.

1. Lube oil (5) is directed through the main spool to port 6 and out to the feeder drive unit to lubricate bearings, clutches and cooling. The spool lands and orifice passages in the gearbox restrict the lube flow.
2. The Forward clutch is permitted to drain back to the tank at ports 1.

Feeder Engaged

When the feeder control switch is placed into the ENGAGED position (forward detented position) the reverse solenoid (15) will be de-activated and the drive solenoid (10) will be activated by PWM. The solenoid will direct modulated supply pressure to the end of the modulation piston (11). As pressure builds, the piston moves against the force of both the inner and outer modulator springs (12 & 13). As the piston moves toward the spool, the inner spring causes the main spool (14) to shift. As the main spool moves, the lube port 6 is unrestricted to permit additional lube flow during clutch lockup.

The main spool will close OFF the Forward clutch drain port and begin directing control pressure to the clutch pack through port (4). As the pressure is directed to the clutch pack, it is also directed through an orifice hole in the side of the spool to the base of the spool, a signal port. As the pressure builds in the clutch pack the pressure also begins to move the main spool back up against the modulating springs, reducing the pressure on the clutch pack. This modulation takes place until the drive solenoid has been fully powered and the main spool is held fully down.

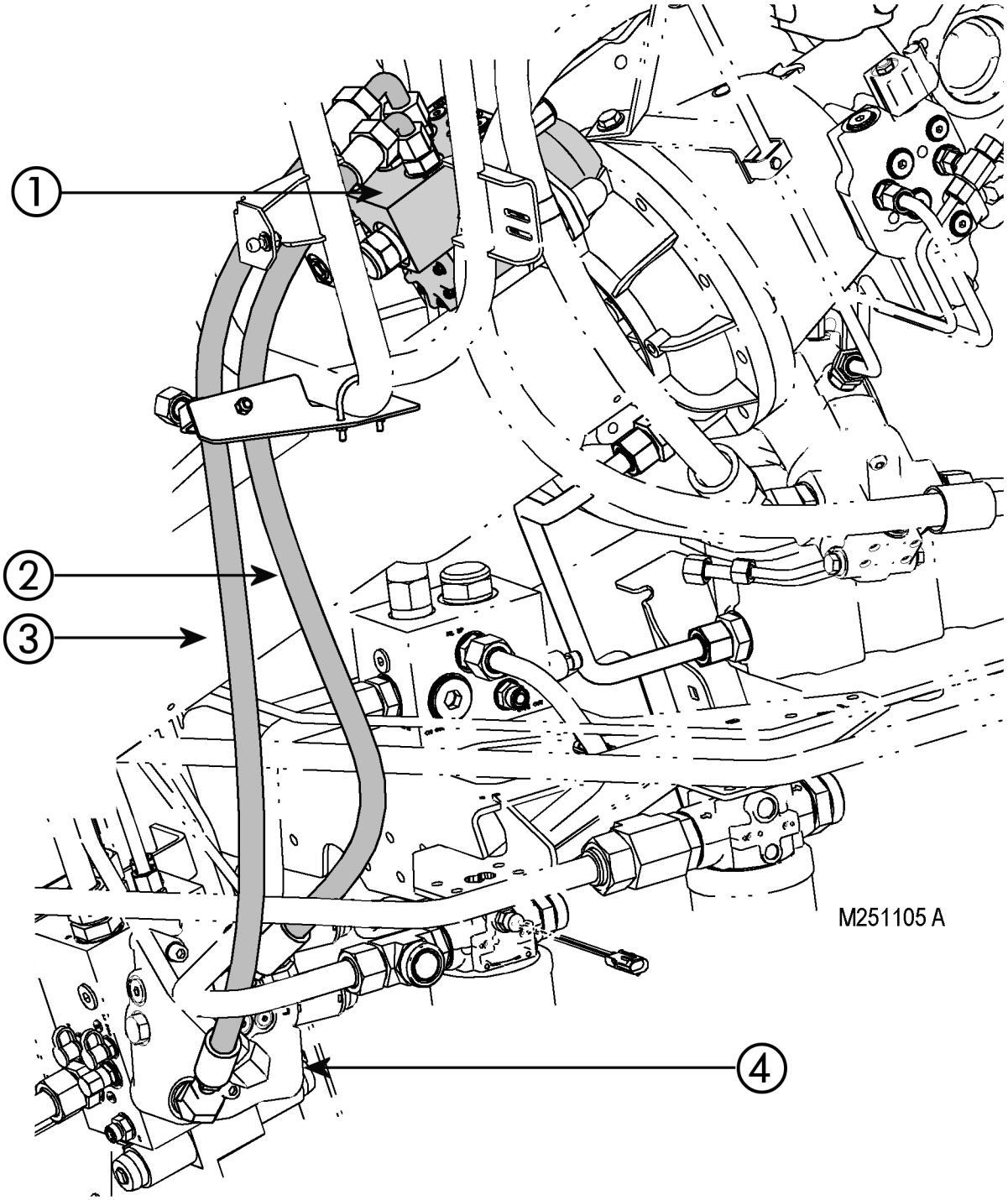
When the main spool is completely moved down, the lube passage again becomes restricted.

Reverser

The reverse solenoid (15) will be activated, directing pressure to the reverse clutch piston (17). The reverser motor will rotate the feeder in a reverse direction.

REVERSE DRIVE HYDRAULIC CIRCUITS

REVERSE DRIVE

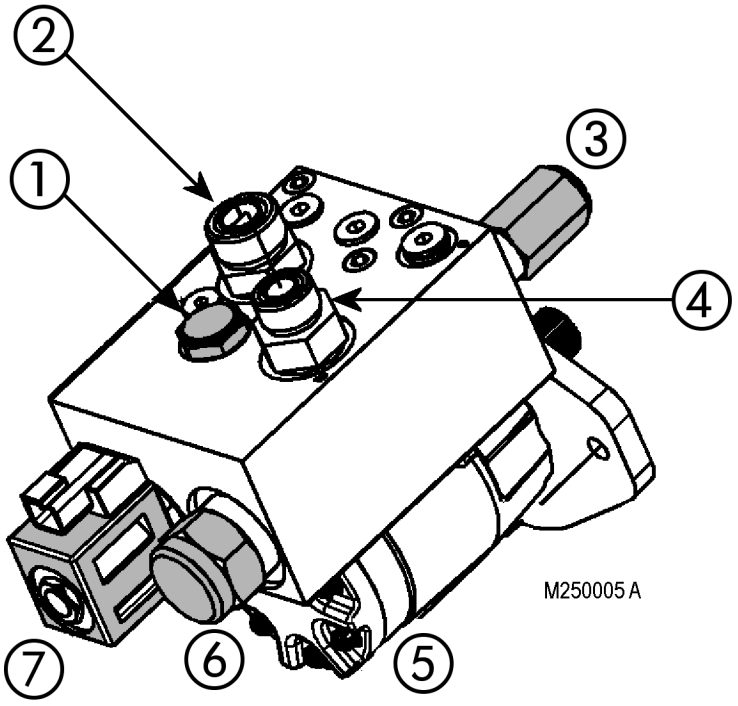


1.	Reverse Drive Motor/Valve Assembly	3.	Reverse Drive Return Hose
2.	Reverse Drive Supply Hose	4.	Header Lift Valve

REVERSE DRIVE HYDRAULIC CIRCUITS

REVERSE DRIVE

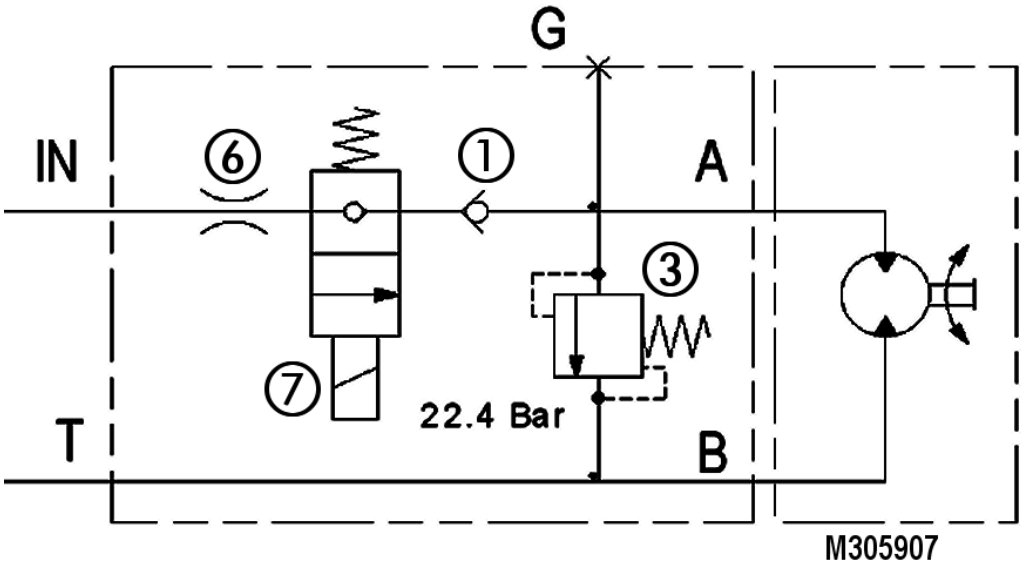
Control Valve, (motor)



1.	Check Valve	5.	Reverse Drive Motor
2.	Return Port	6.	Flow Regulator Cartridge
3.	Relief Valve (T)	7.	Motor Control Solenoid / Cartridge Valve
4.	Supply Port (IN)		

REVERSE DRIVE HYDRAULIC CIRCUITS

REVERSE DRIVE SCHEMATIC



IN	Supply from header lift valve	1.	Check Valve
T	Return to header lift valve	3.	Relief Valve
A	To Motor	6.	Flow Regulator Valve
B	From Motor	7.	Motor Control Solenoid / Cartridge Valve

REVERSE DRIVE HYDRAULIC CIRCUITS

REVERSER DRIVE

The reverser drive unit for the feeder operates on the same principles as any hydraulic motor. The explanation here will be brief.

IMPORTANT: Refer to the "General Hydraulic" section for an explanation on how the charge pump, charge pressure, lube pump and lube circuits are controlled.

Feeder Disengaged or Engaged

The reverser motor will be used to prevent the feeder from creeping. The reverser solenoid (7) will be disengaged, preventing any fluid flow to the motor. The motor is prevented from freewheeling by the check valve (1), this provides a hydraulic lock for the motor. Refer to the Feeder drive assembly to understand how the reverser clutch is controlled.

Feeder Reversed

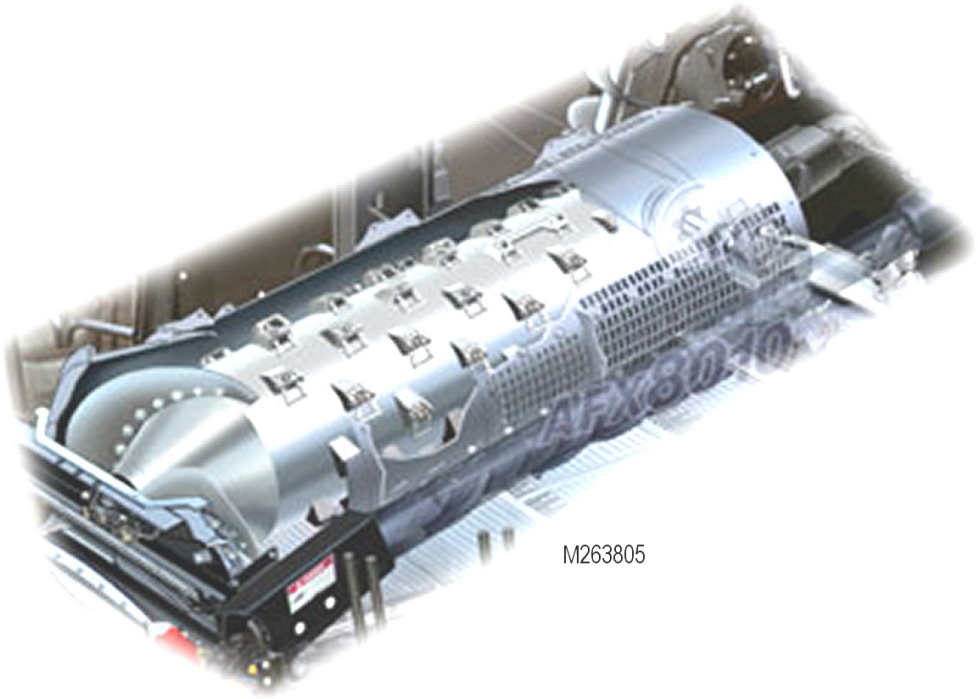
1. The signal valve solenoid will be activated to place the PFC pump on high pressure stand-by. Since the reverser motor flow will be controlled by a fixed orifice, when the pump is placed on high pressure stand-by there will always be the same flow rate through the orifice, providing a constant speed regardless of the feeder load.
2. The reverser solenoid (7) will be activated permitting the pump flow to wash open the check valve (1) and out port "A" to the motor.
3. The system load is monitored at the relief valve (3). The system operating pressure is directed through a pilot line to the non-spring end of the relief, when the pressure exceeds the setting of the spring the valve will shuttle against the spring. This will permit the operating flow to be diverted through the valve to the motor return port "B" and out port "T". The relief valve should open at 3200-3350 PSI (220-230 bar).

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CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 - 9120 SERIES AXIAL-FLOW COMBINE



SECTION 66 THRESHING & SEPARATING OPERATION

Form 5175 Rev. 1/2010

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RACINE, WI 53404 U.S.A.

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Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tips to remember.



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

COMPONENT	SUPPLY VOLTAGE	WORKING RANGE	RESISTANCE: OHMS AT 70°F (21°C)	NORMAL POSITION
Separator Engagement Switch	Battery			Detent and Momentary
Feeder Engagement Switch	Battery			Detent and Momentary
Rotor Increase/Decrease Switch	Battery			N/O
Fan Increase/Decrease Switch	Battery			N/O
Concave Increase/Decrease Switch	Battery			N/O
Concave Position Sensor	5V		5K	
Concave Motor	Battery			
On The Road Switch	Battery			N/O
Seat Switch	12V			N/O
RTF Solenoid	12V		9.2 12.9 at 350°F (180°C)	
ETR Solenoid	PWM		6.2 ? at 350°F (180°C)	
Rotor Pump Solenoid (+)/(-)	PWM		5.2-6.8 7.0 at 350°F (180°C)	
Rotor Drive Motor Speed Sensor	8V	Sensing Metal = 1.3Vdc NOT Sensing Metal = 6.7Vdc		
Rotor Speed Sensor	8V	Sensing Metal = 1.3Vdc NOT Sensing Metal = 6.7Vdc		

ROTOR	LENGTH	DIAMETER Tip Diameter	DIAMETER Tube	WEIGHT	# OF ELEMENTS
Standard Rotor	104”	30”	25”	975 lb.	74
Small Tube Rotor	104”	30”	23”	975 lb.	36

HYDRAULIC SPECIFICATIONS

COMPONENT	PRESSURE
Charge Pressure	425±25 PSI 30±1.7 bar
Control Pressure	320±15 PSI 22±1 bar
Lubrication Pressure	50 PSI 3.5 bar
Rotor Drive Pump Pressure	6500 PSI 450 bar
Servo Pressure	290 – 320 PSI 20-22 bar
Shuttle Valve Pressure	230 PSI 16 bar

BASIC FUNCTIONS

1. Cutting and Gathering (covered in the “Header” section)
2. Positioning the Header and Feeding the crop
3. **Threshing**
4. **Separating**
5. Cleaning
6. Distribute Crop Residue
7. Grain Handling
8. Record Data (covered in the AFS course)

GENERAL INFORMATION

This section is broken down into the following sections:

1. Threshing and Separating components
2. System operations
3. Rotor Drive, mechanical components
4. Electrical controls and calibrations
5. Hydraulic Drive, POWER PLUS drive
6. System calibration
7. Troubleshooting the system

THRESHING FUNCTION

In order to receive maximum productivity from the Axial Flow Combine, it is necessary to understand its basic operating functions. This section reviews the functions of grain threshing; separating the grain from the crop.

The threshing operation must be set to provide the greatest productivity. Productivity may be expressed in three ways:

1. Amount of grain saved from the field.
2. Quality of the grain saved.
3. Capacity of the combine.

The first two should be considered the most important when preparing a combine for the field; they are the ones that will put money in the operator's pocket.

To accomplish the threshing operation, the rotor and rotor module assembly is used to remove the grain from the heads of the crop; and due to such a wide variety of crop types there are many ways to setup the thresher members to achieve maximum productivity.

To achieve maximum productivity from the Axial-Flow combines the proper equipment and adjustments must be made. Due to the rotor design, the crop can be harvested with little if any damage. The operator must make the following major adjustments for the crop harvested.

1. Hold the crop in the threshing zone long enough to complete the threshing operation. Vane adjustment and concave clearance.
2. Move the crop through the machine fast enough to provide for capacity. Rotor RPM and Vane adjustment.
3. Separate the grain from the straw and trash. Concave members.

HOW IS A CROP THRESHED



Lets take a moment and think about how grain is threshed.

If a Mr. Big Farmer wants to get an early sample of wheat to check moisture levels and quality what steps would he use?

Operation

1. He cuts and gathers a few heads of crop into one hand.
2. He uses the other hand to pressing against the crop while moving it in a rotating matter.

How to Control Threshing

The threshing action is control by the farmer the same way it MUST be with the combine. The quality of the threshing job and grain is mainly determined by two functions:

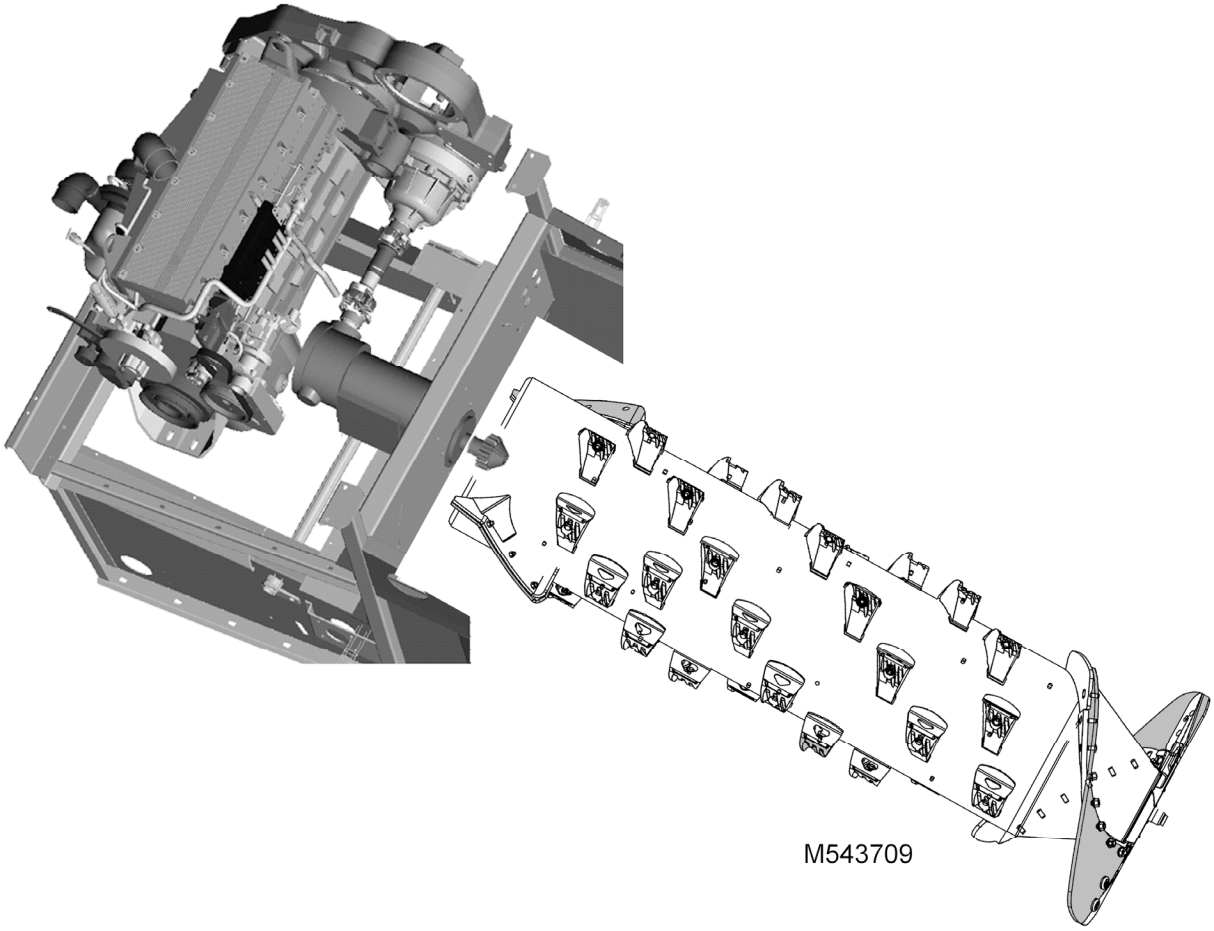
1. The amount of pressure used between the two hands, (concave and rotor). The greater the pressure (the closer the concave is to the rotor), the quicker the grain is threshed, but possible grain damage may occur. Reduced pressure (greater distance between the concave and rotor), the longer threshing will require.
2. The amount of time the grain is moved around between the two hands, (amount of revolution the grain makes in the threshing area). The longer the grain is retained in the threshing area the more completely the threshing will be. The quicker the grain is moved out of the threshing area the less over threshing will be done with less thrash ending up in the cleaning system. The vane settings and threshing elements will determine the length of time the crop stays in the threshing area.

The combine capacity is influenced by the speed at which the threshing is being done, (rotor speed).

1. The slower the rotor speed the thicker the mat of material will be going through the machine and could cause reduced separation. The combine may have to travel slower to prevent over loading.
2. The faster the rotor speed, the thinner the mat of material will be going through the machine and could cause reduced separation and grain damage. The combine may have to travel faster to keep the machine full.

ROTOR

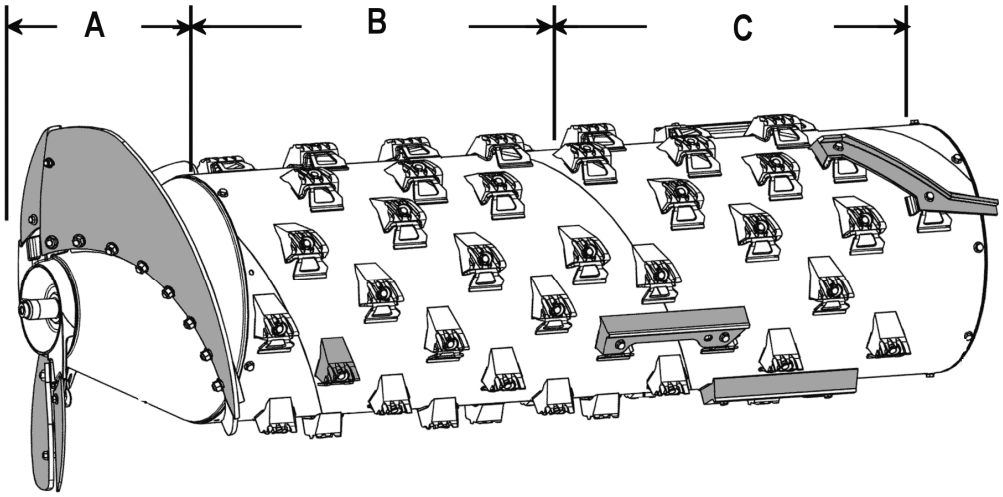
The rotor is the primary part of the threshing and separating system. It is located inside the rotor cage and is supported by a large bearing in the front, and the rotor drive gearbox at the rear. The rotor gearbox through which the rotor is driven has three speed ranges to provide for optimum driving torque. The rotor gearbox is driven by a Power Plus drive which provides for a variable speed adjustments within a working range. The Power Plus drive is driven from the main PTO gearbox.



ROTOR

The rotor is one solid unit that has three distinct areas:

- The transition section “A”
- The threshing section “B”
- The separation section “C”



M511708

The rotor is available in a variety of different configurations to handle different crops and conditions.

AFX Rotors

- Corn and Grain configuration, regular rasp bars and eight spike rasp bars over the separation area.
- Corn, Soy Bean and Grain, regular rasp bars and eight spike rasp bars with 4 straight bars over the separation area.
- Extended wear configuration for Grain and Corn

Small Tube Rotors

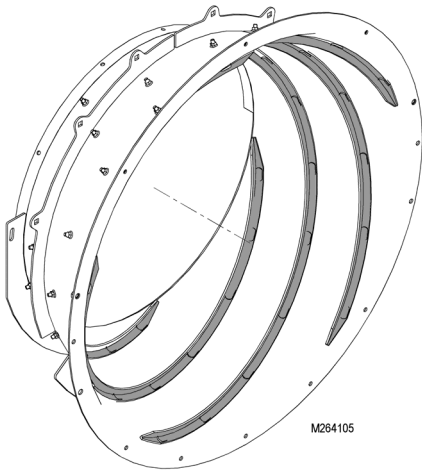
- Rice configuration, small tube rotor, spike rasp bar full length.
- Euro small tube rotor for grain, regular rasp bars and eight spike rasp bars over the separation area.

At this time the small tube rotor is not a standard grain option, although it is found in some grain machines.

TRANSITION CONE

TRANSITION CONE

The standard transition cone comes with bolted in veins. The cone improves tough feeding crop flow into the rotor threshing area.



IMPORTANT: The standard cleaning system (not installed in any 20 series machines) and enhanced cleaning systems will require different transition cones, be sure to check the cleaning system installed before ordering a transition cone.

TRANSITION CONE

TRANSITION CONE

The transition cone is located directly behind the feeder house or rock trap, and in front of the rotor cage. It is a circular cone shaped metal piece that is about 2 feet deep and 12.5 feet in circumference at its largest point. The cone is constructed of a single piece spun into the cone shape and is very resistant to the abrasive action of crop flow. It acts as a distribution area for the crop as it starts to rotate. The cone contains replaceable fixed directional veins that work in conjunction with the impeller blades to perform four important functions.

1. Gather and condense the crop width from the feeder to the diameter of the rotor cage.
2. Divide the crop mat into smaller, thinner mat.
3. Start the rotation of the crop mat and start it moving rearward to the rotor cage.
4. The crop mat is accelerated gradually to threshing speed.

The transition cone along with the thicker crop mat produced by the feeder are two reasons why grain quality is increased. There is a greatly reduced chance for high speed metal to grain impact.

CONE TYPES

This cone is available as a standard or extended wear cone. The extended wear cone is recommended for high abrasive operating conditions, an operator that accumulates several hours yearly or an operator that plans to keep the machine for several years. The extended wear cone is painted RED for identification purposes.

CONE VEINS

The cone incorporates replaceable bolted in veins. The veins assist the rotor augers in moving the material into the threshing area of the rotor cage. If the veins become worn or damaged, machine throughput may become reduced

FEEDING

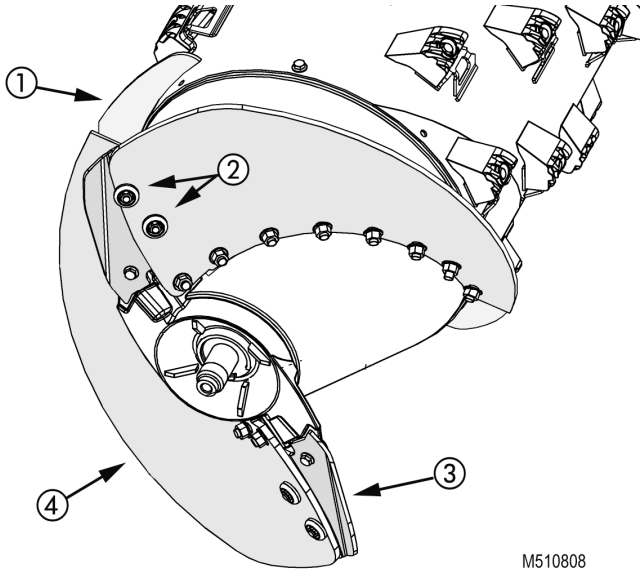
AFX IMPELLERS

The AFX rotor uses two-piece constant pitch impellers (non-adjustable), for increased feeding. The design allows the crop material to flow more smoothly into the cage, resulting in less cone and impeller wear. The combination of the impeller flighting design and rasp bar mounting locations promoted improved material flow through the rotor cage in difficult to thresh crops (such as rice, green soybeans).

The impeller components are made out of AR235 iron for long service life. The front wear blade (3) should be replaced when signs of wear are present, as they wear feeding will deteriorate. The auger blade will probably out last the front wear blade 3-1. Poor feeding may be experienced if the wear bar is allowed to wear to the point that the auger flighting is contacting the crop first.

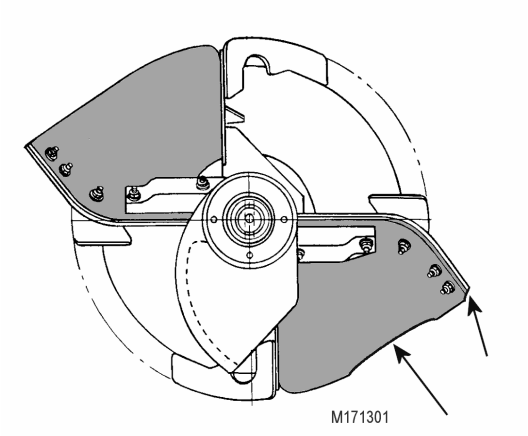
A side benefit of the impeller blades is their ability to pull in air along with the crop material. This suction draws dust and light material into the feeder house making for a much cleaner feeder area than on conventional combine. Visibility is much better, especially at dusk and at night.

1.	Rear Fixed Vein
2.	Bolt Protectors
3.	Wear Blade
4.	Auger



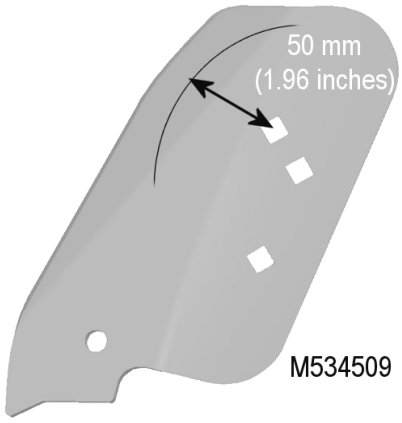
FEEDING

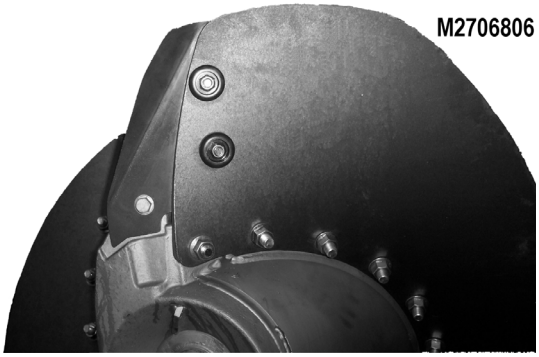
Wait a Minute... How can I tell when the impeller blades need to be replaced? When the outer edge of the wear bar and/or the back side of the impeller blade begins to cup due to wear, the machine's feeding ability and through-put will be greatly reduced.



Wear Areas

The wear bar is considered worn when the leading edge is worn to within 50mm (1.96") of the center line of the outer most bolt hole.





The wear bar and impeller blades were changed to incorporate an additional retaining bolt with bolt guards. The bolt guards used to prevent the bolt from wearing. Whenever working in the cone or rotor area it would be good to inspect the condition on the auger and wear pad retaining hardware.

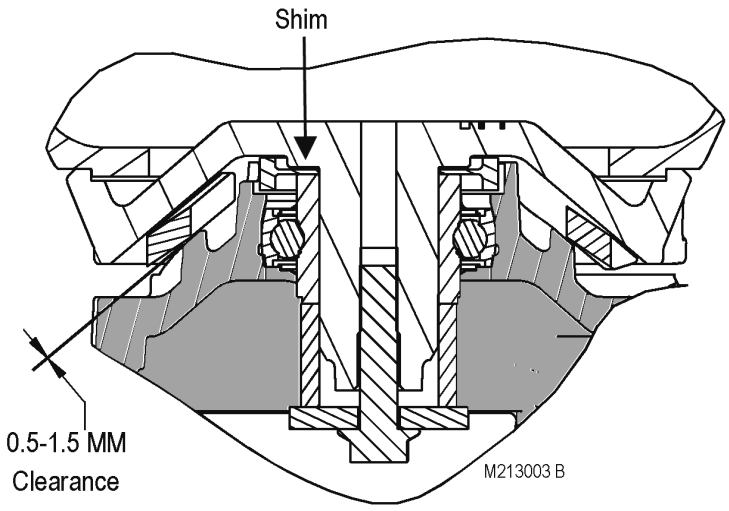
FEEDING

Wait a Minute... When replacing the front wear blade, be sure to install and torque the retaining bolts correctly.

ROTOR IMPELLER WEAR BAR TORQUE PROCEDURE

1. Insure the wear bar and auger flight mating surfaces are clean and dry.
2. Install the wear bar hardware finger tight.
3. Tighten the inner (closest to the center of the rotor) bolts to 50 ft lbs.
4. Tighten the plow bolts, shield and lock nuts to 50 ft lbs.
5. Use approximately a 16 oz. hammer to strike the wear bar 3 times at the leading surface perpendicular to the plow bolt. This will seat the bolt against the auger flight and wear bar.
6. Retighten the wear bar hardware to 50 ft lbs.
7. Tighten all rotor wear bar retaining bolts to 80 ft lbs.
8. If any noticeable loss of torque is identified, repeat steps 5 and 6 again.

FRONT ROTOR SUPPORT



1.	Auger Front Face	3.	Front Bearing Support
2.	Anti-Wrap Rear Face	4.	Retainer Bolt

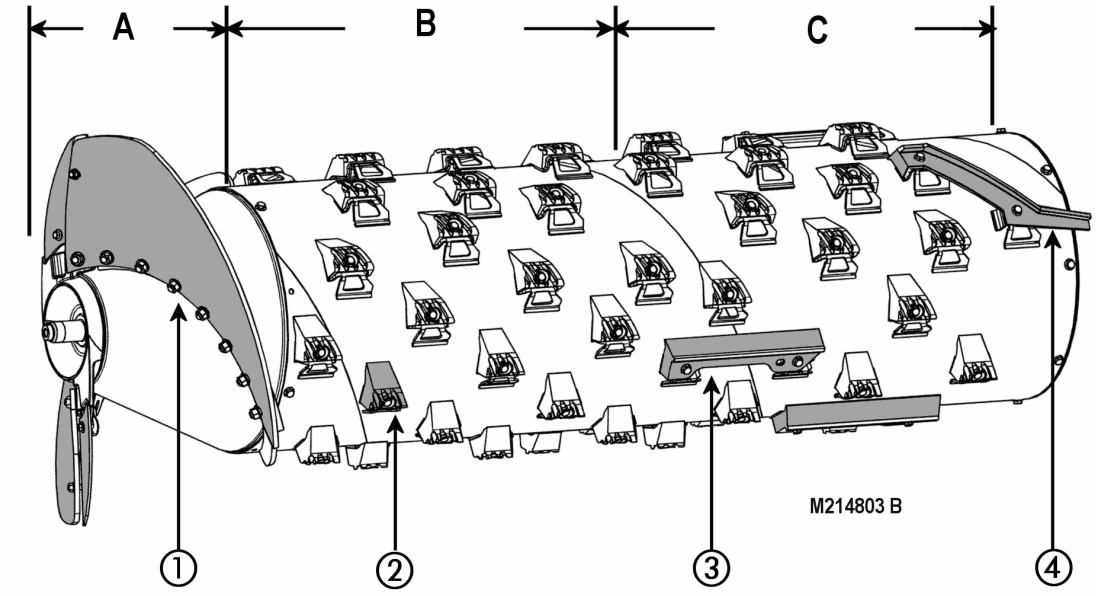
Make sure the front bearing is installed with the locking collar portion of the bearing pointing in towards the rotor and the grease hole in the outer race towards the outside of the carrier.

AFX ROTOR

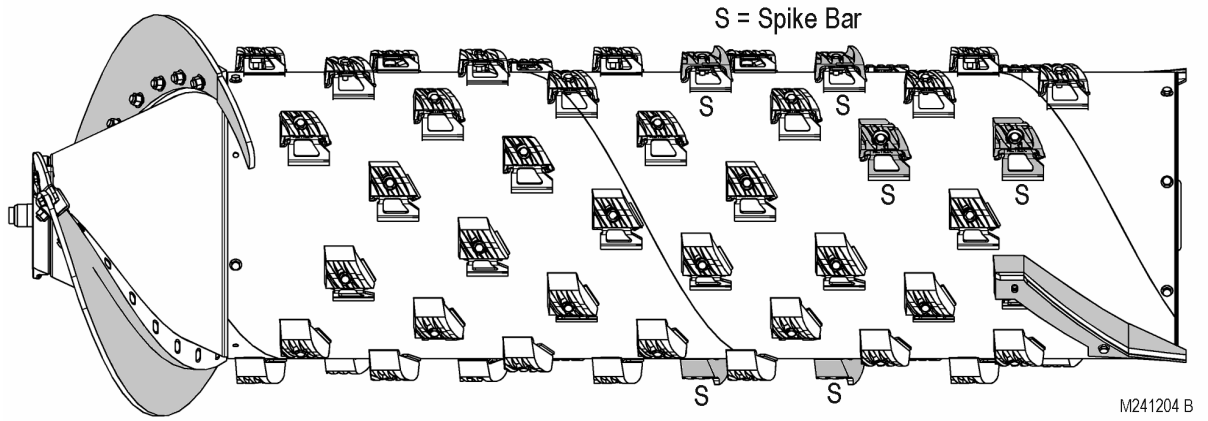
The AFX rotor comes in two major styles: the standard rotor and the small tube rotor. Both rotors have the same 30 inch rasp bar tip diameter; they both fit and operate in the same rotor cage and concave configuration. The small tube rotor has a tube diameter that is 2 inches smaller than the standard rotor. This gives more recessed area between rasp bar mounts for the crop to rest. This frees up the material to flow and churn, requiring less horsepower and less breaking of the crop residue.

STANDARD ROTOR

Setup with Straight Separator Bars (3) to promote additional crop rotations for additional grain separation.



1.	Constant Pitch Impeller	A	Feeding Area
2.	Threshing Elements	B	Threshing Area
3.	Separating Elements	C	Separation Area
4.	Dis-charge Kicker		



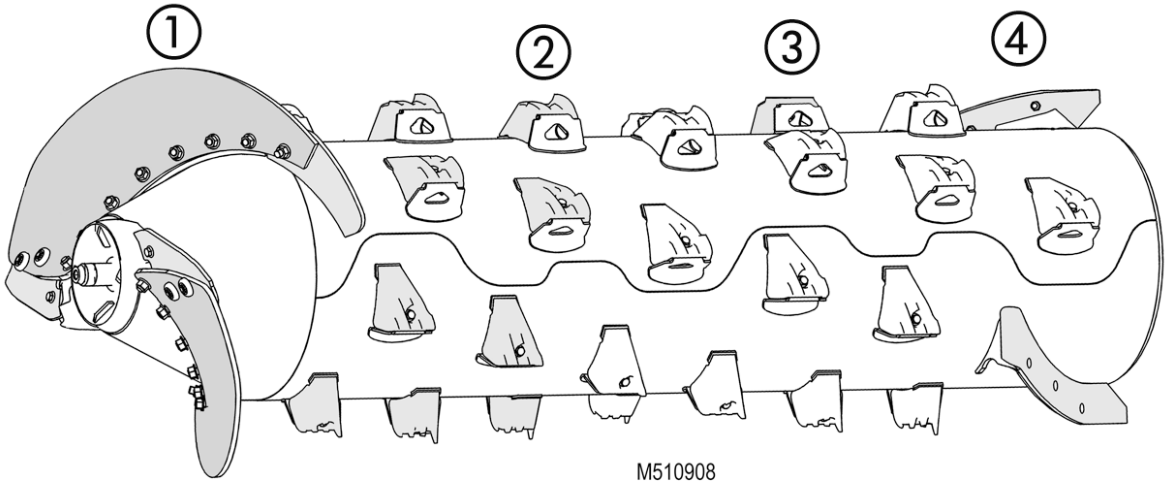
Corn and Bean rotor equipped with spike bars (S) in place of straight separator bars to promote better crop flow and agitation for better separation.

AFX ROTOR

SMALL TUBE ROTOR

At this time the small tube rotor is standard for the rice machines and may be ordered in the others. It operates best in crops that are green, wet, or bulky such as rich, green stem soybeans; providing improved throughput while reducing power requirements. It has not yet been accepted across all crop conditions.

There are different designs of the small tube rotor; it may be equipped with 40 mounting pads (pervious production) or 36 (current production). The rotor has also gone from a spiral formed tube too two separate halves wielded together.



1.	Constant Pitch Impeller
2.	Threshing Elements (Spike)
3.	Separating Elements (Straight)
4.	Dis-charge Kicker

ROTOR

AFX ROTOR

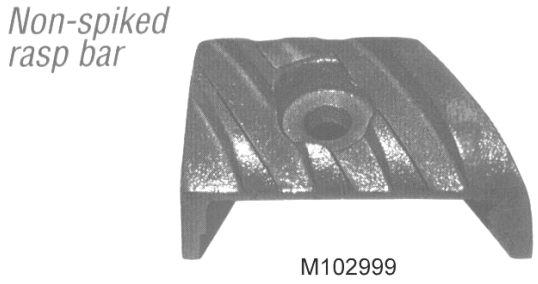
The standard rotor uses non-spike rasp bars and the **Rice Rotor** may use spike rasp bars the full length of it.

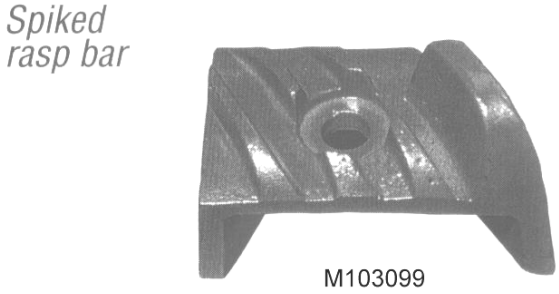
The standard rotor design was originally designed for use in rice and edible beans. Over the years the rotor has been adapted to other crops such as corn, soybeans and small grains. To change from one crop to another, alterations can be made to the rotor without removing it from the combine. Different attachments can greatly improve the combine performance in damp, viney crops like edible beans or soybeans when the stems are not dry.

The rotor has four main components that allow it to be setup for use in a variety of crops and conditions. The rasp bars are positioned in a helical pattern around the entire rotor. This forces the material to move through the machine aggressively. This is ideal for tough, wet conditions. Each type of rotor component works differently.

NON-SPIKED RASP BAR

This part is used as a primary threshing element. The non-spiked rasp bar is used to thresh the crop. It is also used as a secondary separating element and provides positive crop movement. These can be interchanged with straight separator bars or spiked rasp bars on the rear of the rotor.





SPIKED RASP BAR

This part is used as a primary material mover. The spiked rasp bar is used to move the crop through the combine. It will also chop the crop up to prevent the crop from roping. It is found as standard equipment on rice rotors, but can be interchanged in the separation area of the rotor with the straight separator bars and non-spiked rasp bars on corn and bean rotors. The spiked rasp bar provides effective separation, insuring that all crop material is torn apart as well as positively moved through the separation area.

The extended wear rasp bars will be made out of Chrome Alloyed metal which will not chip like chrome plated rasp bars.

ROTOR

STRAIGHT SEPARATOR BAR

This part is used as a primary separating element. The straight separator bar is used to separate the grain from the crop. This bar requires two rasp bar mounting pads in order to install it on the rotor. It causes the crop mat to be thinned allowing the seeds to separate from the residue easier. It is primarily used in high yielding corn to prevent rotor losses. The bars must be installed as complete sets to maintain rotor balance. They are not recommended for very green crops.

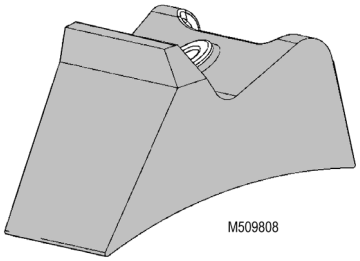
IMPORTANT The small tube rotor's straight bar has a unique mounting process that MUST be adhered to very closely to prevent the bar from coming loose.

Standard AFX Rotor Straight Bar



M103199

Small Tube Rotor Straight Bar

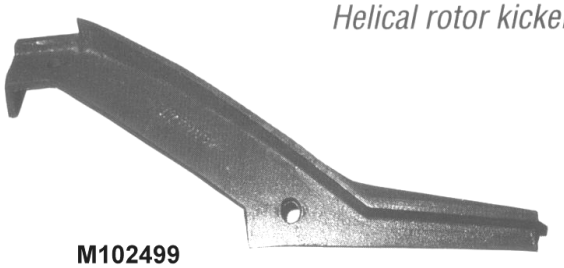


M509808

HELICAL KICKER BAR

This part is used as a primary moving element. This element is used at the very rear of the rotor to flail the material being discharged. The kicker conforms to the helical pattern of the rasp bar locations and requires two rasp bar mounting pads in order to install it on the rotor. An additional set of helical kickers may be mounted over the front and center grates when additional separation is not required, such as sunflowers and some grass seeds. Kickers would be used to move material out of the rotor cage as quickly as possible to prevent overloading the cleaning system or causing additional damage to the straw.

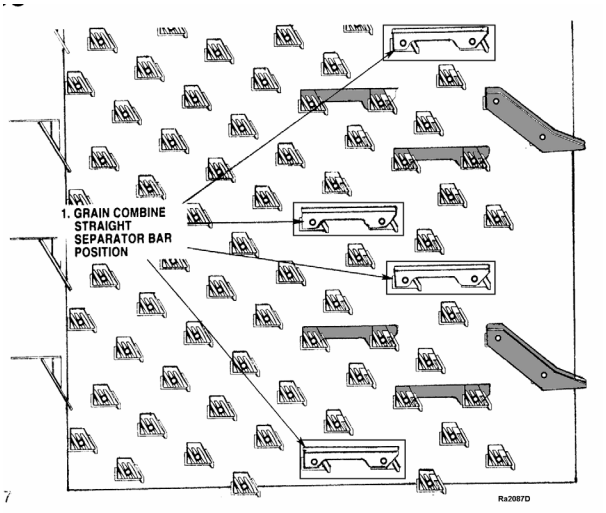
Helical rotor kicker

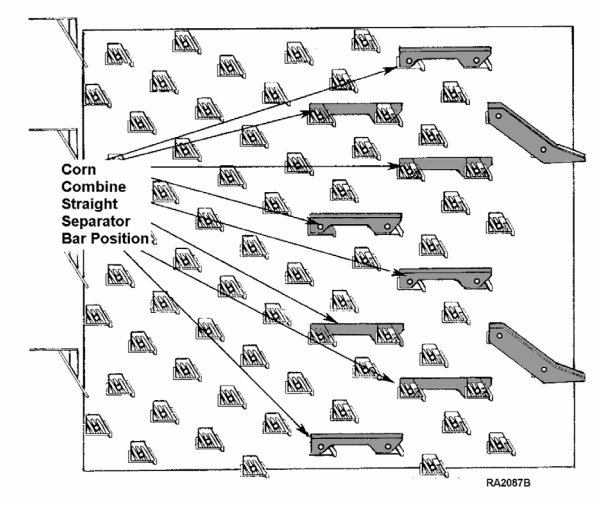


M102499

ROTOR

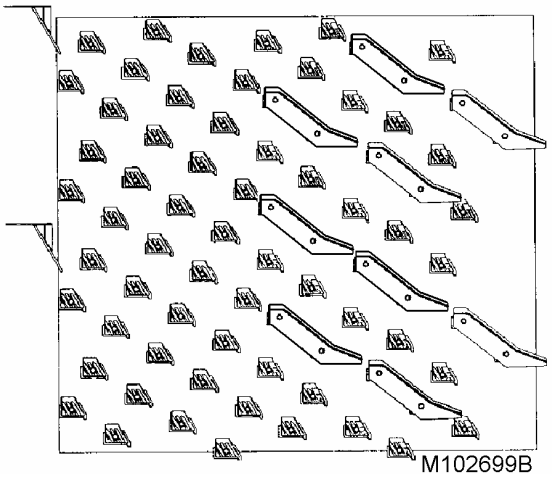
SUGGESTED SET-UP





1. Straight separator bars may be needed for harvesting corn yielding more than 150 bu/acre (9400 kg/ha).
2. Once installed, straight separator bars need to be removed for harvesting rice and edible beans and similar viney crops. Normally the straight bar may be replaced with spike bars.
3. Very tough rice conditions may require the use of spiked rasp bars over the threshing and separating modules. Reset the threshing module stop bolts to insure that the rotor will not contact the concave. Readjusting the stop bolts will require re-calibrating the concave sensor.
4. Use of non-spiked rasp bars in all positions is recommended for most grass seed harvest conditions. Spiked bars may be helpful in extremely damp crops.

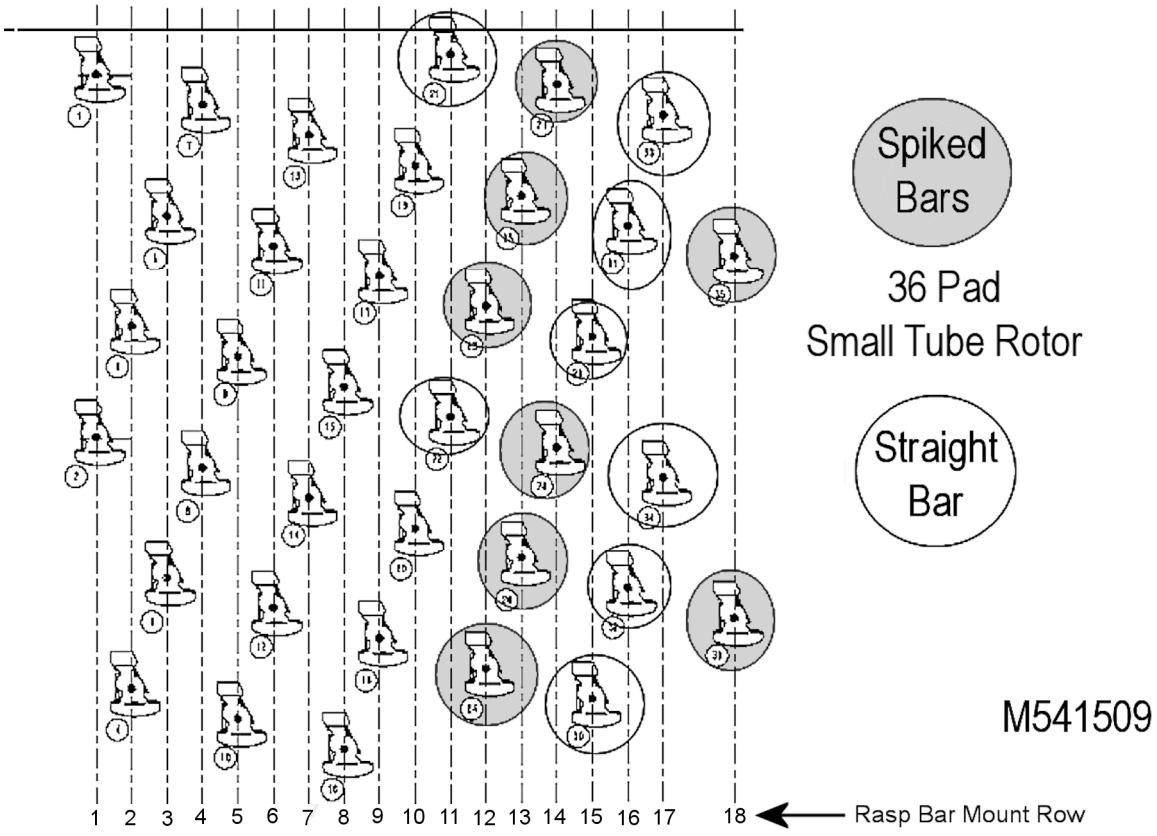
In easily separated crops additional kickers or solid separator modules may be added to move the crop residue out as fast as possible to prevent overloading the cleaning system with MOG.



ROTOR

SMALL TUBE SUGGESTED SET-UP

Refer to the Assist Knowledge base for current settings: “Excessive grain loss with small tube rotor”.



At this time corn is probably the hardest crop to harvest with the small tube rotor, as far as grain loss is concerned. The above lay out is the recommended starting setup.

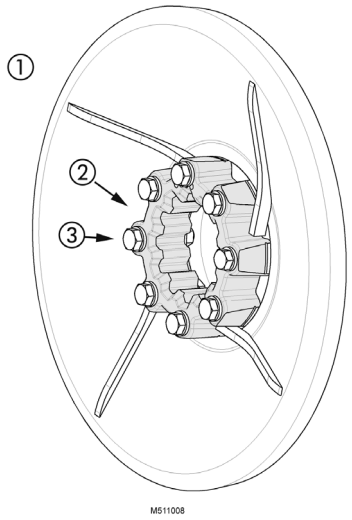
ROTOR

ROTOR DRIVE HUB

The rotor is driven through a splined hub that is bolted into the rear of the rotor end plate located at the rear of the rotor. The hub is retained with 8-M16 bolts torque to 180-190 lb ft.

There are two different rear rotor bulkhead and gearbox cones due to the standard and small tube rotors.

If a new rotor is being installed in an older machine, the gearbox cone will require replacing due to the bolt in hub.



ROTOR REPAIR

REPAIRING ROTOR DAMAGE

When servicing the rotor, it does not necessarily have to be removed from the machine. However, inspection of the rotor itself and component replacement become easier with the rotor out of the combine. It is good practice to replace all the components at one time. If one set of bars is worn excessively, the others are probably worn also. Check all rasp bar mounts while the rasp bars are removed. Clean all material from under them. Also check the condition of the rear coupler mounting hardware.

If the rotor itself is damaged, repair it using the following guidelines.

Holes or cracks can be repaired as follows:

1. Remove **ALL** foreign material from inside the rotor. A shop vacuum works well for this. The inside of the rotor is one large cavity, by removing the rear coupler assembly (if equipped) the rotor may be cleaned out. If the rear bulkhead is wielded in place a hole may be cut in the side of the rotor and wielded back in place once the rotor is cleaned out.
2. Straighten any large indentations and re-weld the cracks.
3. Large holes that cannot be welded may be covered with a low carbon commercial steel 0.100" to 0.125" thick, and welded in place. In normal repair, a patch up to 8 ounces (227 g) will require a patch of equal weight welded 180 degrees from the original patch.
4. Remove **ALL** foreign material from under the rasp bar mounting supports.
5. Check for correct fit of all rasp bars.
6. Check all attaching hardware for tightness (replace all hardware that shows signs of wear).

ROTOR REPAIR

ROTOR BALANCING

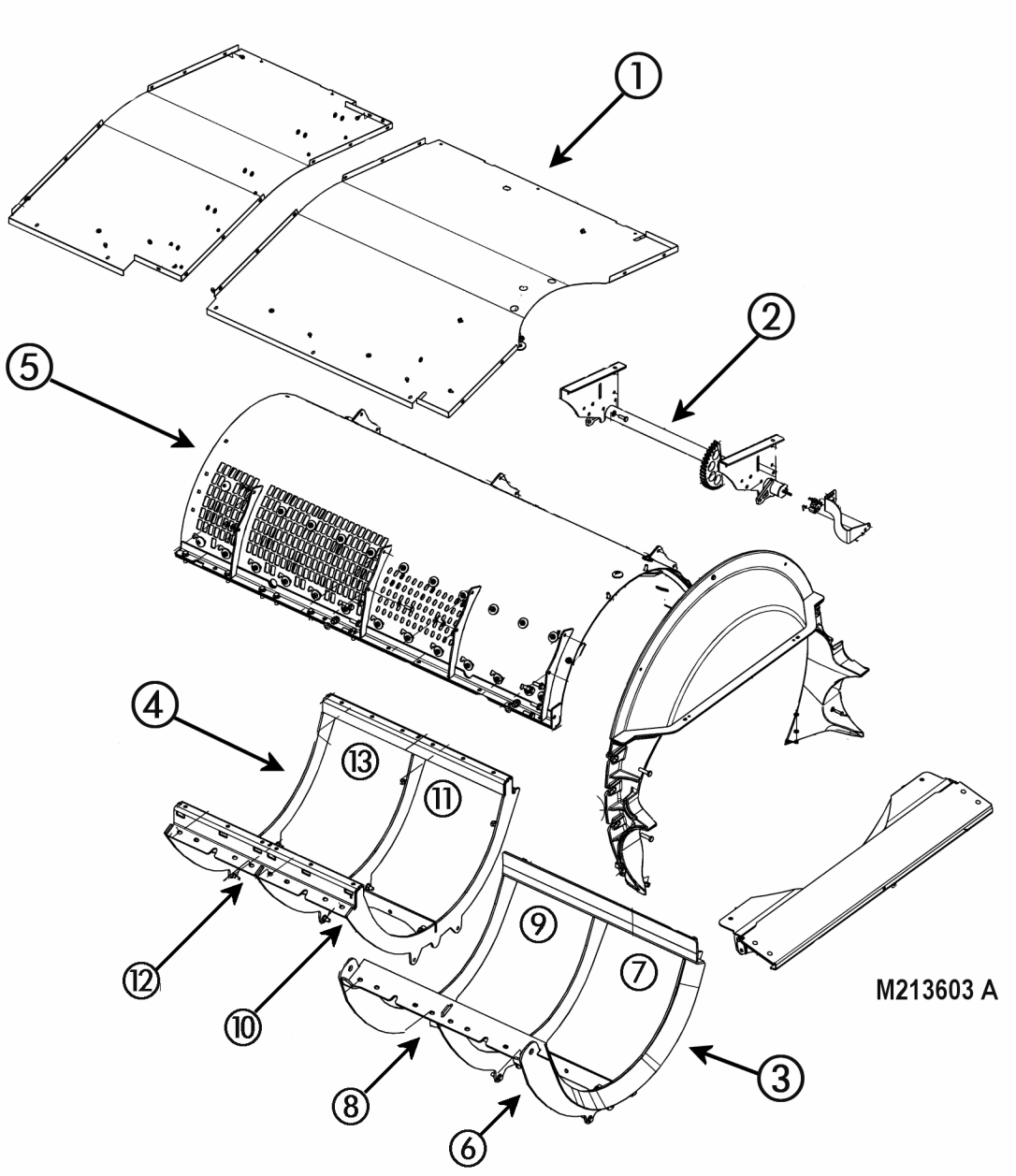
If a customer has a combine rotor that needs balancing, the Grand Island Plant will provide the service. Effective September 1, 2008, there will be a $200 (charge to change with out notice) charge per rotor for balancing. This service is available to any Case IH dealer who is in the process of refurbishing combines and wants the rotor balanced to ensure proper operation.
Reference bulletin AFX SB 013 08

1. Rotor Condition:
   a Rotor must be an OEM rotor, and must NOT contain any NON-CASE IH components.
   b The rotor must be clean.
   c Neither the front cross channel nor the bearing casting can be with the rotor, as the plant will not be responsible for having to destroy a bearing casting while trying to remove it.
   d Verify that the rotor has no run out due to the front support shaft being bent.
   e Check the rear splined area and drive plate for gaps to the rotor, seal any locations that would allow dirt entry. If the dust shield (in the splined hub) has not been installed, install and seal it. If the rotor is equipped with a bolted in drive hub verify its condition.
   f If the rotor ever had a hole in it that allowed foreign material to accumulate inside the rotor, the material must be removed and the hole patched.
   g It is recommended that the replaceable wear items, such as rasp bars, be replaced before the rotor is balanced.
   h If the plant has to perform any of the above services, additional labor will be charged at a rate of $100 per hour (subject to future change).
2. Procedure:
   a Call the Plant and ask for a rotor rebalance appointment (308--389--5758).
   b The dealer is responsible for transporting the rotor to and from the plant.
   c The dealer's open account will be charged $200 per rotor balanced.
   d Plan to arrive at the Plant prior to the balance appointment time, so that the plant can plan to fit the rotor into the balance schedule.

ADDITIONAL INFORMATION
Plant address:
CNH Grand Island Plant
3445 West Stolley Park Road
Grand Island, NE 68803
Phone: 308--389--5758

ROTOR MODULES

MODULES



1.	Top Cover	8.	Module R2
2.	Module Clearance Adjusting Bar	9.	Module L2
3.	Threshing Module Carrier = "H" Frame	10.	Module R3
4.	Separating Module Carrier	11.	Module L3
5.	Upper Cage	12.	Module R4
6.	Module R1	13.	Module L4
7.	Module L1		

ROTOR MODULES

MODULES

After the crop material leaves the transition cone, it enters the front portion of the rotor cage area. The cage contains 8 rotor modules,

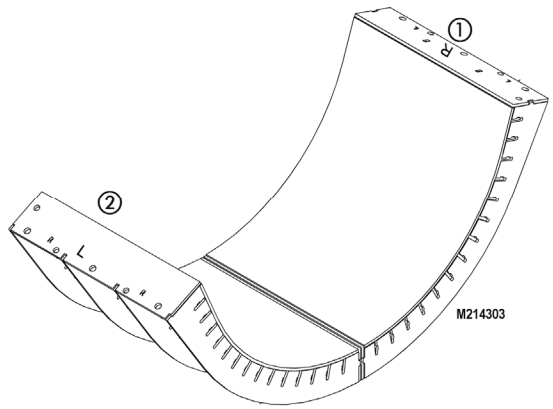
- The modules in rows 1 & 2 are referred to as concaves. The concaves are mounted in a movable "H" frame so the distance between the rotor and modules may be increased or decreased. These units complete the threshing the crop and start the grain separation.
- The modules in rows 3 & 4 are referred to as grates. The grates are mounted in a fixed position frame. These units will complete the grain separation.
- The modules are designated as right and left side modules that wrap around the rotor approximately 90° each, providing a total module wrap of 180°.
- Any module may be placed in any location with respect to the side it is designed to fit.
- The modules are attached to the module carrier using two bolts and mounting pins.

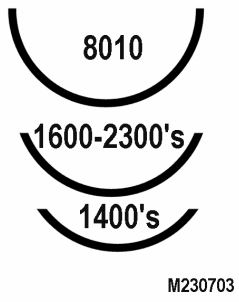
The modules are used to hold the crop material in the rotor cage long enough to be thoroughly threshed. The modules must also have enough capacity to allow the threshed grain to separate from the trash. Different types of modules are available to change how long the material is held in the cage.

As a general rule, 100% of the threshing and 90% of the separation should be completed in the front half of the cage area. This can be fine tuned by running different combinations of modules on the same machine. It is essential that the proper set or combination of modules be used for the crop being harvested. Follow the recommendations made in the **Operator's Manual.**

MODULE LOCATION IDENTIFICATION

The modules are identified by their position. The front right side will be R1 (1), front left side L1 (2) etc.





180 Deg.

156 Deg.

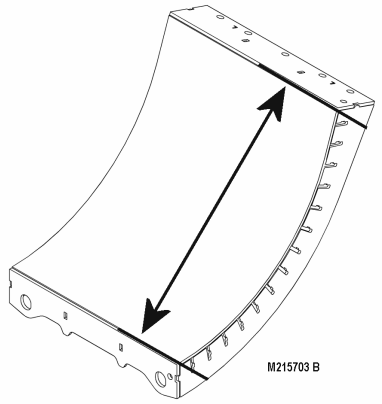
136 Deg.

Module Wrap Around Rotor

ROTOR MODULES

MODULE LOCATION IDENTIFICATION

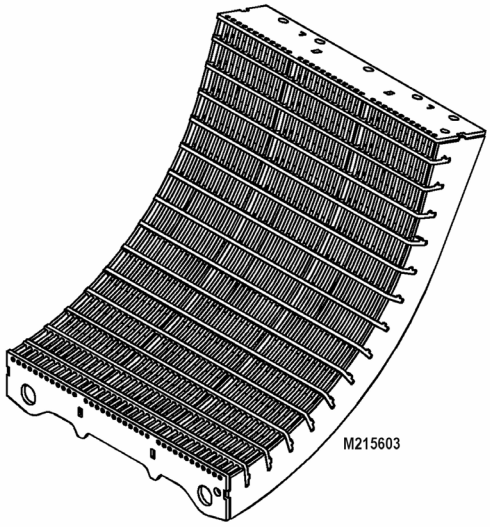
Wait a Minute... How can I identify a left hand or right hand module. The modules are stamped with a L or R on the end plate and should measure from the two outside bars.



Left hand = 21 ¾”
Right hand = 22 ½”

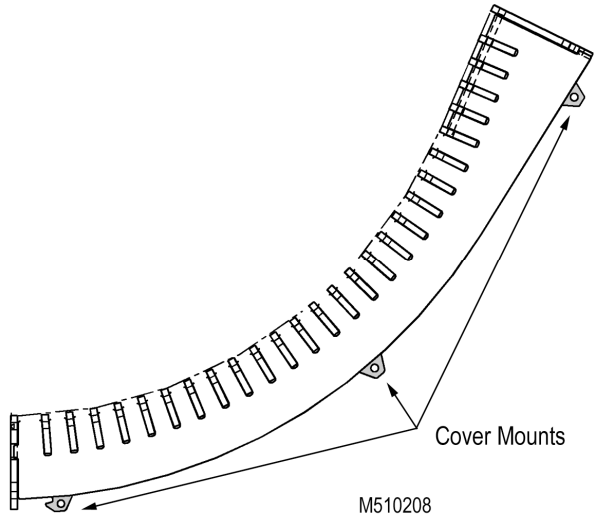
Some module styles are also available in extended wear.

MODULE TYPES



Small Wire

Small Wire - 3/16 inch wire thickness with approximately 0.5 inch spacing center to center. This is most commonly used in small grain type crops. Available in heat treated for extended wear.

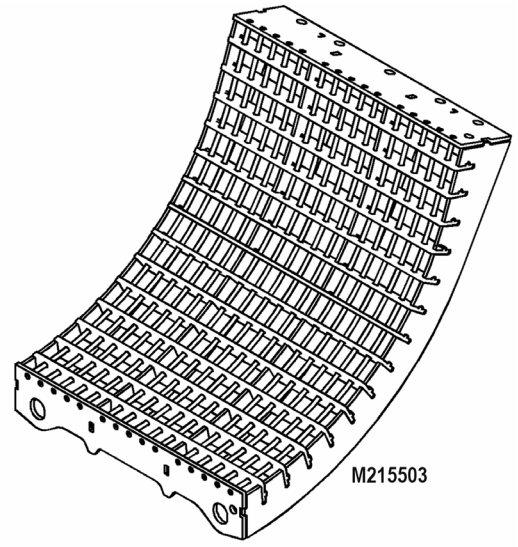


Hard Threshing Small Wire

Hard Threshing – 3/16 inch wire thickness with approximately 0.37 inch spacing center to center, but provides 26 rub bars rather than 14. This makes for smaller openings for the unthreshed heads to fall through. The module also has mounts for a solid pan (cover) to close off the openings of the module, holding the grain in the threshing area for more complete threshing. Normally used in hard threshing wheat.

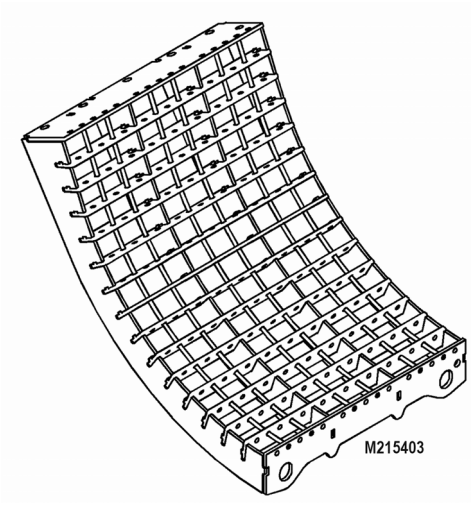
ROTOR MODULES

MODULE TYPES



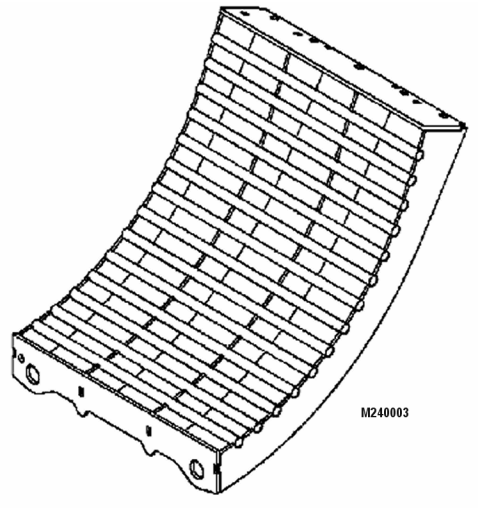
Large Wire

Large Wire - 1/4 inch wire thickness with approximately 1 inch center-to-center spacing of the wires. This is most commonly used in corn, soybeans, and rice. Available in heat treated for extended wear.



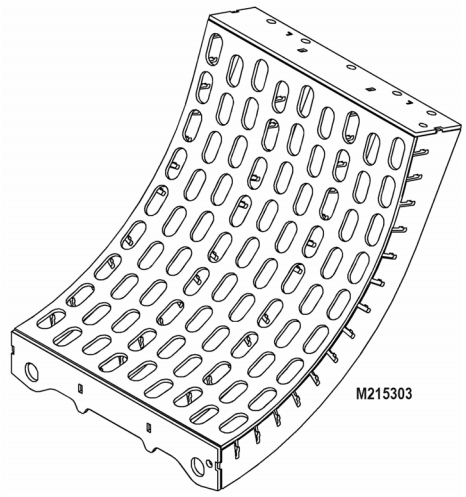
Large Skip Wire

Large Wire Modules – has every other wire removed from the standard large wire module and mainly used in the separating area. All wires may be removed to create a Key Stock Module.



Round Bar Module

Round Bar Modules – May be used in crops where module plugging is a concern. It should be installed at the location where plugging is being experienced, normally located in R2 or R3 location. Reduced threshing aggressiveness will also be experienced with RB modules.

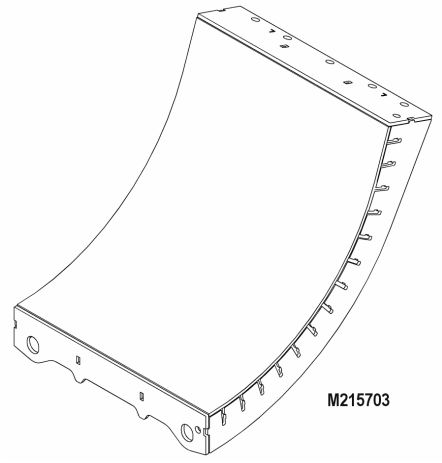


Slotted

Slotted Modules - has slots rather then wires. Slot size is approx. 1"X1.5" and are mainly used in edible beans / sunflowers, and when trying to prevent damage to straw. Can be used to prevent overloading the cleaning system if separation is complete.

ROTOR MODULES

MODULE TYPES

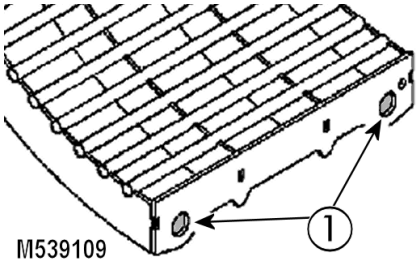


Solid Module

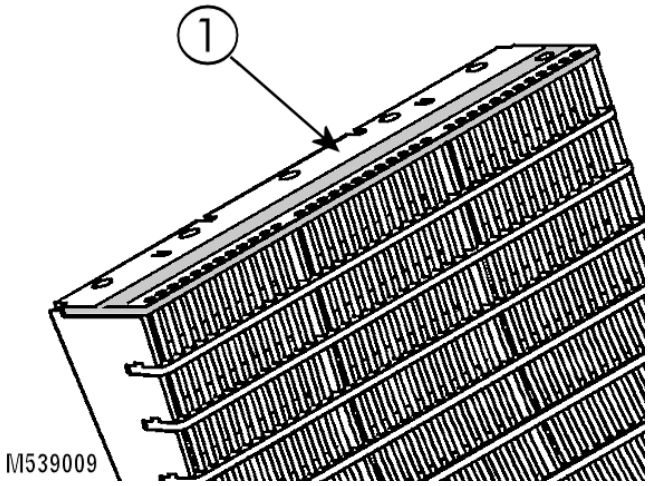
Solid Modules – May be used in very easy threshing and separating crop to prevent excess thrash from over loading the cleaning system.

MODULE MOUNTING

Modules are retained by resting on two dowel bushings in the center of the “H” frame (1) and retaining bolts on the outer edge of the module assembly. Occasionally a module may not rest on the dowel bushings, but may spring up. This can result in incorrect setting of the concave "ZERO" point, poor concave calibration and /or unlevelness of the concave H-frame.



To correct the module positioning, a piece of 12 gauge (0.104" / 2.64mm) flat metal stock (1), 1/2” wide may be tack welded in place as shown. Be sure not to cover the wire removal holes, but keep the metal as close as possible to the holes. The weld must not be higher than the flat metal.



ROTOR MODULES

MODULE TYPES



Wait a Minute... Can I inter mix different style modules? Yes any right or left hand module type may be installed at any location.

EXAMPLE:
The current standard wheat setup is small wire modules in locations R1 thru L2 and large skip wire in R2 thru L4, but if the customer's main crops are Corn and Soy Beans, the following could be possible.

- Small wire modules R1 & L1, large wire modules in R2 & L2, and skip wire in R3 & L4,.
- If the customer encounters hard threshing wheat, add small wire to R2, possibly L2 and maybe R3.
- If there is to much straw on the cleaning system install slotted in L4 and work your way forward as long as the wheat is separated.



Wait a Minute... Remember the job of the module is to hold the crop in the rotor cage long enough to be threshed and then provide for separation.

ROTOR CAGE COVER PLATES

When operating in conditions where the straw breaks up easily, causing cleaning system overloading, cage covers may be installed. The cover will close off portions of the cage perforation, preventing the straw from falling onto the cleaning system. There are two different kit numbers, one for the threshing area and one for the separation area.

ROTOR MODULES

MODULE TYPES

Wait a Minute... What can I do about removing white caps in hard to thresh wheat?

HARD THRESHING KIT, 87748389

The kit includes a R & L module with covers and cage covers.

When harvesting hard to thresh wheat (when you look in the grain tank you see kernels with the last white husks still on), the hard thresh module kit (4) may be installed. The module has additional rub bars and closer wire spacing. This holds the crop in the rotor cage longer, providing for a more aggressive and complete job of threshing.

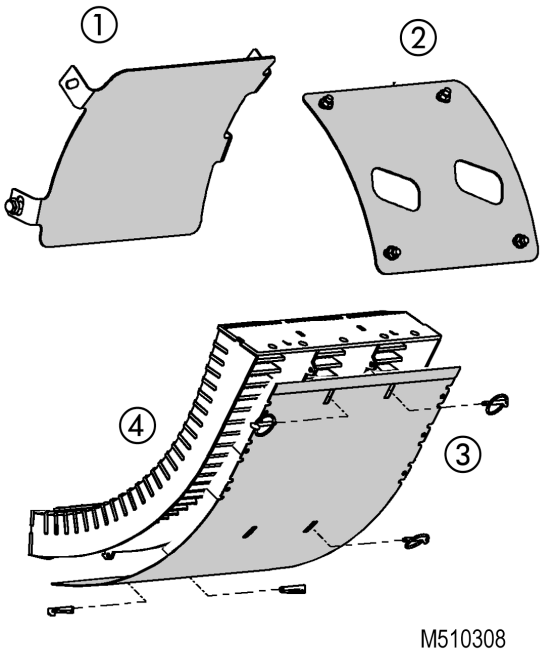
The kit also comes with a module blanking cover (3) that may be installed. The cover prevents ALL grain from falling through the module; providing for NO separation, only threshing. The grain will stay in the rotor cage until it reaches the next module.

The kit also comes with cage blanking covers (1 & 2) to prevent the grain from coming out of the rotor cage perforations.

Each component could be installed as needed.

1.	Right Cage Cover
2.	Left Cage Cover
3.	Module Cover and Retaining Pins
4.	Hard Threshing Module

Since this will eliminate any crop separation, blanking covers should be used very carefully; rotor loss may be experienced with them.

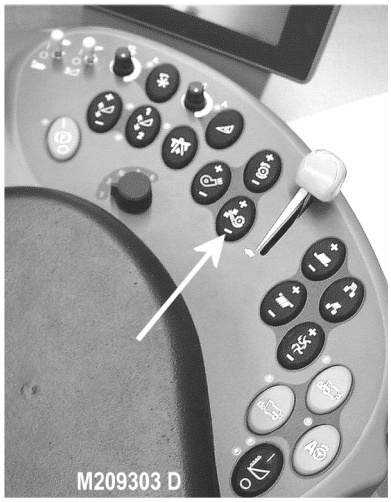


M510308

The blanking covers only attach to module that are designed for them, they will not adapt to all modules.

ROTOR MODULES

THRESHING MODULES



The module position may be changed by pressing the INCREASE/DECREASE switch on the right hand console in the cab. The module clearance will automatically be displayed in the middle of the display while adjustments are being made.

REMEMBER The modules can be adjusted manually if needed by using a ratchet equipped with a 18 mm wrench. The motor would require removal first. Refer to section 1 for instructions for a dealer made tool to be used for module adjustment.

The threshing module INCREASE/DECREASE button is used to set the clearance gap between the rotor and modules. The range of adjustments is 1-50; this reading should be the approximate clearance in mm. The adjusting motor should not draw more than approx. 5-6 amps, if the amperage is high check all pivot points for binding.

The multiple pass threshing allows for a more relaxed setting than a conventional combine does. There is no need to be continually adjusting the module on an Axial-Flow Combine. The 4 threshing module sections allow the operator to fine-tune the threshing capabilities of the combine by running different combinations of modules on the same machine. It is essential that the proper set or combination of modules be used for the crop being harvested. Follow the recommendations made in the Operator's Manual.

CONCAVE ADJUSTMENTS

IMPORTANT:….**The following concave module positioning procedure has been change completely and is totally new. Completely read the procedure before making adjustments. This procedure is to be used on all 7010-9120 machines.**

NEW TERMS

Concave Module Levelness:

The concave modules must be setting parallel to the rotor at the bottom and resting firmly on the mounting bushings. Unlevel concave will diminish the threshing ability of the machine. This parallelness will be checked thru a series of measurements between the concave modules and the rotor. *See measuring tool on below.*

Concave Module Side Shift:

The concave modules may be shifted from right to left in relationship to the rotor, to even out the distribution of material on the cleaning system. The distance between the module and rotor, at the front of concave L1 and the rear of concave L2 MUST be the same distance to ensure uniform threshing and crop flow. This positioning will be check thru a series of measurements. *Do NOT monitor the length of the adjusting draw bolts, they may or May NOT be the same length while the H-frame is in the correct position.*

SPECIAL TOOLS

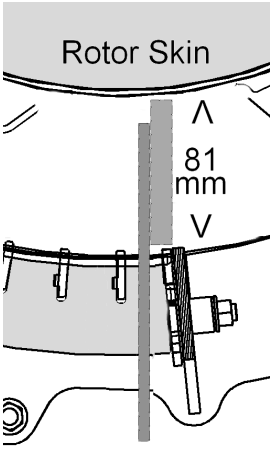
The following tools will need to be made locally and will save time in checking and adjusting module levelness and side shift. Trying to read a tape measure will be very difficult most of the time.

81 mm Gauge or 113 mm Gauge

Used for checking the levelness the Modules. The gauge will rest on the top of the concave rub bar and measure 81 mm to the rotor skin for a standard rotor or 113 mm for a small tube rotor.

75 mm 81 mm or 107 mm Gauge

Used for checking the side shift of the concave. 75 mm for a right shift (**the preferred setting)**, 81 mm for centered and 107 mm for a left shift.



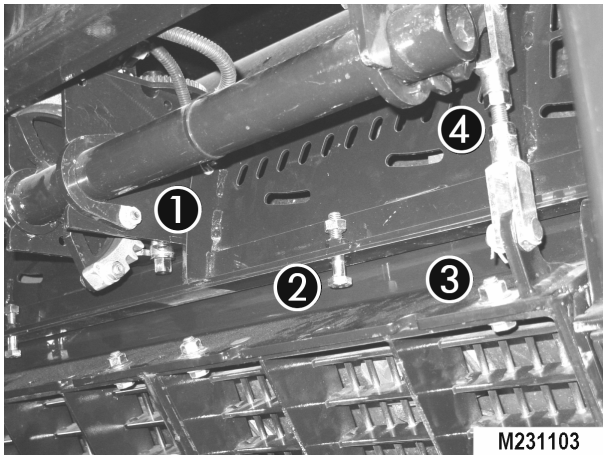
M543609

Picture is example of tool operation only.

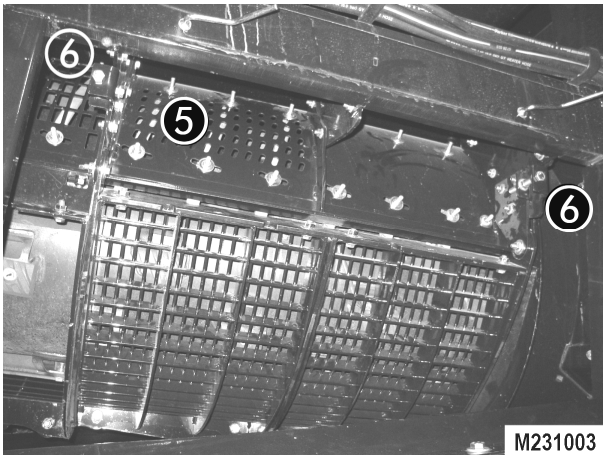
CONCAVE ADJUSTMENTS

AVAILABLE MODULE ADJUSTMENTS

The concave modules have the following three major adjustments available:



Left Side



Right Side

1.	Module Position Motor	5.	Vanes
2.	Module Stop Bolt (Zero Position Setting)	6.	Side Shift Adjustments, Front and Rear
3.	Module Retaining Bolt		
4.	Module Leveling Turn Buckle		

#1 The concave position motor, remember the locally made remote switch that is outlined in the tool section of section #1.

#2 The module stop bolt limits how close the modules will come to the rotor bars.

#4 The module leveling turnbuckle will be used to level the modules.

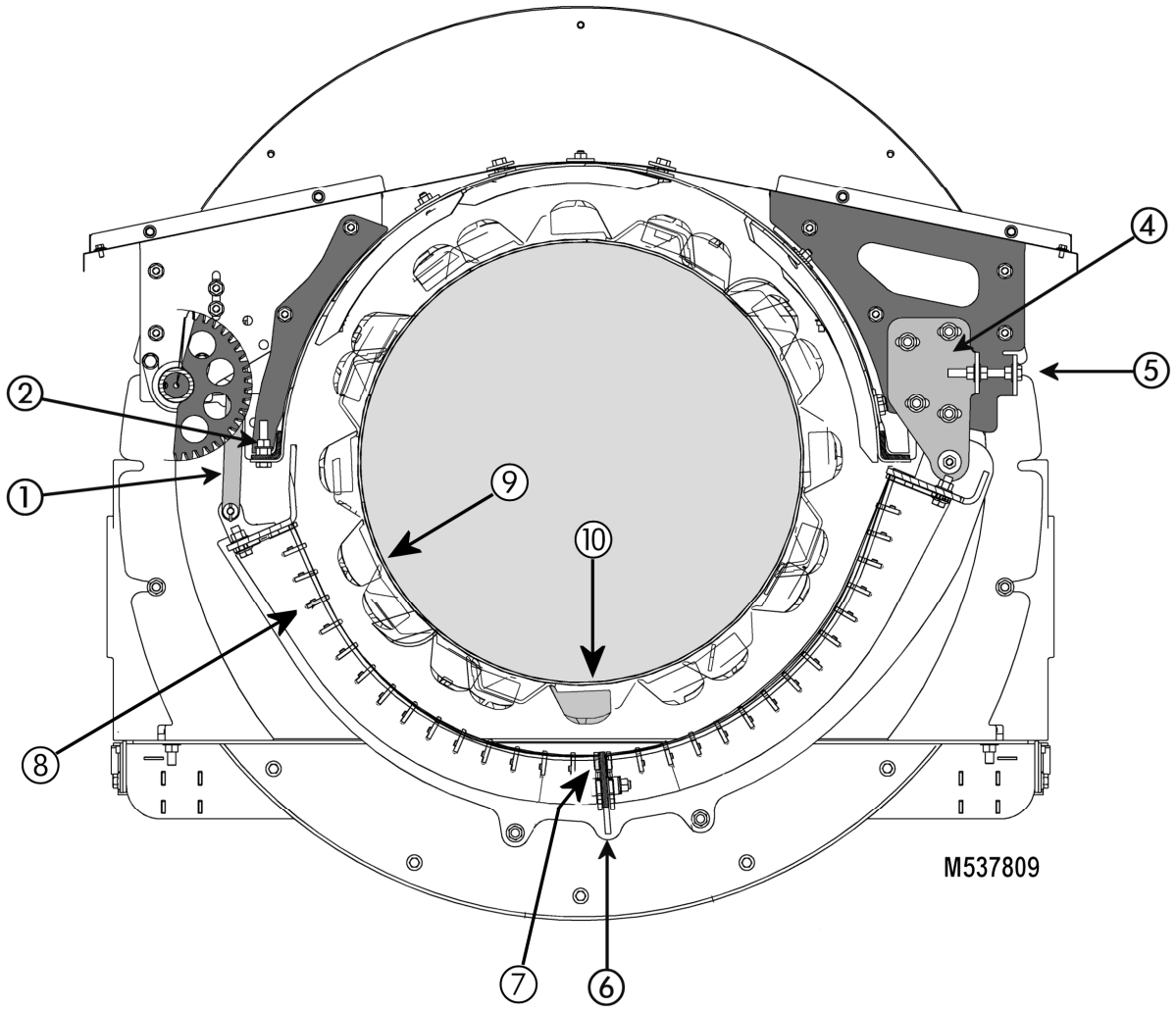
#6 The side shift draw bolts (front and rear) will be used to adjust the side shift operation.

MODULE REMOVAL

The modules are supported at the center on mounting pins and on each side by a series of bolts that connect to an adjustable “H” frame. The modules are easily removed, by removing the bolts at the "H"-frame and pulling the modules out.

IMPORTANT: Verify that all concave modules are resting on the mounting pins before starting the adjustments. Refer to the "Module Mounting" earlier in this section for inserting a shim to force the module down on the pins if required.

THRESHING MODULES POSITION



1.	Leveling Adjustment Turn Buckle	7.	Module Last Rub Bar, NOT the H-Frame
2.	Stop Bolt (Zero Position Setting)	8.	Module Third Rub Bar
4.	Module Positing Plate	9.	Rotor Tube (Skin Face)
5.	Module Position Bolt - Right to Left	10.	Rotor Tube (Skin Face)
6.	Module Support Mounting Pin		

THRESHING MODULES POSITION

STEP #1: LEVELING THE THRESHING MODULES

To insure proper threshing in all crops, it is recommended that the module carrier be leveled and zero clearance set during pre-delivery and/or once a season. This operation will set the distance between points (7) & (10). Perform the following:

	Set Clearance
Standard Rotor	81 mm
Small Tube Rotor	113 mm

1. Shift the rotor gear case to the neutral position.
2. Remove the left hand and right hand rotor access panels.
3. Loosen the locking nuts and back off the module carrier stop bolts (2) on the left side of the machine. This will permit the closing of the module carrier.
4. Remove the modules (R1 & R2) from the right hand side of the machine to gain access for inspection. Module 3L may also be removed so the rotor may be rotated by hand. *The modules Do NOT need to be removed, it is only to make the operation a little easier*.
5. Make a feeler gauge (see previous pages) to check the distance between points (7) and (10), see specification above. The tool should be made so that the measurement can be made between the rotor surface (skin) and the top of the last rub bar on module front of 1L and the rear of L2.



Wait a Minute... Does it make a difference where on the rotor I measure? Yes, due to some rotor run out it will be best to mark a point on the rotor surface (skin), NOT ON A SEAM. Remove all dirt from this location. *It has been noted that when working on the front concave (due to visibility) it is very easy to be measuring on one of the balancing weights or a rasp bar mount ear rather than the rotor skin.* Pick a point on the rotor that is over the front of the L1 module and a point over the rear of the L2 module for marking.

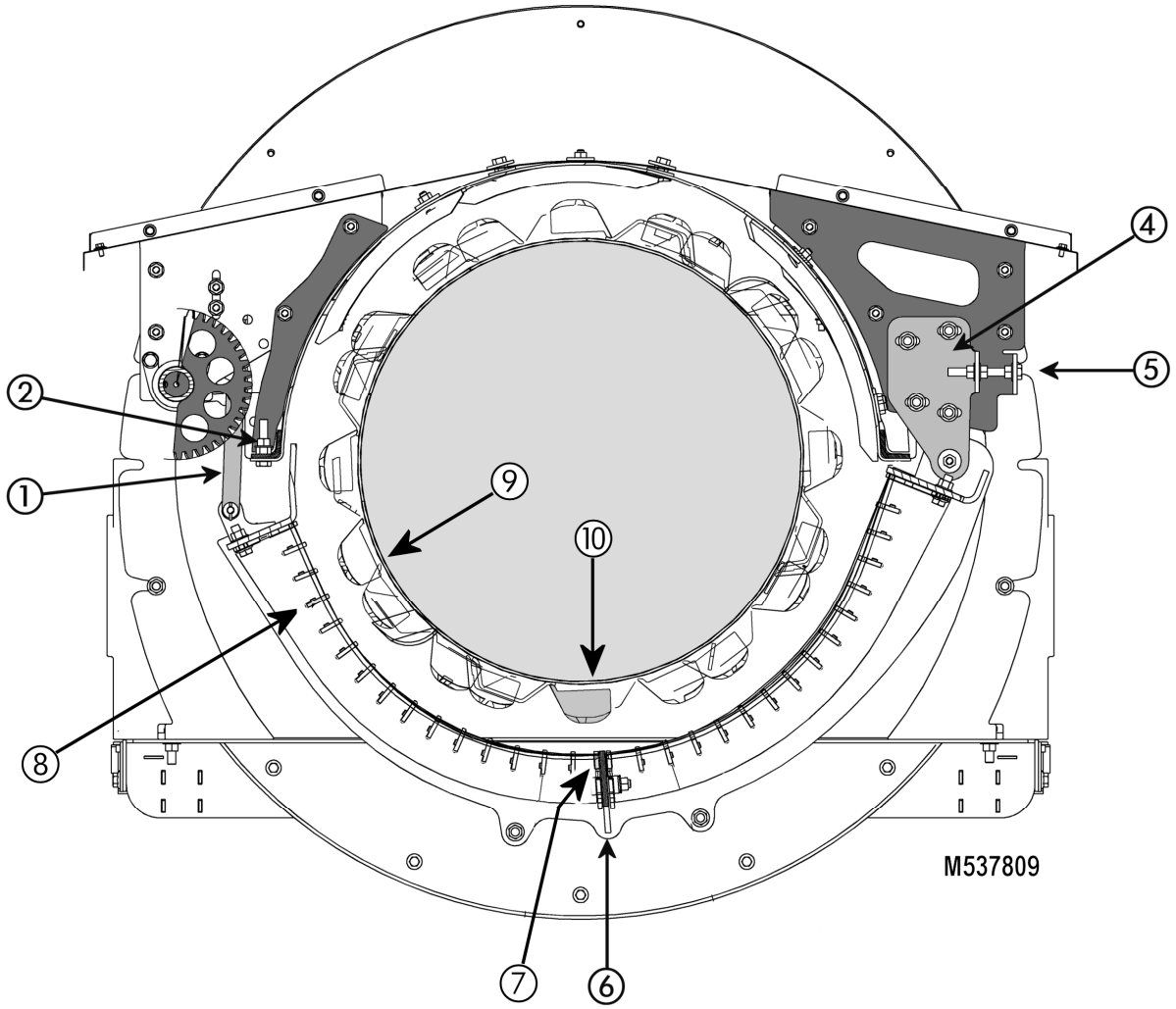
6. Raise or lower the module carrier's rear turn buckle (1), until both the front and rear distances are same. The front and rear must be within 1 mm of each other.



IMPORTANT: Remember when making adjustments, the module frame must always be opened and reclosed. This will remove the backlash in the adjusting components.

7. Finish the procedure by following the "ZERO MODULE" procedure.

THRESHING MODULES POSITION



1.	Leveling Adjustment Turn Buckle	7.	Module Last Rub Bar
2.	Stop Bolt (Zero Position Setting)	8.	Module Third Rub Bar, use the forth bar on the round bar modules
4.	Module Positing Plate		
5.	Module Position Bolt - Right to Left	9.	Rotor Tube (Skin Face)
6.	Module Support Mounting Pin	10.	Rotor Tube (Skin Face)

THRESHING MODULES POSITION

STEP #2: SIDE SHIFTING THE CONCAVE RIGHT TO LEFT

This adjustment may provide improved threshing capabilities and more uniform distribution of threshed material on the cleaning system. It will also aid in keeping the threshing modules cleaner when damp material is encountered. This operation will set the distance between points (8) & (9). Perform the following:

In the chart below is list the ability to move the concave's H-frame 6mm from center. All machines will provide up to the 6mm, some machines due to tolerance may provide addition travel that may be used if required.

	CONCAVE POSITION		
	(1) 6 mm Left	(2) Centered	(3) 6 mm Right
Standard Rotor	86 mm	81	75
Small Tube Rotor	118 mm	113	107

1. Column 1 is the amount you could move the concaves to the LEFT, moving the crop distribution to the RIGHT.
2. Column 2 is the CENTERED location.
3. Column 3 is the amount you could move the concaves to the RIGHT, moving the crop distribution to the LEFT.

IMPORTANT:….Only perform the “Side Shift” adjustments after the concaves have been LEVELED AND ARE AT THE LEVELED POSITION OF 81 OR 113 mm.

IMPORTANT:….Point (8) & (9) will move from the third rub bar to the forth rub bar when using round bar modules.

1. Using the rotor points that were marked during the LEVELING process previously, check the distance at point (8) & (9), making sure to verify rotor and concave types.
2. Loosen the five retaining bolts on both the front and rear of the module carrier supports (4).
3. Adjust the draw bolts (5) to change the distance between the rotor and modules. Moving the module carrier to the left (extending the draw bolt) will cause the distance to increase. Moving the module carrier to the right (retracting the draw bolt) will cause the distance to decrease.

IMPORTANT:….Do NOT measure the length of the draw bolts to square up the module carrier frame. The bolts may not measure the same length when the carrier is parallel to the rotor on all machines.

4. Tighten the lock nuts on the draw bolts. Tighten the five retaining bolts on each end of the module carrier. These bolts must be very tight to hold the assembly in place.
5. Finish the procedure by following the “ZERO MODULE” procedure.

THRESHING MODULES POSITION

STEP #3: ZEROING THE CONCAVES

Zeroing the modules will be the last adjustment made to the module carrier frame. This setting will provide for the running clearance between the rotor and the concaves. This clearance will be required whenever rasp bars or concaves are changed. When harvesting hard threshing wheat the running clearance may require reducing as much as possible.

1. While spinning the rotor by hand (as fast as possible) raise the concaves until the rasp bars begin to lightly tick.
2. Turn the concave STOP bolts (2) down until they contact the module carrier frame on the left hand side.
3. After Step 2, lower the threshing module so that the stop bolts may be turned down an additional 2 full turns and lock them. *This should provide for approximately 1.5mm of clearance at the 6 o'clock position with the concaves completely closed.*
4. Open the module carrier a small distance and close until the motor stalls. Rotate the rotor by hand to insure the rotor does not hit the modules or carrier with the stop bolts set and the modules in their closed position. Also run the rotor at 1000 RPM to check for contact.
5. Install the left-hand access panel.
6. Perform the CONCAVE calibration procedure to let the system learn the working range of the concave position sensor.
7. Complete re-assembly and shift the rotor gear-case to the desired gear.

SEPARATION

Once the grain has been threshed, it must be separated from the trash that came into the combine with it. This function begins to occur as soon as the crop enters the rotor cage. About 90% of the grain will be separated in the threshing area of the rotor cage. This is a secondary function of the threshing section. The more that can be separated here, the more material the machine can handle. Separation in an Axial Flow occurs due to the centrifugal force created by the spinning rotor. The heavy particles (grain) will be thrown out of the rotor cage openings onto the shaker pan, which lies under the rotor.

SEPARATOR MODULES

Grain that does not separate in the threshing area will be separated in the rear half of the rotor cage. This is the separation area. The modules provide agitation and relatively large openings for any grain left in the crop material. They are in a set of four, (same units as described in the threshing section), and are rigidly bolted into place. The modules may be removed by removing the bolts on the out side, (right or left), and slid off the center support. The grates are nonadjustable and there are normally associated with the Skip Wire, Slotted and Solid modules.

SLOTTED OR STAMPED

Consists of a smooth surface grate with slotted punched holes. This type of grate provides for a smoother flow of material with less agitation. The smoother flow will cause less straw breakup and less chance of overloading the cleaning system. The slots are large to provide for efficient separation.

LARGE WIRE

Large wire modules may be used in place of the slotted module to increase grain separation.

SKIP WIRE

Skip wire modules are the same as the large wire module but with out every other wire installed. There are no previsions made in the module to reinstall the missing wires. These are standard on corn and rice machines. This type of grate provides an aggressive agitation of the crop material in the separation area as well as added grain separation in the threshing area for high volume crops.

SEPARATION

SOLID

Consists of a smooth surface that has no openings. These were developed primarily for sunflower or other easy harvesting crops such as some grasses. Most sunflowers will thresh and completely separate in the concave area. Separation in the grate area is not needed, therefore; solid grates are installed so that no trash is allowed to fall on the cleaning system from the grate area. This grate may be used in any combination with the other grates. They will help reduce the chaff load on the cleaning system in any crop condition that provides for early separation.

CAGE COVERS

As mentioned earlier, cage covers may be installed to prevent overloading the cleaning system with MOG. This could be an area where the operator is trying to clean the grain tank by closing the lower sieve, causing high tailings, when they should be address the problem where it was created.

REMEMBER: Do NOT underestimate the value of being able to intermixing modules types to fine tune the threshing and separating job.

CROP SPEED CONTROL

One of the most important aspects of running an Axial Flow correctly is to have the proper control of the crop speed through the machine. Crop speed is controlled completely by the rotor and rotor cage assemblies. As a general rule, the crop material will travel through the machine at about half the rotor speed. Four basic adjustments for crop speed control are available to the operator once the machine is properly equipped for the crop to be harvested.

1. Rotor Speed
2. Concave Clearance
3. Rotor Configuration
4. Cage Vane Position

The most common mistake is running the rotor speed too slow. The rotor in an Axial Flow can be run faster than a conventional cylinder for the following reasons:

1. Multiple passes over the modules allow for a more relaxed and/or less sensitive module setting. This is greatly aided by the deep relief area between rasp bars which gives crop to crop threshing.
2. The relaxed setting allows for faster rotor speed with lower risk to grain damage as compared to a conventional cylinder with tight, critical concave setting.
3. The relaxed clearance and high rotor speed with lower risk to damage, allows for more capacity. Keeping the combine at full capacity minimizes loss and damage because of the crop to crop threshing effect.
4. Prior conventional combine owners tend to be conservative on rotor speed when operating their Axial Flow because of prior experiences. Slower rotor speeds will effect damage, slow ground travel, and reduce capacity. This occurs because the material is staying in the cage too long. The crop flow is reduced and rolling or roping of the crop can occur. This is signaled by a rumbling noise. The horsepower required to run the machine is also increased when this occurs. A faster rotor speed will require less horsepower because the rotor momentum helps move the crop. Separation is also increased because centrifugal force is increased.

CROP SPEED CONTROL

CHANGE ROTOR SPEED

The single easiest way to increase or decrease crop speed is by changing the rotor speed. This is accomplished by pushing the rotor INCREASE/DECREASE switch in the RHC. This adjustment can be made on the go. When adjusting this, use increments of 10-20 RPM at a time until the desired result is accomplished. This will prevent missing the correct operating speed for the crop condition. If the grain scan monitor is set properly, the effect of the rotor speed change can be observed on the monitor. If uncertainty exists, or the machine does not have a grain scan monitor, stop and check the ground. **Rotor Speed provides for machine capacity and separation.**

CHANGE THRESHING MODULE CLEARANCE

A second way to change crop speed is to adjust the threshing module clearance. This is accomplished by pressing the concave INCREASE/DECREASE switch on the RHC. This adjustment can be made on the go, and should be limited to increments of 0.4-0.6 at a time until the desired results is accomplished. The more relaxed, or open the modules are, the slower the material will flow through the machine. This occurs because the rotor does not have as much traction against the material. The crop mat will become thicker. A closed module setting produces faster crop movement and a thinner mat of material. The extreme ends of module adjustment for a given crop will produce similar results. Usually, over threshing, cleaning system overload, excessive power requirements, and grain damage occur. The acceptable module clearance range will be somewhere between these extremes, and compared to a conventional machine, the range is very wide. **Module clearance provides for threshing ability, keeping the modules clean and controlling the material.**

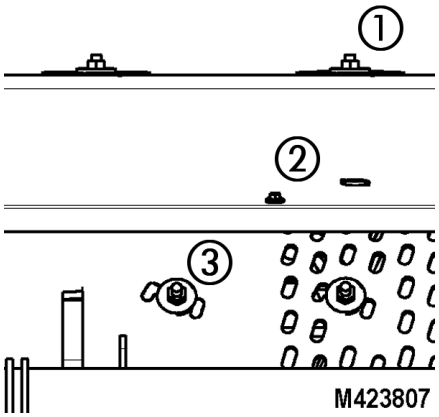
ROTOR CONFIGURATION

A third way to change crop speed is by changing the rotor attachments. By changing the rasp bars with new rasp, straight bars, spike rasp or helical kickers units, the crop flow may be altered.

VANES CROP SPEED CONTROL

CHANGE TRANSPORT VANES

A fourth way to control crop speed is with the cage vanes. Vanes line the left side of the inner skin of the rotor upper cage. These vanes act like threads in a nut. As the rotor spins the crop, the vanes direct it rearward.



1.	Upper Bolt and Sealing Washer
2.	Center Pivot Bolt
3.	Lower Bolt and Detent Slots

All vanes located on the Left side of the cage may be pitched forward or rearward by moving them within slotted holes. The adjusting slots incorporate detent pockets for the bolts to sit in prevent the movement of the veins when reversing the rotor drive. To move the veins the bolts will require loosening and sliding up on the slotted holes in the vein itself. The top bolt will require the removal of the large sealing washer first and then the loosening of the vein bolt. The three vane positions are:

1. **Forward Tilt (Fast)** By loosening the mounting bolts and moving the bottom of the vane forward, the crop material will move through the cage at a faster rate of speed. This can be useful in situations where the grain is separating very early within the machine. The trash can be expelled from the combine faster since the grain is gone. The vanes allow for adjustments of speed in individual areas of the cage since they don't have to be moved as complete sets.
2. **Mid - position (Normal)** This is the recommended position for most crops and conditions. This position can be identified by aligning a hole in the cage with a hole in the vane itself.
3. **Rearward Tilt (Slow)** By loosening the mounting bolts and moving the bottom of the vane rearward, the crop material will move through the cage at a slower rate of speed. This position can be useful if additional threshing or separation time is needed.

VANES CROP SPEED CONTROL



REMEMBER: When do I have to adjust the vanes? Due to the added area of the threshing and separating modules, vanes adjustment is less sensitive and require repositioning less often. The faster the material flows through the rotor cage the more capacity the machine will have and the less MOG that will be directed on to the cleaning system.



Wait a Minute... How do I adjust the vanes? Since the vane don't all have to be in the same position, their position can be intermixed to fit the condition.

Example: A high volume, hard to move crop (damp).
The front 2-3 vanes may be in the middle to slow position to provide for additional threshing. Vanes 4-5 might be in the middle position to help move the crop. Vanes 6-7 may be in the fast position to help with the transition from the threshing area to the separation area. The separation vanes may be in the middle position for additional separation time. If there is no grain loss, start from the rear, move a couple of vanes to the fast position and recheck the operation.

Whenever vane modifications are made, monitor the rotor for grain loss and make adjustments as needed.

SEPARATION

Guidelines For Optimizing Straw Quality

Due to the threshing and separating nature of the Axial-Flow Combine, machine settings, and operating conditions can affect the quality of straw for bailing. The following guidelines are to help you obtain the best straw possible from your Axial-Flow Combine. Each field condition must be looked at closely to identify which options will give you satisfactory results.

RECOMMENDED COMBINE CONFIGURATIONS

Specialty Rotor

- Remove the straight separator bars and install rasp bars.
- Do not use spiked rasp bars, except in some damp conditions.

Other Equipment

- Use small wire concaves or at least position L1 and R1.
- Use slotted grates.
- Solid grates in the L4 and R4 positions may be used if seed loss is not an issue.
- If possible, use a combine equipped with a discharge beater instead of a straw chopper.

Operating Conditions

- Harvest during damp, tough conditions such as early morning or late evening.
- Cut more of the stem than usual.
- Position the residue spreaders in the windrowing position.

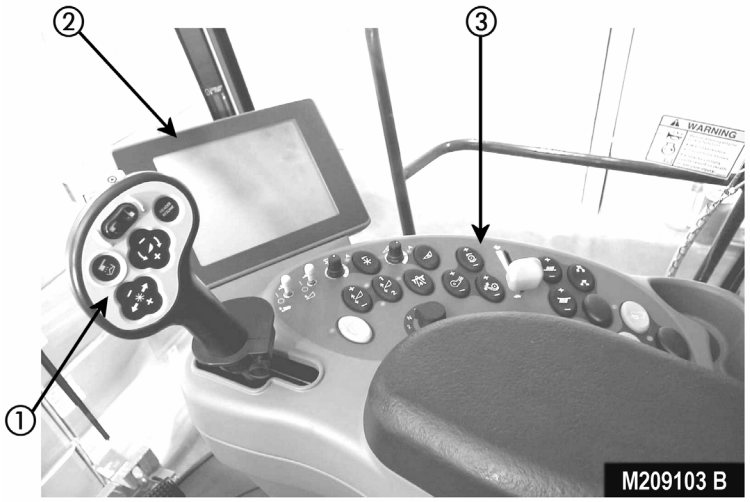
Combine Settings

- Use slower then normal rotor speeds.
- Relax the concave setting while maintaining threshing and separating.
- Adjust the vanes over the grates to the fast or forward position.
- Adjust the vanes over the concaves between the mid to fast position.
- Retract the straw chopper concave and/or slow speed of chopper.

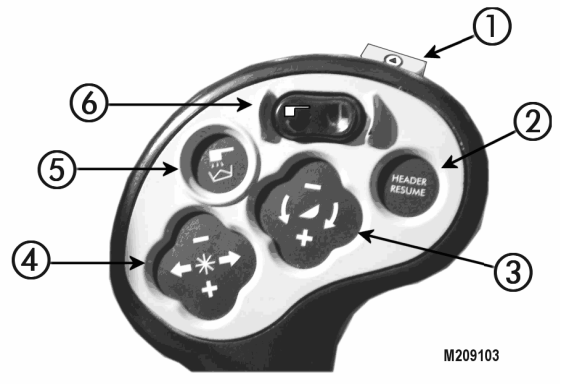


IMPORTANT: Care should be exercised to avoid compromising acceptable grain loss and combine performance.

OPERATOR'S CONTROLS "ROTOR"

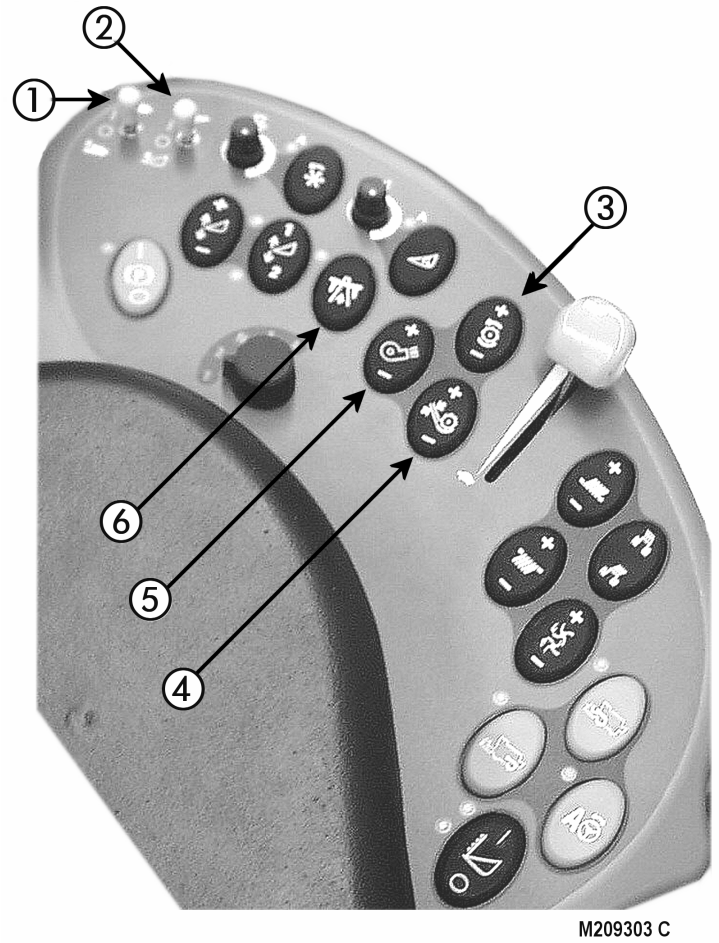


OPERATOR CONTROL CENTER	
1.	Mulit-Function Handle, MFH
2.	Cab Display
3.	Right Hand Console, RHC



MULTI-FUNCTION HANDLE

1.	Emergency Stop Switch
2.	Resume
3.	Header Raise/Lower Tilt Right/Left
4.	Reel Raise/Lower, Fore/Aft
5.	Unloader Engagement
6.	Unloader Swing



RIGHT HAND CONSOLE
(RHC)

1.	Separator Engagement
2.	Feeder Engagement
3.	Rotor Increase(+)/Decrease(-) Switch
4.	Concave Increase(+)/Decrease(-) Switch
5.	Fan Increase(+)/Decrease(-) Switch
6.	On The Road Switch

OPERATOR'S CONTROLS "ROTOR"

DISPLAY

CONFIGURING SCREENS

For normal operation, the operator may or may not need to assign the following items to the one of the **RUN** screens. If the operator momentarily touches the rotor speed or concave position control switches the current setting will automatically be displayed on the screen.

Function	Recommended Screen Location
Rotor Speed	Most Convenient

When the rotor INCREASE/DECREASE switch is pressed a pop up window will appear showing the rotor speed. This indicator only shows current speed, NOT the desired speed, that means that the engine must be running at threshing speed to view what the rotor will be running at.

RIGHT HAND CONSOLE CONTROLS

Separator Switch, S-30

The separator switch is a three-position switch to provide:

1. Forward detented position, is used to provide a signal to the CCM3 to request for separator engagement. It also provides the power that will be used by the CCM3 to power the rotor drive solenoids with, this provides for a positive dis-engagement.
2. Center detented position, is used to dis-engaged the separator and return it to an idle state.
3. Rearward momentary position, is used to direct a signal to the RHM to activate the rotor De-Slug mode of operation.

Located: Right hand console

OPERATOR'S CONTROLS "ROTOR"

Rotor Speed INCREASE/DECREASE Switch, S-17

The operator will use the rotor speed switch to **INCREASE** / **DECREASE** the speed and during deslug operations to rotate the rotor CW and CCW. When the switch is pressed, the current setting is automatically displayed up to four seconds after the switch is released.

The rotor speed switch provides the operator with a method of changing and controlling the desired rotor speed. If the switch is momentarily pressed the rotor speed will be changed at the rate of 10 RPM per toggle, if continually pressed the rotor will change 10 RPM/second. The switch is also used to provide rotor rotating directional control during de-slug operation; rotor increase causes forward (normal clockwise) rotor rotation and rotor decrease causes reverse (counter clockwise) rotor ration.

Located: Right hand console

SENSORS

Rotor Motor Speed Sensor, B-58

The rotor motor speed sensor is used to monitor the speed of the hydrostat motor that is used to start the rotor, change the rotor speed and operate the deslug mode.

Location: Right hand console

Rotor Speed Sensor, B-01

The operator will use the rotor speed switch to **INCREASE** / **DECREASE** the speed and during deslug operations to rotate the rotor CW and CCW. When the switch is pressed, the current setting is automatically displayed up to four seconds after the switch is released.

Location: Right hand console

SYSTEM CALIBRATION

CALIBRATE "ROTOR DRIVE"

The rotor power plus drive unit must be calibrated to insure proper engagement. The calibration should be performed at least one time a year, but may be performed more often if drastic climate temperature changes are experienced.



REMEMBER: The rotor drive calibration may abort and not properly complete. For proper calibration to take place the rotor MUST come to a complete halt several times during the calibration operation, if it continues to coast the system will abort. If the system does abort, it will still operate using the previous calibration information.

ITEMS TO REMEMBER

1. Try to wait until the unit has 50-100 separator hours on it, it was calibrated at the factory.
2. Place the rotor gear box in 1 gear.
3. Operate the engine at approximately 1700 RPM.
4. Warm the system to operating temperatures.
5. Follow the on screen instructions.

HOW SHOULD THE ROTOR DRIVE SYSTEM OPERATE

The entire rotor drive system consists of a PTO and rotor gearboxes, Power Plus drive, hydraulic pump, hydraulic motor, two speed sensors, rotor and electrical/electronic controls. The rotor mechanical drive includes:

1) PTO gearbox
2) Power Plus unit
3) Rotor three-speed gearbox

The rotor drive has very specific operating requirements and must operate in one of the following modes at all times. The system is in control of all rotor operations, maintaining RPM, monitoring, troubleshooting and warnings.

MODES OF OPERATION

Disengagement "Off"

The operator will have placed the separator control switch into the **OFF** (center detented) position, the rotor should not be powered and should be at rest.

Disengagement

When the rotor is disengaged, the ETR clutch is release and the rotor permitted to coast. The rotor will coast down until the rotor speed is below 140 RPM, at which time the RTF clutch will begin a pulsing engagement to slow the rotor down. Once the rotor speed is below 40 RPM the RTF clutch will be engaged.

HOW SHOULD THE ROTOR DRIVE SYSTEM OPERATE

MODES OF OPERATION, CON'T

Calibration

A rotor calibration process provides the electronics the ability to learn the current requirements to properly activate the ETR and pump solenoids. The automatic calibration process is initiated by the operator using the display unit.

The rotor calibration process should not take more than 2-3 minutes to complete and should be re-calibrated as follows:

1. At least once per harvest season
2. If the rotor pump coil or ETR clutch coil is replaced
3. If significant operating and/or weather temperature changed since the last calibration

Engagement "ON"

When the operator places the separator control switch into the forward detented position, the rotor will be started by activating an acceleration mode to start and bring the rotor up to the requested RPM.

1. The RTF clutch pack was engaged during the OFF mode to prevent the rotor from creeping.
2. The electrical system will activate the rotor drive pump to start the rotor turning. The electrical system will be monitoring the rotor drive motor and rotor gear case output speed to determine what gear range the rotor gear case is in and to determine when the rotor is at maximum hydrostatic speed.
3. The electrical system will de-activate the RTF clutch and engage the ETR clutch to connect the engine gear drive to the POWER PLUS drive, completing the rotor acceleration to a direct drive speed determined by the gear box speed selected.
4. The electronics will monitor the actual rotor gear case output speed and make adjustments to the rotor drive pump as required to provide the requested speed at 2100 engine RPM. The rotor speed will be directly proportional to engine speed, if engine speed is reduced so will the rotor speed. The rotor speed will be maintained in a ratio to the engine RPM, it will not be maintained at the requested speed.
5. Adjustments to rotor speed within the same rotor gear case range may be made "on the go", either with the rotor increase/decrease rocker switch or via the display.

The rotor may be re-engaged at any time after the separator switch has been turned off, the rotor does not have to come to a complete stop to re-engage. Re-engagement operation is be influenced by the current rotor RPM; the RTF and rotor motor may or may not be used during re-engagement.

HOW SHOULD THE ROTOR DRIVE SYSTEM OPERATE

MODES OF OPERATION, CON'T

Engagement, con't

IMPORTANT: It is strongly recommended that the rotor be engaged at a lower idle speed.

REMEMBER: When the ROAD switch is pressed the separator, feeder, unloading auger swing, auger engagement, concave adjust nor the rear wheel drive will engage.

IMPORTANT: When a machine is equipped with a straw chopper, the rotor will not engage without a speed signal from the chopper shaft. This sensing is carried through the Feeder Auto Cut Off circuit and is another reason the Feeder Auto Cut Off selection has been eliminated from the display selection list. The setting should never be turned **OFF** with the EST and left in the **OFF** setting.

HOW SHOULD THE ROTOR DRIVE SYSTEM OPERATE

MODES OF OPERATION, CON'T

Rotor Drive Protection

The rotor drive is protected by the high pressure relief valves located in the rotor drive pump. When the rotor is overloaded the relief valves will open permitting the rotor motor to spin rather then working as a brake or motor for the CVT unit. This reaction will depend on the RPM signal from the rotor motor sensor and what software version is loaded in CCM2.

When the rotor motor speed exceeds

- 4500 RPM for more than 0.5 seconds
- Gearbox speed 2, 3800 RPM for more than 0.2 seconds
- Gearbox speed 3, 3000 RPM for more than 0.2 seconds

The feeder and separator will be disengaged.

If during re-engagement with a slugged rotor and the rotor motor RPM sensor does not provide an 800 RPM signal OR the rotor gearbox sensor does not provide a 25 RPM signal within 4 seconds the system will shut down and the ETR clutch will NOT be permitted to engage.

HOW SHOULD THE ROTOR DRIVE SYSTEM OPERATE

MODES OF OPERATION, CON'T

Rotor De-Slug

The rotor de-slug is used by the operator to rotate the rotor in forward and reverse to free a stalled rotor. De-Slug is **NOT** intended to be used to return all the material in the rotor cage to the feeder and back to the head. It should be used to tear and loosen the material that is in the rotor cage, freeing the rotor so that the material can be run on through the machine. By watching the display the operator can determine when the rotor is free to turn and should then use the forward mode to clean out the machine before returning to normal operation. All driving force is provided by the rotor drive motor. The operator would:

1. Run the feeder reverser to clean out the front of the transition cone area.
2. Open the threshing modules completely
3. Place the rotor gearbox in 1st or 2nd range
4. Move the separator switch into the reverse position, (rearward momentary position)
5. Move the separator switch into the forward detented position
6. Press the rotor speed increase switch to operate the rotor in forward mode and speed decrease switch to operate the rotor in reverse mode
7. Return the separator engagement switch to the OFF position, (center detented position) to exit the de-slug state.



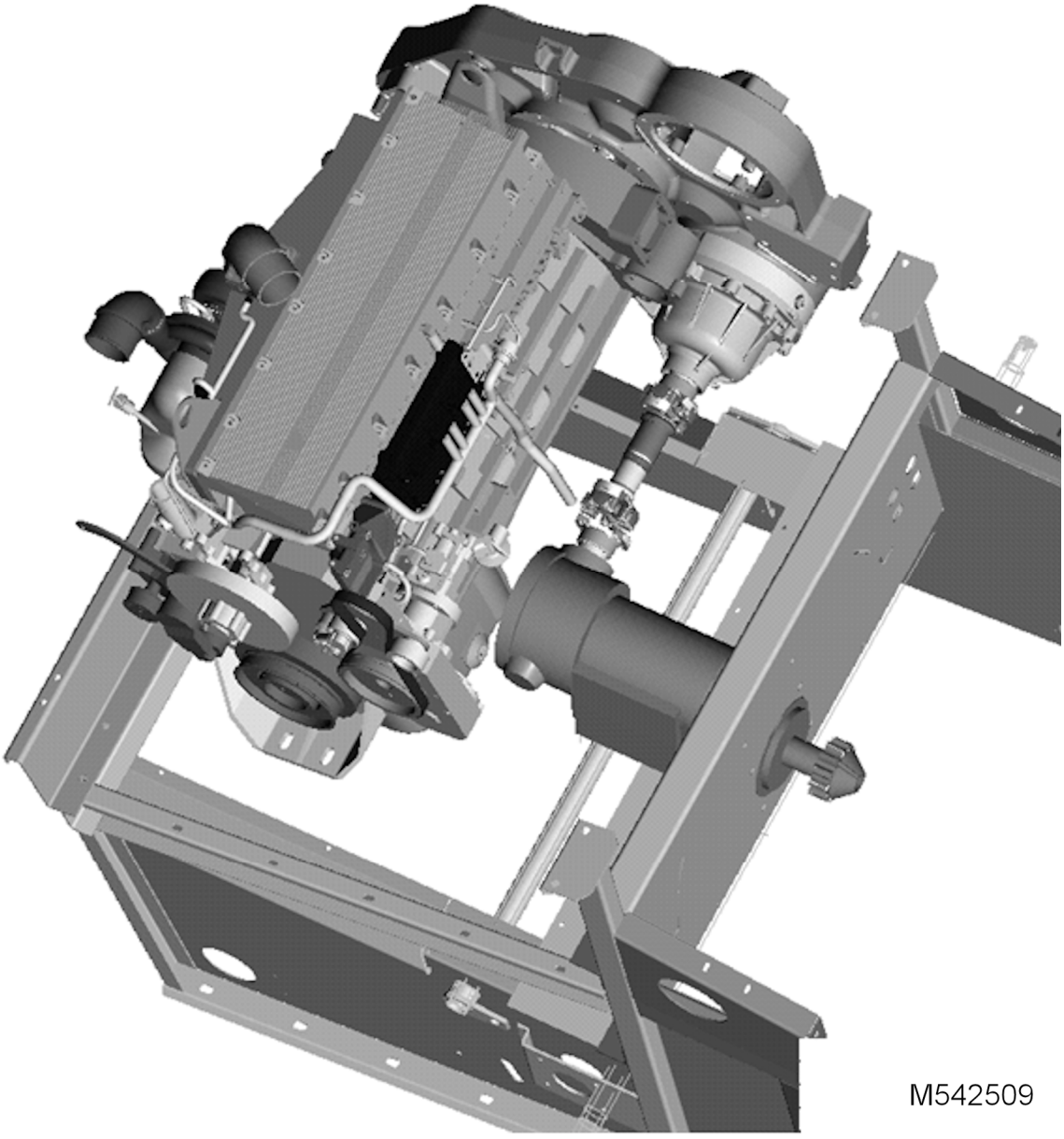
IMPORTANT: When the rotor is slugged DO NOT try to free the rotor by engaging the rotor, ALWAYS us the De-Slug mode. When activating the rotor de-slug mode the operator should activate the feeder reverser first.



IMPORTANT: When using the rotor "De-Slug" mode the rotor drive gear box should be shifted into 1st or 2nd range only, do not use "De-Slug" while operating in 3 range. The first range will provide additional operating torque.

Rotor status data will be regularly conveyed to the operator, as well as fault warnings.

ROTOR DRIVE POWER FLOW

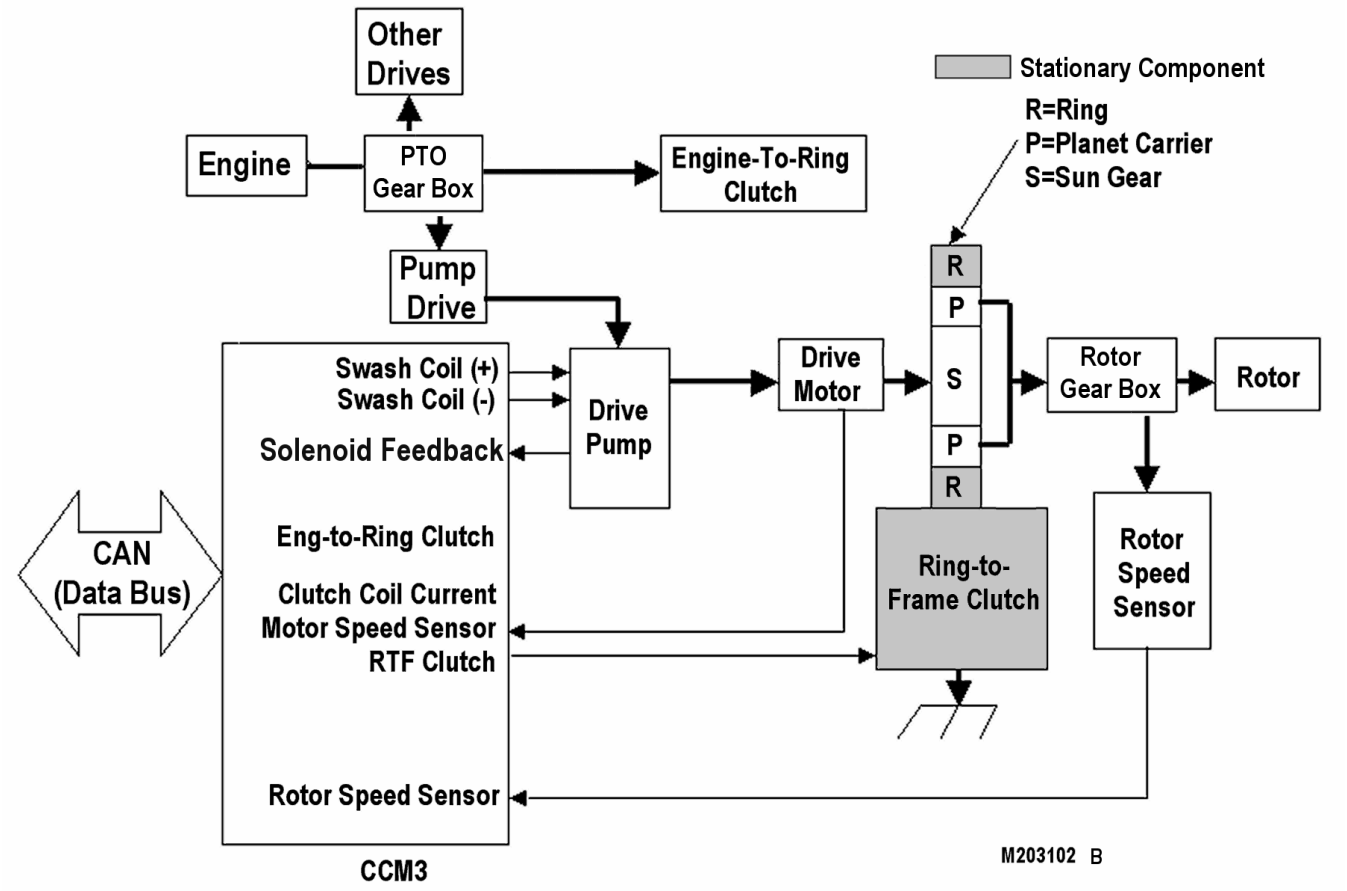


ROTOR DRIVE POWER FLOW

Power flow to the rotor may take one of two paths, or a combination of both.

- **Hydro Power Flow,** Anti-Creep, De-Slug, Rotor Start-Up
  Mechanical Power Flow
  Combined Power Flow

Power from the engine is directed through the PTO gearbox to drive the rotor hydro pump, drive motor, sun gear, planetary carrier, rotor gearbox and rotor.



ROTOR DRIVE POWER FLOW

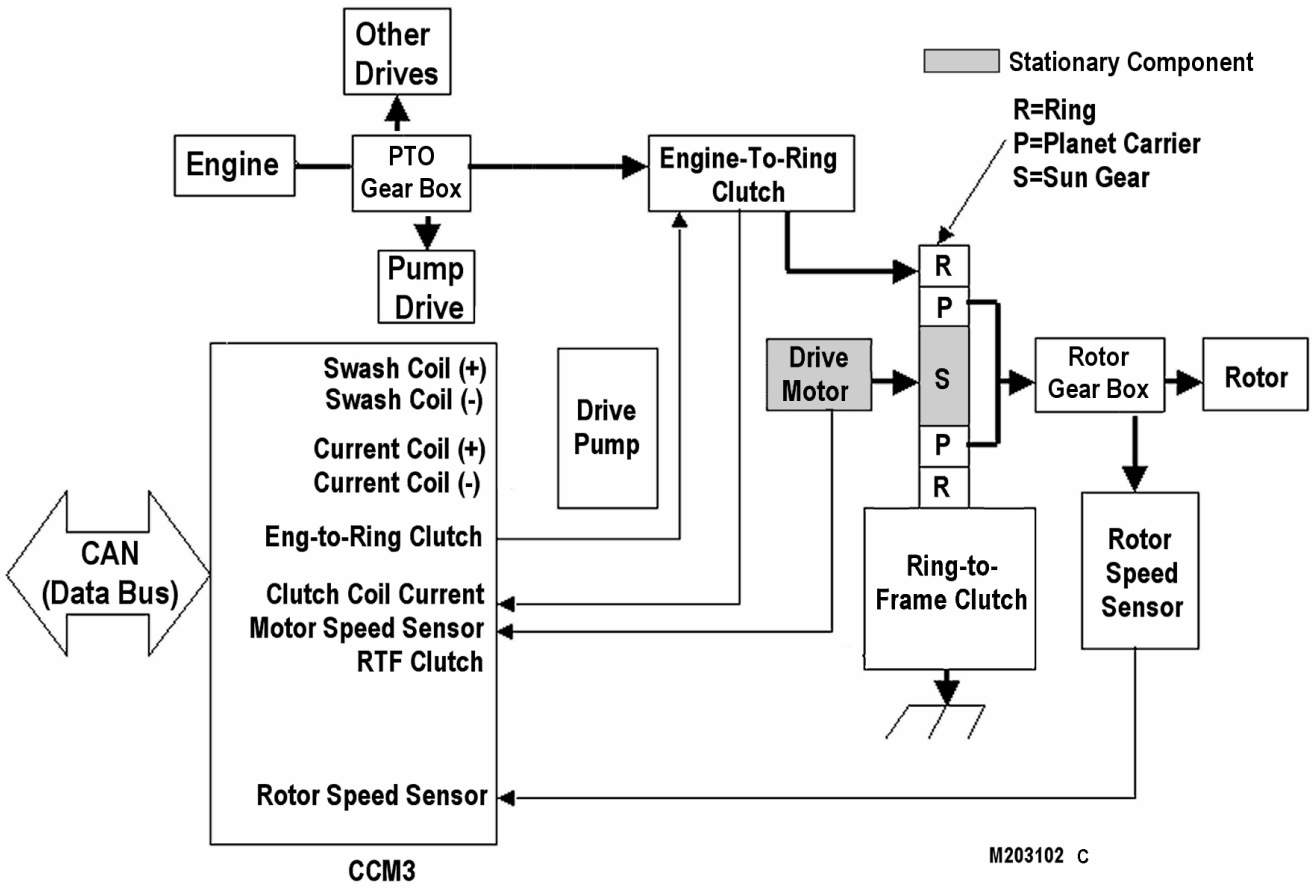
Power flow to the rotor may take one of two paths, or a combination of both.

Hydro Power Flow

- **Mechanical Power Flow,** Rotor at direct drive speed

Combined Power Flow

Power from the engine is directed through the PTO gearbox to drive the engine clutch, ring, planetary carrier, rotor gearbox and rotor.



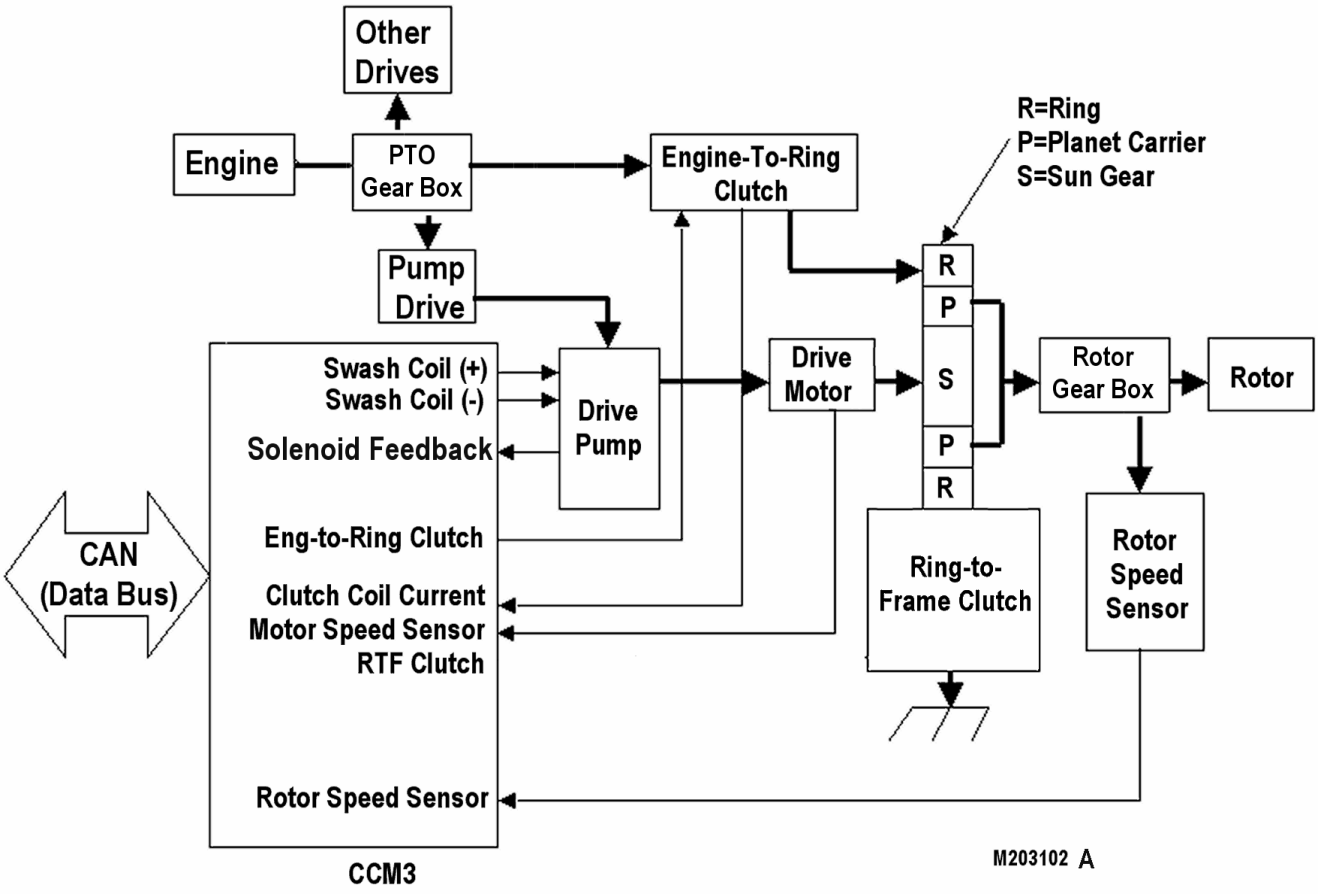
ROTOR DRIVE POWER FLOW

Power flow to the rotor may take one of two paths, or a combination of both.

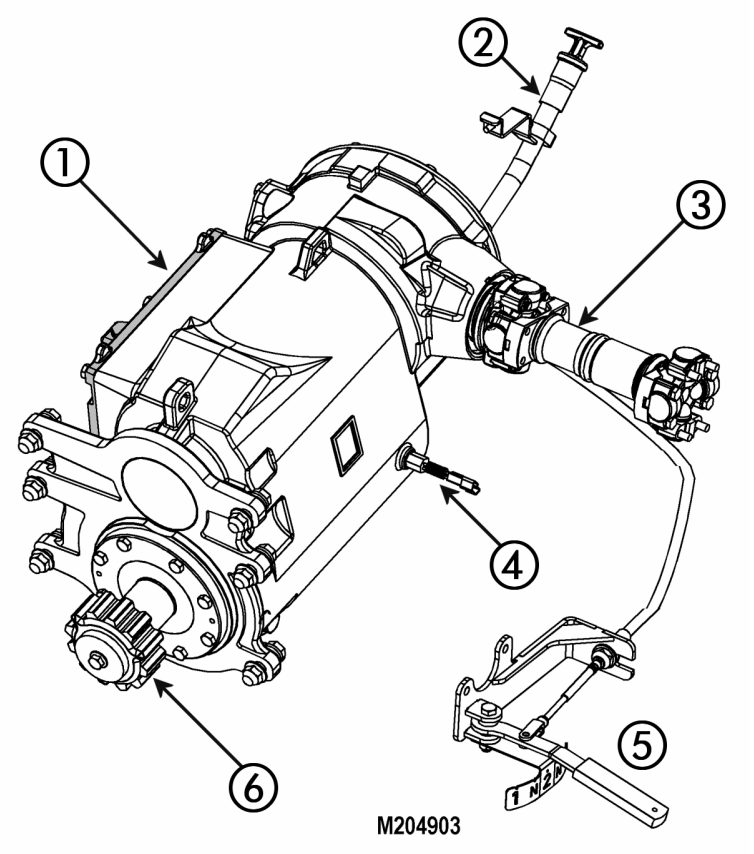
Hydro Power Flow
Mechanical Power Flow

- **Combined Power Flow,** Rotor running at a speed other then direct drive speed

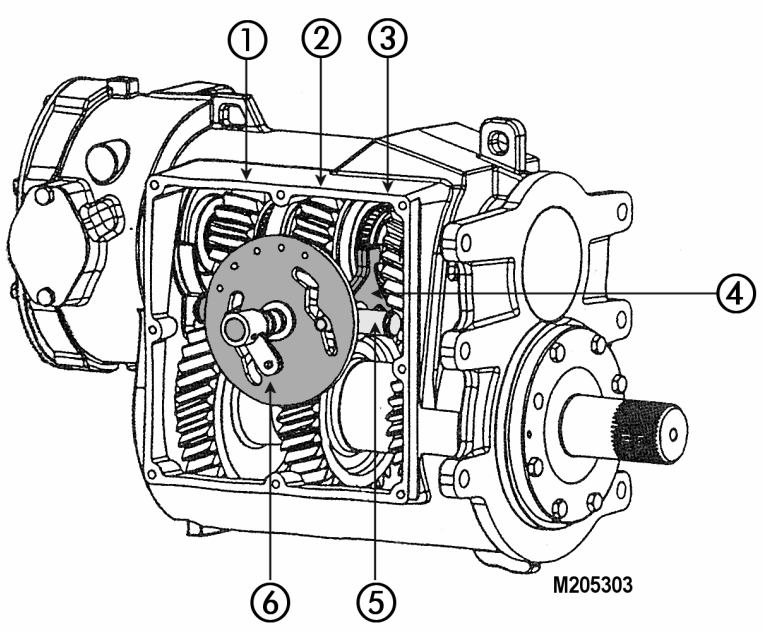
Power from the engine is directed through the PTO gearbox to drive the engine clutch, ring, planetary carrier, rotor gearbox and rotor. The hydro pump and motor will control the speed of the sun gear to change the speed at which the planetary carrier is walking around it.



ROTOR GEARBOX



1.	Shift Cover
2.	Oil Level
3.	Input Drive
4.	Rotor RPM Sensor
5.	Range Shift Control
6.	Output Drive Coupling



1.	1st. Range
2.	2nd. Range
3.	3rd. Range
4.	Shift Fork
5.	Shift Rail
6.	Shift Cam

ROTOR GEARBOX

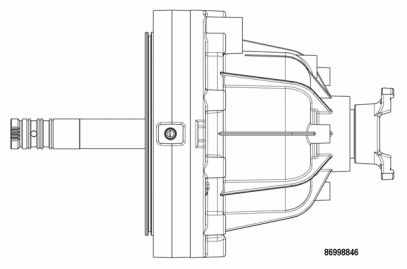
The rotor drive gearbox provides for three different speed ranges and neutral. The ranges are shifted by means of a shift linkage that is mounted below the PTO gearbox. The ranges are changed by means of shift collars inside the transmission, so the rotor MUST be at rest when changing ranges. The gearbox is powered from the Power Plus drive unit.

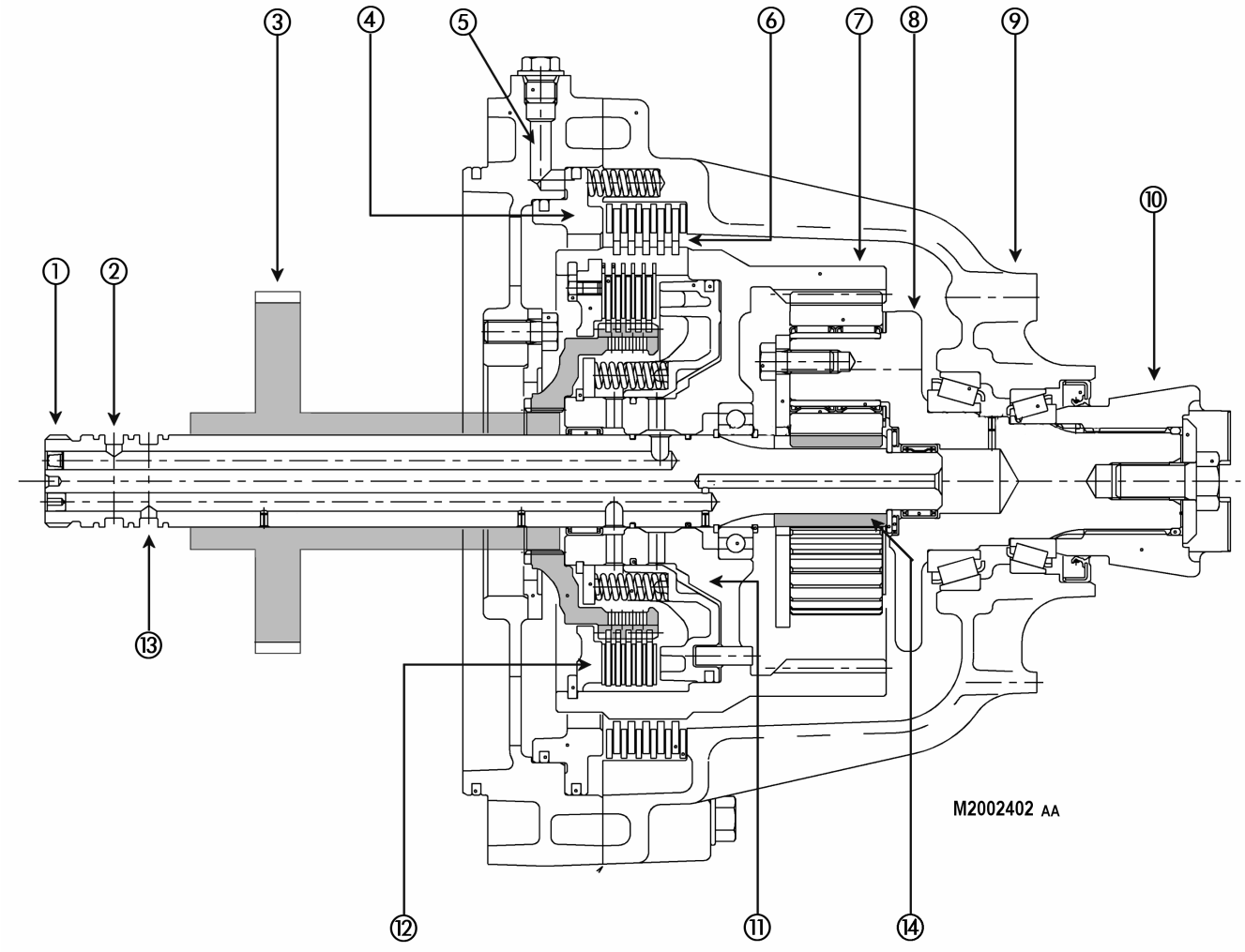
The rotor drive is optimized when operated around the mid-point of the RPM range. This will provide as close to a direct drive from the engine to the rotor gearbox as possible.

Range	RPM Speed Range Rotor Drive Motor Modifying the Speed (+-20 RPM)	RPM Speed Engine Drive Only (Approximately)	Drive Motor Max. Speed (Rotor Engagement)
1	220-450	345	98
2	430-780	610	173
3	730-1180	920	261

REMEMBER: The rotor drive is the most efficient at speed that requires the least amount of rotor drive motor operation. As the rotor drive motor is used to change the rotor's speed it is always more efficient to increase rotor speed when possible rather then to be reducing speed.

POWER PLUS DRIVE (CVT)





1.	Hydro. Motor Input	8.	Planetary Carrier
2.	ETR Clutch Lock-Up	9.	Frame
3.	Engine Input Gear	10.	Out-Put Shaft
4.	RTF Clutch Piston	11.	ETR Clutch Piston
5.	RTF Clutch Lock-Up	12.	ETR Clutch Plates
6.	RTF Clutch Plates	13.	Lubrication Oil
7.	Ring	14.	Sun Gear

POWER PLUS DRIVE (CVT)

MECHANICAL COMPONENTS

Rotor Motor Input, (1)

The input shaft from the rotor drive motor connects to the shaft by way of a coupler. The motor provides forward (increase speed), reverse (decrease speed) or holding for the planetary sun gear.

Located: center shaft of the POWER PLUS drive unit.

ETR Clutch Lock-Up Port, (2)

The ETR clutch lockup port is used to direct the lockup fluid to the piston, locking up the clutch plates.

Located: In the POWER PLUS drive.

Engine Input Gear, (3)

The input gear transfers the engine power from the PTO gear box to the POWER PLUS outer shaft.

Located: In the POWER PLUS drive.

RTF Clutch Piston and Clutch Plates, (4 & 6)

The RTF clutch is used to lock the ring (7) stationary so the rotor drive motor can control the speed of the planetary unit (8).

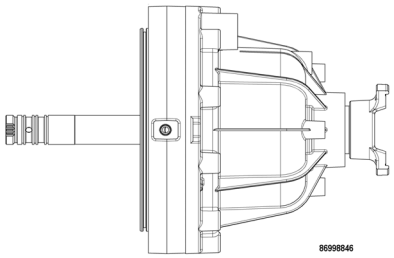
Located: In the POWER PLUS drive.

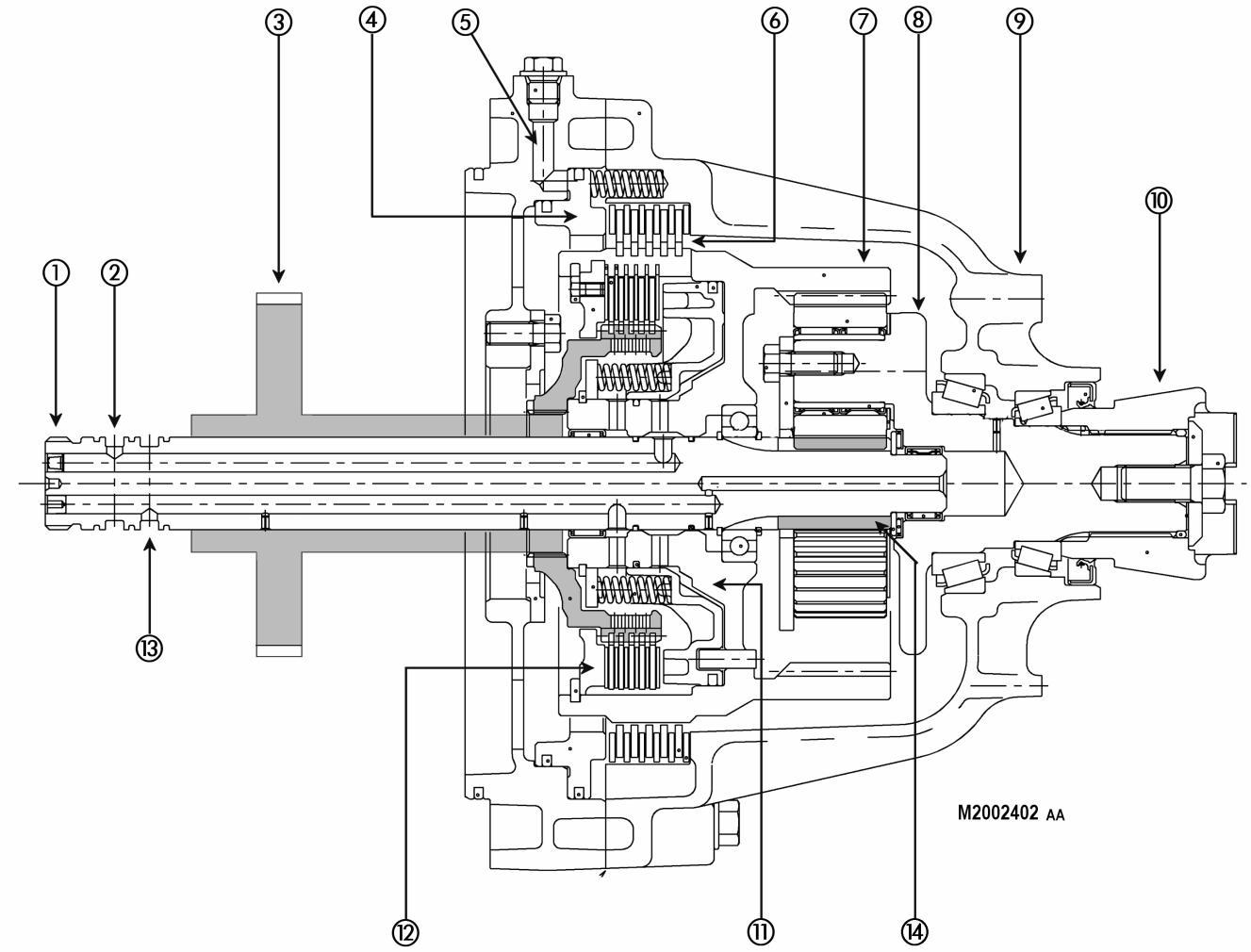
RTF Clutch Lock-Up, (6)

The RTF clutch port directs lock-up pressure to the RTF piston, locking up the RTF clutch plates.

Located: In the POWER PLUS drive.

POWER PLUS DRIVE (CVT)





1.	Hydro. Motor Input	8.	Planetary Carrier
2.	ETR Clutch Lock-Up	9.	Frame
3.	Engine Input Gear	10.	Out-Put Shaft
4.	RTF Clutch Piston	11.	ETR Clutch Piston
5.	RTF Clutch Lock-Up	12.	ETR Clutch Plates
6.	RTF Clutch Plates	13.	Lubrication Oil
7.	Ring	14.	Sun Gear

POWER PLUS DRIVE (CVT)

MECHANICAL COMPONENTS, CON'T

Ring, (7)

The planetary ring is used to transmit the engine power to the planetary unit when the ETR clutch is engaged or to provide the planetary a stationary outer gear for the planetary to walk around when the RTF clutch is engaged.

Located: In the POWER PLUS drive.

Planetary Carrier, (8)

The planetary provides a gear ratio change between the input and output shafts. This will enable operation in one of three modes:

- When the planetary is being driven by the ring (7) from the ETR clutch (11 & 12) and the sun gear (14) is being held stationary by the rotor drive motor (1). Output shaft (10) will be rotated at a fixed RPM in ratio to engine RPM.
- When the planetary is being driven by the sun gear (14) from the rotor drive motor and the ring is being held stationary by the RTF clutch. The output shaft (10) will be rotated at variable speed, (forward or reverse) determined by the rotor drive motor RPM and direction of rotation.
- When there is a combination of both of the above operations. The ETR clutch is engaged providing the ring gear a fixed drive and RPM, but the rotor motor operates the sun gear at variable RPM's and direction. The variability of the sun gear provides a variable rotation speed of the planetary carrier.

Located: In the POWER PLUS drive.

Frame, (9)

The frame is the outer housing that encloses the POWER PLUS drive unit.

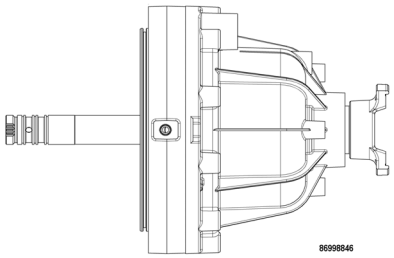
Located: In the POWER PLUS drive.

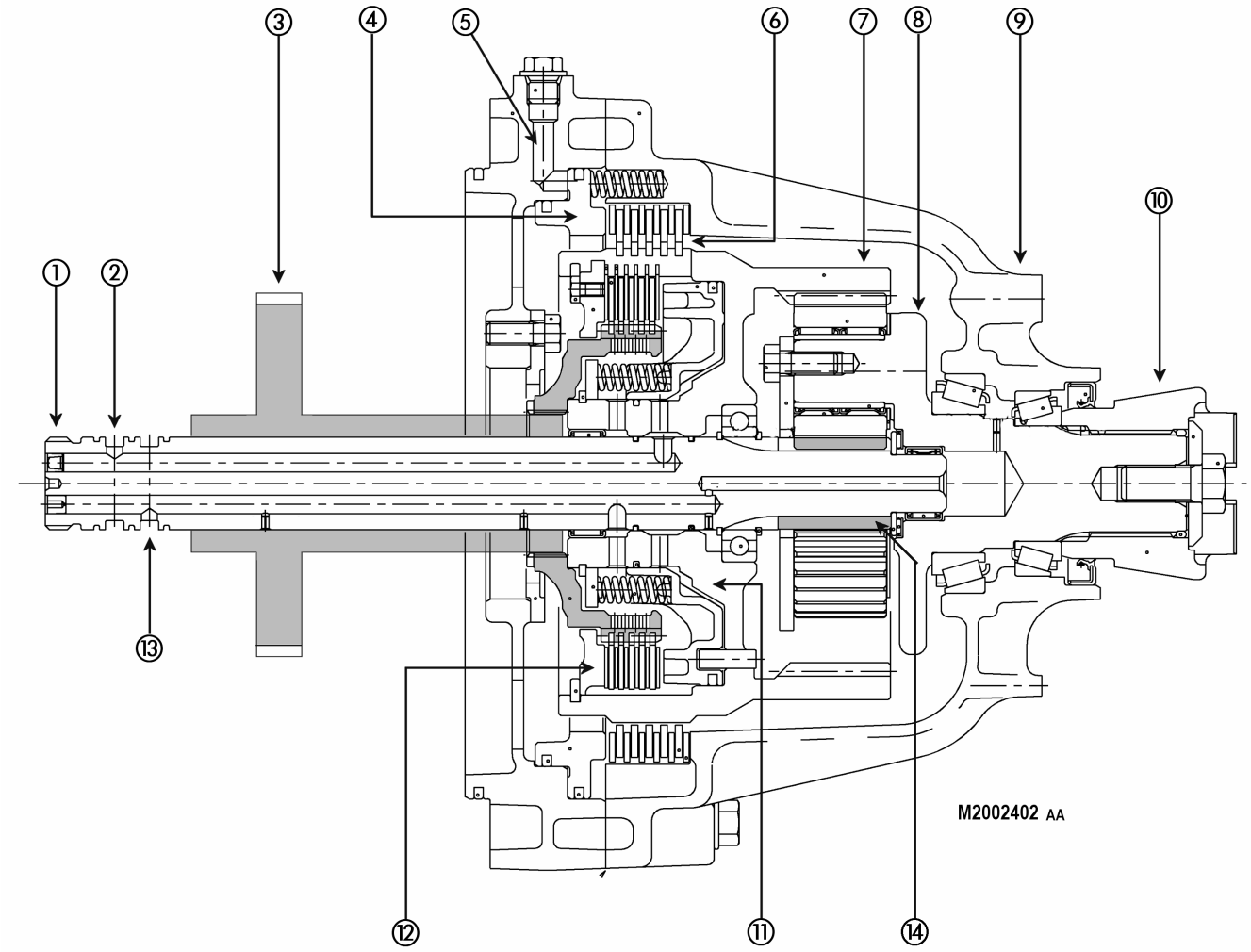
Output Shaft, (10)

The output shaft transmits the driving force to the rotor three speed gear case.

Located: Right hand end of the POWER PLUS drive unit.

POWER PLUS DRIVE (CVT)





1.	Hydro. Motor Input	8.	Planetary Carrier
2.	ETR Clutch Lock-Up	9.	Frame
3.	Engine Input Gear	10.	Out-Put Shaft
4.	RTF Clutch Piston	11.	ETR Clutch Piston
5.	RTF Clutch Lock-Up	12.	ETR Clutch Plates
6.	RTF Clutch Plates	13.	Lubrication Oil
7.	Ring	14.	Sun Gear

POWER PLUS DRIVE (CVT)

MECHANICAL COMPONENTS, CON'T

ETR Clutch Plates and Piston, (11 & 12)

The ETR clutch is used to connect the engine input drive (3), to the ring gear (7) powering the ring gear. This operation drives the output shaft at one constant speed that is proportional to engine speed.

Located: In the POWER PLUS drive.

Lubrication Oil Port, (13)

The lubrication supply port directs lubrication oil to the center of the rotor motor input shaft to supply lubrication to the complete POWER PLUS drive unit.

Located: In the POWER PLUS drive.

Sun Gear, (14)

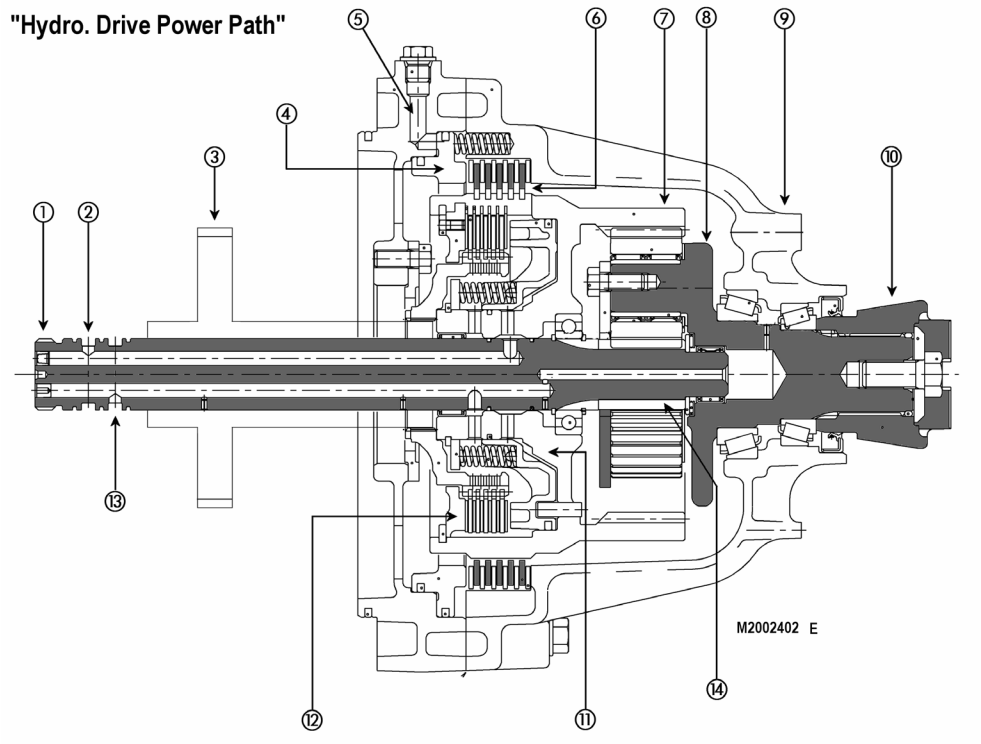
The sun gear transfers the hydro motor to the planetary. The gear will either be stationary, turning clockwise or turning counter clockwise.

Located: In the POWER PLUS drive.

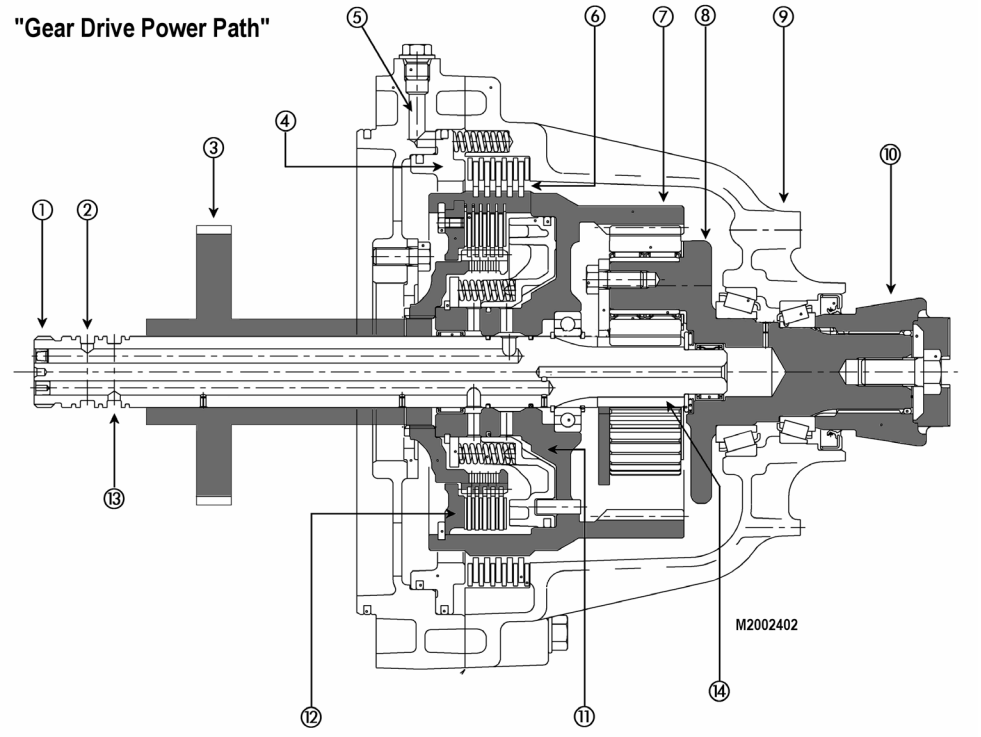
MECHANICAL POWER FLOW

Rotor drive motor power flow

(Stationary item #7)

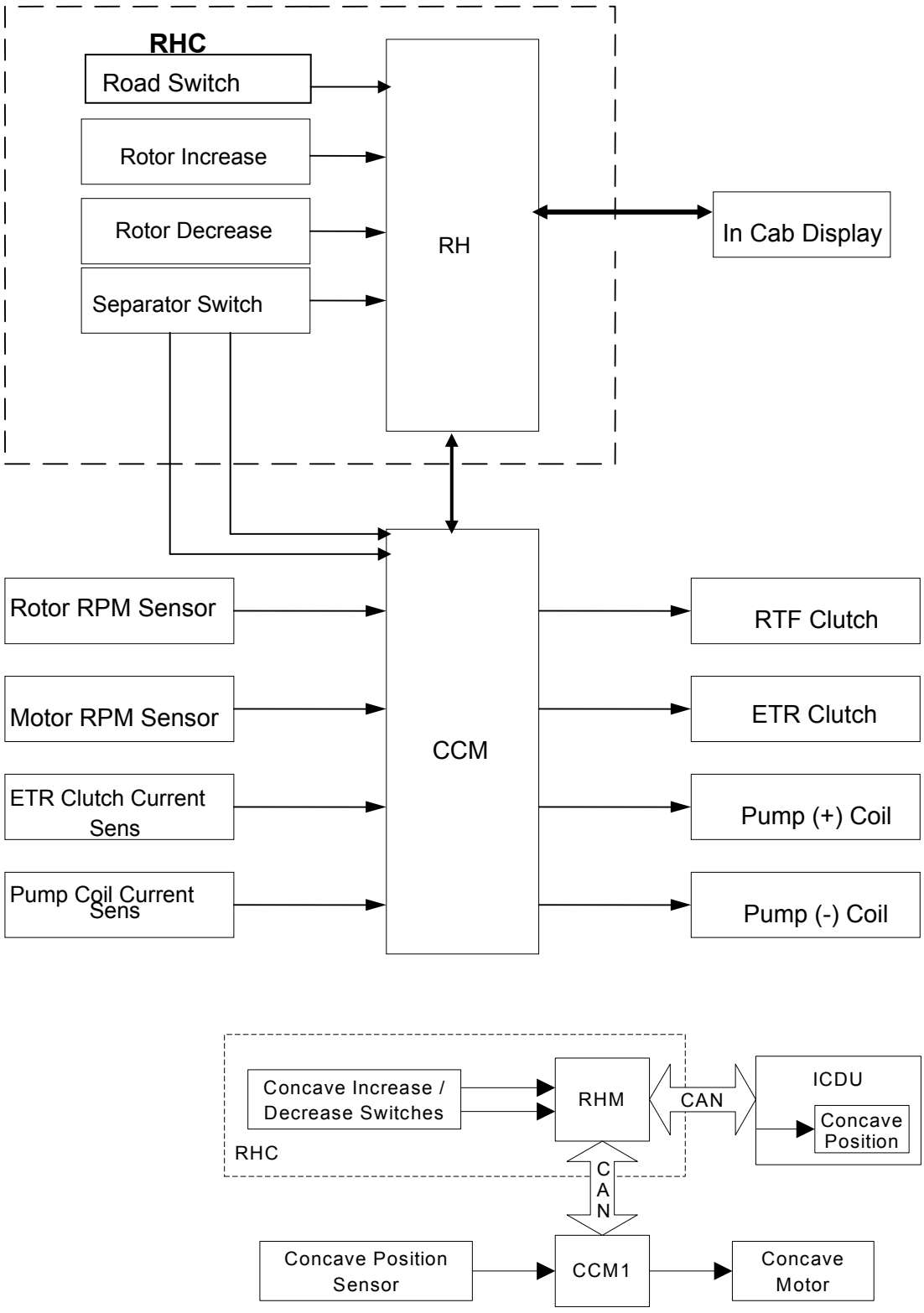


Engine power flow (Stationary item #14)



ELECTRICAL CONTROLS

FLOW CHART



ROTOR DRIVE ELECTRICAL COMPONENTS

The entire feeder drive system consists of a PTO and feeder gear boxes, Power Plus drive, hydraulic pump, hydraulic motor, feeder engagement switch, AUTO/MANUAL switch, feeder speed/ratio potentiometer, speed sensor, and electronic controls.
The feeder electrical circuit include:

1) Rotor RPM sensor
2) Rotor Motor RPM sensor
3) Drive pump (+)/(-) coils (PWM) with feedback current
4) Engine to Ring (ETR) clutch coil (PWM) with feedback current
5) Ring to Frame (RTF) clutch coil (ON/OFF)
6) Electronic controllers, CCM3, RHM, CCM2, DISPLAY
7) Operator controls
8) Seat switch
9) Resistor module
10) Diode module

Items that may influence the systems operation:

- Engine RPM – must be above 1000 RPM
- Rear Ladder – must be raised
- Road Mode – indication lamp must NOT be lit
- Chopper RPM – the chopper shaft speed must be seen before the rotor will operate

ELECTRICAL COMPONENTS

The entire rotor drive system consists of the following components:

AFS 200 / Pro 600 In Cab Display Units

The display is used to for two way communication between the combine and the operator.

Located: Adjacent to the Right hand console

Separator Switch, S-30

The separator switch is a three-position switch to provide:

1. Forward detented position, is used to provide a signal to the CCM3 to request for separator engagement. It also provides the power that will be used by the CCM3 to power the rotor drive solenoids with, this provides for a positive dis-engagement.
2. Center detented position, is used to dis-engaged the separator and return it to an idle state.
3. Rearward momentary position, is used to direct a signal to the RHM to activate the rotor De-Slug mode of operation.

Located: Right hand console

Rotor Speed Increase/Decrease Control, S-17

The rotor speed switch provides the operator with a method of changing and controlling the desired rotor speed. If the switch is momentarily pressed the rotor speed will be changed at the rate of 10 RPM per toggle, if continually pressed the rotor will change 10 RPM/second. The switch is also used to provide rotor rotating directional control during de-slug operation; rotor increase causes forward (normal clockwise) rotor rotation and rotor decrease causes reverse (counter clockwise) rotor ration.

Located: Right hand console

CCM1 Controller

The CCM1 controller controls the concave operation by receiving CAN bus signals from the RHM, display and sensors, and motor.

Located: Under the instructor's seat, the rear controller

CCM3 Controller

The CCM3 controller controls the rotor operation by receiving CAN bus signals from the RHM, display and sensors, and controlling solenoids.

Located: Under the instructor's seat, the front controller

ELECTRICAL CONTROLS

ELECTRICAL COMPONENTS, CON'T

CCM2 Controller

The CCM2 controller monitors and provides the CAN bus with the straw chopper RPM signals.

Located: Under the instructor's seat, the front controller

Feeder Switch, S-31

The feeder switch is supplied power once the separator switch is placed into the RUN (forward) position.

Rotor Pump Solenoid, L-40 & L-41

The pump uses two solenoids to control the position of the pump swash plate in order to provide variable pump displacement and rotation direction. The pump swash plate is defaulted to the Neutral position when both solenoids are de-activated. The CCM3 controls both solenoids.

Located: Hydro pump mounted on the PTO gearbox

Rotor Drive Motor RPM Sensor, B-58

The rotor drive motor RPM sensor is used by the CCM3 to calculate input RPM to the POWER PLUS drive by the hydrostatic motor. This RPM is used for five functions:

1. During rotor acceleration, it is used in conjunction with rotor speed sensor to calculate which gear range the rotor gearbox is currently in.
2. It is used to signal a motor over-speed condition during a rotor slug event.
3. It is used to determine whether the rotor is slugged when engaging the separator. If motor speed is not detected the ETR clutch will not be permitted to engage.
4. It is used to assure speed match between planetary ring and engine RPM for rotor re-engagement.
5. It is used with engine speed information to help the CCM3 calculate the rotor speed in the event that the rotor speed sensor fails during operation.

The sensor is a Hall-effect sensor and requires no adjustments, torque not to exceed 11 ft.lb.

Located: Rotor motor housing, mounted on the PTO gear box

ELECTRICAL CONTROLS

ELECTRICAL COMPONENTS, CON'T

Rotor RPM Sensor, B-01

The rotor RPM sensor is used by the CCM3 to calculate the rotor's actual speed.

Located: In the rotor gear case output.

RTF Solenoid, L-46

The ring-to-frame clutch is used to connect the rotor motor drive to the POWER PLUS output shaft, permitting the rotor to be driven by the rotor motor independent of the engine-input shaft. The RTF is used:

1. While starting the rotor from a dis-engaged mode, to bring it up to a speed that will match the current engine speed. Also during rotor de-slug mode for reversing.
2. To assist during a controlled deceleration of the rotor when the separator is dis-engaged.
3. To prevent rotor rotation due to viscous drag when the separator is dis-engaged (idle state).

Located: Mounted on the side of the rotor control valve body.

ETR Solenoid, L-45

The engine to ring clutch is used to connect the engine input to the POWER PLUS output shaft, permitting the rotor to be driven by the engine. This permits only one preset output speed from the POWER PLUS drive.

Located: Mounted on the end of the rotor control valve body.

Concave Increase/Decrease Control, A-13

The Concave switch provides the operator with a method of changing the clearance between the rotor and the concave grates. The range is from 0, against the stop bolts, to 24, fully open.

Located: Right hand console

ELECTRICAL CONTROLS

ELECTRICAL COMPONENTS, CON'T

Concave Position Sensor, R-07

The Concave Position sensor is used to inform the operator through the DISPLAY the clearance of the concave. The sensor is also used to position the concave when a Harvest Preset is used.

Located: On the left side of the upper chassis in front of and attached to the torsion bar of the concave cage.

Concave Motor, M-04

The Concave motor is the actuator that moves the concave grates to provide the concave clearance.

Located: On the left side of the upper chassis over the torsion bar of the concave cage.

ELECTRICAL OPERATIONS

REFERENCE SCHEMATIC FRAMES:

Frames: 15, 16 and 18

KEY COMPONENTS:

Engine speed signal B-05, Rotor Drive Motor RPM signal B-58, Rotor RPM signal B-01, Straw Chopper RPM signal B-10, Rotor Drive pump solenoids with feedback current L-40 & L-41, Engine to Ring (ETR) clutch solenoid with feedback current L-45, Ring to Frame (RTF) clutch solenoid L-46, Electronic controller, CCM3, CCM2, Operator controls, Rear ladder switch, Seat switch

ELECTRICAL OPERATION

The electrical circuits are supplied power from fuses F-38, F-45, F-47 and F-48, and each controller is chassis grounded.

POWER SUPPLY FUSES

F-38, Is supplied power from the KEY switch terminal 6 whenever the switch is placed in the RUN position to provide power to each controller, CCM1-3.

F-45, Is supplied power from the Cab Relay “K24” to provide power to the “A” terminals of the three speed sensors: Rotor, Rotor Drive Motor and Feeder speed.

F-47, Is supplied power from the Cab Power relay “K26” to provide power to the controllers, CCM1-3.

F-48, Is supplied power from the Cab Power relay “K26” to provide power to the RHM, Separator switch terminal 2 and 5, Neutral Start switch, Feeder switch terminal 5, Rotor speed increase/decrease switch terminal 29.

GROUNDS

Controller CCM1 and CCM3 is ground by two grounding points, by its mounting to the cab floor #2 and the frame ground #3.

Ring to Frame solenoid is chassis ground is located at the upper frame post, LH side, ground point #5.

ELECTRICAL OPERATIONS

MODES OF OPERATIONS

OFF

When the separator switch S-30, is placed into the **OFF** position there is **NO** voltage signal directed to the CCM3 terminal J1-7. Terminal 7 is telling the controller that the rotor is not requested.

Using the power that is received at terminal J3-11, the CCM3 will direct power out terminal J3-3 to the RTF clutch, causing it to lock up so that the rotor motor may act as a break to prevent rotor creepage.

Separator Engaged

When the separator switch is placed into the ENGAGED position, (forward detented position) a signal voltage is directed out of the separator switch terminal 6 to the CCM3 terminal J1-7 to requesting the rotor to be started and to CCM2 terminal J1-7 requesting the beater/chopper clutch be engaged. This will be the power supply the CCM's to power the rotor ETR and beater clutch solenoids.

The switch also directs voltage out of terminal 3 to the CCM3 terminal J1-17 provide power to operate the rotor pump solenoids and to power the feeder switch.

The CCM3 will

1. Checks for the proper engine speed that is being transmitted over the data bus from the engine controller. The speed must be between 1000-2100 RPM.
2. Checks to see that the rear ladder is in the home position, transmitted over the data bus.
3. Checks to see that the operator seat switch is closed, transmitted over the data bus.
4. Checks for chopper RPM (if equipped), transmitted over the data bus.
5. Use the power that is being received from fuse F-47 at J3-11 and direct it out terminal J3-3 to the RTF solenoid, L-46 terminal 1. This causes the clutch to lock-up to permit the rotor pump to drive the rotor.
6. Use the power that is being received from the separator switch at terminal J1-17 to provide a PWM power supply out terminal J3-31 to the Rotor Pump (+) solenoid, L-40 terminal A. The solenoid will cause the pump's swash plate to tilt, causing the pump to create flow in the correct direction. The solenoid provided a ground at the CCM3 terminal J2-10. The current flow on this circuit is monitored by the CCM3 against its known calibration values to assure a smooth engagement.

ELECTRICAL CONTROLS

MODES OF OPERATIONS, CON'T

Separator Engaged, con't

7. Monitors the Rotor Motor speed B-58, at CCM3 terminal J3-14 and the Rotor gear box speed B-01 at CCM3 terminal J3-13 to determine which speed range the rotor gearbox is in. The range and rotor speed information will be sent out over the data bus for the Display.
8. The power being directed to the Rotor Pump (+) L-40 or (-) L-41solenoids will be increased/decrease as required to bring the rotor up to a speed that would match the current engine speed, if possible, or up to the maximum speed of the Power Plus drive motor.
9. The RTF clutch solenoid will be de-activated. The Rotor Pump (+) solenoid will be de-activated and the centering springs will bring the pump swashplate to a zero flow. The ETR clutch solenoid L-45 will receive a PWM power supply from the CCM3 terminal J2-30.
10. Once the ETR clutch is engaged, the actual rotor RPM will be compared against the desired rotor speed. If the speed is too slow, the CCM3 will provide a PWM power supply to the Rotor Pump (+) solenoid, if the speed is too fast, power will be supplied to the (-) solenoid.



IMPORTANT:

Engagement Can Be Influenced by:

1. With a slugged rotor or if fuse #45 should be blown the rotor motor and rotor speed sensors will not be operating. When engaged and **NO** speed change from either sensor is received at the controller, the rotor will be dis-engaged and not be permitted to start.
2. If the rotor gearbox speed sensor is not operating and the rotor motor speed sensor increases above 800 RPM with in approx. 2.5 seconds the ETR clutch will be permitted to engage.
3. If the rotor motor speed sensor is not operating and the rotor gearbox speed sensor increases above 25 RPM with in approx. 2.5 seconds the ETR clutch will be permitted to engage.
4. If the chopper RPM signal is not greater than 300 rpm within 2.5 seconds from engagement the beater/chopper and rotor drive will be disengaged.

ELECTRICAL CONTROLS

MODES OF OPERATIONS, CON'T

De-slug

When the separator switch is held in the **DE-SLUG** position (rearward momentary position), a signal voltage is directed out of the separator switch terminal 1 to the RHM controller terminal 8. The RHM control will place a message on the data bus for the CCM3 controller to operate the rotor drive in the de-slug mode. The separator switch must then be placed back into the normal engagement (**ON**) position, directing a voltage signal from terminal 3 and 6 as described in the ENGAGEMENT mode. The CCM3 has been placed into the de-slug mode, but the operator must use the rotor increase/decrease switch S-17 to tell it which direction to rotate the rotor. Pressing the **INCREASE** switch will cause the rotor to rotate in a clockwise direction, (normal rotation), and pressing the **DECREASE** switch will cause the rotor to rotate in a counter clockwise direction, (reverse direction). (Once the De-Slug state has been entered the DISPLAY will provide message instructions for the operator). The rotor speed will be between 20-110 RPM (depending on engine speed and rotor gearbox range) for both directions. De-slug power is provided totally by the Power Plus motor. Returning the separator switch to the **OFF** position (center detented position) will exit the De-Slug operation, returning the CCM3 to the **NEUTRAL** state.



IMPORTANT: When activating the rotor de-slug mode the operator should activate the feeder reverser momentarily before starting the de-slug mode.

The CCM3 will

- Check for the proper engine speed that is being transmitted over the data bus from the engine controller. The speed must be between 1000-2100 RPM.
- Use the power that is being received at CCM3 terminal J1-11 and direct it out terminal J3-3 to the RTF solenoid. This causes the clutch to lock-up to permit hydro drive for the rotor.

When the RHM

- Receives a voltage signal from the rotor speed increase switch at connector X030 terminal 11. A message is placed on the data bus for the CCM3 to power the rotor in the normal operating direction.
- Receives a voltage signal from the rotor speed decrease switch at connector X030 terminal 4. A message is placed on the data bus for the CCM3 to power the rotor in the reverse direction.

ELECTRICAL CONTROLS

MODES OF OPERATIONS, CON'T

De-slug, con't

The CCM3 will

- Use the power that is being received from the separator switch at terminal J1-17 and provide a PWM power supply out terminal J3-31 to the Rotor Pump (+) solenoid. The solenoid will cause the pump's swash plate to tilt, causing the pump to create flow in the clockwise direction. The solenoid is grounded through the CCM3 terminal J2-10. The current flow on this circuit is monitored by the CCM3 against its known calibration values to assure a smooth engagement.
- Use the power that is being received from the separator switch at terminal J1-17 and provide a PWM power supply out terminal J3-21 to the Rotor Pump (-) solenoid. The solenoid will cause the pump's swash plate to tilt, causing the pump to create flow in the counter clockwise direction. The solenoid is grounded through the CCM3 terminal J2-10. The current flow on this circuit is monitored by the CCM3 against its known calibration values to assure a smooth engagement.



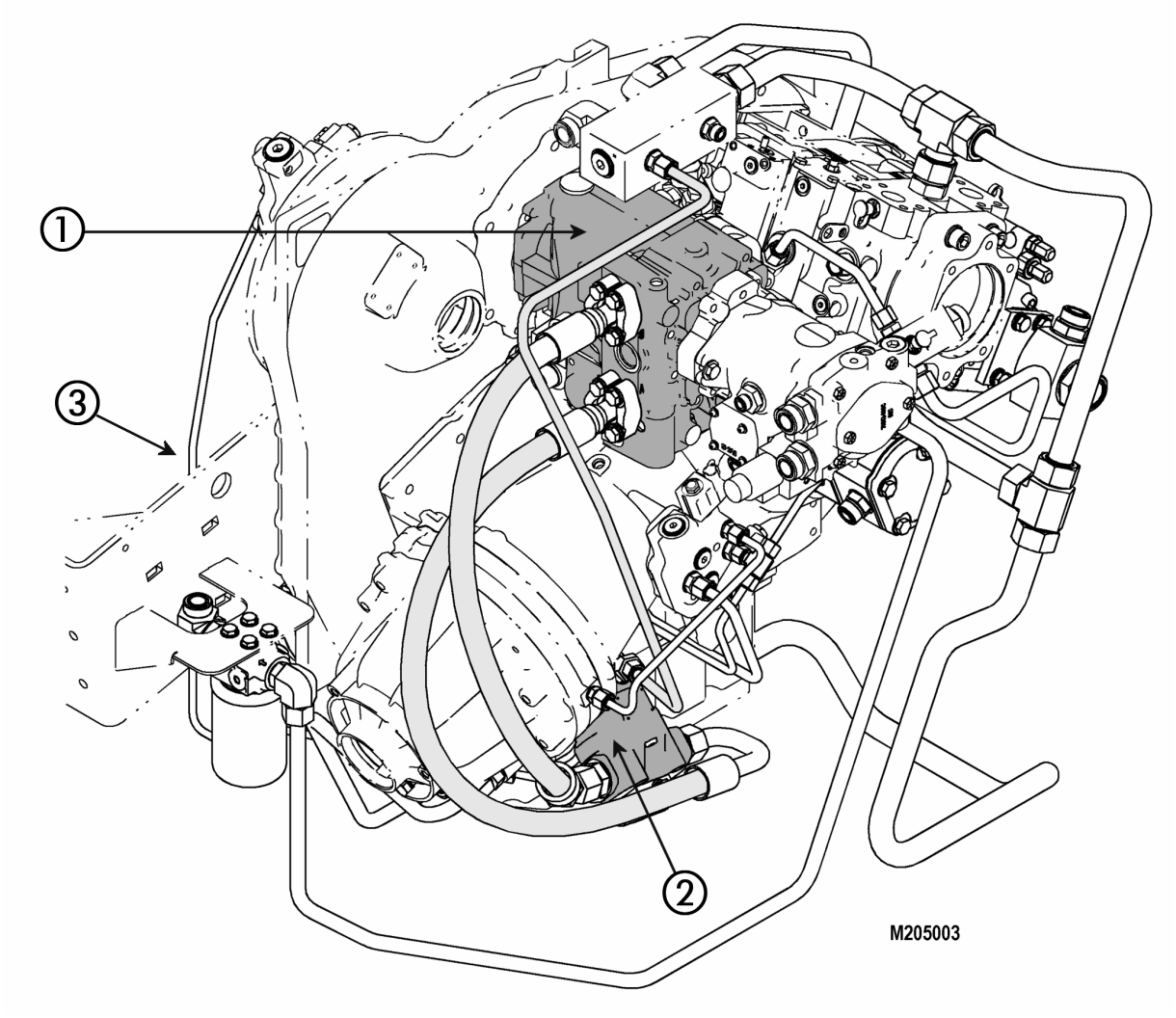
IMPORTANT: When the rotor de-slug mode is used the operator is advised to also activate the feeder reverser.



Wait a Minute... What about the feeder operation? When the separator switch is moved from the ENGAGED position the feeder will be shut down, remember that the feeder has to be engaged AFTER the separator is engaged.

POWER PLUS HYDRAULIC CIRCUITS

EATON PUMP WITH VARIABLE SPEED FEEDER



1.	Rotor Pump	2.	Rotor Motor	3.	Power Plus Drive

POWER PLUS HYDRAULIC CIRCUITS

The entire rotor drive system consists of a PTO and rotor gear boxes, Power Plus drive, hydrostatic pump, drive motor, two speed sensors, rotor and electrical/electronic controls.

REFERENCE MATERIAL:

General Hydraulic Section for “Control Pressure”
Hydraulic Schematics

KEY COMPONENTS:

Rotor Control Valve Assembly, Rotor Drive Pump and Motor, Ring to Frame Clutch, (RTF), Engine to Ring Clutch, (ETR)

The rotor control valve is used to control the two clutches that are used to control the power input source that will be used to drive the rotor.



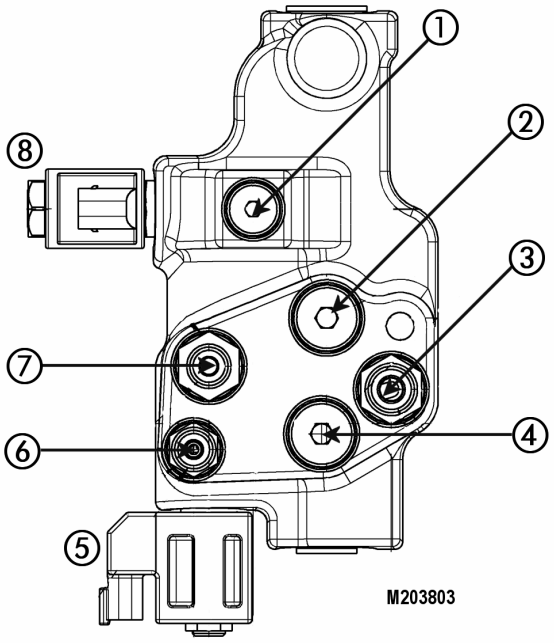
IMPORTANT: Refer to the “General Hydraulic” section for an explanation on how the charge pump, charge pressure, lube pump and lube circuits are controlled.

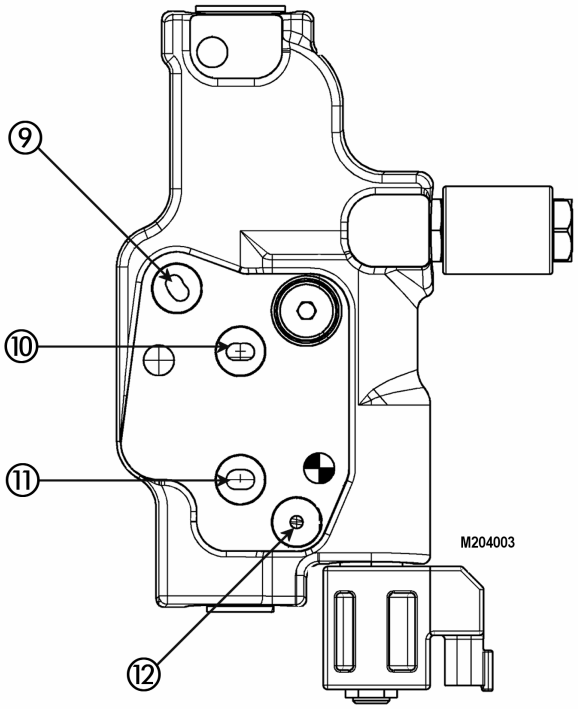


IMPORTANT: During the MY08 the rotor drive pump will be changing to a Rexroth pump. The rotor motor will remain the same unit.

POWER PLUS HYDRAULIC CIRCUITS

CONTROL VALVE





Port Identification			
1.	Plugged	7.	Control Pressure Supply
2.	Plugged (ETR Pressure test port)	8.	Engine to Ring Solenoid
3.	Lube Supply	9.	Tank
4.	Plugged (Lube Pressure test port)	10.	Engine to Ring Clutch Port
5.	Ring to Frame Solenoid	11.	Clutch Lube
6.	Ring to Frame Clutch Port	12.	Tank

The hydraulic control valve is supplied oil by external pipes from two sources,

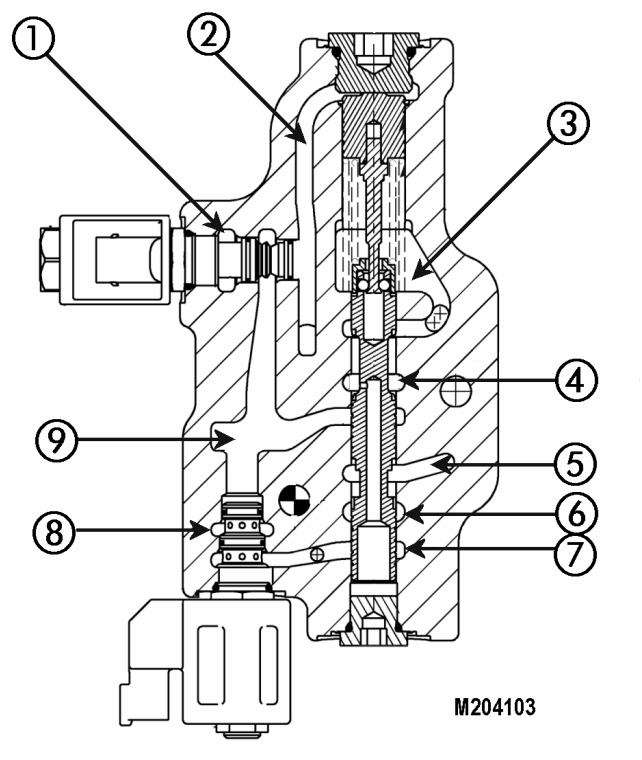
1. A constant 290-320 PSI (20-22 Bar) regulated “Control Pressure” from the charge pump. Port 7
2. Lube supply at a maximum pressure of 50 PSI (3.5 bar) from the lube supply pump. Port 3

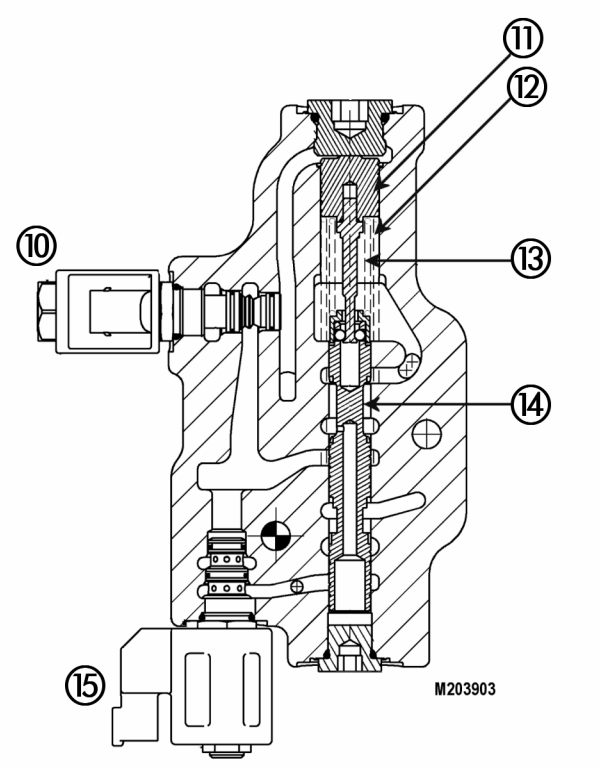
The valve directs oil to the following functions by external and internal pipes and ports,

1. Internal to the ETR clutch. Port 10
2. Internal to lube. Port 11
3. External to the RTF clutch. Port 6

POWER PLUS HYDRAULIC CIRCUITS

CONTROL VALVE

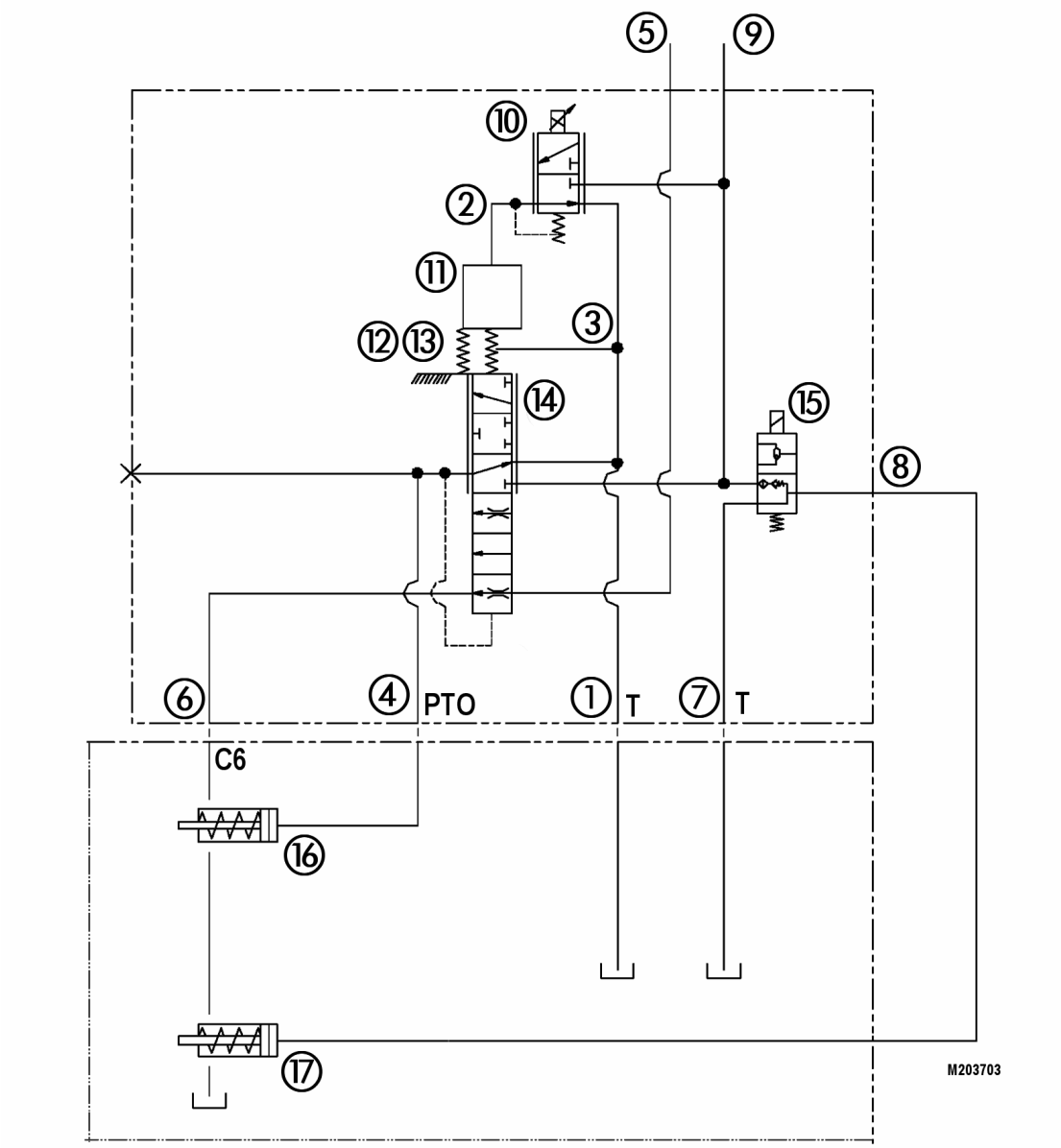




Component and Port Identification			
1.	Tank	9.	Valve Supply
2.	Modulation	10.	Engine to Ring Solenoid
3.	Tank	11.	Modulator Piston
4.	Engine to Ring Clutch	12.	Preload Spring (outer)
5.	Lube Supply	13.	Modulation Spring
6.	Lube Out	14.	Modulation Spool
7.	Tank	15.	Ring to Frame Solenoid
8.	Ring to Frame Clutch		

POWER PLUS HYDRAULIC CIRCUITS

CONTROL VALVE



Component and Port Identification			
1.	Tank	10.	Engine to Ring Solenoid
2.	Modulation	11.	Modulator Piston
3.	Tank	12.	Preload Spring (outer)
4.	Engine to Ring Clutch	13.	Modulation Spring
5.	Lube Supply	14.	Modulation Spool
6.	Lube Out	15.	Ring to Frame Solenoid
7.	Tank	16.	Engine to Ring Clutch Pack
8.	Ring to Frame Clutch	17.	Ring to Frame Clutch Pack
9.	Valve Supply (Control Press.)		

POWER PLUS HYDRAULIC CIRCUITS

CONTROL VALVE OPERATIONS

Rotor Dis-Engaged

When the rotor control switch is placed into the **OFF** position, the ETR and rotor (+)(-) solenoids are de-activated. The supply pressure (9) is dead headed at the ETR solenoid (10) the main control spool (14) and RTF solenoid (15). Once the rotor speed is below 50 RPM the RTF clutch is activated to prevent the rotor from creeping.

1. Lube oil (5) is directed through the main spool to port 6 and out to the Power Plus unit for lubrication. The spool lands restrict the lube flow.
2. The ETR clutch pack is drain back to the tank at port 1.

Rotor Engaged

When the rotor control switch is placed into the ENGAGED position (forward detented position) the following sequence will take place:

1. The RTF solenoid (15) will be activated, directing pressure to the RTF clutch piston (17). The rotor drive pump and motor will start the rotor turning, and when the rotor has reached the correct speed the solenoid will be de-activated. The clutch will release.
2. The ETR solenoid (10) will be activated by PWM. The solenoid will direct modulated pressure to the end of the modulation piston. As pressure builds, the piston moves down against the force of both the inner and outer modulator springs (12 & 13).

   As the piston moves down, the inner spring causes the main spool (14) to shift down. As the main spool moves down, the lube port 6 is unrestricted to permit additional lube flow during clutch lockup.

   The main spool will close off the ETR clutch drain port and begin directing regulated pressure to the clutch pack through port (4). As the pressure is directed to the clutch pack, it is also directed through an orifice hole in the side of the spool to the base of the spool, a signal port. As the pressure builds in the clutch pack the pressure also begins to move the main spool back up against the modulating springs, reducing the pressure on the clutch pack. This modulation takes place until the ETR solenoid has been fully powered and the main spool is held fully down.

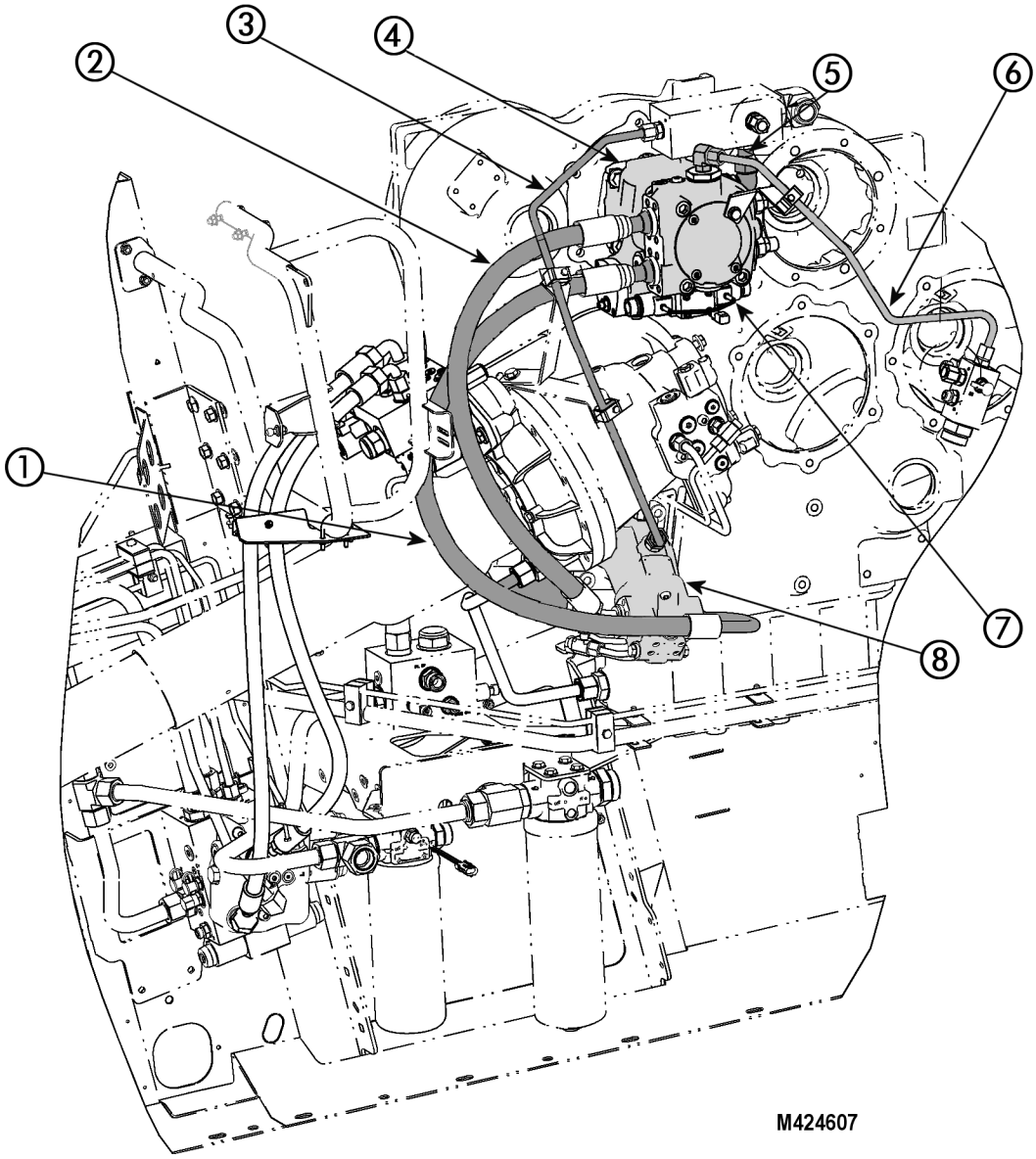
   When the main spool is completely moved down, the lube passage again becomes restricted.

De-Slug

When the rotor control switch is placed into the De-Slug position, (rearward momentary position) only the RTF solenoid will be activated.

POWER PLUS HYDRAULIC CIRCUITS, (REXROTH)

HYDROSTATIC DRIVE, REXROTH WITH FIX FEEDER SPEED DRIVE

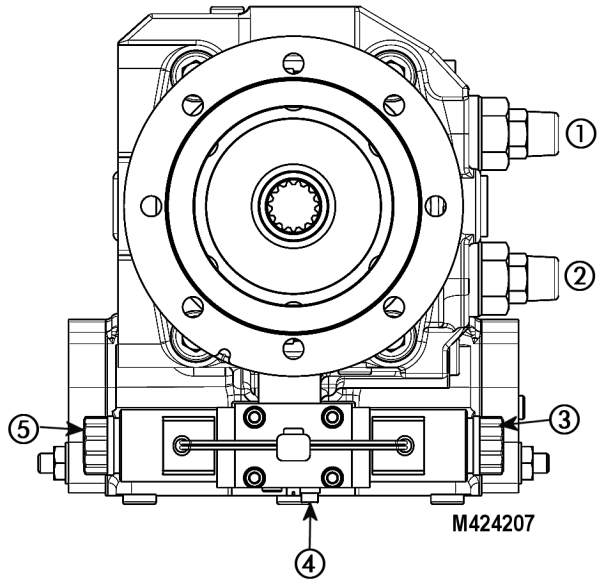


1.	Pump Work Port “B”	5.	Pump Case Drain
2.	Pump Work Port “A”	6.	Charge Pressure Supply
3.	Motor Case Drain	7.	Pump Control Valve
4.	Rotor Pump	8.	Rotor Motor

POWER PLUS HYDRAULIC CIRCUITS, (REXROTH)

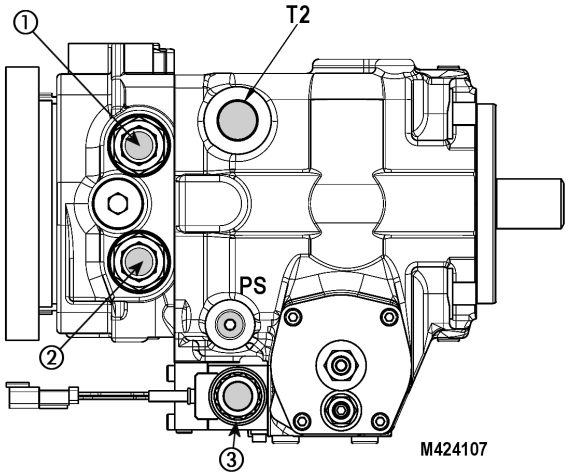
ROTOR DRIVE PUMP

Outside View

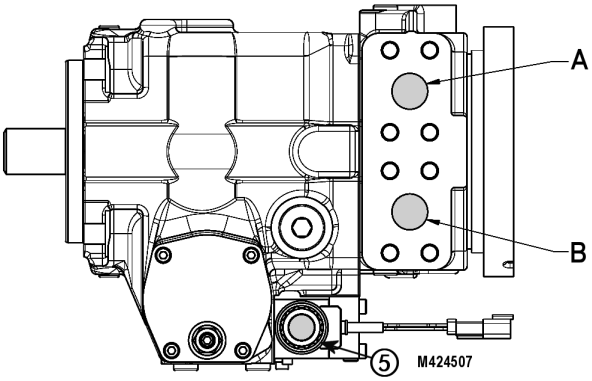


1.	Multi-Function Valve
2.	Multi-Function Valve
3.	Control Solenoid (Reverse)
4.	Valve Centering Screw
5.	Control Solenoid (Forward)
A	Motor Work Port “A” (Reverse)
B	Motor Work Port “B” (Forward)
MA	Work Port “A” Test Port
MB	Work Port “B” Test Port
PS	Supply Pressure Test Port
S	Charge Supply Port
T2	Pump Case Drain
X1	Servo Pressure Test Port
X2	Servo Pressure Test Port

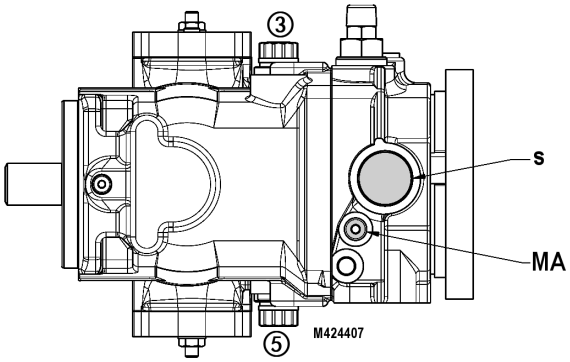
Rear Side View



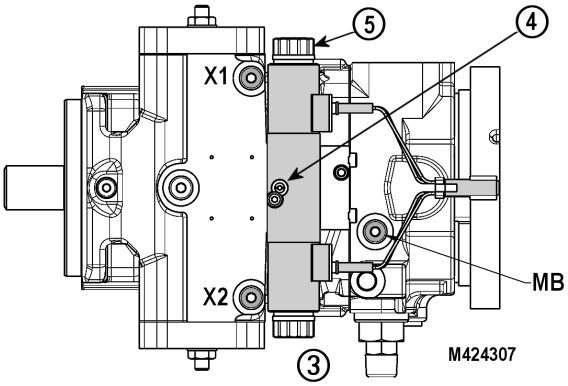
Front Side View



Top View



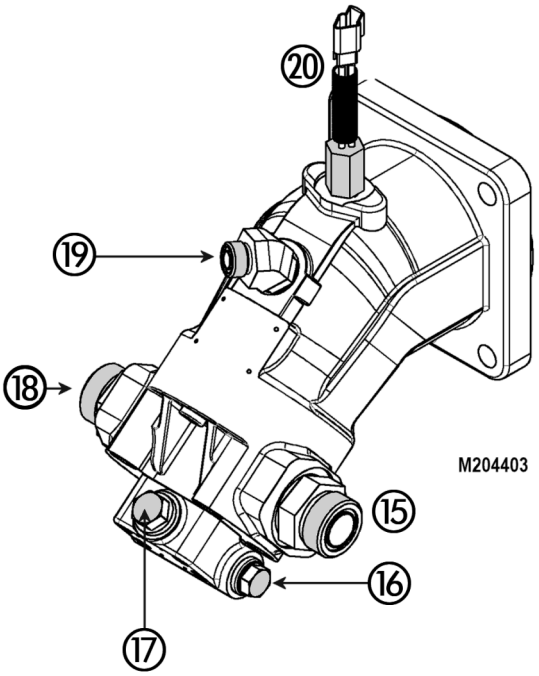
Bottom View



POWER PLUS HYDRAULIC CIRCUITS, (EATON)

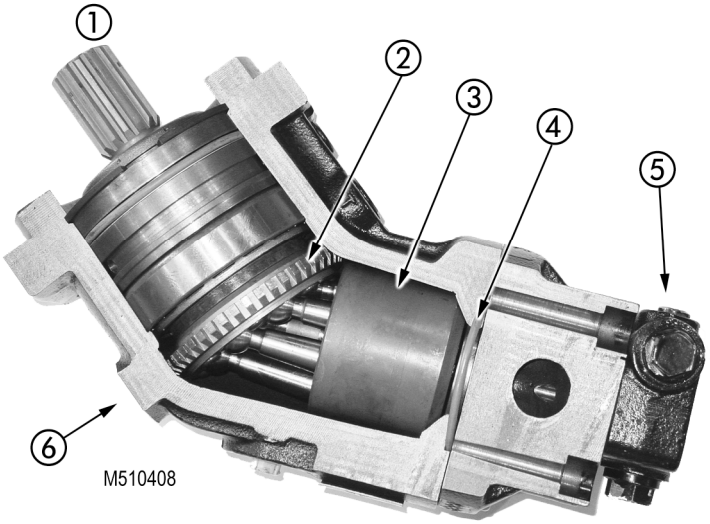
HYDROSTATIC DRIVE

Rotor Drive Motor



Rotor Drive Motor

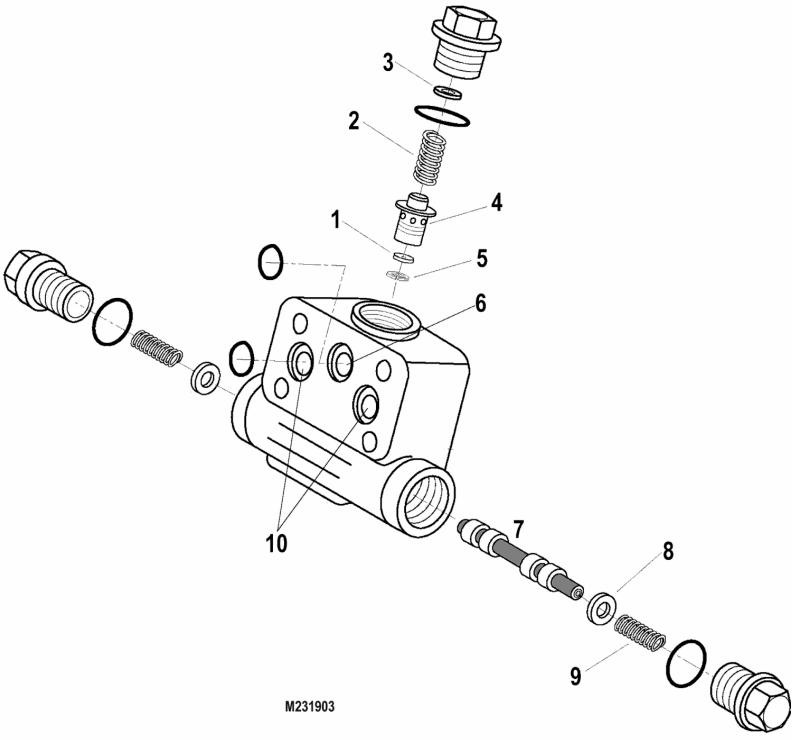
15.	Port
16.	Shuttle Spool
17.	Shuttle Relief
18.	Port
19.	Case Drain Port
20.	Motor Speed Sensor



1.	Output Shaft & Bearing
2.	Speed Sensor Ring
3.	Rotating Group
4.	Bearing (Valve) Plate
5.	Motor Valve
6.	RPM Speed Sensor Port

POWER PLUS HYDRAULIC CIRCUITS, (EATON)

HYDROSTATIC DRIVE

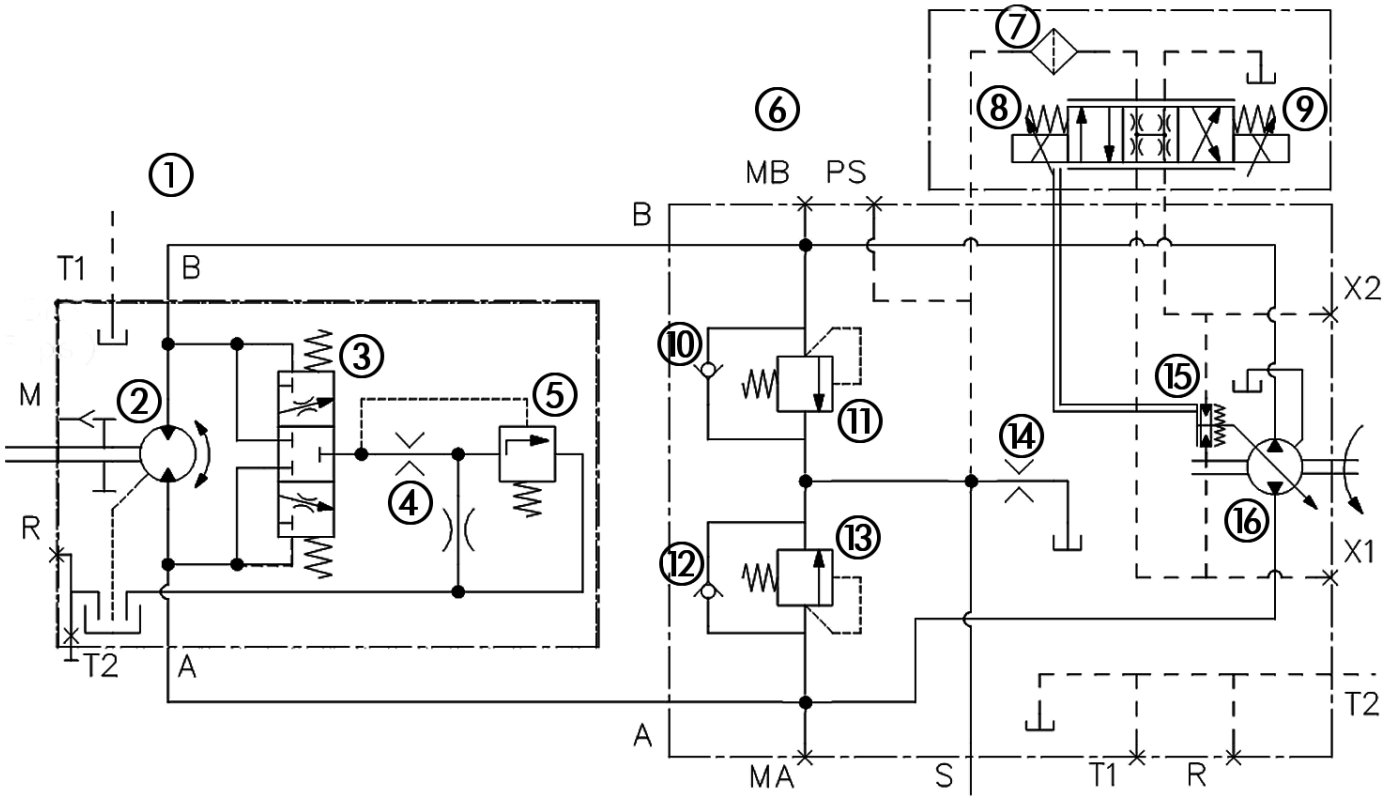


Motor Control Valve

1.	Flushing Orifice
2.	Shuttle Relief Spring
3.	Shuttle Relief Shims
4.	Shuttle Relief Poppet
5.	Snap Ring
6.	Flush Port
7.	Shuttle Spool
8.	Washer
9.	Spool Centering Spring
10.	Drive Pressure Ports

POWER PLUS HYDRAULIC CIRCUITS, (REXROTH)

HYDROSTATIC DRIVE



M423907

1	Rotor Drive Motor
2	Motor Rotating Group
3	Shuttle Spool
4	Flushing Orifice
5	Shuttle Relief
6	Rotor Drive Pump
7	Control Valve Inlet Screen
8	Control Solenoid
9	Control Solenoid
10	Charge Check Valve (Multi-Function)
11	High Pressure Relief (Multi-Function)
12	Charge Check Valve (Multi-Function)
13	High Pressure Relief (Multi-Function)
14	Case Flush Orifice 0.089” (2.25mm)
15	Servo Pistons
16	Pump Rotating Group

A	Motor Work Port “A”
B	Motor Work Port “B”
MA	Work Port “A” Test Port
MB	Work Port “B” Test Port
PS	Supply Pressure Test Port
R	Capped
S	Charge Supply Port
T1	Case Drain
T2	Pump Case Drain
X1	Servo Pressure Test Port
X2	Servo Pressure Test Port

POWER PLUS HYDRAULIC CIRCUITS, (REXROTH)

IMPORTANT: Refer to the “General Hydraulic” section for an explanation on how the charge pump, charge pressure, lube pump and lube circuits are controlled.

Rotor Disengaged

The pump is supplied with a constant supply of charge pressure oil (425 PSI (30 bar)) at port (S). The oil flow will force open the charge check valves (10 & 12) charging the closed loop circuit of the pump and motor. The flow is directed through a screen (7) to protect the directional control solenoids. The flow is directed through an orifice (14) 0.089” (2.25mm) to provide pump lubrication, cooling and flushing.

Rotor Engaged, (example solenoid 9 is activated)

1. Directional control solenoid (9) is powered with PWM. The solenoid will work as a pressure reducing valve to provide variable pressure to the swash plate servo piston and test port (X2). The servo will tilt the swash plate, causing the pump to create a flow out port (A) and test port (MB). This drive pressure will hold the charge check valve (10) on its seat. The power that is being supplied to the solenoid will be modulated to provide for the proper motor RPM.
2. The pump’s discharge from port (B) is directed to the motor’s rotating assembly (2) and to the shuttle spool (3). Due to the drive pressure being higher then the control pressure the shuttle spool will be moved down, permitting control pressure to be exposed to the shuttle relief valve. The shuttle relief is set at a lower pressure setting 230 PSI (16 bar) than the control pressure so the relief is forced open. This provides the motor with lubrication, cooling and flushing through orifice (4).
3. If the rotor should become over-loaded, the drive pressure is monitored at the high pressure relief valve (11). If the drive pressure exceeds 6500 PSI (450 bars) the pressure valve will open, directing the full pump flow back into the control circuit.

TROUBLE SHOOTING



Wait a minute, how can I trouble shoot a system that incorporates mechanical drives, electrical circuits and hydraulic circuits?

The most challenging part of repairing any operation is determining which part of the operation has failed as quickly as possible, but without overlooking any possibilities. Your first test must be able to verify whether the problem is in the electrical circuit, hydraulic circuit or the mechanical components.

First verify if a fault code is being displayed. If so, follow the explanation associated with the fault code. If not, make your first test with a voltmeter where electrical power converts to mechanical power, "The Solenoid", to verify voltage is being supplied and a ground provided.

- ✓ If voltage and ground is supplied, the electrical circuit is not the main problem. Look at the hydraulic or mechanical circuit.
- ✓ If voltage and/or ground is not being supplied, then you must fix the electrical circuit first before moving on to the hydraulic and/or mechanical circuits.
- ✓ What other components are supplied the same hydraulic supply that is supplying the rotor drive circuits? Are they working? Check control pressure.
- ✓ Check for stuck control spools, plugged orifices, open relief valves, etc.

ROTOR DRIVE CREEPAGE

If the rotor fails to drive or fails to stop and there is no fault code being displayed the system will require additional troubleshooting to determine the problem.

ROTOR WILL CONTINUE TO CREEP AFTER ENGINE START UP.

1. RTF clutch not engaging
   a It is normal for the rotor and feeder to creep when starting the engine and before the controllers have completed their self test. Remember the rotor must be below 50 RPM before the RTF is commanded to engage.
   b The clutch or piston or valve spool could be hanging. If this is the problem the rotor should not start correctly since the RTF clutch is used during the motor acceleration process.
   c Verify the RTF clutch is be commanded "**ON**" by using the diagnostic screens. Go to MAIN >DIAGNOSTIC >THRESHING ROTOR >RTF CTCH VLV
   d If NOT, check the following machine configurations using the EST:
      Mechanical Drive Type: PTO
      CVT Rotor: Installed
   e Insert a pressure gauge into the RTF clutch supply port on the CVT valve. With the separator **OFF**, there should be 290-320 psi.

2. Rotor pump swash plated not centered
   a Activate the rotor de-slug mode, but do NOT press the rotor increase /decrease switch. The rotor should NOT turn.
   b Verify there is NO current being supplied to the rotor CVT coils by using the display. Go to the MAIN>DIAGNOSTIC>THRESHING ROTOR>CVT PMP ISENSE, the reading should be "0" voltage. If in doubt, unplug the coil.
   c Press one of the rotor speed buttons, the rotor should rotate and when the button is released it should return to a STOPPED state. If the rotor creeps the pump swashplate may require centering.
   d Manually operate each solenoid cartage by pressing in the center pins to verify that the cartages and/or spools are not hanging up.

ROTOR DRIVE CREEPAGE

3. ETR clutch hanging or dragging
   a The clutch, piston or valve spool could be sticking
   b Verify that there is NO current to the ETR clutch solenoid when the separator is turned **OFF.** Using the display go to the MAIN>DIAGNOSTIC>THRESHING ROTOR>ETR CTCH INSENSE, there should be no current reading.
   c Insert a pressure gauge into the ETR clutch supply port on the CVT valve. With the separator **OFF**, there should be less then 10 psi.
   d Stop the engine, place the rotor transmission in NEUTRAL and using an inch pound torque wrench on one of the drive shaft retaining bolts between the PTO gearbox and the rotor transmission check to see what torque is required to rotate the shaft. It should be less then 20 lb in. A high torque could be an indication of the ETR clutch dragging.

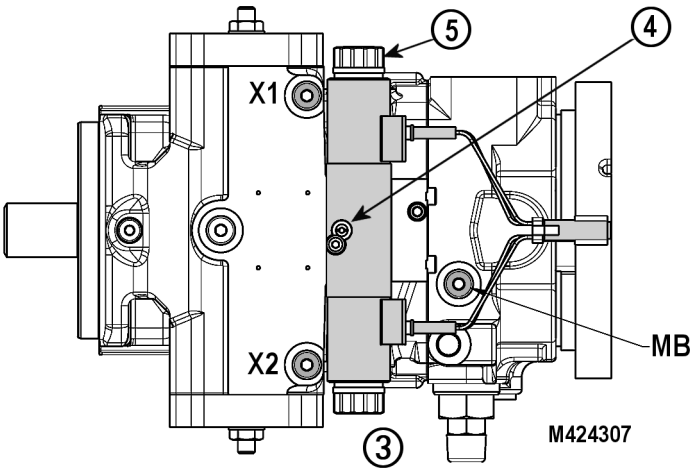
4. Rotor will NOT STOP running after the separator is dis-engaged
   a If the rotor transmission is in third gear and it will coast down to approximately 50-80 RPM within a couple of minutes the system may be normal
   b Place the rotor transmission in low range. If the rotor coast down below 50 RPM and the rotor stop abruptly the system is probably normal.
   c If the rotor will not slow down or speeds back up with engine the ETR clutch is probably dragging. Stop the engine, place the rotor transmission in NEUTRAL and using an inch pound torque wrench on one of the drive shaft retaining bolts between the PTO gearbox and the rotor transmission check to see what torque is required to rotate the shaft. It should be less then 20 lb in. A high torque could be an indication of the ETR clutch dragging.
   d The ETR solenoid valve or main spool could be sticking. If the rotor seems to engage and disengage the valve is probably OK. Verify the valve operation by inserting a gauge into the ETR clutch supply port on the CVT valve. With the separator **OFF**, there should be less than 10 psi.

Possible install newer CCM3 controller software, which incorporates deceleration.

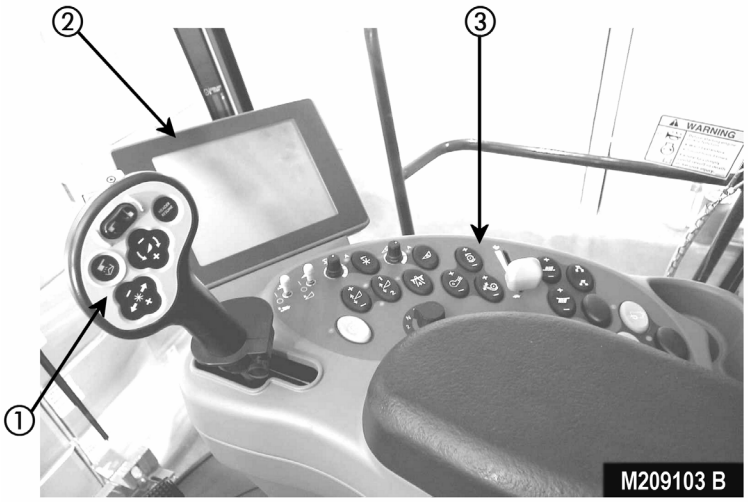
ROTOR PUMP SWASHPLATE CENTERING,

ROTOR PUMP NEUTRAL ADJUSTMENT PROCEDURE:

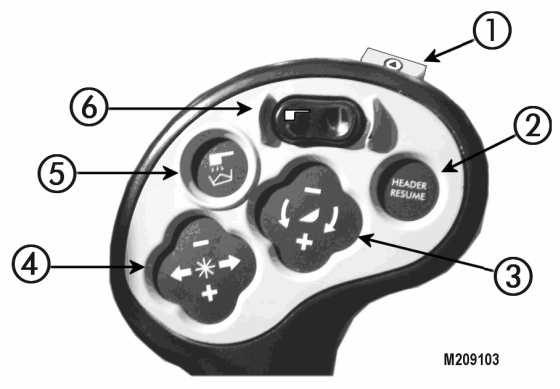
1. Locate the rotor pump neutral adjustment screw on pump controller valve, on bottom of rotor pump between the two control solenoids.
2. Loosen the locking screw and slowly rotate the neutral adjustment screw clockwise or counterclockwise until rotor motor begins to rotate, mark the adjustment screw location.
3. Rotate the neutral adjustment screw in the opposite direction until the rotor motor begins rotating in the opposite direction. Mark the adjustment screw location.
4. Rotate the neutral adjustment screw to the position midway between the two previous marks. Retighten the locking screw.
5. Neutral adjustment is completed.



OPERATOR'S CONTROLS "CONCAVES"

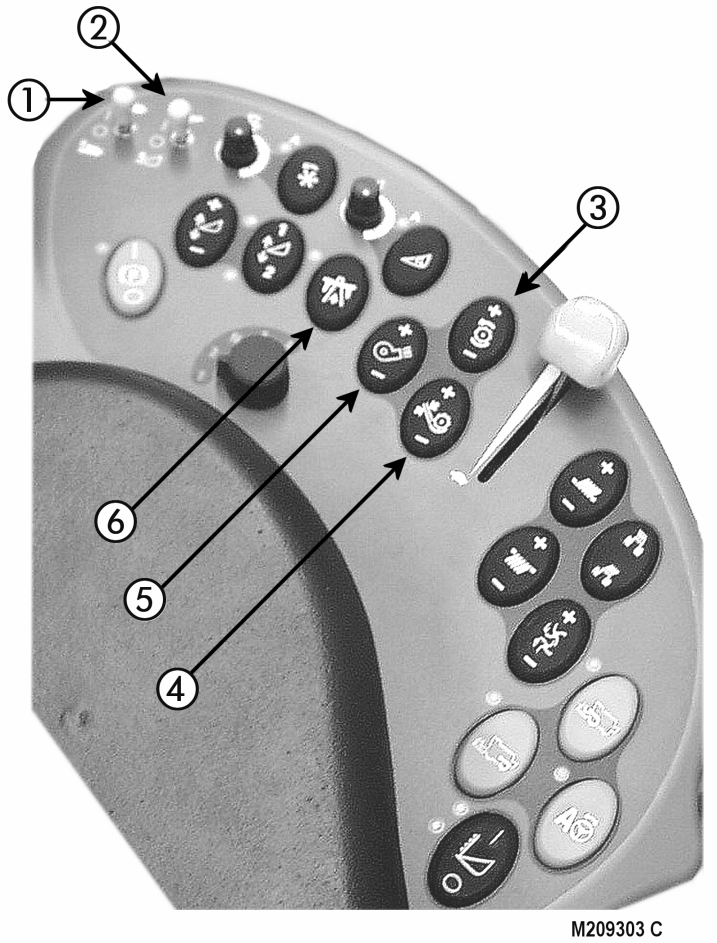


OPERATOR CONTROL CENTER	
1.	Mulit-Function Handle, MFH
2.	AFS200 or AFS PRO 600
3.	Right Hand Console, RHC



MULTI-FUNCTION HANDLE

1.	Emergency Stop Switch
2.	Resume
3.	Header Raise/Lower Tilt Right/Left
4.	Reel Raise/Lower, Fore/Aft
5.	Unloader Engagement
6.	Unloader Swing



RIGHT HAND CONSOLE
(RHC)

1.	Separator Engagement
2.	Feeder Engagement
3.	Rotor Increase(+)/Decrease(-) Switch
4.	Concave Increase(+)/Decrease(-) Switch
5.	Fan Increase(+)/Decrease(-) Switch
6.	On The Road Switch

OPERATOR'S CONTROLS "CONCAVES"

DISPLAY

CONFIGURING SCREENS

For normal operation, the operator may or may not need to assign the following items to the one of the **RUN** screens. If the operator momentarily touches the rotor speed or concave position control switches the current setting will automatically be displayed on the screen.

Function	Recommended Screen Location
Concave Position	Most Convenient

Concave Position

The operator uses the concave position display to monitor the actual concave position (opening).

RIGHT HAND CONSOLE CONTROLS

Concave Position Switch, S-16

The operator will use the concave position switch to **OPEN** / **CLOSE** the concaves. When the switch is pressed, the current setting is automatically displayed up to four seconds after the switch is released.

Location: Right hand console

SENSORS

Concave Position Sensor, R-06

The operator will use the concave position switch to **INCREASE** / **DECREASE** the opening between the rotor and modules. When the switch is pressed, the current setting is automatically displayed in a pop up window on the display and for an additional -4- seconds after the switch is released.

Location: Right hand console

CONCAVE OPERATION

MOTOR OPERATION

The concave control will provide the operator with the ability to INCREASE or DECREASE the concave opening from the cab. The concave electrical system shares the same circuitry with the Euro machines grain tank covers. This system is defaulted to operate the grain tank covers, therefore an additional operation takes place to toggle the circuit to the concave function when ever the operator press the concave INCREASE/DECREASE switch located on the RHC.

REFERENCE SCHEMATIC FRAMES:

Frames: 17

KEY COMPONENTS:

Concave Switch S-16, Concave Clearance Motor M-04, Concave/Cover Relay K-16, CCM1, RHM, Fuse F-24 & F-48,

INCREASE

The INCREASE/DECREASE switch S-16 is supplied 12V from fuse F-48. When the momentary switch is pressed to the INCREASE position the voltage is directed out terminal 3 to the RHM connector X030 terminal 3. The RHM will place two messages on the data bus:

- for the CCM1 to increase the distance between the rotor and the concave assembly
- For the DISPLAY to display the current concave position in a popup window

The CCM1 will use the voltage it is supplied from fuse F-38 at terminal J1-4 and directs it out connector X018 terminal J1-6 to the concave/cover relay K-16 terminal 1. The relay is supplied a chassis ground at terminal 2. When the relay activates it will provide a path between terminals 3 and 5.

The CCM1 will direct operating voltage that it received from fuse F-24 at terminal J2-11 out connector X019 terminal J2-1 to the concave motor terminal B. The motor is provided a ground from terminal 2 to the concave/cover relay terminal 5, out terminal 3 to the the CCM1 connector X019 terminal J2-21. The motor will operate as long as the operator holds the switch or until the motor reaches the end of its travel.

MOTOR OPERATION

DECREASE

When the switch is pressed to the DECREASE position the voltage is directed out terminal 2 to the RHM connector X030 terminal 8. The RHM will place two messages on the data bus:

- for the CCM1 to decrease the distance between the rotor and the concave assembly
- For the DISPLAY to display the current concave position in the “Data Drive” position

The CCM1 will use the voltage it is supplied from fuse F-38 at terminal J1-4 and directs it out connector X018 terminal J1-6 to the concave/cover relay K-16 terminal 1. The relay is supplied a chassis ground at terminal 2. When the relay activates it will provide a path between terminals 3 and 5.

The CCM1 will direct operating voltage that it received from fuse F-24 at terminal J2-11 out connector X019 terminal J2-21 to the concave/cover relay terminal 3. The relay will direct the voltage out terminal 5 to the concave motor M-04 terminal A. The motor is provided a ground at terminal 1 from the CCM1 connector X019 terminal J2-1. The motor will operate as long as the operator holds the switch or until the motor reaches the end of its travel.

CONCAVE POSITION SENSOR

REFERENCE SCHEMATIC FRAMES:

Frames: 17

KEY COMPONENTS:

Concave Position Sensor R-06, CCM1, & F-38,

OPERATION

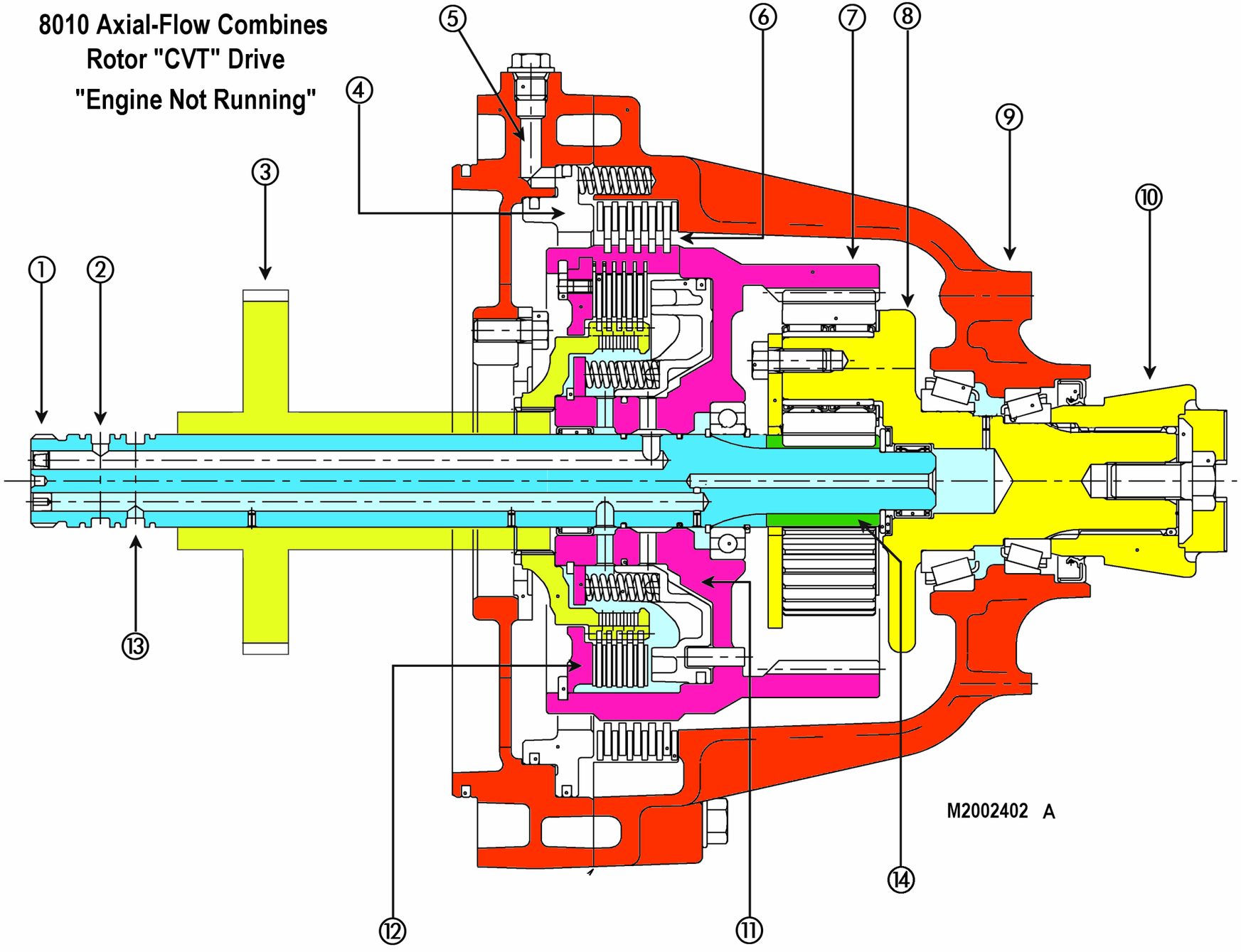
The position sensor R-06 is supplied 5V at connector X189 terminal B from the CCM1 connector X019 terminal J2-31 and a return ground from terminal A back to the CCM1 connector X019 terminal J2-14. As the sensor is rotated a variable voltage signal will be directed out terminal C back to the CCM1 connector X019 terminal J2-19.

The CCM1 will place two messages on the data bus:

- A current position message that will be used when the operator selects a “Harvest Condition” with a preset concave position.
- A current position message that may be displayed on the DISPLAY in the “Data Driven” position

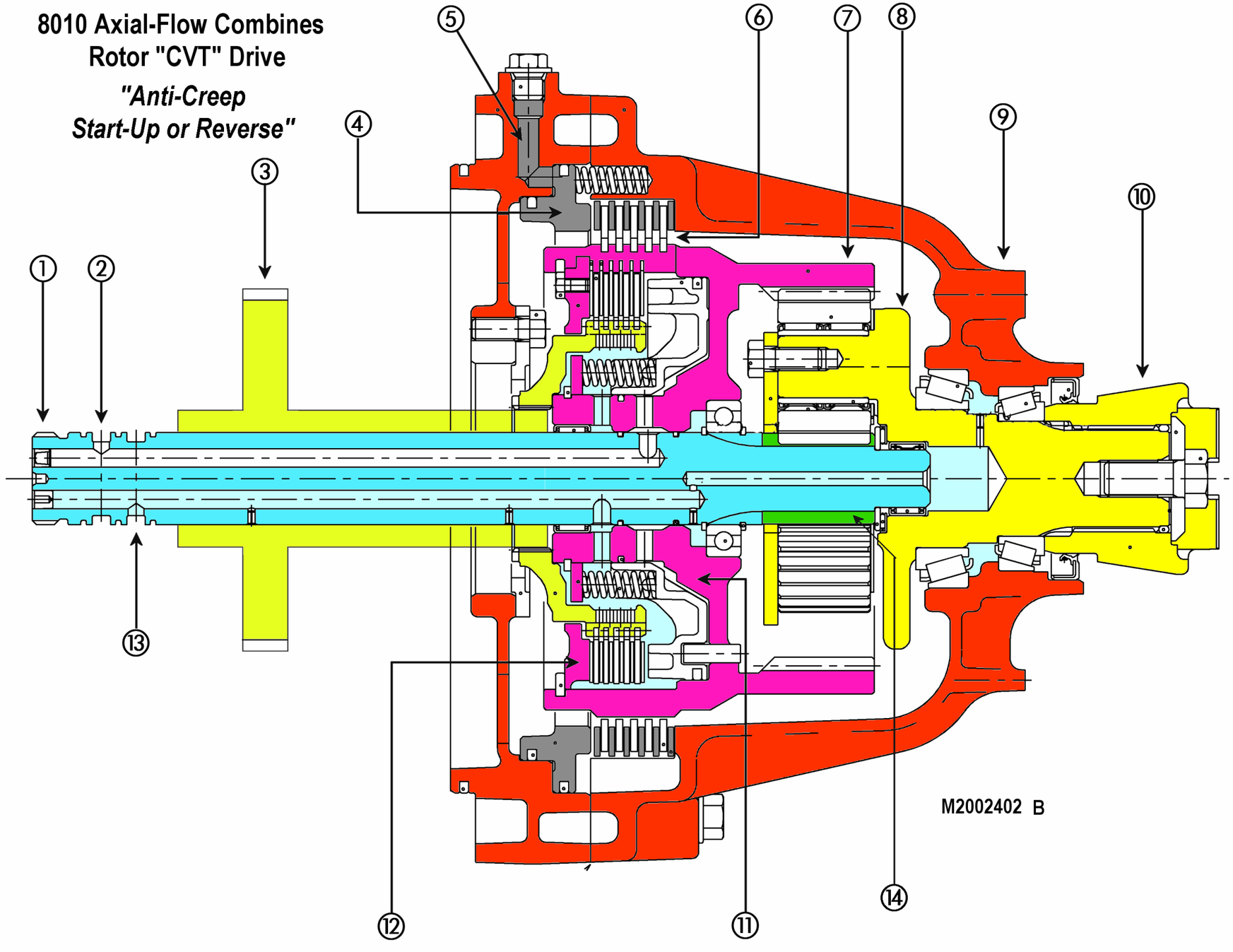
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8010 Axial-Flow Combines
Rotor "CVT" Drive
"Engine Not Running"

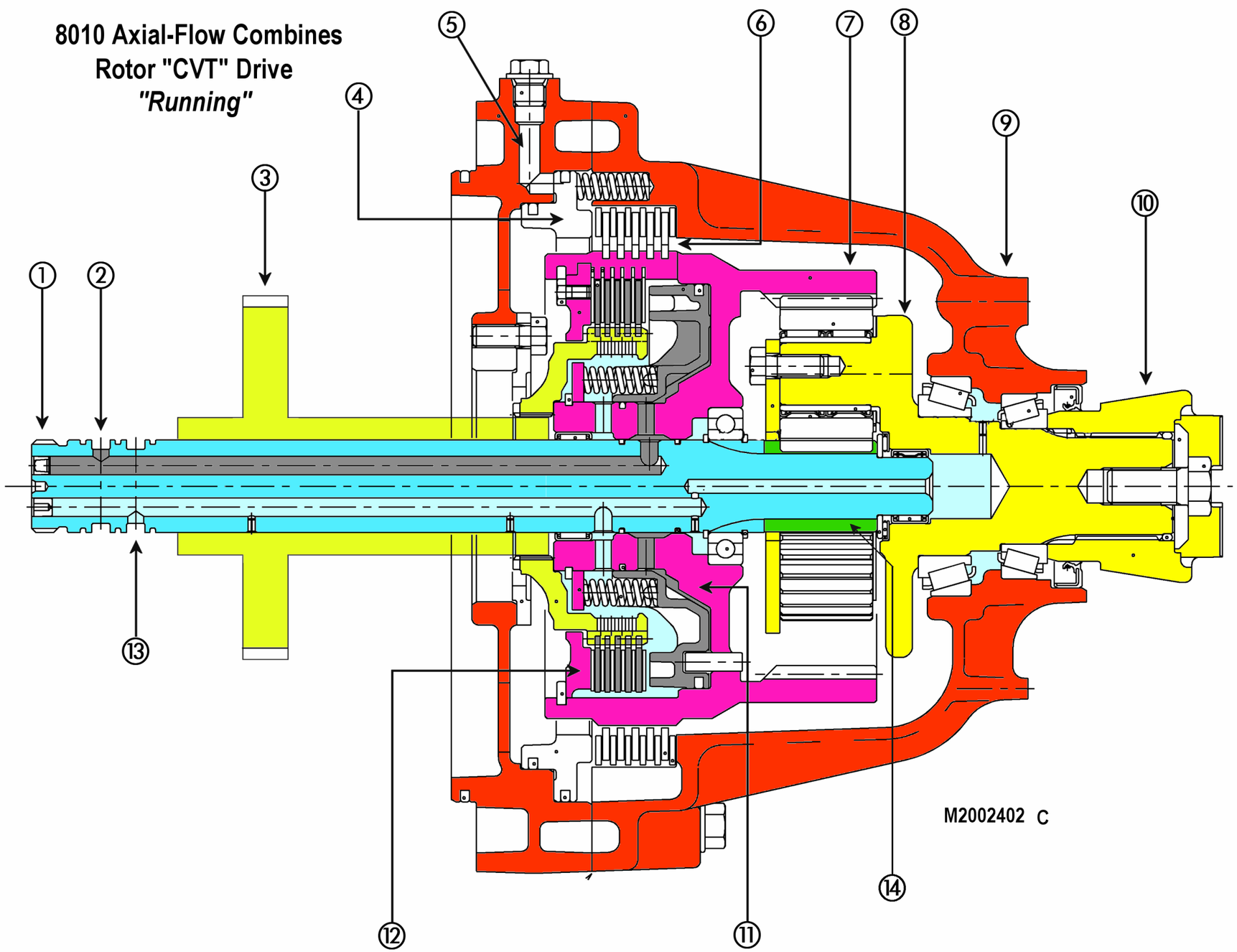


1.	Hydro. Motor Input	3.	Engine Input Gear	5.	Lock-Up RTF Clutch	7.	Ring	9.	Frame	11.	ETR Clutch Piston	13.	Lubrication Oil
2.	Lock-Up ETR Clutch	4.	RTF Clutch Piston	6.	RTF Clutch Plates	8.	Planetary Carrier	10.	Out Put Yoke	12.	ETR Clutch Plates	14.	Sun Gear

8010 Axial-Flow Combines
Rotor "CVT" Drive
"Anti-Creep Start-Up or Reverse"

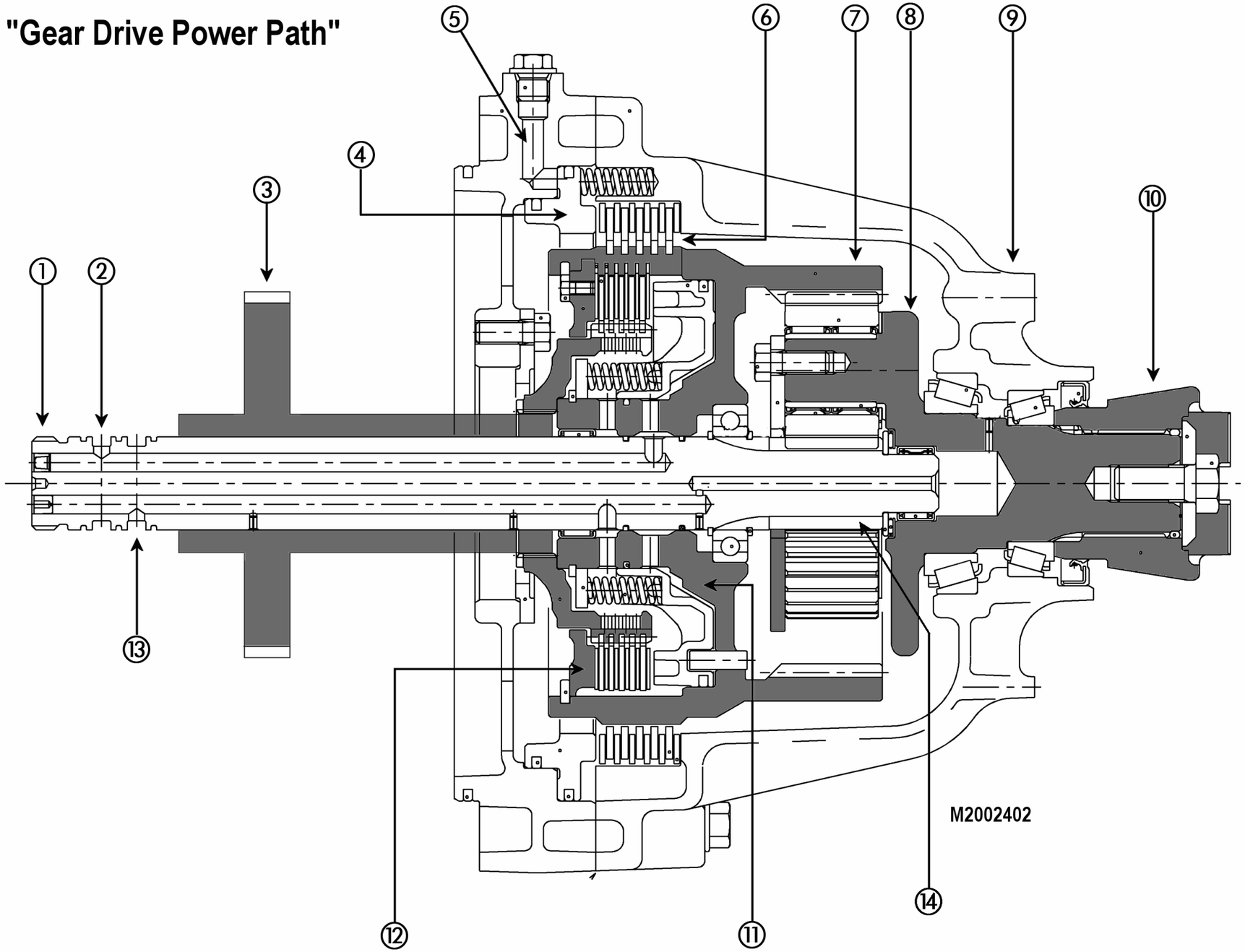


1.	Hydro. Motor Input	3.	Engine Input Gear	5.	Lock-Up RTF Clutch	7.	Ring	9.	Frame	11.	ETR Clutch Piston	13.	Lubrication Oil
2.	Lock-Up ETR Clutch	4.	RTF Clutch Piston	6.	RTF Clutch Plates	8.	Planetary Carrier	10.	Out Put Yoke	12.	ETR Clutch Plates	14.	Sun Gear



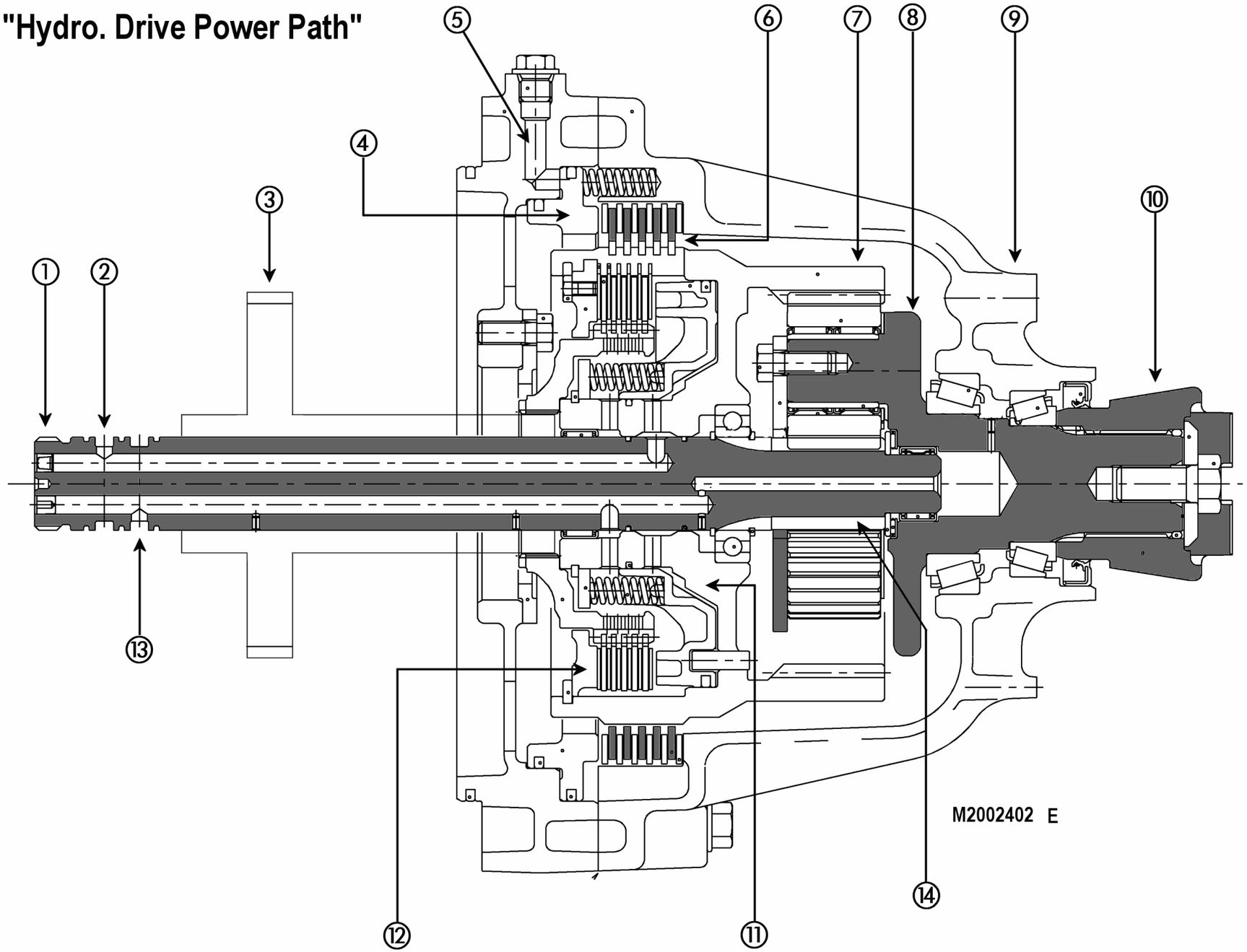
1.	Hydro. Motor Input	3.	Engine Input Gear	5.	Lock-Up RTF Clutch	7.	Ring	9.	Frame	11.	ETR Clutch Piston	13.	Lubrication Oil
2.	Lock-Up ETR Clutch	4.	RTF Clutch Piston	6.	RTF Clutch Plates	8.	Planetary Carrier	10.	Out Put Yoke	12.	ETR Clutch Plates	14.	Sun Gear

"Gear Drive Power Path"



1.	Hydro. Motor Input	3.	Engine Input Gear	5.	Lock-Up RTF Clutch	7.	Ring	9.	Frame	11.	ETR Clutch Piston	13.	Lubrication Oil
2.	Lock-Up ETR Clutch	4.	RTF Clutch Piston	6.	RTF Clutch Plates	8.	Planetary Carrier	10.	Out Put Yoke	12.	ETR Clutch Plates	14.	Sun Gear

"Hydro. Drive Power Path"

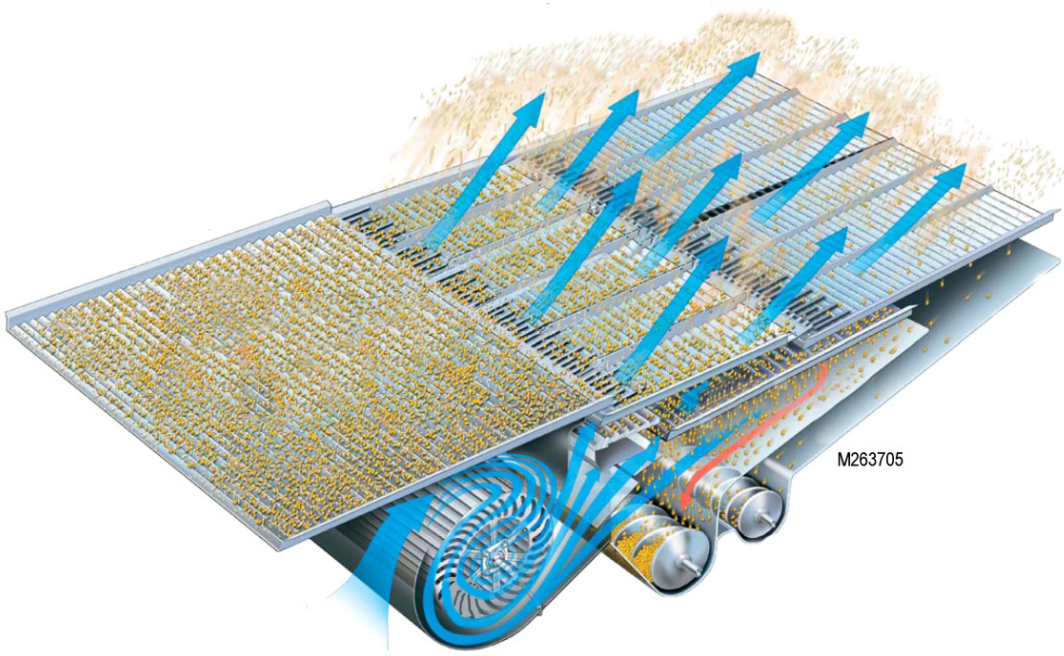


1.	Hydro. Motor Input	3.	Engine Input Gear	5.	Lock-Up RTF Clutch	7.	Ring	9.	Frame	11.	ETR Clutch Piston	13.	Lubrication Oil
2.	Lock-Up ETR Clutch	4.	RTF Clutch Piston	6.	RTF Clutch Plates	8.	Planetary Carrier	10.	Out Put Yoke	12.	ETR Clutch Plates	14.	Sun Gear

CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 - 9120 SERIES AXIAL-FLOW COMBINE



SECTION 67 CLEANING / RESIDUE MANAGEMENT

Form 5175 1/2010

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RACINE, WI 53404
U.S.A.

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KEEP AN EYE OUT FOR SYMBOLS, WHICH WILL ALERT YOU TO SPECIAL INFORMATION.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This symbol will preface tip that you should remember



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

SPECIFICATIONS

MECHANICAL SPECIFICATIONS

COMPONENT	TORQUE SETTING
Retresher Slip Clutch	375 ft bl on input shaft
Clean Grain Elevator Clutch	440 lb ft Torque

ELECTRICAL SPECIFICATIONS

COMPONENT	SUPPLY VOLTAGE	WORKING RANGE	NORMAL POSITION
Separator Engage Switch	Battery		Detent and Momentary
Feeder Engagement Switch	Battery		Detent and Momentary
Fan Increase/Decrease Switch	Battery		N/O
Tailings Processor Speed Sensor Clean Grain Elevator Speed Sensor Spreader (Windrow) Position Sensor Sieve Speed Sensor Chopper Speed Sensor	8V	No Metal 4.3V (light On) Metal 6.+V (light Off)	
Fan Speed Sensor	8V	No Metal 6.7V Metal 1.3V	
Spreader Speed Sensor	8V	No Metal 6.3V Metal 1.3V	
Tailings Volume Sensor	5V	0.5-4.5V 90 deg. rotation	
Sieve Actuators Motor	12V	Normally draws 0-5 amps Stalls = 12 amps	
Sieve Actuator Sensor		10K Ohms	

SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

COMPONENT	SUPPLY VOLTAGE	WORKING RANGE	RESISTANCE: OHMS AT 70°F (25°C)
Beater/Chopper Clutch Solenoid	PWM		6.2 Ohms
Fan Drive Solenoid	PWM		4.7 Ohms
Spreader Drive Solenoid	PWM		4.7 Ohms

HYDRAULIC SPECIFICATIONS

COMPONENT	PRESSURE
Control Pressure	320±15 PSI 22±1 bar
Lubrication Pressure	50 PSI 3.5 bar

CLEANING SYSTEM LEVELING

SYSTEM DESIGN	FRAME WIDTH	DEGREES OF TRAVEL	PERCENT OF TRAVEL	STOP BOLTS
Aggressive Cleaning Sys.	Narrow (7120)	7.8	13.6	30mm
	Wide (81/9120)	6.9	12.1	30mm

SHAFT SPEEDS

COMPONENT	RPM
Tri-Sweep Tailing Processor	Upper Pulley - 660 Middle Pulley - 486 Lower Pulley - 550

GENERAL INFORMATION

This section is broken down into the following sections:

1. Cleaning System
2. Grain Handling
3. Residue Management
4. Beater/chopper drive components
5. Tri-Sweep Tailing Processor
6. System calibration
7. Troubleshooting the system

One of the features of the 20 serie combine is that the complete combine threshing and separating operations are NOT engaged by the same PTO clutch. The rotor drive uses the Power Plus drive while the separator utilizes the Beater/chopper clutch, for that reason the rotor drive is covered in the “Thresher Drive” section. This section will cover the beater/chopper clutch, re-thresher, cleaning and grain handling system.

The cleaning assembly is used to remove the grain from MOG (Material Other Then Grain) that falls through the rotor modules along with the grain. Due to such a wide variety of seed types, size and weight there are many ways to setup the cleaning system to achieve maximum productivity. This chapter will cover the cleaning and residue operations of the machine.

To achieve maximum productivity from the Axial-Flow combines the proper equipment and adjustments must be made. The operator must make the following major adjustments for the crop harvested.

1. Adjusting the sieves to provide for grain separation.
2. Adjusting the fan to provide for chaff supporting.
3. Preventing tailings.
4. Carrying the grain to the grain tank.



IMPORTANT: Remember the most effective adjustment to be made to the cleaning system is adjustments that eliminate MOG on the cleaning system to begin with. Adjust the threshing operation.

LEVELING THE COMBINE

The cleaning system has been designed to operate properly when held in a given position; level right to left and front to back.

RIGHT TO LEFT

The right to left adjustment is automatically made with the self leveling system, the system should be verified as to it accuracy. With the machine running, park it on uneven ground, shut OFF the separator and check the sieve for levelness right to left. Using a 4ft. carpenter's level, lay the level across the grain pain to check the levelness. See system adjustments latter in this section.

FRONT TO BACK

The front to rear levelness may be effected by tire size, load and air pressure. When setting the rear axle height, measure the angle of the combine frame along the upper and lower chassis split line. There is a ledge to sit an inclinometer (angle meter) on for measuring. The rear should be approximately 3 degrees higher then the front. This should make the center rail of the UPPER sieve higher in the rear by approximately 5 degrees.



REMEMBER: Rear axles may be set for the best trucking size and MUST be checked during pre-delivery.

INTRODUCTION

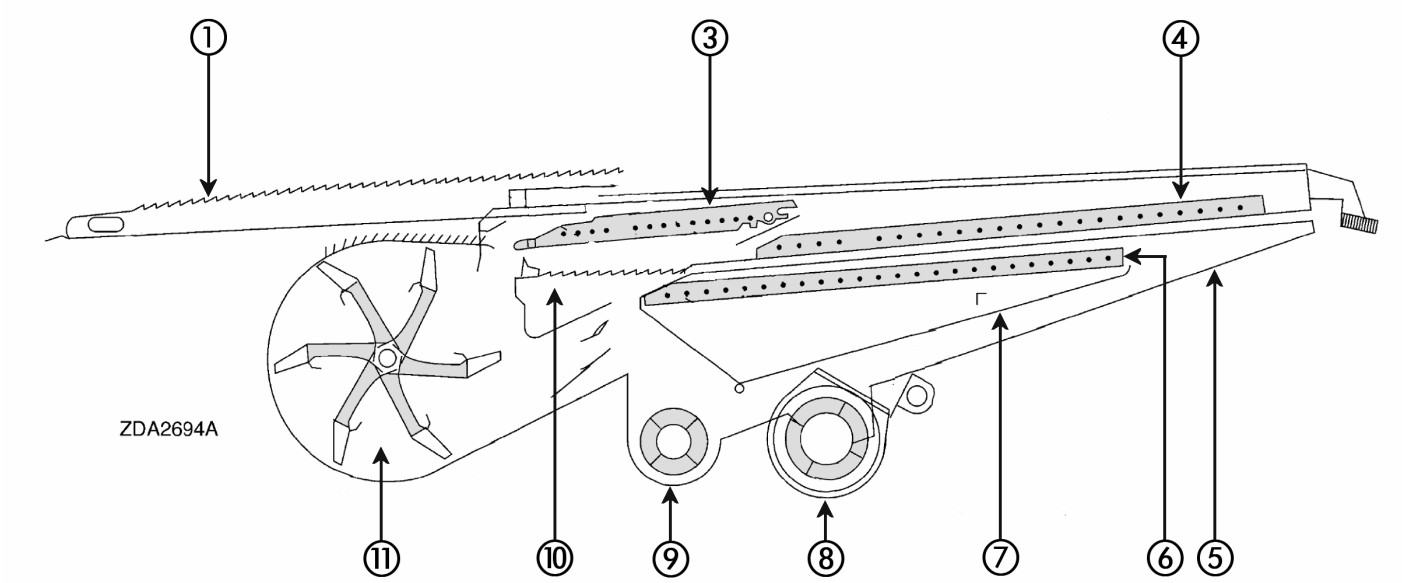
The cleaning activity of the Axial-Flow combine is the final separation of grain from material that has been distributed through the rotor modules. Grain is separated by the pre-sieve, upper and lower sieves to remove unwanted foreign material. Chaff and other unwanted material is suspended by air and discharged out of the rear of the combine. Adjustments required for this function are the cleaning fan speed and the adjustments of pre-sieve, upper and lower sieves.

To ensure optimum efficiency of the cleaning system, the threshed material should be distributed evenly across the sieve area. Only through experimentation and the use of a "Quick Kill" will an operator find the correct combination of pre-sieve, upper and lower sieve settings that yield the maximum grain savings, clean grain tank sample and reduced tailings return. A number of special configuration sieves are available for specialty crop applications.



REMEMBER: The most common mistake in adjusting the cleaning system is to close down the lower sieve in order to clean up the sample, this leads to a high level of tailings and grain damage. Normally what is required is to increase the opening of the lower sieve and increase the cleaning fan RPM.

INTRODUCTION



1.	Grain Pan, upper	7.	Clean Grain Pan
3.	Pre-Sieve	8.	Reprocessor
4.	Upper Sieve	9.	Clean Grain Auger
5.	Tailings Pan	10.	Small Grain Pan, Pre-Sieve
6.	Lower Sieve	11	Cleaning Fan

INTRODUCTION

Cleaning

The grain and chaff on the grain pan (1) are transported to the rear by the reciprocating action of the cleaning system. The self-leveling cleaning system is controlled by an inclination sensor and electrical actuator that ensures that the cleaning system automatically remains horizontal (level side to side), even when operating on side slopes up to 14% or 12% on the enhanced cleaning system. This innovation increases the capacity of the cleaning system considerably by allowing the material to distribute evenly over the full width of the grain pan.

The cleaning assembly is composed of an pre-sieve (3), upper sieve (4) and a lower sieve (6) which move in opposite directions. A first separation takes place on the grain pan (1) as the lighter chaff forms the top layer and the heavier grain the bottom layer. As the grain is transported rearward it begins to level out over the grain pan right to left. This helps to provide a more even feeding of material onto the cleaning system. The material falls through the finger grate, installed at the rear of the grain pan, onto the pre-sieve (3).

The air coming from the secondary air passage from the cleaning fan (11) blows the chaff over the pre-sieve so that grain with a reasonably high degree of cleanliness falls through the pre-sieve. The pre-sieve should remove approximately 20% of the grain, if too much grain is removed with the pre-sieve it may flow off the front edge of the lower sieve into the fan housing. This action will be repeated a second time between the pre-sieve (3) and upper sieve (4). The air coming from the main air passage from cleaning fan (11) blows the chaff over the upper sieve out of the machine, while the grain, unthreshed heads and small volumes of heavy chaff fall onto the lower sieve (6). In addition, the grain separated by the pre-sieve (3) is guided by the small grain pan (10) to the lower sieve. The installation of a pre-sieve considerably increases the cleaning system capacity as the main separation of grain and chaff occurs at both finger grates. The lower sieve provides the final cleaning operation.

Grain that passes through the lower sieve is carried over the grain pan (7) to the clean grain cross auger (9). Unthreshed heads, which do not fall through the lower sieve, are transported by the return auger (8) to the reprocessor (8) for rethreshing. From the reprocessor this material is placed back on the grain pan for an additional trip through the cleaning system.

CLEANING SYSTEM COMPONENTS

CLEANING FAN

The cleaning fan is located below and forward of the sieves and is used to separate the grain from the chaff and to aid in the removal of the trash. The only way to separate the grain from the chaff is to provide enough air volume to float the chaff over the sieves while the grain falls through. Normally the operator will try to close the sieves too far, restricting the air flow, when the sieves should be opened for capacity and increasing the air flow as required.

The lower sieve has two major functions:

- Finger opening to permit the grain to fall through, but not the trash
- Maybe more important, the sieve is used as a windboard to correctly direct the fan blast up and through the upper sieve. The upper sieve is where the majority of the cleaning is accomplished.

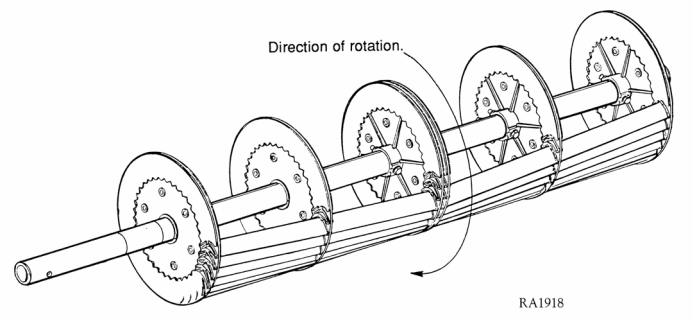
Since the trash is heavier then the grain it can NOT be separated with air, it must be separated with the sieve adjustment. The main thing here is not to permit trash on the cleaning system to begin with, make adjustments to the thrashing and separating area.

The cleaning fan is hydraulically driven and may be adjusted electrically from the cab between 300 and 1150 RPM. The cross flow fan uses 40 small blades (20 per half) held by composite discs in 5 locations. The blades are advanced in the middle slightly, they are not straight across. Each blade can be removed separately if needed.

The fan will operate in a closed loop control system, meaning that the fan speed will be maintained at the desired level anytime the engine RPM is above 1800 RPM. When below 1800 RPM the fan will be running at its maximum speed. If the engine is pulled down the fan speed can be maintained at its maximum speed down to approximately 1900 engine RPM.

CLEANING SYSTEM COMPONENTS

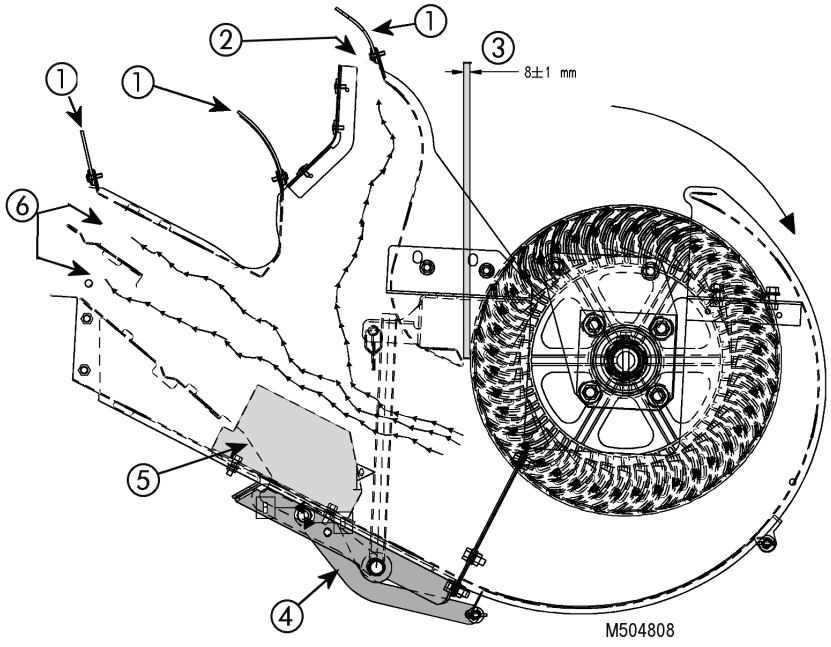
REMEMBER: Use the operator's manual or appropriate supplement for recommendations when setting fan speed. Don't be afraid to increase the fan speed over the operator's manual settings.



GENERAL FAN CHARACTERISTICS

1. It is virtually impossible to blow grain out of the machine with the cross flow fan (except grass seed).
2. The fan is very quiet. It can not be heard in the cab at speeds as high as 1150 rpm.
3. The large intake area causes the intake velocity to be very low, reducing the amount of foreign material to be drawn into the fan. When operating in a crop, which is cut higher then the lowest height of the front axle or operating in sticky ground condition where the tires may kick up trash, fan inlet screen may be required to prevent excess foreign material from being drawn into the fan which will plug the fan discharge chutes(2 & 6). Very heavy trash ingestion may also be collected on the underside of the sieves, reducing their efficiency.

1.	Air Chute Seals
2	Pre-Sieve Air Chute
3	Fan to Cutoff Plate Clearance
4	Lower Fan/Chute Clean Out Door
5	Air Deflectors
6	Lower Sieve Air Chute

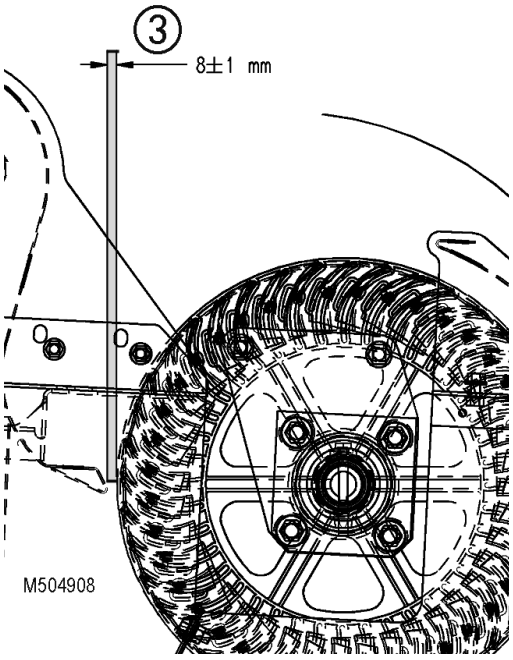


CLEANING SYSTEM COMPONENTS

The cleaning fan on the 20 series combines has added two new features over the previous 10 series, Fan to Cut Off plate adjustment and Fan/Air Chute clean-out door.

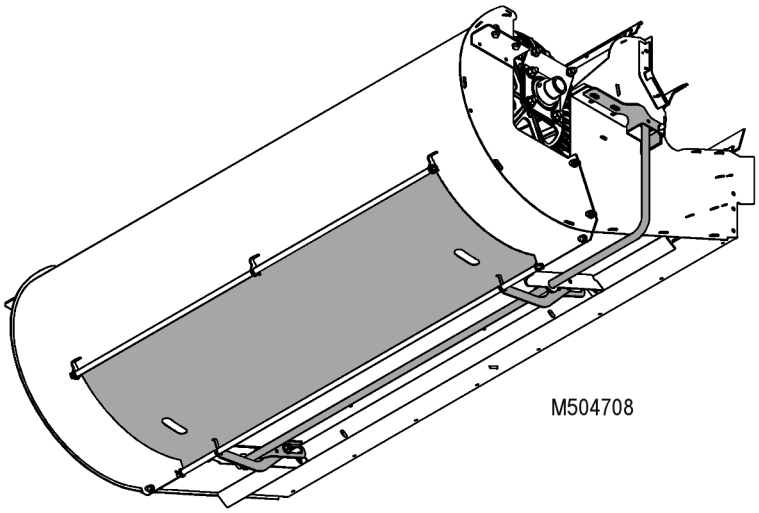
FAN CUT-OFF ADJUSTMENT

During any service work on the fan and or housing, always verify the fan's plastic disc clearance to the cut-off plate. If the disc makes contact with the plate, it could fail. There should be 8±1mm running clearance. Be sure to rotate the fan to determine the closes point. The main thing is that the disc never makes contact.



FAN HOUSING CLEAN-OUT DOOR

The fan housing access door permits the operator to clean out the fan housing and air chute of foreign material. There is an over center lever on the left hand side of the fan housing that the operator would use to open the door.



CLEANING SYSTEM COMPONENTS

CLEANING SYSTEM ADJUSTMENTS WITH CROSS FLOW FAN

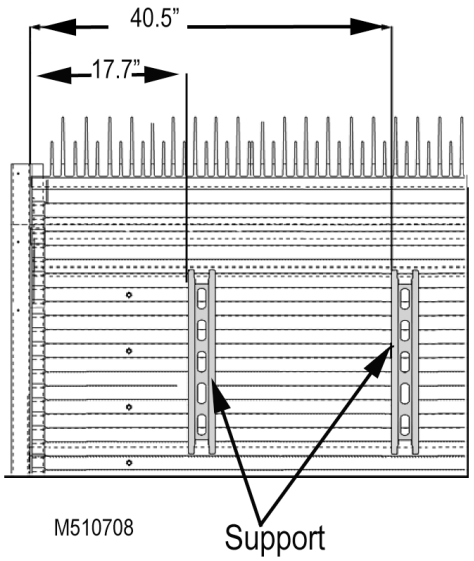
1. The lower sieve will be run more open than in the past.
2. The pre-sieve will be run more closed then the upper sieve. For most grain crops this section will not be opened more than 3/8 inch, with corn 5/8 inch.
3. Given the machine is threshing the grain properly, a less than clean sample can generally be attributed to a upper setting that is too far open. Especially the front part of the upper.
4. Running the upper sieve tighter than in the past should produce less grain loss and a cleaner sample.
5. Run the fan fast. Normally 100 RPM less then on a 2300's for most conditions.
6. Run the rear of the upper sieve 5/8 to 3/4 inch open. The fan provides an excellent air pattern and velocity at the back of the upper sieve for last chance cleaning. If green material is dropping down from the beater pan and entering the sample, close the rear of the upper sieve **slightly** to eliminate this condition.
7. In major crops grown in the U.S. such as corn , soybeans, wheat, barley, etc, excellent cleaning results can be achieved with standard style sieves. It is not necessary to use specialty sieves like the Peterson sieve with this fan in these types of crops. Specialty sieves do need to be used in vegetable crops, or crops with very small seeds, very brittle stalks, etc.
8. If grain is falling into the fan, any one of three items can remedy the situation:
    1. Reduce the opening of the pre-sieve
    2. Open the lower sieve.
    3. Reduce the opening of the upper sieve.
    4. Speed up the fan.
9. If a Peterson upper sieve is being used, do not fully close the front section of the upper or grain will slide forward and fall into the fan.

CLEANING SYSTEM COMPONENTS

GRAIN PAN, UPPER

The grain pan is located below the rotor modules and is used to transport the grain and chaff to the cleaning sieves. As the shaker pan moves back and forth the heavier grain starts to separate from the lighter chaff and becomes the bottom of the layer of material. When the material gets to the pre-sieve the grain may be quickly separated from the chaff and trash. Attached to the rear end of the pan is a finger grate to help sift the material onto the pre-sieve, which help to separate the grain and to prevent a heavy mat of material just laying on the pre-sieve that the air blast can not lift.

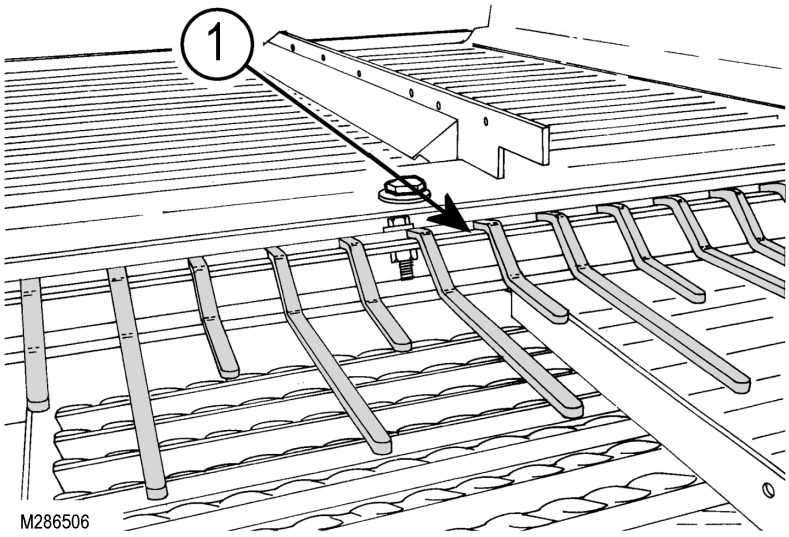
If the machine is used in crops that produce light MOG levels on the grain pan it may flex more then normal, this may create cracks Refer to bulletin AFX SB 011 08 for a reinforcing kit.



CLEANING SYSTEM COMPONENTS

FINGER GRATE

The finger grate is used to sift the heavy mat of material that is coming off the grain pan on to the pre-sieve, permitting the air blast to suspend the lighter material. If the fingers are missing due to wear or breakage, there may be very poor cleaning performed by the pre-sieve and the lower sieve could be experiencing a heavier then normal load of chaff and trash. This will also promote high tailings.



PRE-SIEVE

The pre-sieve is an additional sieve that is located at the rear of the grain pan and in front of the upper sieve. The pre-sieve provides the first opportunity for the grain to be separated from the chaff and trash. Its main function is to provide early separation of the grain from the chaff and trash. The pre-sieve should NOT be opened as wide as the upper, refer to the operator's manual for crop settings. The pre-sieve is adjusted at the right rear corner of the cleaning system; it cannot be equipped with electric adjustment controls. If the pre-sieve is opened to wide, excess grain may flow off the front of the show sieve, into the fan housing.

REMEMBER: It is very important that the machine is properly leveled front to rear for the grain pan and sieve to perform correctly.

CLEANING SYSTEM COMPONENTS

UPPER SIEVE

The upper sieve is used to pre-clean the grain by removing the thrash and 90% of the chaff from the grain. The grain is cleaned by to methods:

Air

The air blast that is coming up through the sieve from the cleaning fan is used to lift and suspend the lighter chaff while the heavier grain falls through to the lower sieve. As the sieve oscillates the chaff is agitated to promote grain separation.

Sieve Opening

The sieve finger opening is reduced to prevent the heavier thrash from also falling through with the grain. If the finger opening is reduced too much the air blast will not lift the crop and separation will be reduced dramatically, if opened too much the thrash will fall through overloading the lower sieve.

On some sieves the last few rows of the upper sieve may be adjusted separately from the forward section and provides for a last chance to capture any unthreshed or separated grain. This section will normally be opened more then the forward section. Anything that falls through this section will be directed into the tailing auger, to the reprocessor and back to the front of the upper sieve for recleaning.

Do not move the upper sieve to it upper mounting position, excess air volume will be lost.



Wait a Minute... I understand that the sieve must be configured and calibrated is that correct? Yes when replacing 1 1/8" with a 1 5/8" sieve and the machine is equipped with electric sieve adjustment, the system will require reconfiguring and calibrating for the "Auto Crop Settings" and the display to be accurate.



IMPORTANT: If the sieve that is installed has an adjustment for the front ¾ and a separate adjustment for the rear ¼; **MAKE** sure the rear section's manual adjust handle is set to give the rear section a more open setting then the front section through out the entire electric adjustment range.

CLEANING SYSTEM COMPONENTS

LOWER SIEVE

The lower sieve is located directly below the upper sieve and performs the final cleaning of the grain. The lower sieve has two functions:

Air Blast

The lower sieve is used as a wind board to direct the airflow up and through the upper sieve. If the grain tank sample is dirty it is normal for the operator to close the lower sieve, in many cases this is the wrong thing to do. It may be very helpful to open the lower sieve to direct the air blast and increase the airflow.

Sieve Opening

The sieve finger opening is reduced to prevent the heavier thrash from also falling through with the grain. If the finger opening is reduced too much the air blast will not lift the crop and separation will be reduced dramatically, if opened too much the thrash will fall through and into the grain tank. Any material that comes off the rear of the lower sieve is directed into the tailings return to be reprocessed.



Wait a Minute... I understand that the sieves must be calibrated is that correct? Yes when replacing 1 1/8” with a 1 5/8” sieve and the machine is equipped with electric sieve adjustment, the system will require reconfiguring and calibrating for the “Auto Crop Settings” to be accurate.

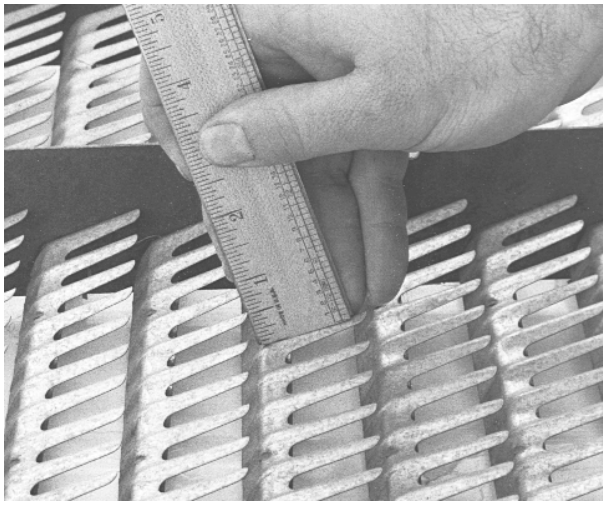
CLEANING SYSTEM COMPONENTS

SIEVES ADJUSTMENTS

When checking sieve opening measure from the tip of one finger to the base of the next finger.

Always make the final adjustments while OPENING the sieves.

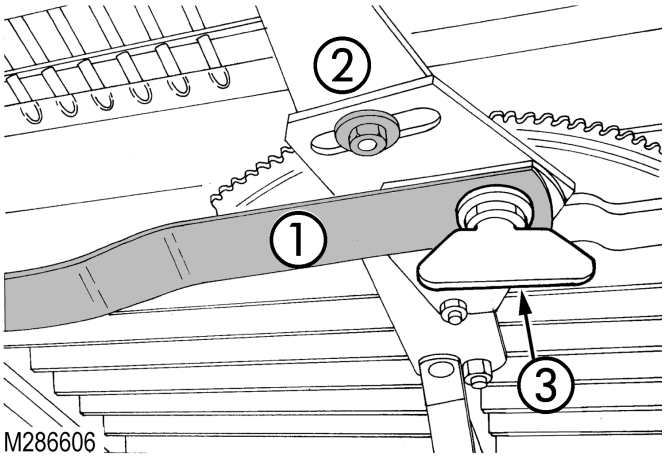
An easy way to check sieve adjustment is to use a bolt of the proper size and slide it between the rows of fingers.



SYNCHRONIZING SIEVE ADJUSTMENT

On machine with the wide cleaning system, the upper and lower sieves are split, right and left; because of this they must be adjusted so that they both open and close at the same rate. On a sieve that incorporates a separate adjustment for the last few rows will also require adjustments so all sections move concurrently, since all four segments will be moved at the same time with the same actuator.

1.	Actuator linkage to all segments
2.	Linkage adjusting bolt
3.	Linkage release wing nut

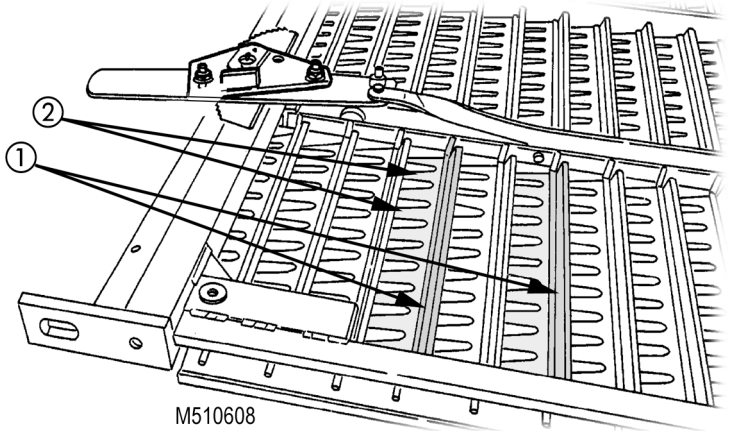


CLEANING SYSTEM COMPONENTS

SIEVES ADJUSTMENTS

The sieve serve two separate function

1.	Fingers for Cleaning
2.	Wind boards for directing the air flow through the upper sieve.



If the sieve is shut to tight for cleaning, the wind board will be taken out of the wind stream. Less air will be directed up towards the upper chaffer sieve. When a customer is trying to harvest small grain with a large sieve adjustment can be difficult.

SIEVE REFERENCE PAGE

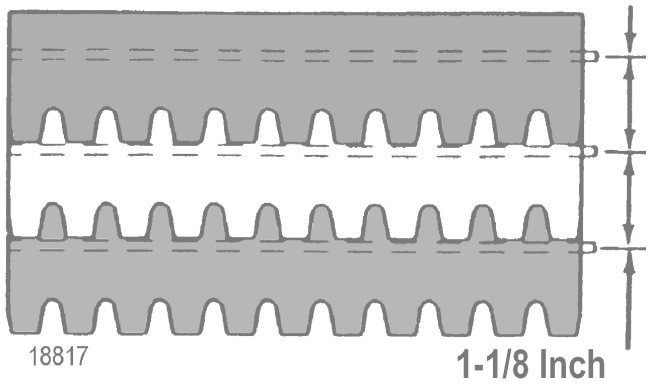
SIEVE EXAMPLES

Sieve spacing is determined by measuring the distance between to adjacent finger pivot wires. The distance will measure 1 1/8” or 1 5/8” regardless of the style of sieve.

1-1/8” GRAIN SLAT

Position: Pre-Sieve
Lower Sieve

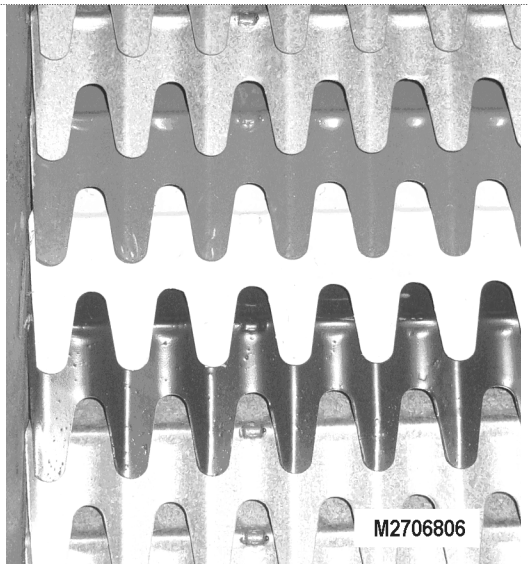
The distance between slat tips and/or wire spacing equals 1-1/8". This sieve is recommended for small grains, rice and/or various seeds. The sieve opening can be adjusted for cleaning in low volume small crops and trashy conditions. The opening between slats is limited due to the slat spacing and finger size; this may limit capacity in high yielding crops.



1-1/8” CLOSZ SLAT

Position: Upper Sieve

The distance between slat tips and/or wire spacing equals 1-1/8". This sieve has the same tooth design as the 1-5/8” closz slat sieve but with the 1-1/8” spacing; it can do a better cleaning job in low volume small grain, rice and/or various seeds. The sieve opening can be adjusted for cleaning in low volume small crops and trashy conditions. The opening between slats is limited due to the slat spacing and finger size; this may limit capacity in high yielding crops.



SIEVE REFERENCE PAGE

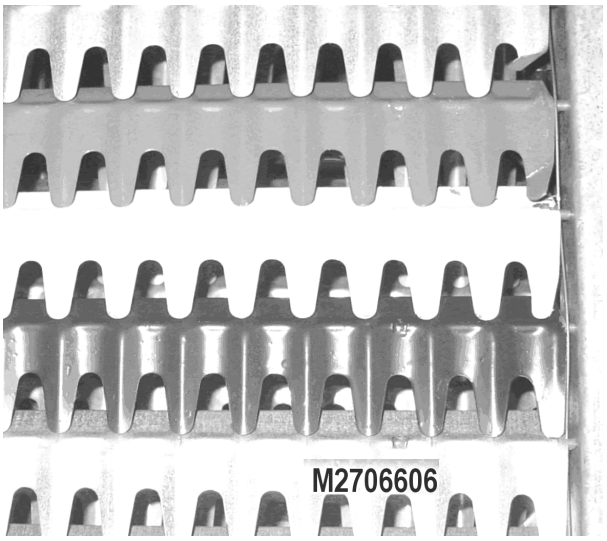
SIEVE EXAMPLES

1-5/8" CLOSZ SLAT

Position: Pre-Sieve
Lower Sieve
Upper Sieve

The distance between slat tips and/or wire spacing equals 1-5/8". The tooth depth is about half of the open slat design with less of the finger webbing area left open when the sieve is closed. This is a high capacity sieve for rice, maize, soybeans and small grains. When installed in the upper sieve location, it works well in lower yielding corn. It has a higher capacity than the 1-1/8" sieve.

It will normally be used as a high volume lower sieve in corn.

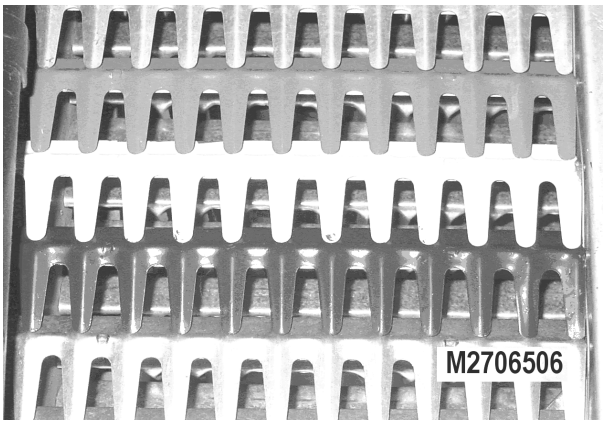


1-5/8" CORN SLAT

Position: Pre-Sieve
Upper Sieve

The distance between slat tips and/or wire spacing equals 1-5/8". This sieve has a deep tooth opening for large, high volume crops. Because of the large open area of the sieve, it uses more air, and has higher capacity. This sieve does not have to be set as wide as other sieves to achieve good capacity. Less plugging with cobs and trash will occur when using this sieve.

NOTE: This sieve does not incorporate a rear section over the tailings pan that may be adjusted separately from the front portion.



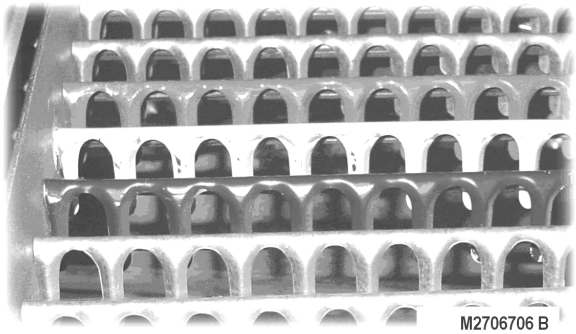
SIEVE REFERENCE PAGE

SIEVE EXAMPLES

1-1/8" PETERSON SIEVE

Position: Upper Sieve

The distance between slat tips and/or wire spacing equals 1-1/8". The slat teeth on this sieve curl down, preventing trash from falling between the rows of slats. This sieve has been used predominantly for grasses due to its excellent air control. It can be completely closed, no open space at all. It is also very good for small grains such as wheat, barley and Milo.



FIXED HOLE SIEVES

The following are all non-adjustable round-hole lower sieves. They are used mostly for vegetable and seed crops. Their applications are generally known to the specific customer.

Round Hole Frame

- 2.5 mm (0.10") round hole. Alfalfa and clover
- 10 mm (0.40") round hole. Grain sorghums
- 16 mm (0.60") round hole. Peas and soybeans
- 18 mm(0.70") round hole. Edible, Lima, kidney beans and corn

CLEANING SYSTEM COMPONENTS

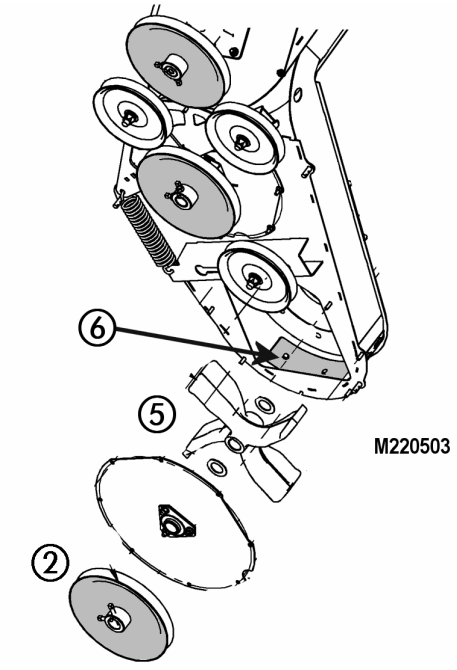
TAILINGS AUGER

The tailings auger is used to transport any tailings to the Tri Sweep tailings processor. The auger trough incorporates a clean out door that extends the full width of the machine, to provide easy access to the auger area. This auger trough cover may be replaced (though parts) with a rough surfaced cover to aid in processing the tailings if required. The cover has proven to work well in hard threshing cereal grains. The tailing auger is also used to transmit the drive from the right side of the machine to the lefts side of the machine to drive the cleaning system.

TRI-SWEEP TAILINGS PROCESSOR

Any material that falls through the last few rows of the upper sieve or off the rear of the lower sieve is directed to the tailings auger and the tailings processor. The only material that should be found in the tailings would be a very small number of unthreshed grains. The processor will rethresh the grain and deliver it back to the upper sieve for cleaning.

The tailings processor uses a series of three, four bladed impellers to transport the material. As the material is discharged from the tailings auger, it enters the lower impeller unit. The material is pressed between the impeller paddles and the clean out door which works as a concave. The aggressive movement of material across the paddle and concave should perform the required rethreshing.



2.	Processor Impeller Driven Pulleys
5.	Processor Impeller
6.	Processor Lower Door Assembly

CLEANING SYSTEM COMPONENTS

TRI-SWEEP TAILINGS PROCESSOR, CON'T

The Tri Sweep Processors use a 21" center impeller to reduce the distance between the lower and center impellers. This provides better dirt and/or wet material handling. The center impeller's **tip speed** will be approx. 5% faster then the lower impeller, and the upper impeller's tip speed will be approx. 10% faster then the center impeller.

IMPORTANT: If the processor is disassembled for repairs, it is easy to install the drive pulleys on the wrong shaft; which will cause the processor to plug. When installed correctly shaft RPM should be:

Shaft	Pulley Size	RPM (Approximately)
Lower	12”	550
Center	13.25”	485
Top	10”	660

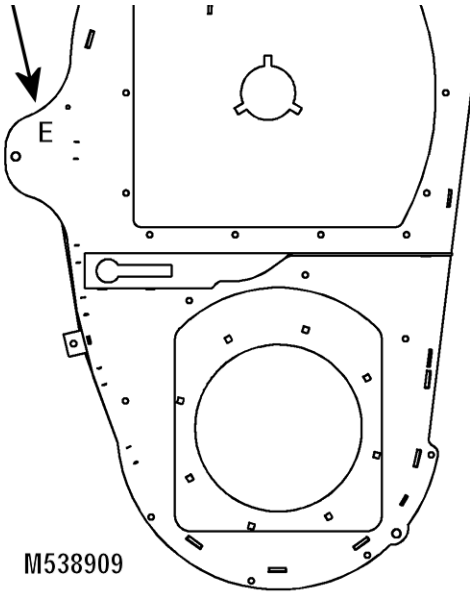
HARD THRESH KIT

There is a hard thresh kit for the tailings auger cleanout cover and tri-sweep lower cover. The hard thresh covers incorporates rough surfaces to promote threshing as the tailings are moved past them.

The processor is also available in a standard wear and extended wear housing. On these units the lower covers are NOT interchangeable. The extended wear cover is thicker than the standard wear cover, and must only be used on the extended wear housing.

87737486 cover standard wear
87737484 cover extended wear

The letter “E” denotes “Extended Wear” housing



CLEAN GRAIN ELEVATOR

Once the grain falls through the lower sieve it is directed to the clean grain auger by the grain pan and on to the clean grain elevator to be carried to the grain tank. The clean grain elevator will be equipped with the grain moisture bypass unit and flow sensor.

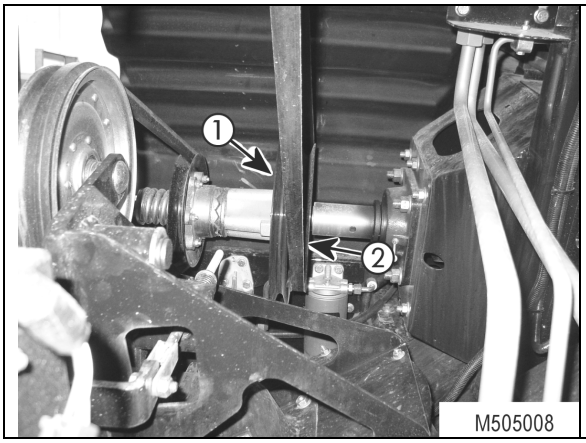
SCRAPER BLADES (METAL PADDLE)

When operating in adverse conditions there are scraper blades (84083472) that may be attached to the backside of the standard rubber paddles. This will help to keep the mud and foreign material from building up in the elevator housing. Normally the recommendation is to install two units evenly spaced.

ELEVATOR SPEED

The elevator drive may be equipped with the standard two speed drive or a single speed. When equipped with the single speed drive, the speed will be the same as the slow speed of the two speed drive system.

Low speed should be good for most all crop, providing approximately 4000 bu/hr capacity. The slow speed will also provide less crop damage and system wear. High speed would work for high volume crops such as corn or rice, providing approximately 6000 bu/hr capacity. Crop moisture has a great impact on elevator efficiency. Remember that the drive system affects the clean grain auger, elevator and bubble up auger speed.



1.	High Speed Drive Pulley
2.	Low Speed Drive Pulley



1.	Elevator Drive Chain
2.	High Speed Driven Pulley
3.	Low Speed Driven Pulley
4.	Elevator Drive Slip Clutch

IMPORTANT: Changing between speeds may require a new calibration for the grain flow sensor on the yield monitor system.

CLEAN GRAIN ELEVATOR

ELEVATOR SPEED

The machines will be shipped from the factory set to the slow speed.

Function	High Speed	Standard or Slow Speeds
Clean Grain Elevator, (measured at the clean grain auger)	439 RPM	325 RPM

IMPORTANT: Be sure to set the drive to the correct speed before starting any crop/flow calibrations.

REMEMBER: High speed has always been the standard speed on all the 10 series machines.

ELEVATOR DRIVE CLUTCH

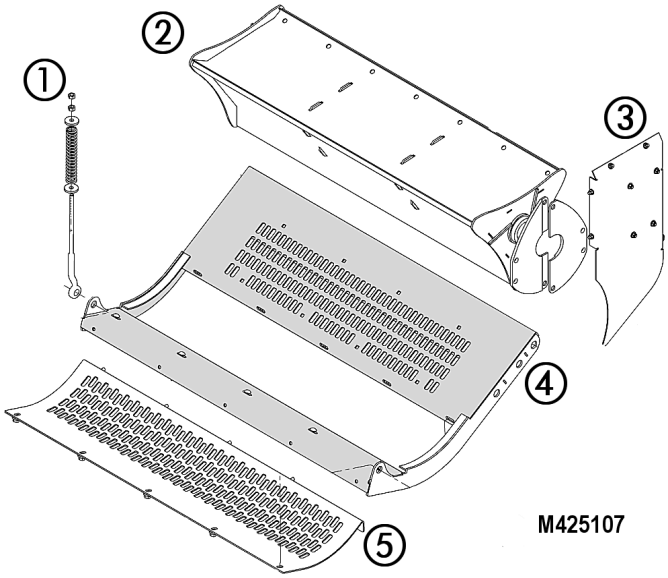
The elevator drive clutch was changed from a 295 lb ft torque clutch to a 440 lb ft clutch to provide less slippage during operating in high volume grains.

RESIDUE MANAGEMENT

The 20 series Axial-Flow combine may handle residue in several different way to fit the operator's method of farming. Residue management starts with the residue leaving the rotor cage and being distributed evenly across the field. The machine may be equipped with a Beater, Standard Chopper, Fine Cut Chopper and Windrowing Kit.

BEATER

The beater is used to transport the trash to the rear of the machine where it can be distributed by the straw spreader. The beater utilizes a spring loaded lower pan which holds the material up against the beater.

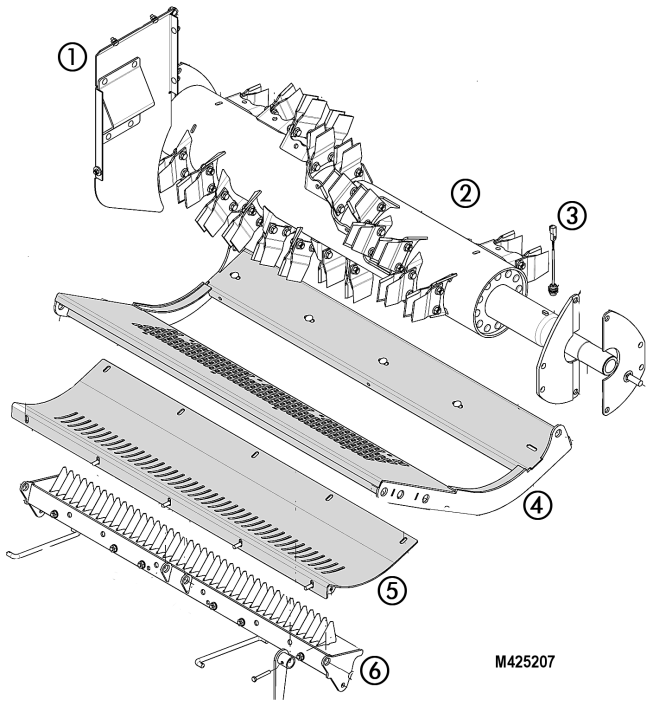


1	Beater Bottom Cushion Springs
2	Beater
3	Rotor Discharge Deflector
4	Beater Bottom
5	Rear Filler Pan, may be perforated or solid

REMEMBER: A beater equipped machine will have a fixed position windrow door and will NOT permit windrowing with out the installation of a dealer installed kit. This may change in the future. *Kit number 87474575 (87479645 ERU) and 87493756.*

RESIDUE MANAGEMENT

STANDARD CUT STRAW CHOPPER



FINE CUT CHOPPER

All but EURO

1	Rotor Discharge Deflector
2	Chopper Rotor, Fine cut 56 knives, Standard cut 21 knives
3	Chopper RPM Sensor
4	Chopper Bottom, perforations behind the rotor have been eliminated.
5	Rear Filler Pan, Rear perforations have been eliminated to prevent excess MOG on the cleaning system
6.	Stationary Knife Assembly

STRAW CHOPPER

The straw chopper takes the place of the standard discharge beater to reduce the size of the trash as it is spread back out on the ground, by reducing the particle size the residue does not hamper no-till operations. There are two different styles of choppers:

- Standard Chopper, uses 28 blades and 21 stationary knives to chop the residue.
- Fine Cut Chopper Package (*Dealer installed kit only),* uses 56 knives and 42 stationary knives to provide a finer cut, reduced particle size, of the residue. This chopper may be better suited for the no-till operations. (In some case by removing the stationary knives this unit does a better job of saving straw.) .

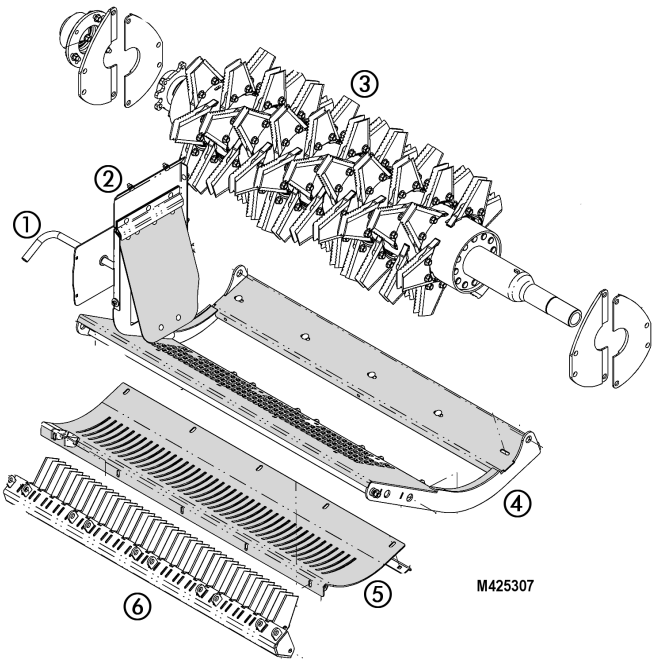
The chopper may be operated at two different speeds:

- Fast Speed (2800 RPM), is used when harvesting crop other then corn to provide a finer cut.
- Slow Speed (800), would be used with corn due to the harder corn cobs being thrown harder and possibly damaging the rear upper sieve. Slow speed could also be used when grain straw requires baling; the straw may come out of the machine in better condition for baling.

REMEMBER: A standard chopper equipped machine will NOT permit spreading chafe and windrowing straw without the installation of a dealer installed kit. This may change in the future. *Kit number 87474575 (87479645 ERU) and 87493756.*

RESIDUE MANAGEMENT

EXTRA FINE CUT CHOPPER, (MAGNACUT)



Extra Fine Cut Chopper
3X3

1	Discharge Deflector Adjustment
2	Rotor Discharge Deflector
3	Chopper Rotor
4	Chopper Bottom
5	Rear Filler Pan, Rear perforations have been eliminated to prevent excess MOG on the cleaning system
6.	Stationary Knife Assembly

STRAW CHOPPER

The straw chopper takes the place of the standard discharge beater to reduce the size of the trash as it is spread back out on the ground, by reducing the particle size the residue does not hamper no-till operations.

- 7120 chopper uses 63 blades and 20 stationary knives to chop the residue.
- 8120-9120 chopper uses 126 knives and a cast iron stationary knife holder with 40 knives to provide a finer cut, reduced particle size, of the residue. This chopper may be better suited for the no-till operations.
- The station knives are designed to break-away, swinging out of the way if an obstruction is run through the chopper. The new cast iron holder incorporates a new knife retention design when if the knives breaks-away.

The chopper may be operated at two different speeds:

- Fast Speed (3000 RPM), is used when harvesting crop other then corn to provide a finer cut. This speed requires a different DRIVE pulley and belt, the driven is still the same.
- Slow Speed (800), would be used with corn due to the harder corn cobs being thrown harder and possibly damaging the rear upper sieve. Slow speed could also be used when grain straw requires baling; the straw may come out of the machine in better condition for baling.

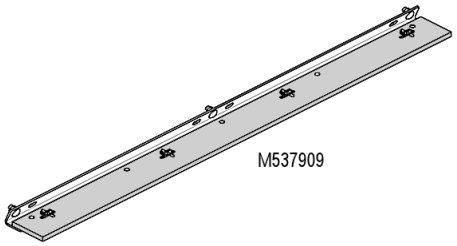
REMEMBER: This chopper comes equipped for windrowing as standard equipment.

RESIDUE MANAGEMENT

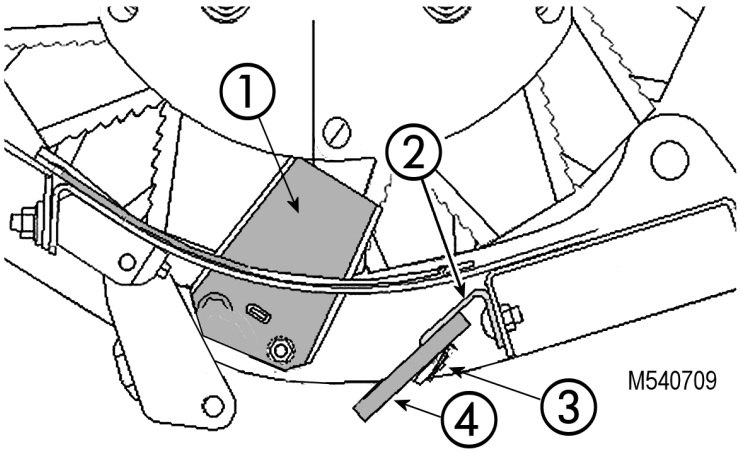
MAGNACUT CHOPPER

KNIFE STOP KIT 87481752

The knife stop may be added to the MagnaCut to help prevent the stationary knives from coming free of the machine if they should break away.



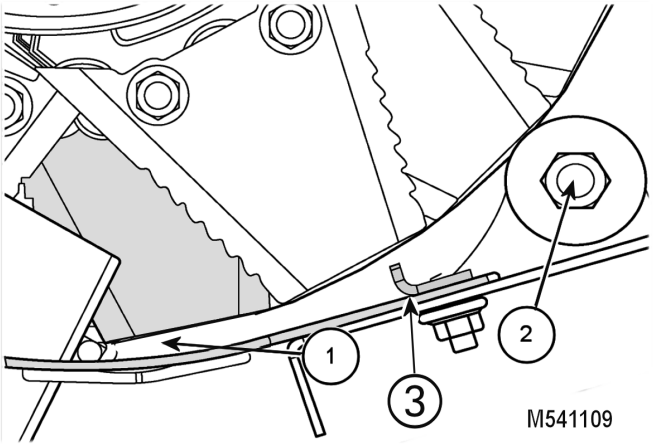
1.	Stationary Knife
2.	Support Mounting
3.	Rubber Retainer Clip
4.	Rubber Cushion



SHRED BAR

A shred bar (3) is shipped with the unit that may be installed. It may provide additional residue shredding.

The concave adjustment (2) should be adjusted to provide for 0.4 inches (10mm) clearance at point (1).



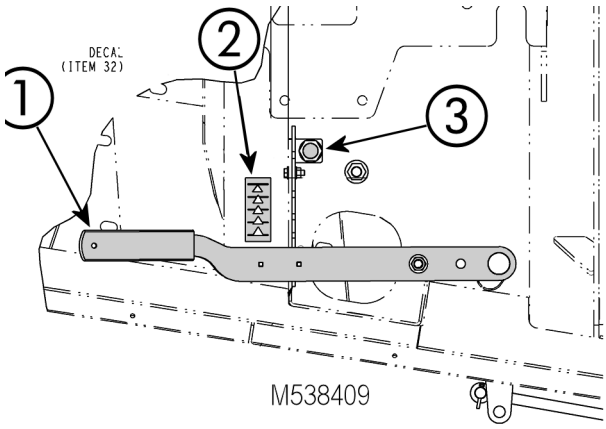
REMEMBER: The stationary knives in the MagnaCut chopper consumes a large amount of horsepower.

The MagnaCut chopper can be changed from an extra fine cut to a fine cut by removing half of the rotor blade, 126 down to 63; normally the ones next to the retainer nuts. THE ROTOR WILL REQUIRE REBALANCING. Refer to the Assist Knowledge “Excessive Vibration of the 3x3” chopper”.

RESIDUE MANAGEMENT

The chopper assembly uses a stationary set of knives to provide a more efficient cutting action. The knives may be position at different depths into the residue path as the required amount of cutting and crop types change. It is very import that the knives are rotated out of the residue flow when harvesting corn.

Starting at pin number Y9G207601 (MY10) a knife position sensor (3) has been added to monitor the position of the knife positioning handle. If the software detects that the crop type is such as the knives should NOT be used, and the knives are in ANY of the cutting positions; a message will be displayed to alert the operator. Following is a list of possible condition:



Header Type as Selected on the Pro-600 Display	Corn		Not Corn	
	Knife Retracted	Knife Engaged	Knife Retracted	Knife Engaged
Before Separator Engagement	Allow Engagement	A-137 Separator will NOT engage	Allow Engagement	Allow Engagement
At 2.5 Seconds after Separator Engagement	A-042 Disengage if chopper speed is <300 RPM			
At 10 Seconds				A-137 Disengage if Chopper speed is <1000 RPM
Continuous Monitoring	A129 Alarm if chopper speed is >1500 RPM			A-137 Alarm if Chopper speed is less than <1000 RPM

A-042: Chopper RPM too LOW
A-129: Chopper RPM too HIGH
A-137: Disengage Chopper Knives

This monitoring is also in effect during deslug mode.

RESIDUE MANAGEMENT

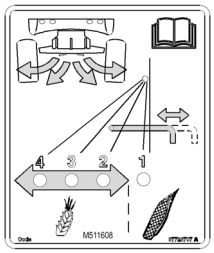
As listed in the art work on the previous pages, there is a deflector that has been added to the right hand side of the rotor discharge chamber to move the material farther to the left as it enters the chopper. This will help to distribute the material more evenly into the straw spreaders. The deflector has worked well in all crops, except very wet heavy material; it performs better then the directional vein that could be added to the chopper bottom. This deflect may be added to older machines also with the standard chopper or beater.

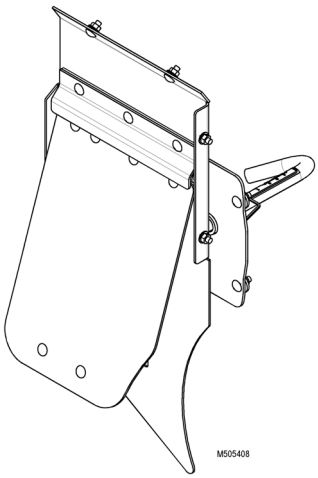
Deflector Kit: 87550493
Bulkhead: 87550492

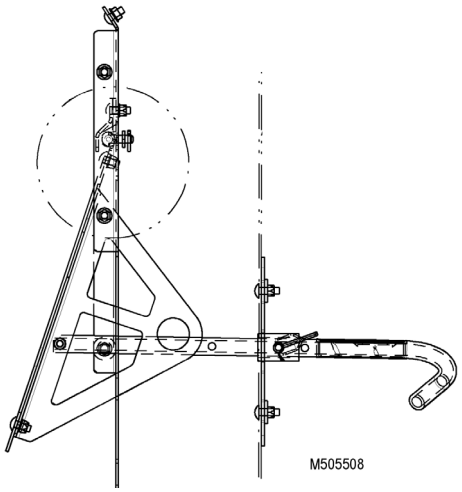


MANUAL ADJUSTMENT

The deflector has three positions and works very well with the standard AFX rotor. The adjustment lever would be all the way out for corn, and adjust as needed for other crops.

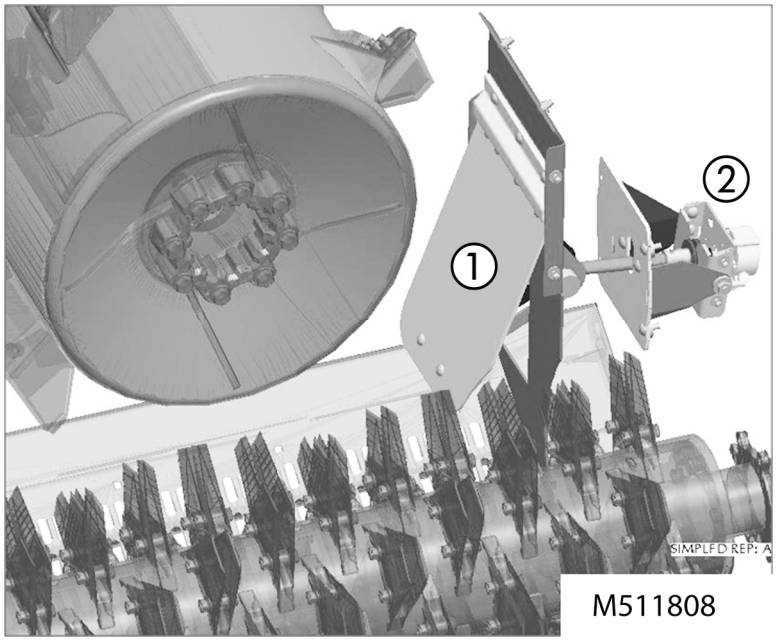






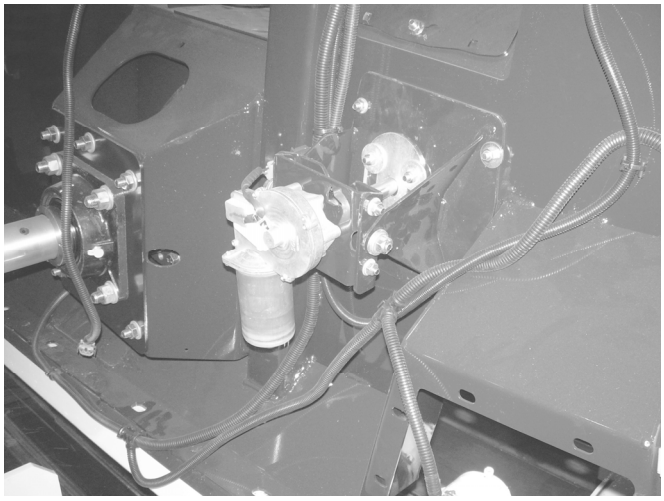
RESIDUE MANAGEMENT

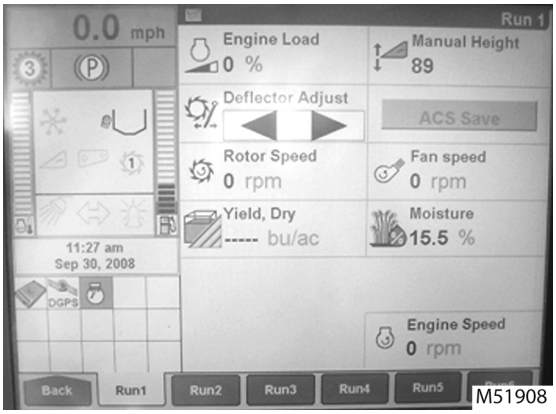
The residue deflector is also available (standard for EURO) with remote electrical adjustment.



M511808

1.	Deflector
2.	Adjustment Motor





M51908

The deflector is positioned using the display screen. The deflector adjustment should be added to one of the RUN screens to provide access. If the deflector reaches one of the limits IN or OUT, or the motor draws too much current, the arrow for that direction will be grayed out until the deflector is moved in the opposite direction.

RESIDUE MANAGEMENT

RESIDUE SPREADING

The straw spreader is used to distribute the residue to permit soil preparations for the next crop or no-till operations. The throw pattern may be changed by adjusting the position of the deflector and also by changing the speed of the spreader. The spreader speed can be changed from the cab using a switch mounted on the right hand console. The speed may be changed to provide a desired throwing pattern.

- **Fast Speed**, providing up to 750 RPM, is used on all crops except corn. Adjusting the control to gain different flow rates to the spreader motors may vary the spreading pattern.
- **Slow Speed**, providing approximately 320 RPM, is used with corn crops.

The spreader discharge pattern may be influenced by the following adjustments:

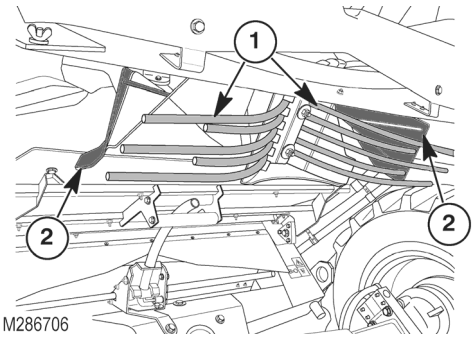
Step #1

By adjusting the speed of the spreader. Slowest speed for corn and variable speed for other crops.



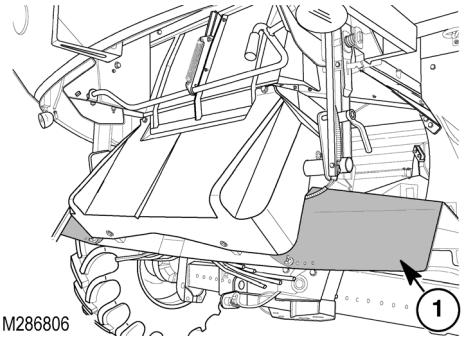
Step #2

The throw distance may be changed by adjusting the clearance between the spreader paddles (2) and the finger bars. The wider the clearance, the shorter the throw distance will be. If there is not enough material behind the machine, one or two of the fingers could be removed or shortened.



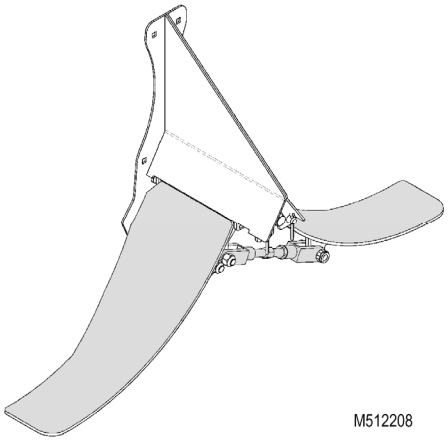
Step #3

The throw distance may be changed by adjusting the position of the spreader deflectors (1). There are two positions, up for spreading and down for corn. *The deflectors should be the last adjustment made*.

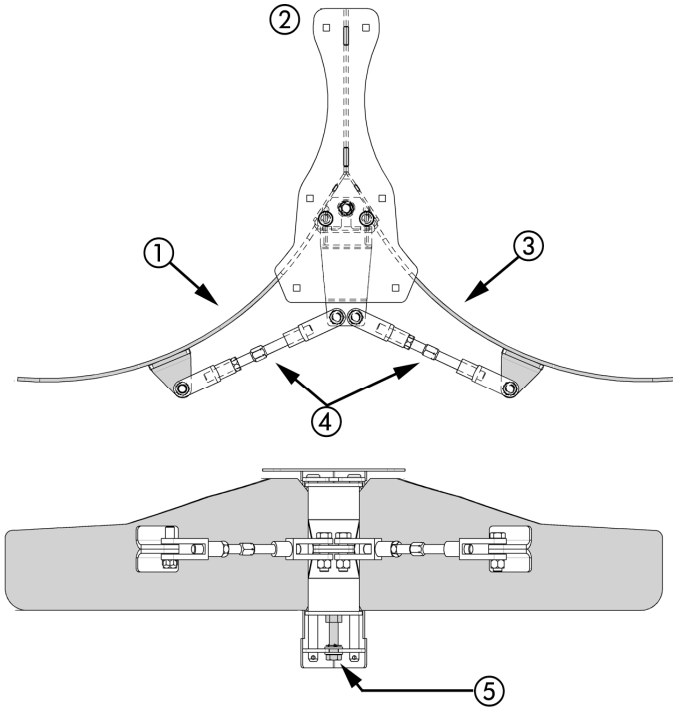


RESIDUE MANAGEMENT

The straw spreader fingers may be changed out for adjustable deflectors to provide additional spreading control. The deflectors may be pivoted to change the throw and moved fore/aft to change the amount of material placed behind the machine.



M512208



M512108

1.	Deflector (replacing the fingers)
2.	Mounting
3.	Deflector (replacing the fingers)
4.	Deflector Adjustment Rods
5.	Deflector Positioning Adjustment

The starting position for the adjustment rods should be approximately 9.1 inches (232mm) from center of pin to center of pin.

RESIDUE MANAGEMENT

The spreader incorporates features to provide various spreading functions:

1. Spread both chaff and chopped or unchopped straw
2. Spread the chaff and windrow the chopped or unchopped straw
3. Windrow both chaff and chopped or unchopped straw

REMEMBER: This function is only standard on the MegnaCut chopper, the required kits must be installed when using the beater or standard cut chopper.

When the spreader is moved to the UP position (storage), the spreader position sensor will direct a signal to the CCM1 to prevent the spreader from operating. If the spreader is lowered into the working position WHILE the separator is running the spreader will NOT be engaged until the separator switch is toggled.

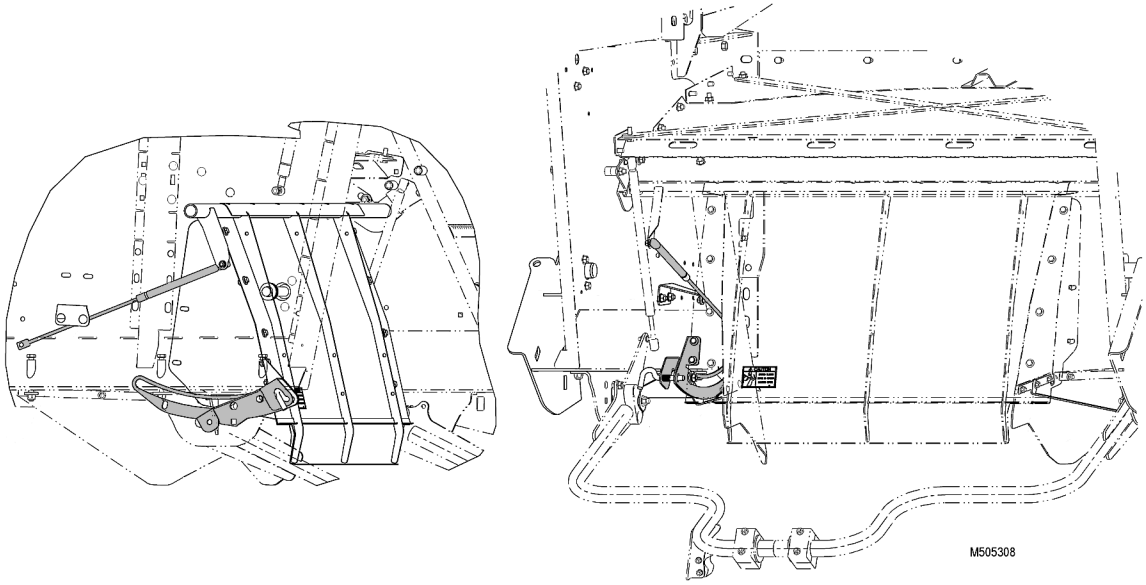
The tilting of the spreader unit FORE/AFT has been removed for the MY09 machines, only the spreading or NOT spreading position is available.

RESIDUE MANAGEMENT

WINDROW KIT

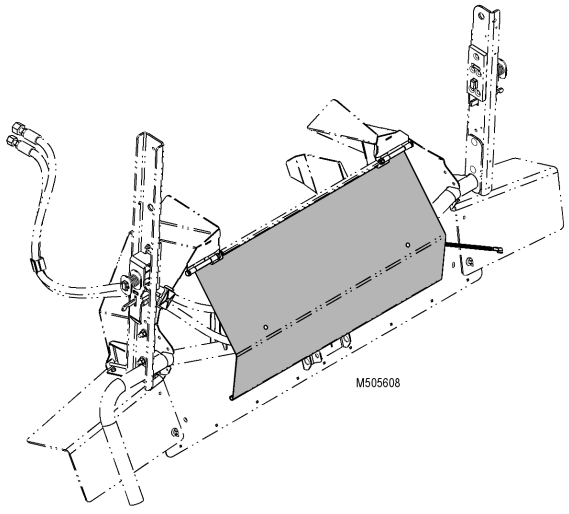
The following two kits would be required to permit spreading chafe and windrowing straw with the beater or standard 28 blade chopper.

Kit 87493756 includes components to convert the fixed rear windrow door to a movable door.

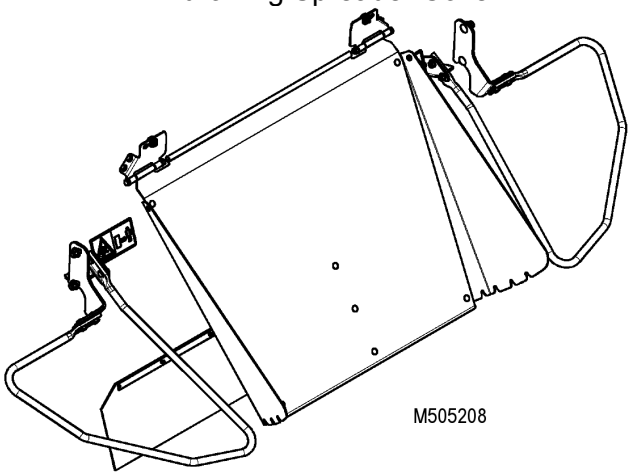


Kit 87724575 includes components for the straw discharge chute. Covers the spreader motors. Note, hoops are Euro only (Kit 87479645).

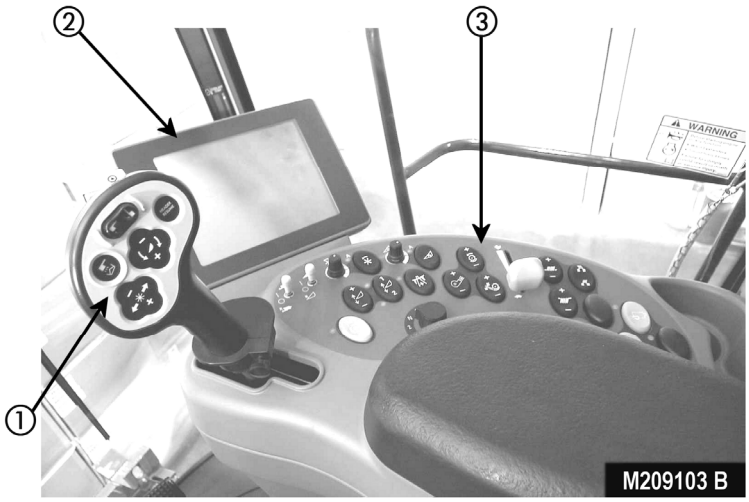
Standard Spreader Cover



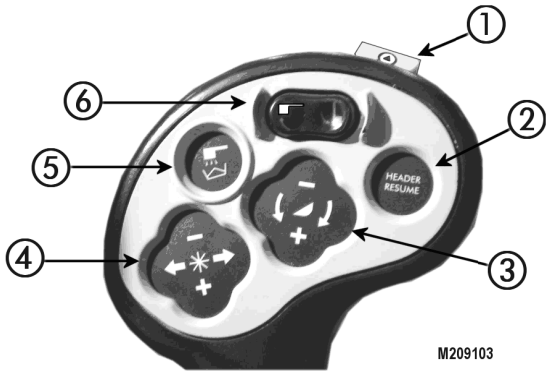
Windrowing Spreader Cover



OPERATOR'S CONTROLS

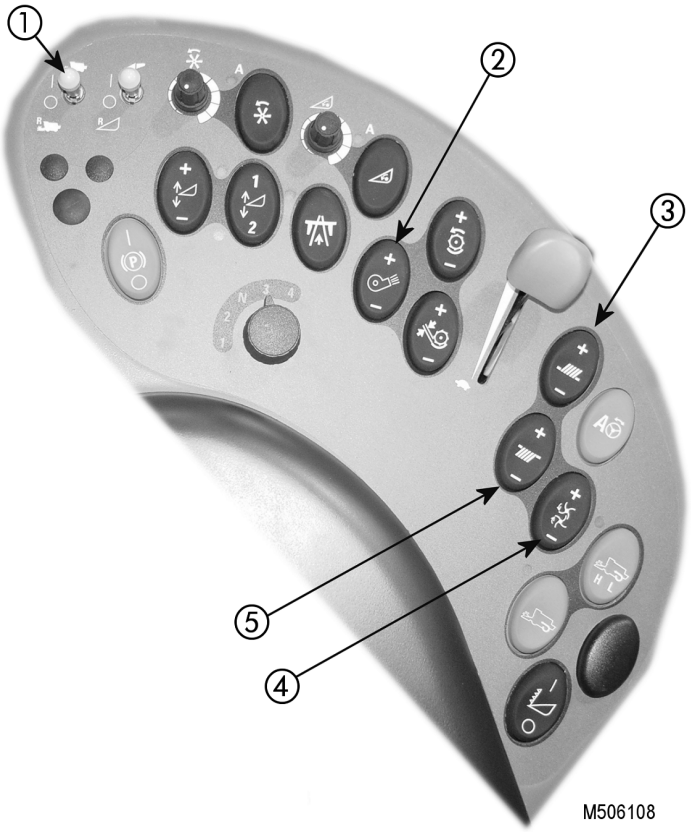


OPERATOR CONTROL CENTER	
1.	Mulit-Function Handle, MFH
2.	Integrated Cab Display Unit, UD+
3.	Right Hand Console, RHC



MULTI-FUNCTION HANDLE

1.	Emergency Stop Switch
2.	Resume
3.	Header Raise/Lower Tilt Right/Left
4.	Reel Raise/Lower, Fore/Aft
5.	Unloader Engagement
6.	Unloader Swing



RIGHT HAND CONSOLE
(RHC)

1.	Separator Engagement
2.	Fan Increase/Decrease Switch
3.	Upper sieve Opening Adjustment
4.	Spreader Speed Control
5.	Lower sieve Opening Adjustment

OPERATOR'S CONTROLS

The separator system includes the control and monitoring of the Beater/chopper clutch, Cleaning, Re-threshing, Grain Handling and Residue management. All the operations are controlled with:

Separator Engagement Switch, S-30

The separator Engagement switch is used to signal the CCM2 and CCM3 to activate the Rotor, Beater/Chopper, Fan and Spreader drives.

Located: In the Right Hand Console.

Fan Speed Increase/Decrease Switch, S-15

The Fan Speed increase/decrease switch is used to change the operating speed of the cleaning fan. When the fan speed switch is activated a signal is placed on the data bus for the CCM1 to change the speed and for the display to display the fan RPM. Fan speed will change by 10 RPM if the switch is toggled or by 50 RPM per second by 10 RPM increments when held for more then 1 second.

Located: In the Right Hand Console.

Upper and Lower sieve Increase/Decrease Switches and Rear Switches, S-13 & 14

The Upper and Lower sieve increase/decrease switches may be used to change the opening width of the upper or lower sieve from the cab. When the switch is activated a signal is placed on the data bus for the CCM3 to change the sieve opening and for the display to display the opening width.

REMEMBER: As with any sieve adjustment, always open the sieve so that it may clean out, re-close and make your adjustment while OPENING the sieves.

OPERATOR'S CONTROLS

Electrically control are used to make adjustments to the upper and lower sieve. The machine is equipped with two sets of controls:

a) Located at the left rear of the machine is a set of switches. The switches, may be used as long as the Separator is not RUNNING to make adjustments. The upper set adjusts the upper; the lower set is for the lower. When using these switches, the sieves will move in the direction of the switch and as long as it is held.

b) Located on the right hand console, in cab adjustment will be made using crop pre-sets in the display that are crop sensitive. When changing crop type the sieve will automatically be adjusted per the pre-sets. They may also be adjusted using the INCREASE/DECREASE switches located on the RHC. With each toggle of the **INCREASE** switch will cause the sieves to open 1 numerical value. With each toggle of the **DECREASE** switch will open the sieve to clean out, close more then required and reopen to a point closed 1 numerical value.

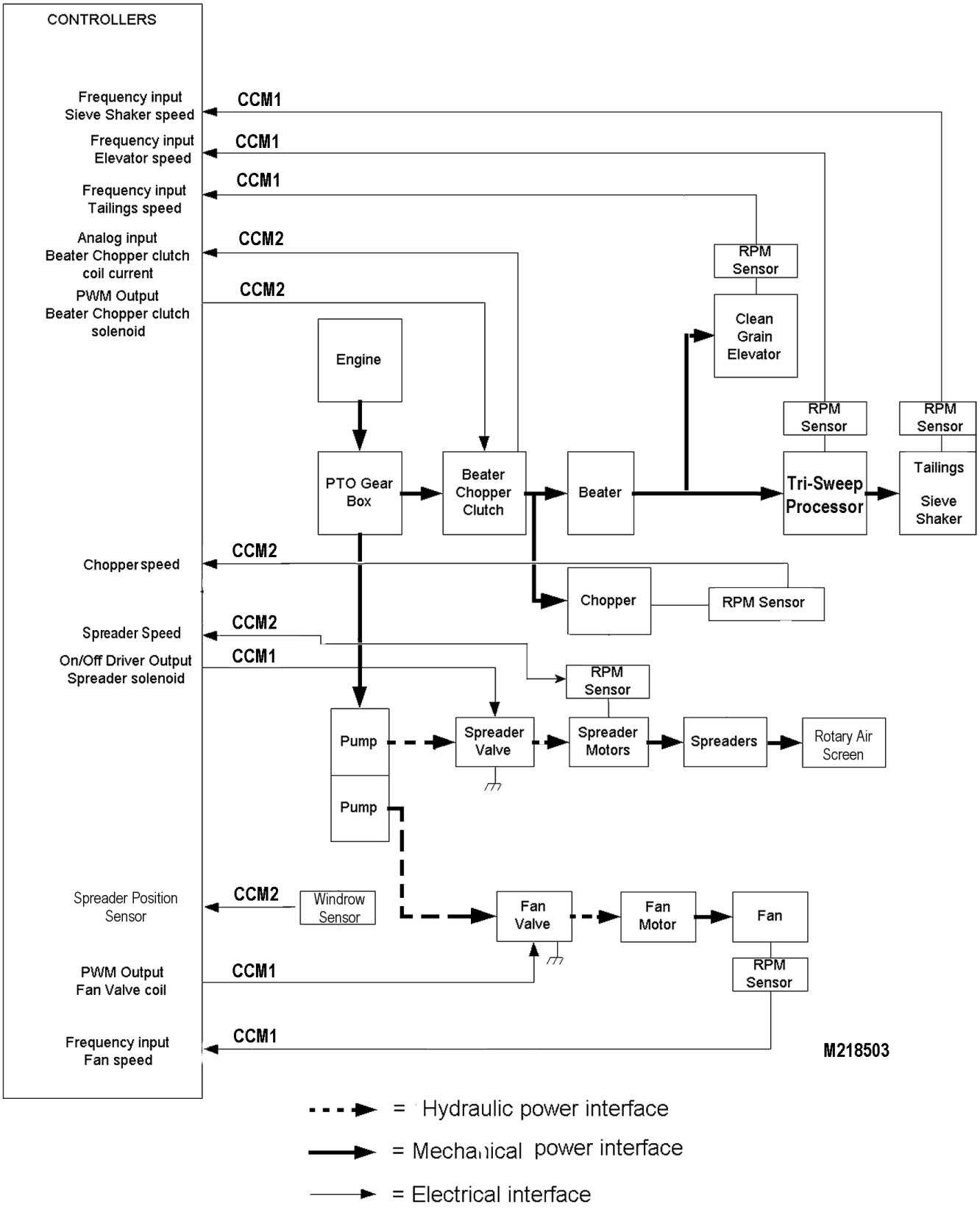
Located: In the Right Hand Console.

Straw Spreader Speed Control, S-90

The spreader speed control will be used to change the speed of the spreaders, changing the spread pattern. The slowest speed should always be used when harvesting corn.

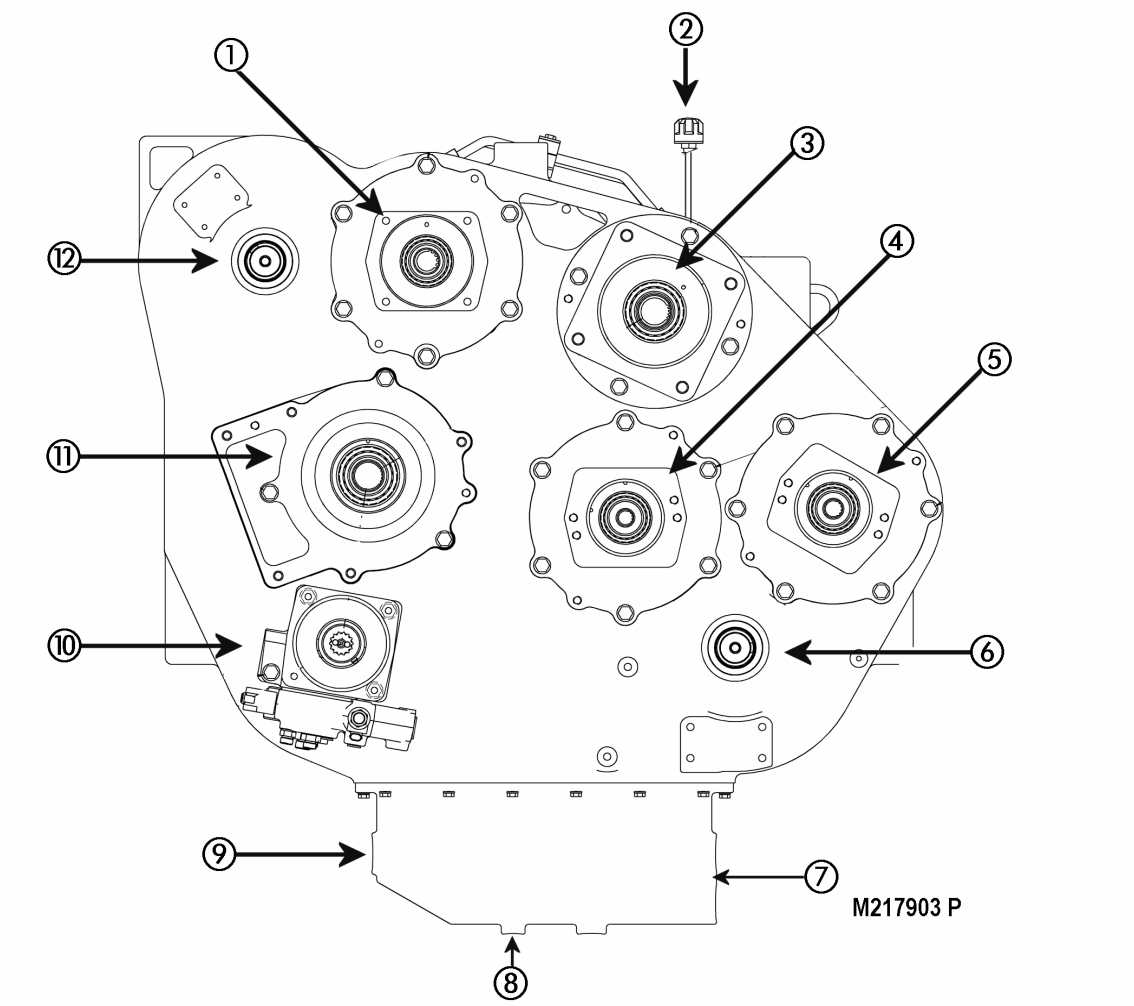
Located: In the Right Hand Console.

SYSTEM POWER FLOW



BEATER/CHOPPER CLUTCH

PTO GEARBOX FACING OUT

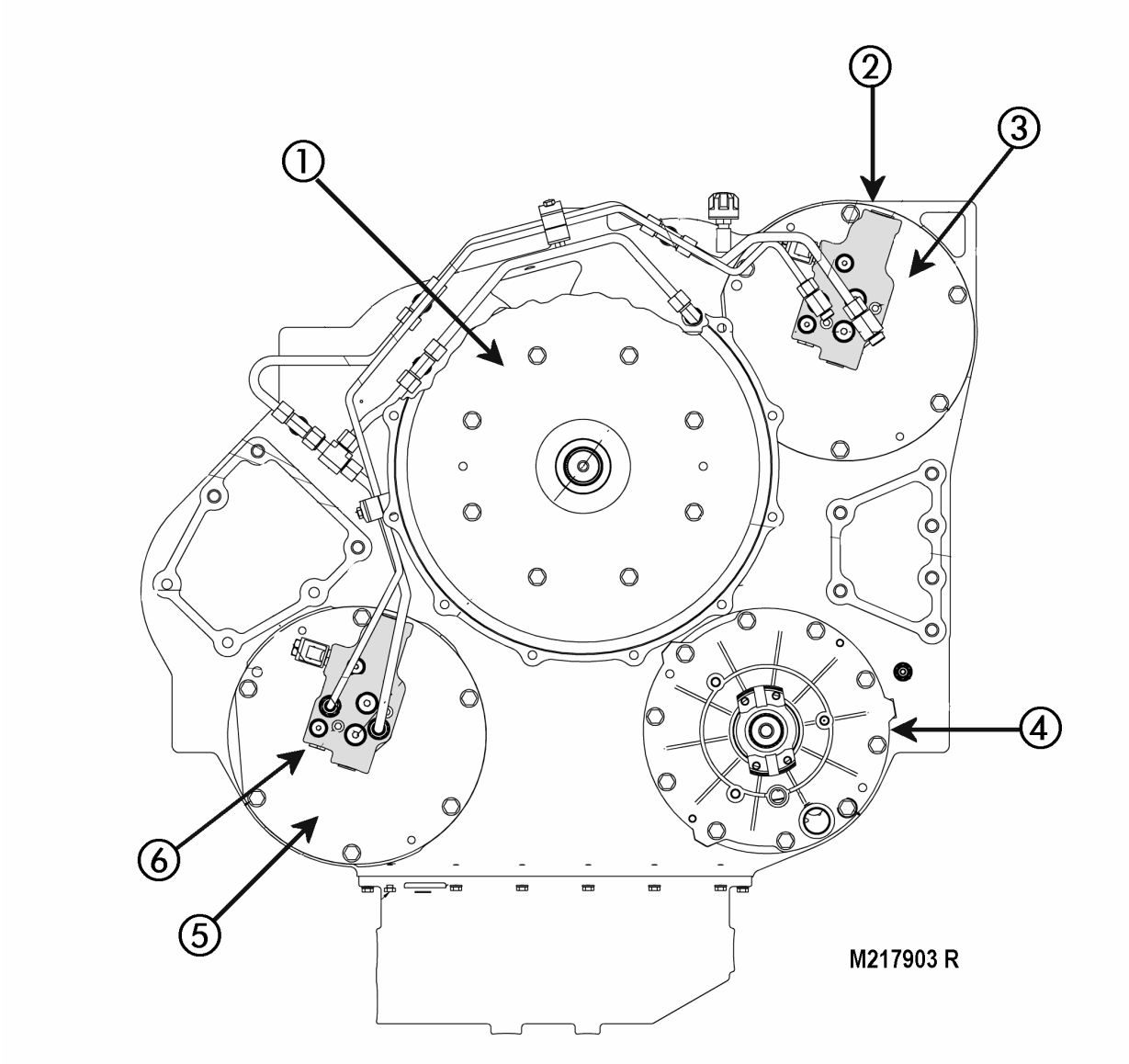


1.	Feeder/Rotor Pump Drive	7.	Supply/Return Port
2.	PTO Gearbox Breather	8.	PTO Gearbox Drain
3.	Hydrostatic Pump Drive	9.	Feeder Drive Drain
4.	Gear Pump Drive	10.	Rotor Drive
5.	PFC Pump Drive	11.	Feeder Drive
6.	Beater/chopper Clutch Drive	12.	Unloader Clutch Drive

Verify that the PTO gearbox dip stick is securely placed into the tube.

BEATER/CHOPPER CLUTCH

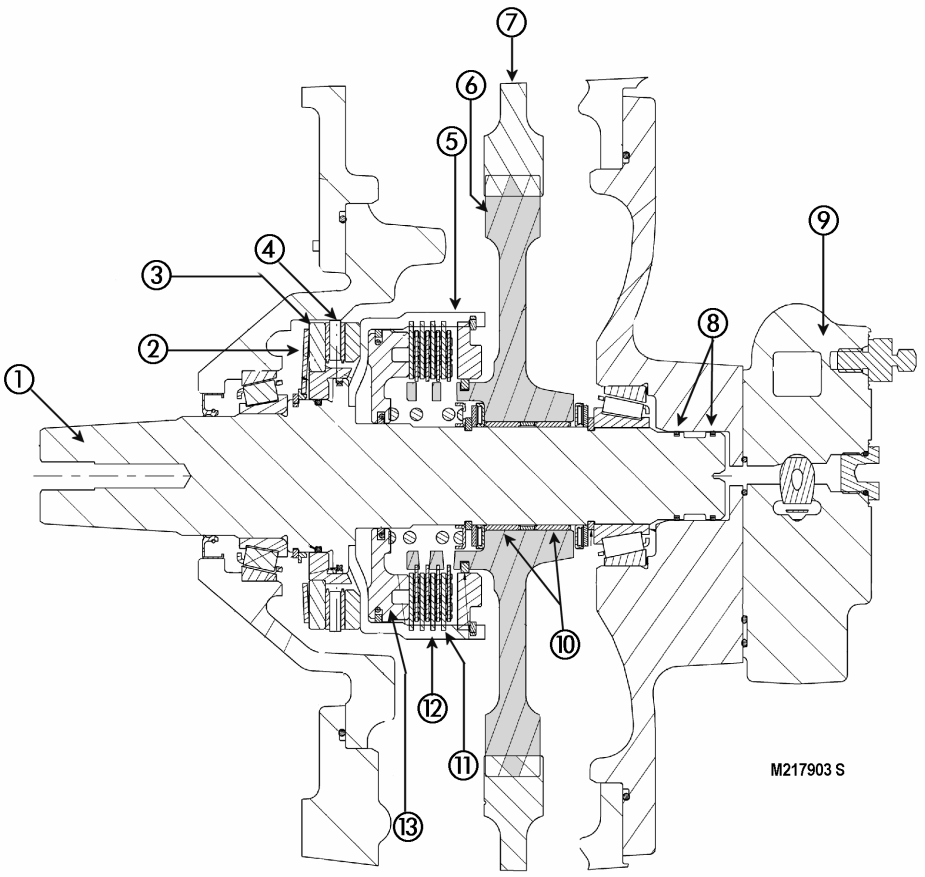
PTO GEARBOX ENGINE SIDE

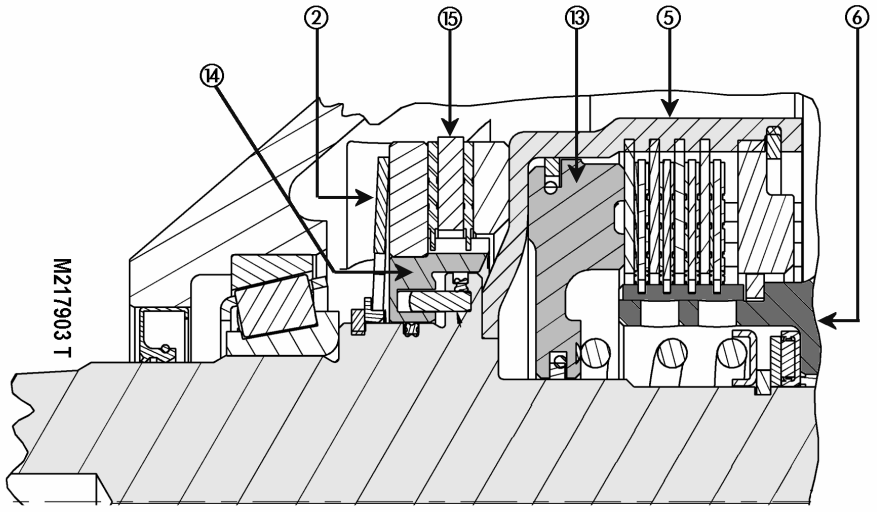


1.	PTO Gearbox Input Shaft	4.	Rotor Drive Unit
2.	Unloading Auger Clutch Valve	5.	Beater/chopper Clutch
3.	Unloading Auger Clutch	6.	Beater/chopper Clutch Valve

BEATER/CHOPPER CLUTCH

BEATER/CHOPPER CLUTCH





1.	Output Shaft	6.	Clutch Driven Gear	11.	6-Clutch Plates,(not shown)
2.	Spring, Bellevue Washer	7.	PTO Drive Gear	12.	6-Clutch Plates,(not shown)
3.	Friction Plate, Brake	8.	Sealing Rings, Piston	13.	Clutch Piston
4.	Steel Plate	9.	Clutch Control Valve	14.	Brake Piston
5.	Clutch Pack	10.	Needle Bearings	15.	Brake Pack

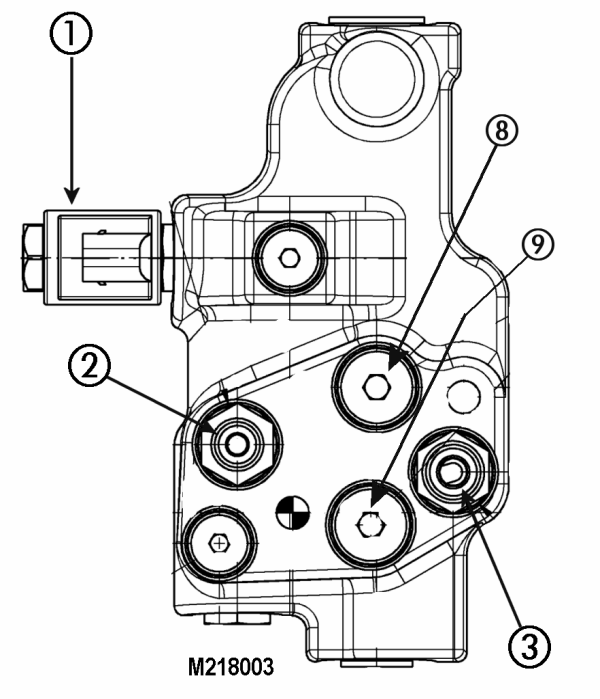
BEATER/CHOPPER CLUTCH

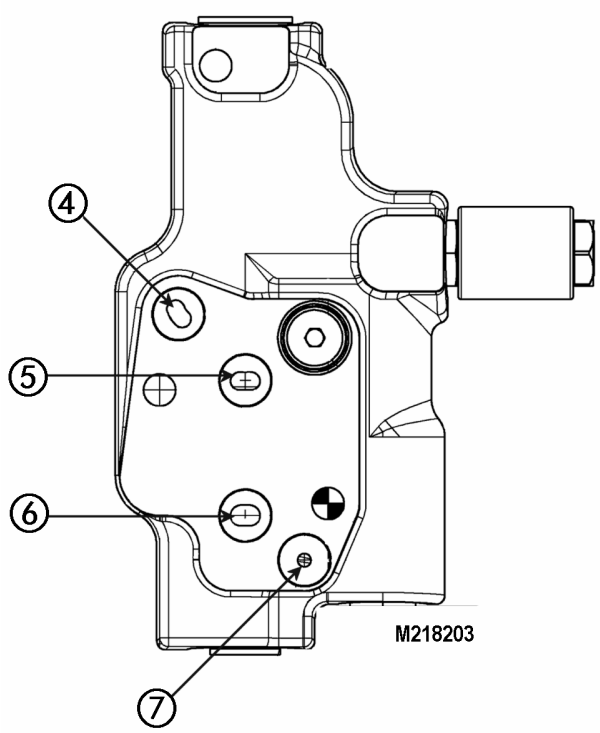
BEATER/CHOPPER CLUTCH

There are two different beater/chopper clutches used. The 70/8010 uses a 4 plate clutch while the 9010 and all 20 series use a 6 plate clutch due. If the clutch is being replaced, the 6-plate clutch may be installed in all the machines. When a 6 plate clutch is replacing a 4 plate clutch, a different driven gear must also be installed to provide a longer hub to engage all six plates.

BEATER/CHOPPER CLUTCH

BEATER/CHOPPER VALVE

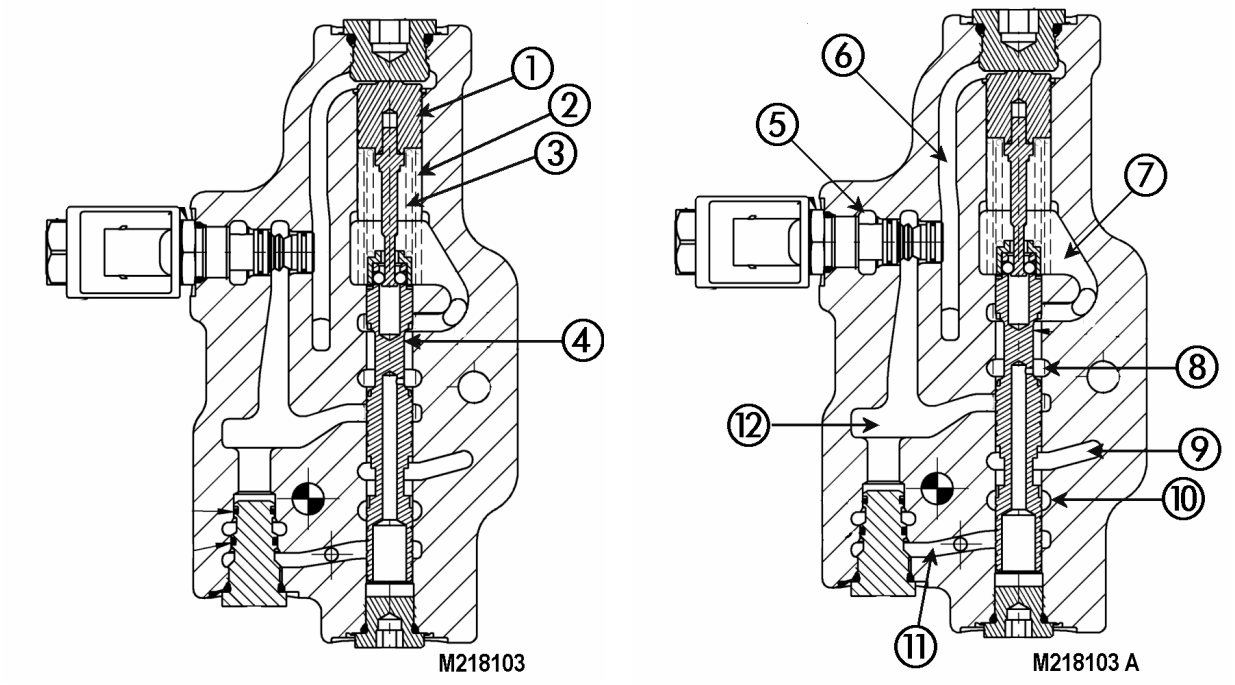




1.	Beater/chopper Clutch Solenoid	5.	Clutch Port
2.	Control Pressure Supply	6.	Lubrication Port
3.	Lubrication Supply	7.	Tanks
4.	Tank	8.	Plugged (Clutch Test Port)
5.	Tank	9.	Plugged (Lube Test Port)

BEATER/CHOPPER CLUTCH

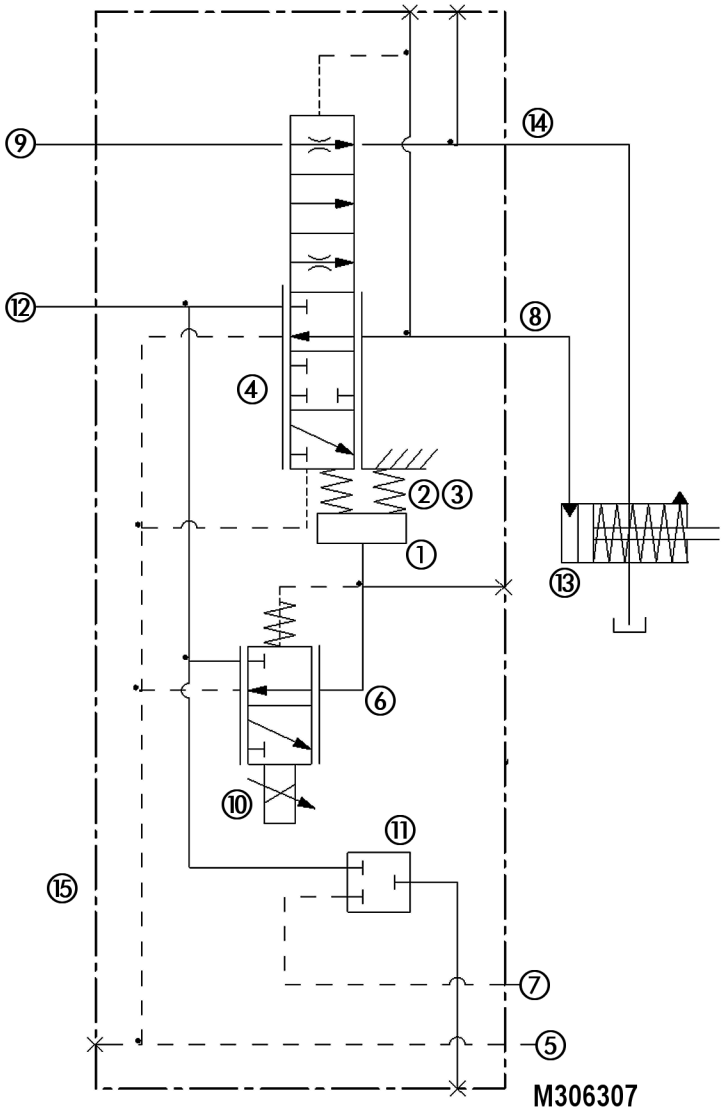
BEATER/CHOPPER VALVE



1.	Modulator Piston	7.	Tank
2.	Preload Spring, (spring)	8.	Clutch Port
3.	Modulation Spring, (spring)	9.	Lubrication Supply
4.	Modulation Spool	10.	Lubrication Port
5.	Tank	11.	Tank
6.	Modulation Port	12.	Control Pressure Supply

BEATER/CHOPPER CLUTCH

HYDRAULIC SCHEMATIC



1.	Modulation Piston	9.	Lubrication Supply
2.	Pre-Load Spring, (outer)	10.	Beater/chopper Clutch Solenoid
3.	Modulation Spring	11.	Solenoid Port Plug
4.	Modulation Spool	12.	Control Pressure Supply
5.	Tank	13.	Beater/chopper Clutch
6.	Modulation Port	14.	Lubrication Port
7.	Tanks	15.	Valve
8.	Clutch Port		

BEATER/CHOPPER CLUTCH

CONTROL VALVE OPERATIONS

REFERENCE MATERIAL:

General Hydraulic Section for “Control Pressure”
Hydraulic Schematics

KEY COMPONENTS:

Chopper valve, Clutch assembly

OPERATION

Separator Dis-Engaged

When the separator control switch is placed into the **OFF** position, the solenoid is de-activated. The supply pressure (12) is blocked at the solenoid (10) and the main control spool (4).

1. Lube oil (9) is directed through the main spool to port (14) and out to the clutch pack to lubricate bearings, clutches and cooling. The spool lands and orifice passages in the PTO gearbox restrict the lube flow.
2. The clutch and brake pistons are permitted to drain back to the tank at ports (5).
3. The brake spring (2) engages the brake plates (15) to prevent the drive from creeping.

Separator Engaged

When the separator control switch is placed into the **ENGAGED** position (forward detented position) the Beater/chopper solenoid (10) will be activated by a PWM signal. The solenoid will direct modulated supply pressure to the end of the modulation piston (1). As pressure builds, the piston moves against the force of both the inner and outer modulator springs (2 & 3). As the piston moves toward the spool, the inner spring causes the main spool (4) to shift. As the main spool moves, the lube port (14) is unrestricted to permit additional lube flow during clutch lockup.

The main spool will close off the clutch drain port and begin directing control pressure to the clutch and brake pistons through port (8). As the pressure is directed to the clutch pack, it is also directed through an orifice hole in the side of the spool to the base of the spool, a signal port. As the pressure builds in the clutch pack the pressure also begins to move the main spool back towards the modulating springs, reducing the pressure on the clutch pack. This modulation takes place until the solenoid has been fully powered and the main spool is held fully down.

When the main spool is completely moved down, the lube passage again becomes restricted.

BEATER/CHOPPER CLUTCH

ELECTRICAL OPERATION

REFERENCE MATERIAL:

Electrical schematic frames 18, 23, 27

KEY COMPONENTS:

Separator Switch S-30, CCM2, CCM3, Solenoid L-22, Chopper Speed Sensor B-10, Tailings RPM B-39, Sieve RPM B-56, Spreader Position Sensor B-11, Spreader RPM B-55

OPERATION

Dis-Engaged

When the separator switch (S-30) is placed in the **OFF** position there is **NO** power signal directed to the CCM2 terminal J1-7. Lack of voltage at this terminal signals the controller to de-activated the beater/chopper clutch solenoid L-22.

Engaged

When the operator engages the separator drive by placing the separator switch S-30 into the **ON** (forward) detented position there are two signals sent out;

- Terminal 6, directs voltage to the CCM2 connector X015 terminal J1-7 which controls the beater/chopper clutch and the CCM3 connector X012 terminal J1-7 to control the rotor engagement.
- Terminal 3, directs voltage to the feeder switch to power it and to the CCM3 connector X012 terminal J1-17 to power the rotor engagement.

Using the power the CCM2 receives at terminal J1-7, PWM power is directed out terminal J2-30 to the clutch solenoid L-22 terminal A. The solenoid is provided a ground at terminal B by the CCM2 terminal J2-40. The solenoid will be modulated over a two-second period to provide a smooth engagement.

The CCM2 also places a message on the data bus that the separator switch has been moved to the **ON** position. The CCM1 will pickup this message and engage the cleaning fan and straw spreaders, see their explanation later in this section.

BEATER/CHOPPER CLUTCH

ELECTRICAL OPERATION, CON'T

SPEED MONITORING

Two shaft speed sensors are used with the beater/chopper clutch operation:

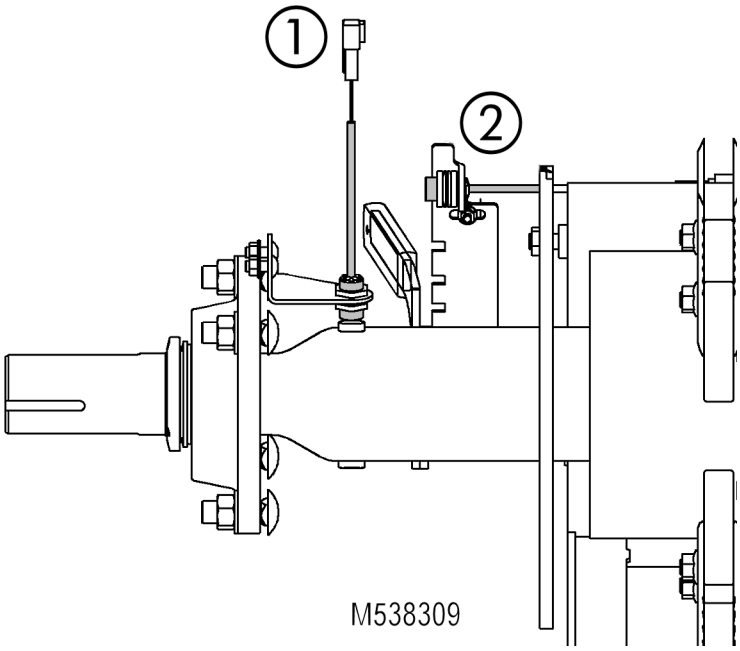
Beater Shaft RPM,

The tailings processor speed sensor is mounted at the center pulley and is used to monitor the beater/clutch operations as well as the tailings processor.

Chopper Shaft RPM, B-10

If equipped with a straw chopper there is a separate speed sensor on the left bearing mount to monitor the chopper speed. This is required since the chopper two speed drive could be accidentally placed into the neutral position.

1.	Chopper Speed Sensor
2.	Stationary Knife Position Sensor



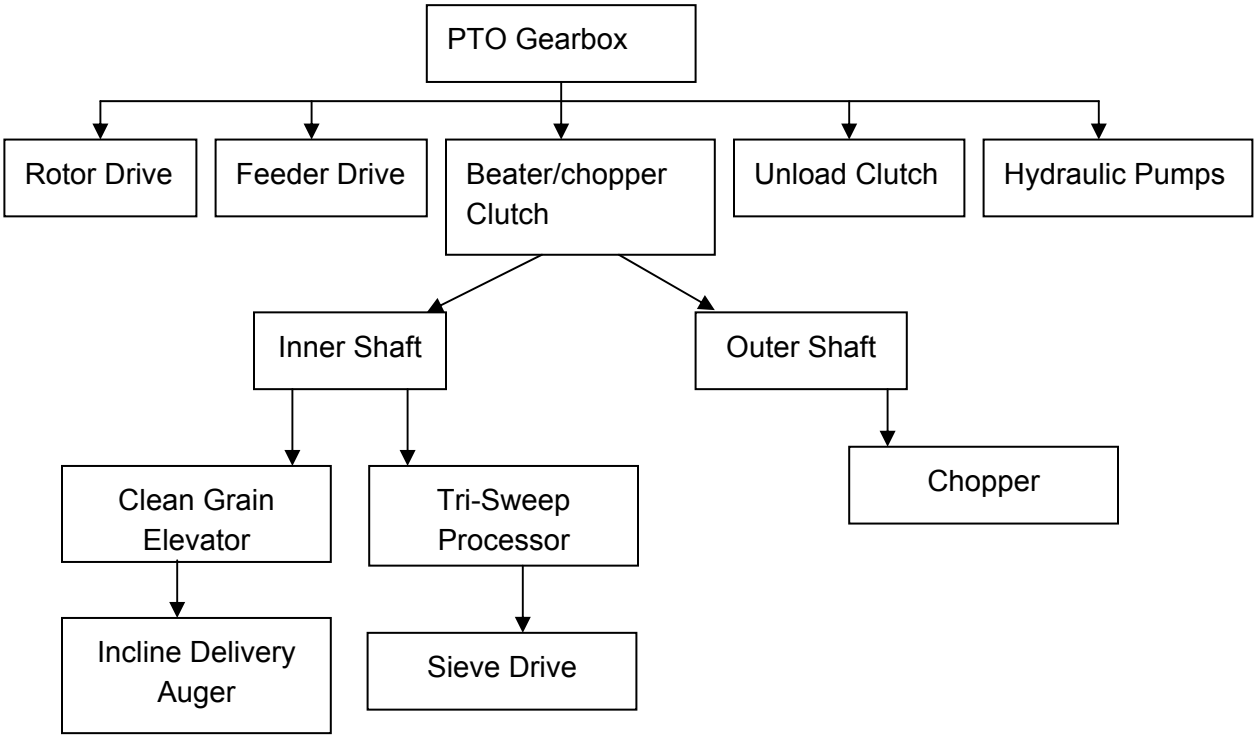
REMEMBER: If the Chopper RPM does not exceed 300 RPM within 2.5 seconds, the engagement of the separator, rotor and feeder will be aborted and the operator will receive a message to disengage the separator drive.



BEATER/CHOPPER CLUTCH DRIVES

The separator is driven from the PTO gearbox through a multi-disc oil bath clutch. While the clutch is driving the separator, the beater/chopper provides the drive for the rest of the cleaning system.

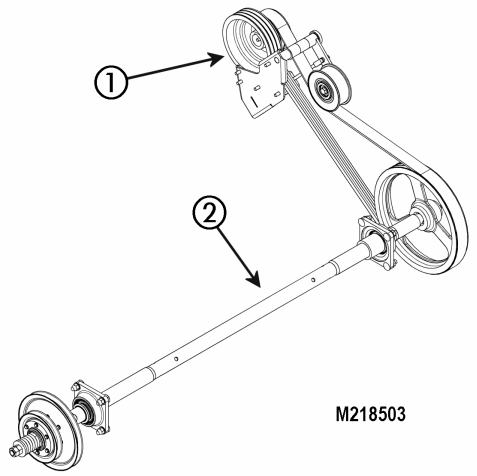
POWER FLOW



BEATER/CHOPPER SHAFT

The machine may be equipped with or without the optional straw chopper, the power flow through to the Tri-Sweep Tailings processor and cleaning system is different depending on the option.

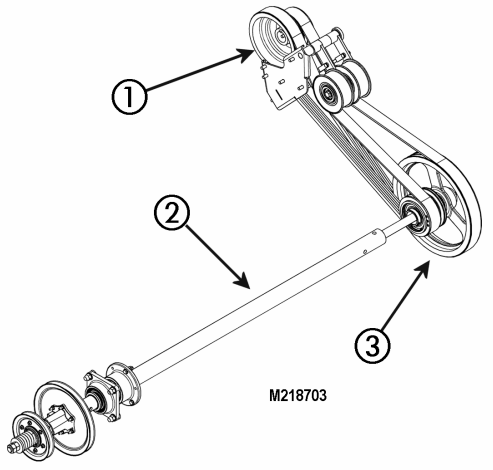
EQUIPPED WITH A BEATER



1.	Beater/chopper Clutch Drive Pulley
2.	Beater Shaft to Retresher and Clean Grain Elev. Drive

The power flow is from the Beater/chopper Clutch to the left end of the beater shaft via a three-strand V belt. The beat shaft acts as a jack shaft, driving the beater as well as the reprocessor and clean grain elevator.

EQUIPPED WITH A STRAW CHOPPER

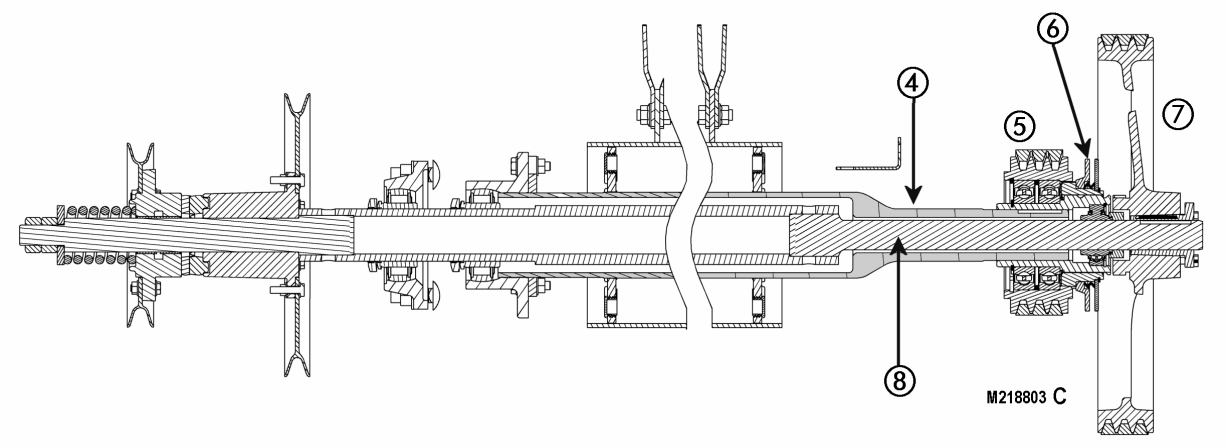


1.	Beater/chopper clutch drive pulley
2.	Inner Shaft. Beater Shaft to Retresher and Clean Grain Elev. drive.
3.	Large pulley, drive for Retresher and Clean Grain Elev. and slow speed for Chopper

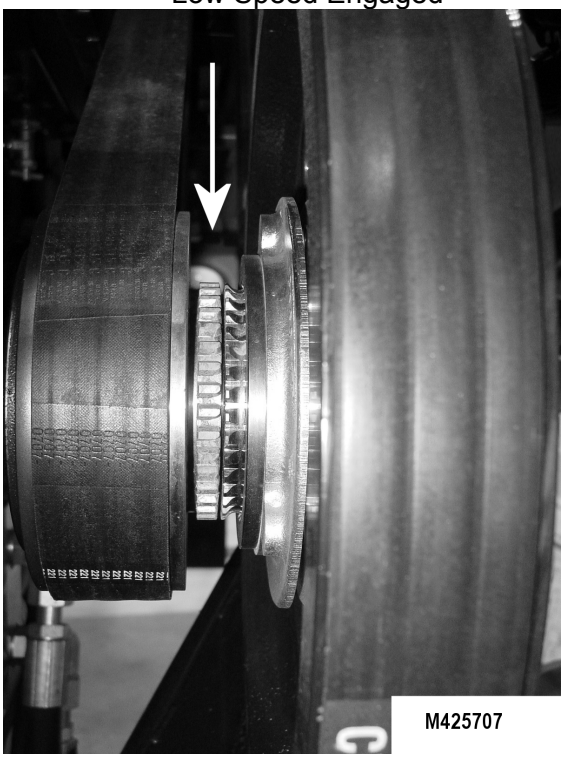
When equipped with a straw chopper the beater/chopper shaft (2) is two shafts, the inner shaft provides the drive for the reprocessor, elevator and cleaning system while the outer tube provides the drive for the chopper. The large pulley (3) always provides the drive for the reprocessor, clean grain elevator, cleaning system and slow speed of the chopper, while the small pulley only provides the drive for the chopper high speed.

BEATER/CHOPPER SHAFT

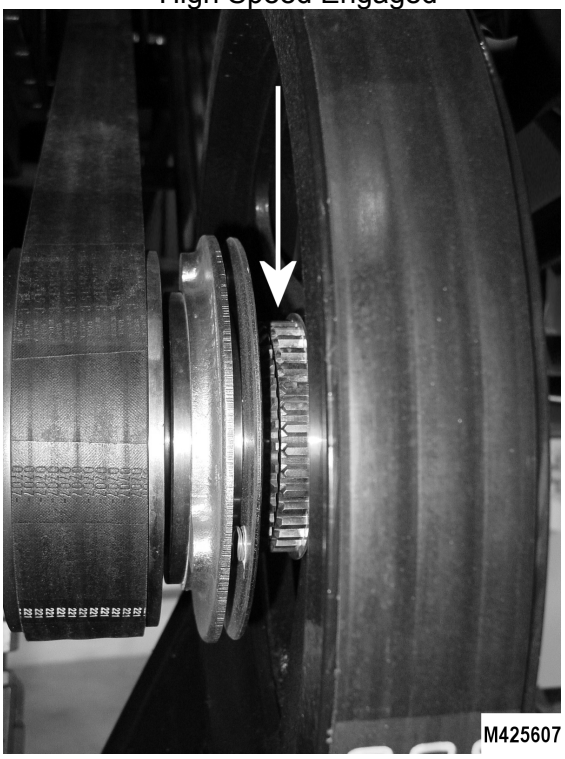
EQUIPPED WITH A STRAW CHOPPER



Low Speed Engaged



High Speed Engaged



BEATER/CHOPPER SHAFT

EQUIPPED WITH A STRAW CHOPPER

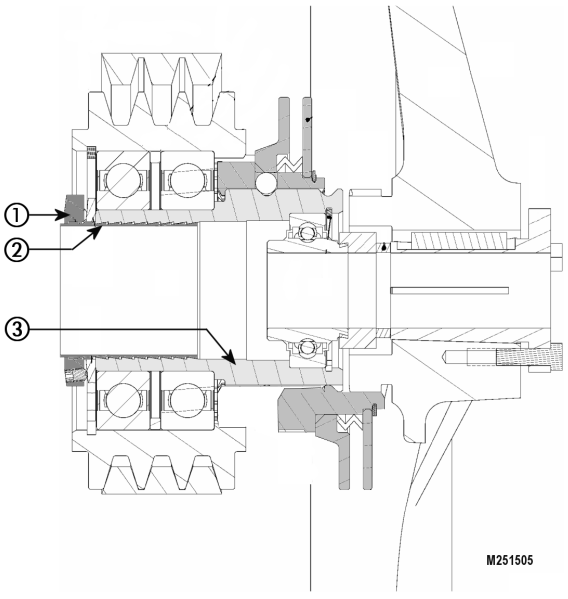
CONCENTRA HUB, (87332634)

The Concentra hub uses a tapered locking sleeve in place of the drive key to transfer the driving force. Set screws in the pulling collar (1) are used to pull the inner ring (2) out of the hub. The OD of the inner ring and the ID of the hub have tapered lugs that tighten the inner ring to the shaft as they are pulled apart from each other. It is very important that the set screws are torque properly.

Locking procedure:

1. Clean the shaft of any rust or burs.
2. Align the hub on the shaft so the inner ring split is 180 degs from the key way in the shaft.
3. Install the hub so that the pulleys are in alignment
4. Position the pulling ring so the set screws are not aligned with the split in the inner ring.
5. Tighten the set screws evenly until they are snugly finger tight.
6. Using the red plastic torque gauge that came with the hub tighten the screws evenly, (the gauge will fit over the provided allen wrench). Proper torque is indicated when the allen wrench bows enough to be in alignment with the end of the gauge. If the gauge is not available torque the screws evenly to a torque of 5-6.5 Lb ft (7-9 Nm)
7. Tap the item #1 with a hammer and recheck the torque.

1.	Pulling Collar
2.	Inner Ring
3.	Hub



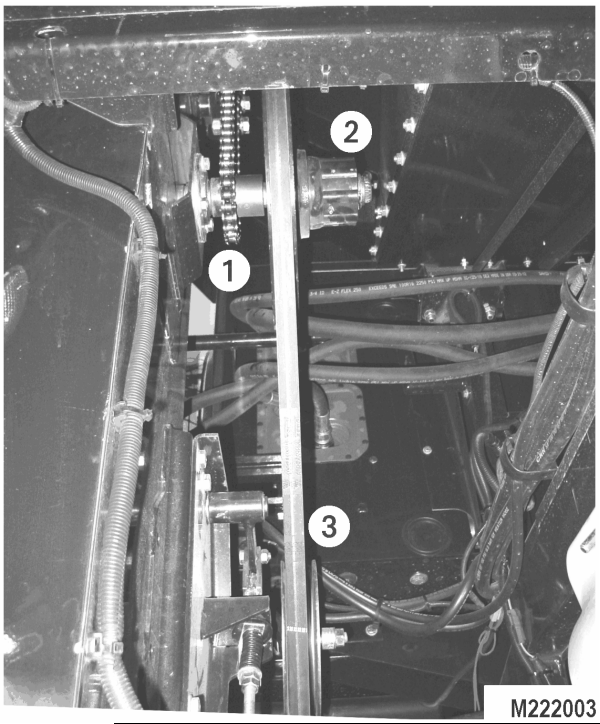
IMPORTANT: When operating in LOW speed the inner bearing is not rotating, so the grease is not spread. For every 50 hrs of operation in LOW speed the operator should operate the chopper in HIGH speed for 10 min. no load to let the bearing rotate.

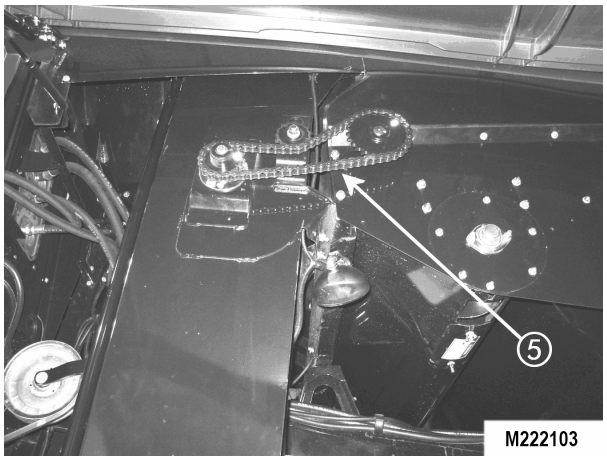
BEATER/CHOPPER SHAFT

The reprocessor and clean grain elevator is driven from the right hand end of the beater/chopper shaft.

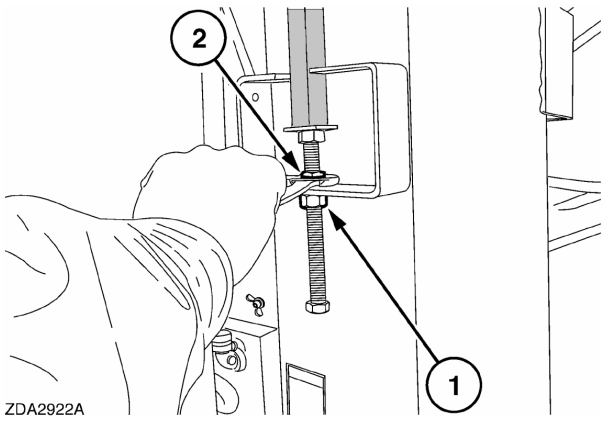
CLEAN GRAIN ELEVATOR

The clean grain elevator is driven of the right hand end of the beater shaft (6). The drive pulley (3) is keyed to the end of the shaft and also has the drive portion of the slip clutch for the reprocessor.





1.	Bubble Up Auger Drive	4.	
2.	Clean Grain Elevator Clutch	5.	Bubble Up Drive Chain
3.	Elevator Drive Belt		



Elevator Chain Adjustment

The elevator chain should be able to be slid side ways on the lower sprocket.

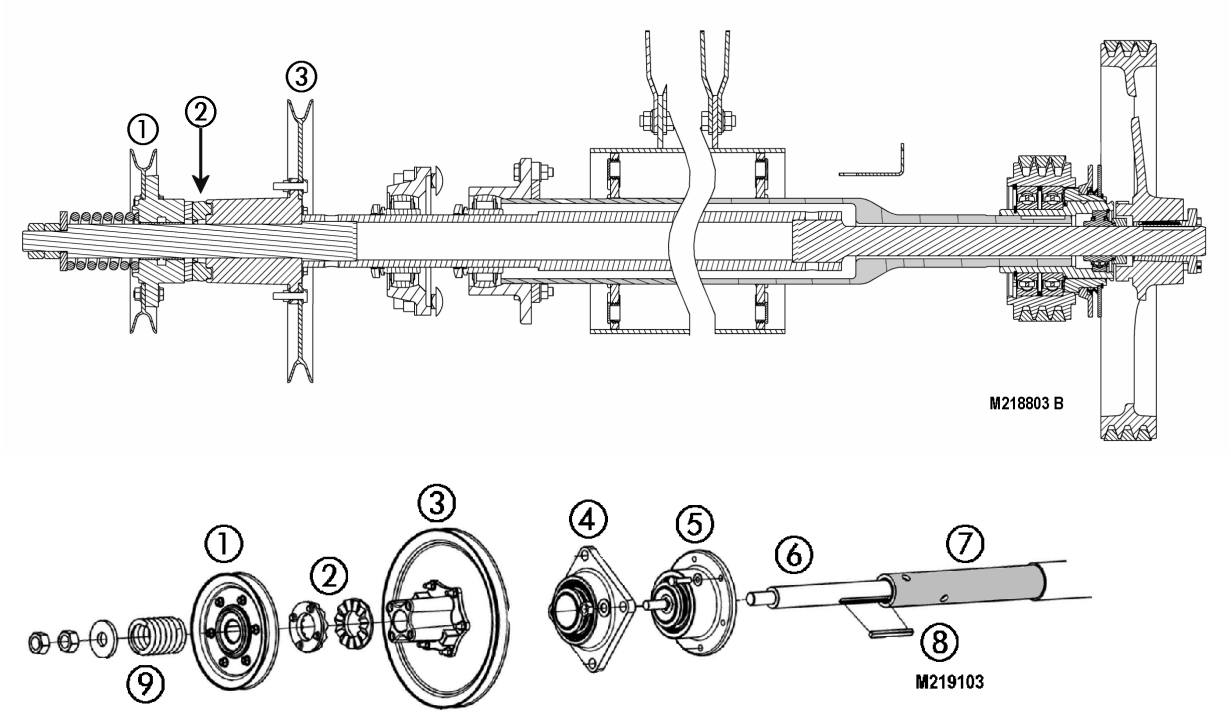
1.	Jam Nut
2.	Adjusting Nut

REMEMBER: Elevator chain adjustment does NOT effect the Grain Flow sensor.

BEATER/CHOPPER SHAFT

TRI-SWEEP PROCESSOR

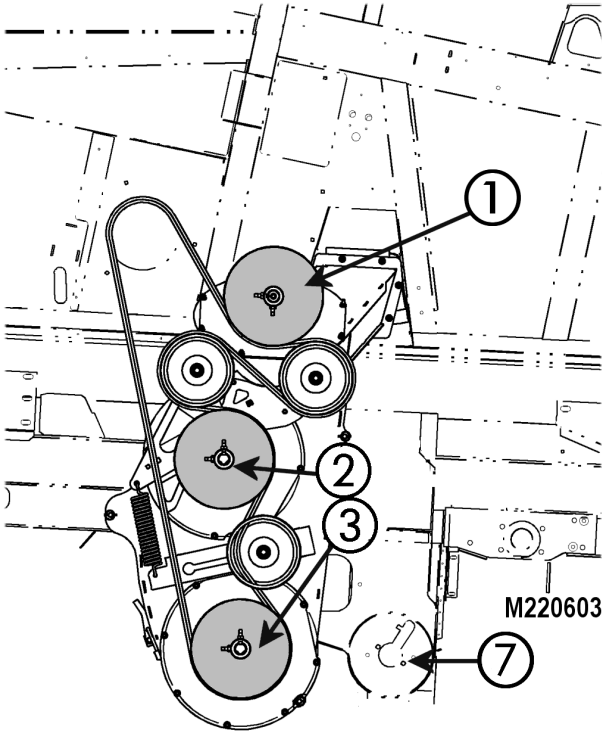
The processor is protected with a spring (9) loaded ratchet clutch (2) that is driven through the clean grain elevator drive pulley (3). The reprocessor drive and clutch also provides the drive and protections for the cleaning system.

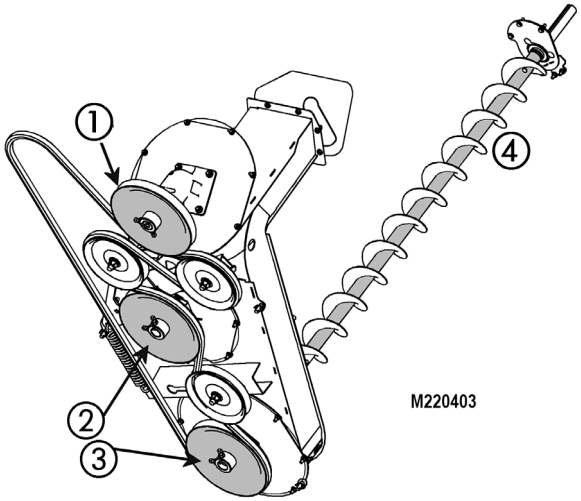


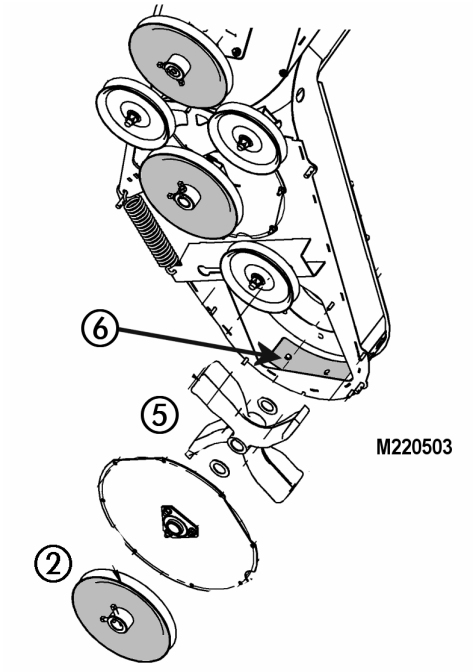
1.	Reprocessor Drive Pulley	6.	Beater Shaft
2.	Reprocessor Drive Slip Clutch	7.	Chopper Tube
3.	Clean Grain Elevator Drive Pulley	8.	Elevator Key
4.	Beater Shaft Bearing Support	9.	Reprocessor Clutch Spring
5.	Chopper Shaft Bearing Support		

BEATER/CHOPPER SHAFT

TRI-SWEEP PROCESSOR





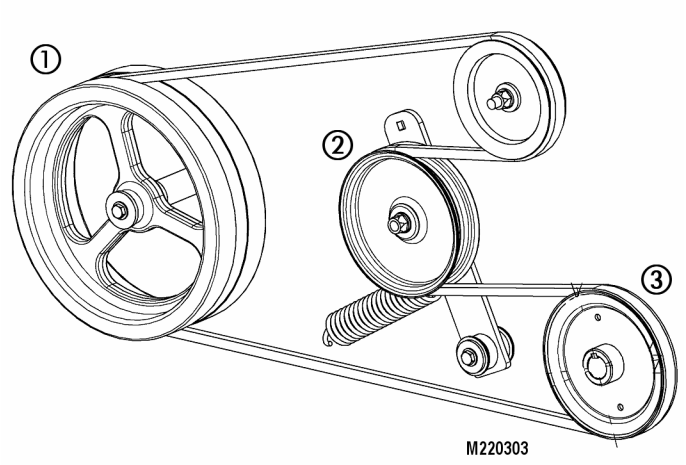


1.	Upper Impeller pulley, (660 RPM)
2.	Center Impeller Pulley, (486 RPM)
3.	Lower Impeller/Tailing Auger pulley (550 RPM)
4.	Tailings Auger
5.	Reprocessor Impeller
6.	Reprocessor Concave
7.	Clean Grain Auger

The drive belt tensioning spring should be adjusted to the spring gauge length.

BEATER/CHOPPER SHAFT

CLEANING SYSTEM DRIVE



1.	Driven Pulley	2.	Idler	3.	Driver Pulley

The cleaning system is driven from the left-hand end of the tailing auger (3) through a belt drive. The belt and tension system has to be able to maintain the belt tension regardless of the Self-Leveling cleaning system's position.

The driven pulley (1) acts as a flywheel to smooth out the systems vibrations and the deep belt groove prevents the belt from coming **OFF** when the cleaning system self-levels itself.

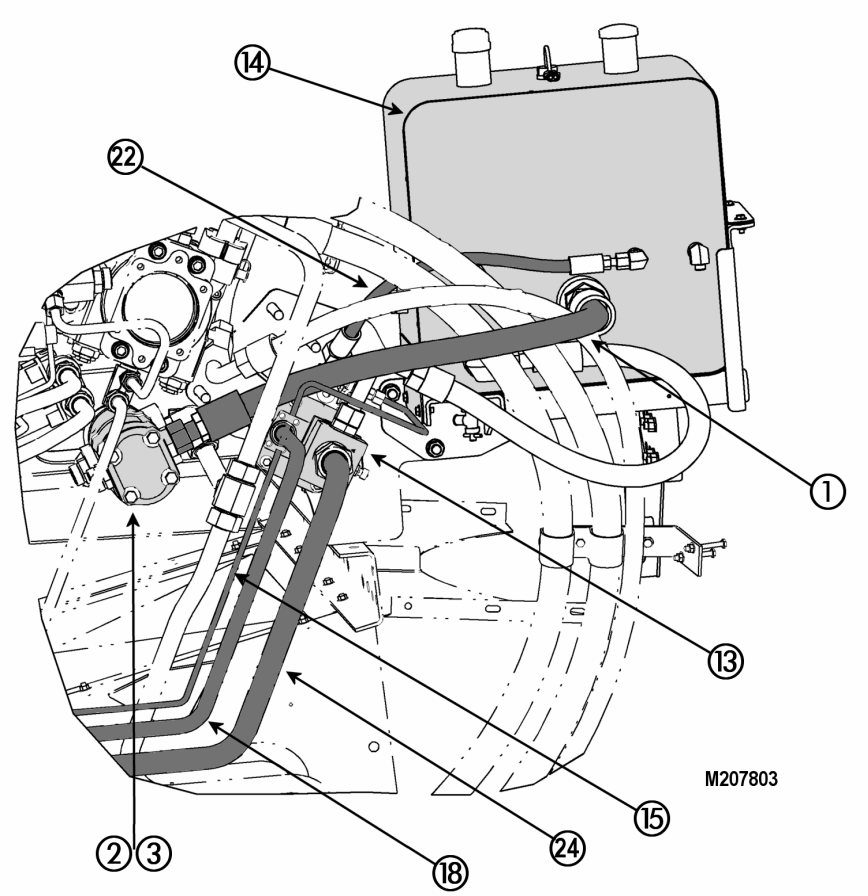
Belt tension is maintained using pulley location and a spring.

Pulley The upper rear pulley is used to tension the belt. The pulley may be mounted in one of three holes. The pulley should be mounted in the rear hole for added tension.

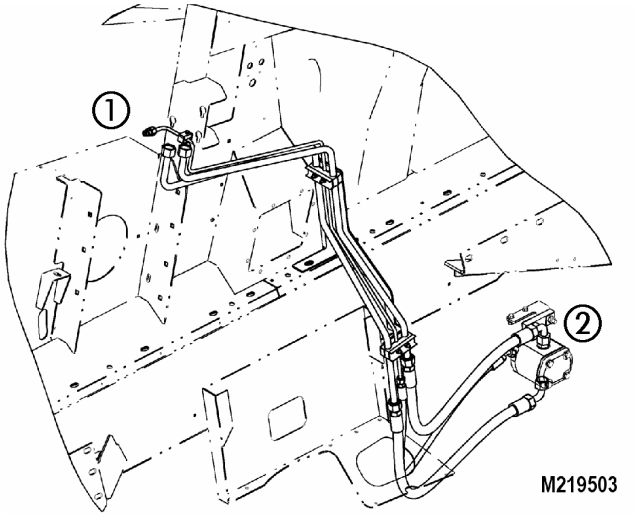
Spring Later machine have two spring locating holes in the pulley arm, the spring should be mounted in the lower hole, but may be placed in the upper hole to help to prevent belt slap.

CLEANING SYSTEM

FAN DRIVE COMPONENTS



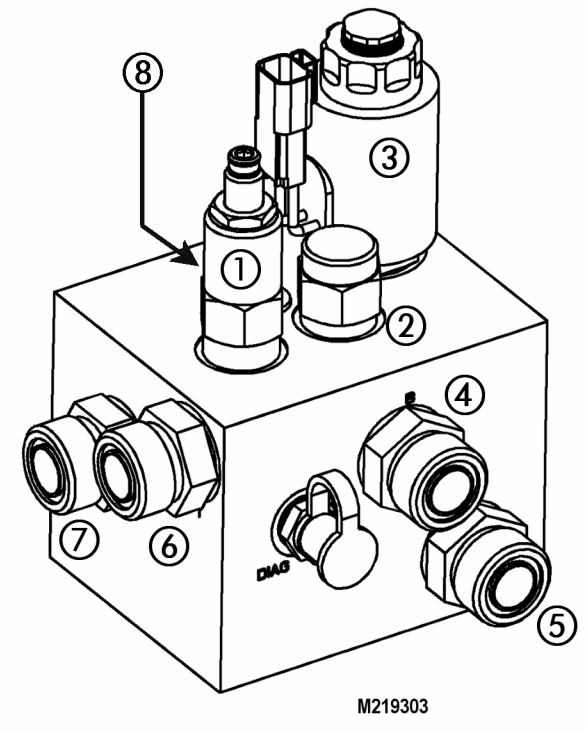
1.	Supply to Spreader and Fan Pumps	15.	Signal Line to Compensator
2&3.	Gear Pump Assembly, Spreader and Fan Drive	18.	PFC Pump Discharge Line
13.	PFC Piston Pump	22.	PFC Pump Case Drain
14.	Hydraulic Reservoir	24.	PFC Pump Suction



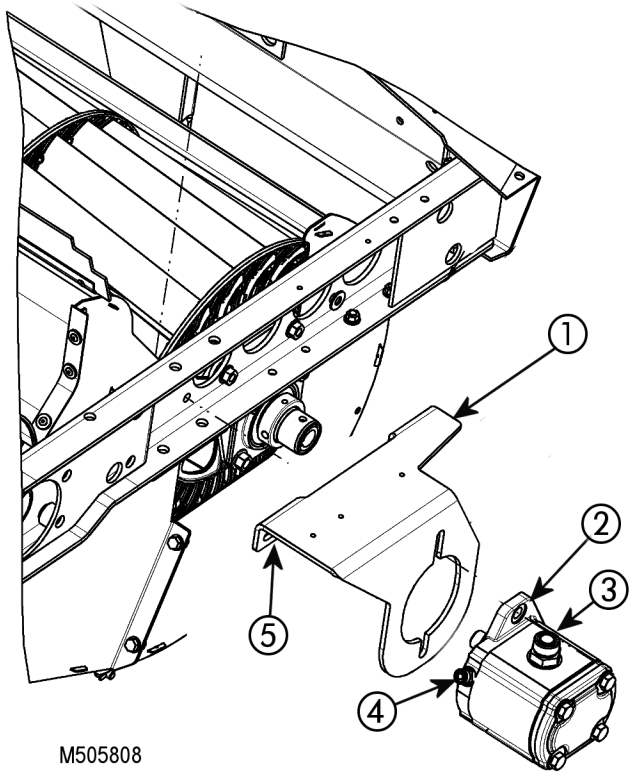
1.	Fan Valve Location
2.	Fan Drive Motor

CLEANING FAN

FAN DRIVE COMPONENTS



1.	Circuit Relief Valve
2.	Pressure Compensating Valve
3.	Fan Solenoid
4.	“B” Motor Return
5.	“A” Motor Supply
6.	“T” Tank
7.	“P” Valve Supply
8.	Orifice Plug



1.	Bracket Front Mount Bolt
2.	Motor Mount Bots
3.	Motor Supply Port
4.	Case Drain Port
5.	Bracket Rear Mount Bolt

CLEANING FAN

FAN DRIVE COMPONENTS, CON'T

When mounting the fan drive motor, it is important to get the motor properly lined up with the fan shaft to prevent bind and reduced fan RPM.

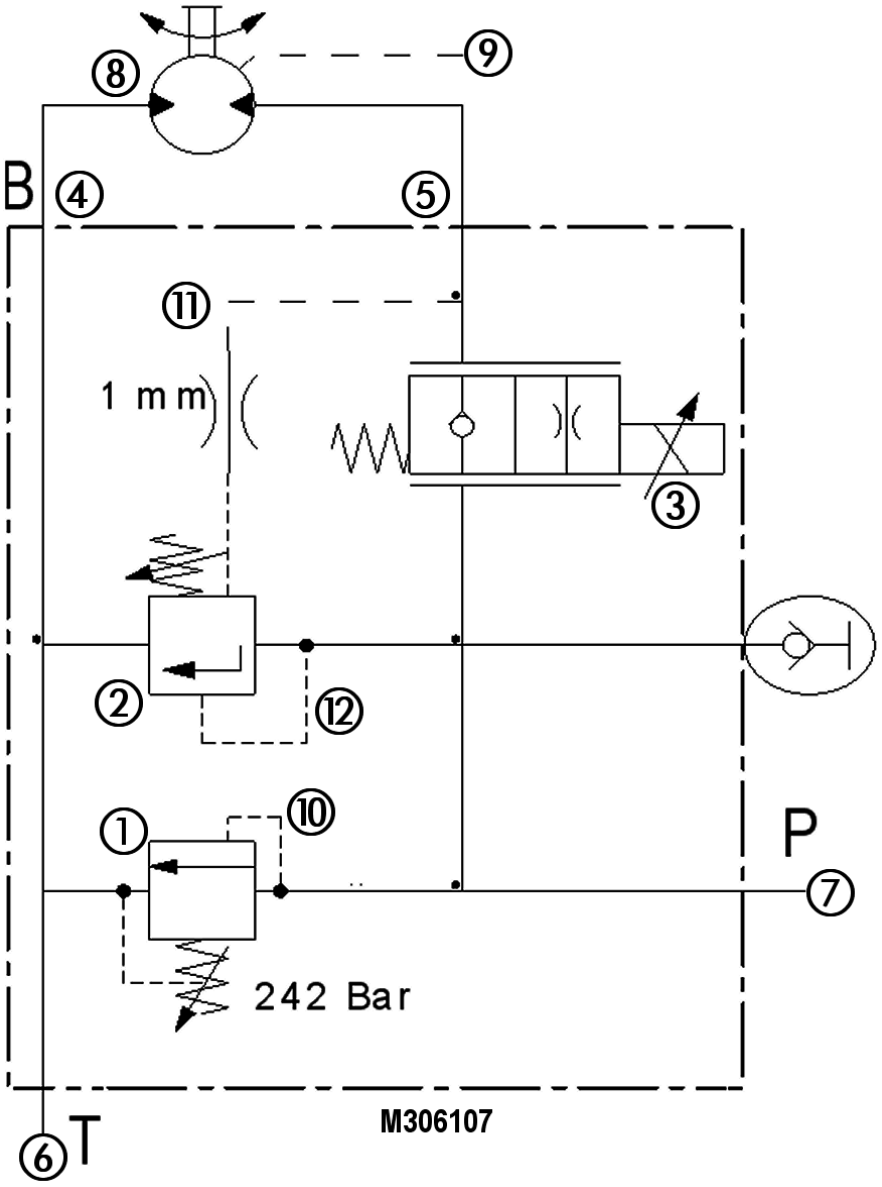
Mounting Steps

1. Mount the motor to the mounting bracket, tightening the pump and bracket bolts finger tight.
2. Tighten the front bracket bolt while rotating the fan. Rotating the fan helps to improve alignment.
3. Tighten the rear bracket bolt.
4. While rotating the fan tighten the top motor mounting bolt and then the lower.

If fan speed is not stable, one item to check is the case drain for the fan motor. If the motor has run in a mis-alignment position it could have been damaged and may have excessive leakage. The motor should not have much more then 0.5 gpm case drain flow.

CLEANING FAN

FAN DRIVE SCHEMATIC



1.	Circuit Relief Valve	7.	Valve Supply Port
2.	Pressure Compensating Valve	8.	Fan Motor
3.	Fan Motor Solenoid	9.	Motor Case Drain
4.	Motor Return Port	10.	Supply Pressure Pilot Line
5.	Motor Supply Port	11.	Work Pressure Pilot Line
6.	Tank Port	12.	Supply Pressure Pilot Line

CLEANING FAN

CONTROL VALVE OPERATION

REFERENCE MATERIAL:

General Hydraulic Section for the “Fan Pump Supply and Return”
Hydraulic Schematics

KEY COMPONENTS:

Fan valve, Fan Solenoid, Relief Valve, Pressure Compensating Valve, and Fan Motor

FAN NOT RUNNING, “SEPARATOR DIS-ENGAGED”

When the separator switch is in the **OFF** position the fan drive is not required, so the fan drive solenoid (3) will be de-activated. The full fan pump flow will be diverted through the pressure-compensating valve (2) back to the tank port (6). Since there is NO flow through the fan drive solenoid, there will NOT be any pressure directed through the pilot line (11) to the spring end of the pressure compensating valve and the valve will open at approximately160 PSI.

FAN RUNNING, “SEPARATOR ENGAGED”

When the operator moves the separator switch to the **ON** position, the CCM2 directs a PWM power supply to the fan drive solenoid (3). The solenoid will shuttle against the spring, directing oil flow to the fan motor (5) and through the pilot line (11) to the spring end of the pressure compensator valve (2). At this time the pressure compensator valve is monitoring the supply pressure (12) from the fan pump and the fan work pressure (11). Since the pressure compensating valve is monitoring both pressures the spring becomes the controlling factor on when the valve opens, maintaining the pressure differential across the solenoid valve. By maintaining the pressure differential the solenoid valve will maintain a given flow rate regardless of the operating pressure.

The supply pressure is monitored (10) at the circuit relief (1), if the system pressure should increase above 3500 PSI it will open diverting the flow to the tank port (6).

REMEMBER: Motor case drain (9) must be less 10 psi while operating to prevent shaft seal leakage.

CLEANING FAN

FAN ELECTRICAL OPERATION

REFERENCE MATERIAL:

Electrical schematic frames: 19, 27
General Electrical Section: Symbols, wire color codes, component locations

KEY COMPONENTS:

Fan Solenoid (L-44), Fan Speed Sensor (B-16), Fan Speed Increase/Decrease Switch (S-15), Display, CCM1, RHM, Fuse F-43

ACCELERATION, "SEPARATOR ENGAGED"

When the operator places the separator switch into the **ON** (forward detented) position, the CCM3 places a message on the data bus. The CCM1 pickups the message and using the power received at X019 terminal J2-2, the CCM1 directs a PWM power supply from connector X019 terminal J2-13 to the fan drive solenoid (L-44) terminal 1. The solenoid is chassis grounded at the front frame ground, the system does not take the oil or solenoid temperature into consideration.. The control will try to accelerate the fan to the desired RPM:

1. If the engine speed is below 1800 RPM the fan control will direct a given power to the fan solenoid, the fan speed is not controlled.
2. If the engine speed is above 1800 RPM the fan control will operate in a closed loop mode. The PWM signal will vary as required to maintain the desired RPM regardless of engine speed, up to the capacity of the pump.

Acceleration will be modulated over a 3 second period.

FAN RUNNING

The fan speed sensor monitors the speed of the fan. The sensor is supplied 8V from the CCM1 terminal 3-13 and a return ground at CCM1 terminal J3-18. The fan speed may be changed in one of two ways:

1. The operator may press the fan speed INCREASE / DECREASE switch on the RHC. The switch is supplied 12V and when pressed to the INCREASE position a 12V signal is directed to the RHM connector X030 terminal 10, if pressed to the DECREASE position the signal will be directed to terminal 1. The RHM places the message on the data bus for the CCM1 to change the fan speed.
2. The operator may preset a fan speed in the cab display for each specific crop type, this would be done in the ACS PRE-SETS.

The fan speed will be maintained within 5% of the desired speed any time the engine is above 1800 RPM. If the desired speed is 1150 RPM, the maximum fan speed, the speed may start to fall off below 1900 RPM engine speed.

CLEANING FAN

ELECTRICAL OPERATION, CON'T

DIS-ENGAGING, "SEPARATOR DIS-ENGAGED"

When the operator places the separator switch into the **OFF** position the CCM3 will place a message on the data bus for the CCM1 to disengage the fan drive. The fan will NOT be disengaged until the cleaning system RPM is below 70 RPM, measured at the sieve shaker speed sensor. If this sensor is not present or is in error then the control looks at the tailings processor speed and when its speed is below 150 RPM the fan is dis-engaged. If both sensor are in error then the fan drive is turned **OFF** when the separator switch is turned **OFF**. The fan continuing to run after shut down helps to prevent thrash and chaff from falling through the sieves as the system slows down.

The fan is also disengaged with the other systems if the rear ladder is lowered while engaged.

CLEANING SYSTEM

UPPER SIEVE ADJUSTMENTS

REFERENCE:

Electrical Schematic Frame: 19 21

KEY COMPONENTS:

Display, Increase/Decrease Switches (S-13), Rear Switches (S-46), Actuation Motors (M-06), Relay (K-18), CCM3,

INCREASE, (IN CAB)

The INCREASE/DECREASE switch is a momentarily N/O switch. When the operator momentarily presses (toggles) the upper sieve INCREASE switch, the a 12V signal is directed out terminal 7 to the RHM connector X030 terminal 2. The RHM places a message on the data bus. Using power received at connector X013 terminal J2-11, the CCM3 send voltage out connector X013 terminal J2-21 to the relay K-18 terminal 3, through the relay and out terminal 4 to the sieve actuator connector X227 terminal D. The actuator is provided a ground through terminal E back to the CCM 3 connector X013 terminal J2-1.

DECREASE, (IN CAB)

To decrease the opening the CCM3 will switch the power supply from terminal J2-21 to J2-1 and the ground from terminal J2-1 to J2-21. Also when decreasing the sieve opening the actuator will open the sieve, permitting it to clean out, then reduce the opening more than required so that the opening is actually adjusted while it is increasing the opening. **Example**: if the current opening is at 12 and the operator wants to reduce it to 10, the operator would toggle the decrease switch TWO times. The sieve indicator will show the sieve OPENING, then closing to approximately 08 and reopen to 10.

POSITION SENSOR

A position potentiometer built into the motor actuator housing monitors the movement of the sieve. The potentiometer receives 5V power at connector X227 terminal A from the CCM3 connector X013 terminal J2-31. The potentiometer has a return wire from terminal B to the CCM3 connector X013 terminal J2-14. The potentiometer's signal wire terminal C is directed back to the CCM3 connector X012 terminal J2-22. The CCM3 places the actuator position on the data bus for the operator to monitor through the cab display.

CLEANING SYSTEM

LOWER SIEVE ADJUSTMENTS

REFERENCE:

Electrical Schematic Frame: #19, 21 and 26

KEY COMPONENTS:

Display, Increase/Decrease Switches (S-14), Rear Switches (S-46), Actuation Motors (M-07), Relay (K-18), CCM3,

INCREASE, (IN CAB)

The INCREASE/DECREASE switch is a momentarily N/O switch. When the operator momentarily presses (toggles) the lower sieve INCREASE switch, a 12V signal is directed out terminal 10 to the RHM connector X030 terminal 6. The RHM places a message on the data bus. The CCM3 will direct voltage out connector X012 terminal J1-6 to the Upper/Lower sieve relay (K-18), activating it so the CCM3 can activate the lower sieve motor (M-07) rather then the upper sieve motor. The CCM3 will send voltage out connector X013 terminal J2-21 to the relay K-18 terminal 3, through the relay and out terminal 5 to the sieve actuator connector X228 terminal D. The actuator is provided a ground through terminal E back to the CCM 3 connector X013 terminal J2-1.

DECREASE, (IN CAB)

To decrease the opening the CCM3 will switch the power supply from terminal J2-21 to J2-1 and the ground from terminal J2-1 to J2-21. Also when decreasing the sieve opening the actuator will open the sieve, permitting it to clean out, then reduce the opening more than required so that the opening is actually adjusted while it is increasing the opening. **Example**: if the current opening is at 12 and the operator wants to reduce it to 10, the operator would toggle the decrease switch TWO times. The sieve indicator will show the sieve OPENING, then closing to approximately 08 and reopen to 10.

POSITION SENSOR

A position potentiometer built into the motor actuator housing monitors the movement of the sieve. The potentiometer receives 5V power at connector X228 terminal A from the CCM3 connector X013 terminal J2-31. The potentiometer has a return wire from terminal B to the CCM3 connector X013 terminal J2-14. The potentiometer's signal wire terminal C is directed back to the CCM3 connector X012 terminal J2-19. The CCM3 places the actuator position on the data bus for the operator to monitor through the cab display.

CLEANING SYSTEM

ELECTRICAL SIEVE ADJUSTMENTS, CON'T

IDENTIFYING THE SIEVE ACTUATOR

There are two different sieve actuators used, they will require different software to operate. The original actuator, since 2003, is painted black, for MY09 the part has been sourced from SKF (87711042) and is painted silver. The new unit is exchangeable with the older unit, BUT does require different software and must be setup in the machine configuration (refer to section 42 for machine configuration). The new software will permit the machine to be configured for either unit. The new unit will operate at a slower speed and require less amperage to operate.

CONFIGURATION EXAMPLE:

128	Lower Sieve Spacing	Type 1 & 1 1/8"	Black Unit
		Type 2 & 1 1/8"	SKF (Silver Unit)
		Type 1 & 1 5/8"	Black Unit
		Type 2 & 1 5/8"	SKF (Silver Unit)

IMPORTANT There will be mounting adaptation required between the two units, a service bulletin will be written to outline the mountings.

CALIBRATION: "UPPER SIEVE"

For the electrical sieve control to operate properly they must be calibrated. There are four main steps to perform the calibrations:

1. Using the display configure the machine for the current sieve type that is installed, etc 1 1/8" or 1 5/8".
2. On a wide cleaning system machine, (62" wide) make sure that the linkage connecting the left side to the right side is adjusted properly to synchronize the opening width on both Upper Sieves. Verify by opening the sieve to any setting that is measurable and manually measure the opening for both sides of the sieve. If adjustments are required, adjust the adjusting handle on one of the sieves.
3. Using the display enter the Upper Sieve calibration procedure. The operator will be instructed to MANUALLY set the sieve to a specific opening. REMEMBER to close the sieve and make the adjustment while opening.
4. Using the display press the START button to complete the calibration procedure. The system will learn the potentiometer value for the known position.

Configuration and steps 1 thru 4 would have to be completed for the Lower Sieve also.

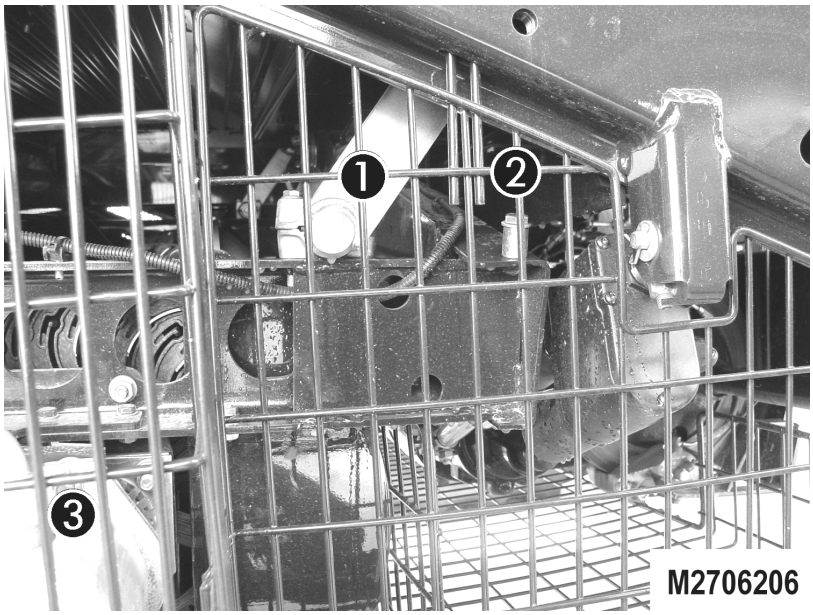
SELF-LEVELING SYSTEM

CLEANING SYSTEM IDENTIFICATION

The AFX series combine may be equipped with two different cleaning system, the standard or the enhanced cleaning system. Proper identification of the cleaning system and stop bolt inspection must be completed before system calibration is completed.

TYPE OF CLEANING SYSTEM

The picture below may be used for identification. If the shaker bushing (1) has a split line that is vertical then it would be a standard cleaning system. If the split line is horizontal it would be an enhanced cleaning system.



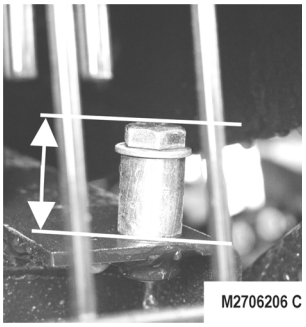
1.	Shaker Bushing Cap. Horizontal split cap shown for the enhanced cleaning system
2.	Shaker Leveling Stop Bolt (a bolt is located on each side of the machine)
3.	Fan Motor

LEVELING STOP BOLT

The stop bolt (2) is used to limit the amount of cleaning system travel. The bolt will require checking prior to calibrating to insure that the clean system is not over traveling and permitting the crank arms to contact the frame. The bolt should be measured from the top of the cap screw to the mounting surface that the bolt is threaded into.

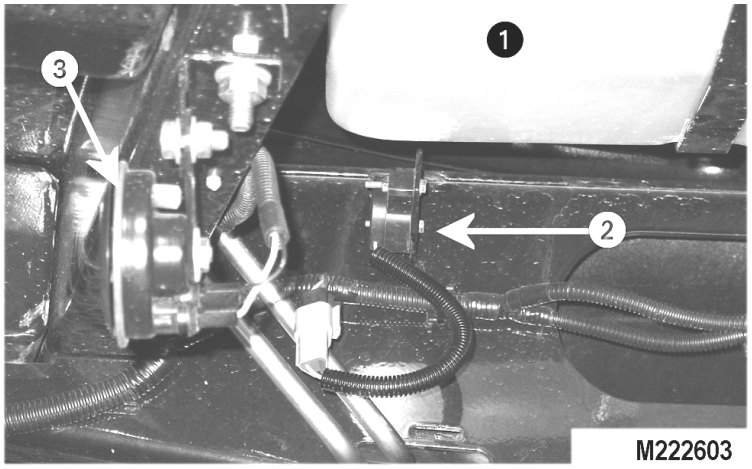
	STOP BOLTS
Standard Cleaning Sys.	18mm (0.75”)
Enhanced Cleaning Sys.	30mm (1.2”)

REMEMBER: Verify that the stop bolt is not contacting mud build up in the frame.

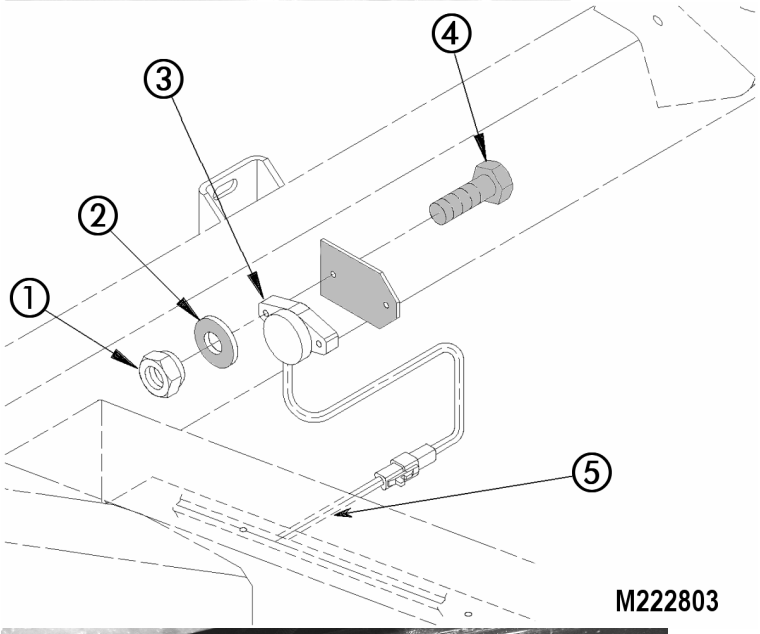


SELF-LEVELING SYSTEM

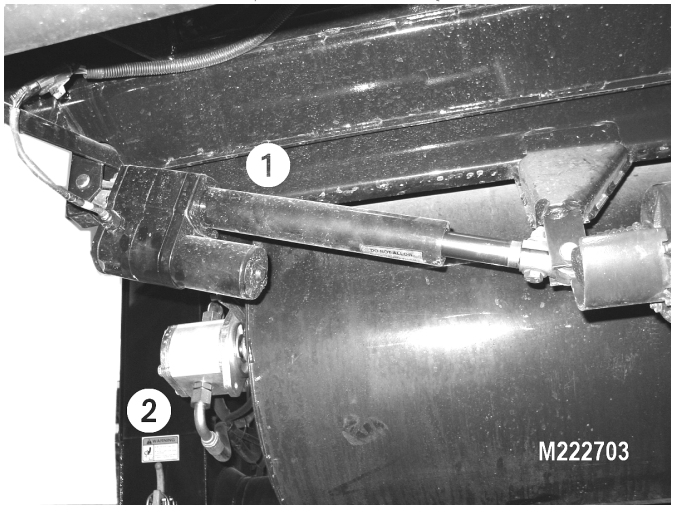
LEVELING SYSTEM



1.	Brake Reservoir
2.	Lateral Inclination Sensor
3.	Horn



1.	Retaining Nut
2.	Washer
3.	Lateral Inclination Sensor
4.	Retaining bolts
5.	Harness



1.	Sieve Leveling Actuator
2.	Fan Motor

SELF-LEVELING SYSTEM

LEVELING SYSTEM

REFERENCE:

Electrical Schematic Frame: #19, 20 and 26

KEY COMPONENTS:

Display, Fuse (F-22), Lateral Inclination Sensor (B-02), Actuation Motors (M-03), CCM1

INCLINATION SENSOR

LEVEL

When the combine is setting level, the lateral inclination sensor (B-02) that is mounted under the right hand side of the cab frame is setting level and sending a base voltage signal, (that was learned during calibration, normally around 2.5V) from terminal C to the CCM1 connector X019 terminal J2-33. The sensor receives a 5V power supply at terminal A from the CCM1 connector X019 terminal J2-31 and is provide a return ground at terminal B from the CCM1 connector X019 terminal J2-14.

ON A SLOPE

When the combine is on a slope the lateral inclination sensor will sense the un-levelness and directs a voltage signal to the CCM1 connector X019 terminal J2-33. If the voltage is ABOVE the calibrated LEVEL voltage the cleaning system will tilt CCW, and if the voltage is BELOW the calibrated LEVEL voltage the system will tilt CW.

Inclination Sensor Signal Wire ”C” Voltage	Combine Levelness	Sieve Reaction
3.0V	Level	Level
3.8V	Right Side Down	Tilts CCW
2.0V	Left Side Down	Tilts CW

A voltage change of approximately 0.15V will command a sieve reaction. The sensor is filled with a fluid to dampen the movement of the internal sensor, due the thickness of the fluid reaction time will vary with ambient temperature. Normal time to travel from full CCW to CW will be less then two seconds.

SENSOR MOUNTING

If the inclination sensor is mounted on the FRONT side of its bracket the wires MUST be DOWN, if mounted on the rear side of the bracket the wires MUST be UP. Either way the sensor needs to be parallel with the mounting bracket.

SELF-LEVELING SYSTEM

LEVELING SYSTEM, CON'T

IMPORTANT: If for any reason, the actuation motor assembly is removed from the machine, DO NOT TURN THE ACTUATION SHAFT. If the actuation shaft is turned past its end of stroke (causing the motor to turn), the internal position sensor will not read correctly and WILL REQUIRE RESETTING.

ACTUATION MOTOR AND POSITION POTENTIOMETER, M-03

The Actuation Motor and position potentiometer is used to hold the cleaning system level when the separator is operating. When the system is operating, the CCM1 will be comparing the readings from the inclination sensor and the actuation motor's pot to determine which direction of rotation and how much to power the motor in order to maintain the levelness of the cleaning system.

The actuation motor is mounted in front of the cleaning fan. The shaft portion of the unit will be rotated to make adjustments to the systems levelness. As long as the shaft is rotated, with OUT turning the motor, the pot's position will not be effected. If the shaft is rotated to its limits (IN or OUT) and is rotated further (turning the motor), the pot will also be repositioned.

Motor

The motor is a sealed unit and is not serviceable. Since the motor is required to be operated in a CW or CCW rotation there is no specific power or ground wire. The CCM 1 controls the unit by providing a power supply and a ground as required from connector X020 terminal J3-39 & 40 and J3-19 & 20 to the motor connector X088 terminals D and E.

Position Potentiometer

The position pot is mounted inside the motor housing and may not be replaced separately. The pot's connector X088 is supplied 5V at terminal A from the CCM1 connector X020 terminal J3-26 and a return at terminal B from the CCM1 connector X020 terminal J3-18. The YELLOW sensing wire at terminal C is directing a variable signal voltage back to the CCM1 connector X020 terminal J3-32.

SELF-LEVELING SYSTEM

LEVELING SYSTEM, CON'T

CALIBRATION



IMPORTANT: This is a VERY critical calibration and MUST be performed correctly. If calibration is not done correctly the cleaning system will remain UNLEVEL at all times, causing the grain to shift to one side and over load the cleaning system. One degree out of level can effect the cleaning system performance.

1. Make sure the combine in setting level by checking the front axle. Inflating tires may be used to level the machine for this calibration process.
2. To calibrate the leveling system, use the display to activate the calibration procedure and follow the instructions as given on the display screen. This procedure lets the combine learn the position of the inclination sensor when the combine is setting level and the travel of the actuation motor's potentiometer. The unit will stop in the center of its actuation motor's travel, which may or may not be with the cleaning system level.
3. Place a level on the grain pan and if not level proceed to step 4.
4. If adjustment is required, remove the attaching pin at the rod end. Adjust the actuation rod by rotating the shaft as required to level the cleaning system.
5. DO NOT repeat calibration procedures again trying to verify the operation, the system may not return to levelness. Run the machine on UN-LEVEL ground and the cleaning system should remain level within 0.5 degs (within 0.5 inches across the grain pan).

SELF-LEVELING SYSTEM

LEVELING SYSTEM, CON'T



Wait a Minute... Does the cleaning system have to run level to perform properly? Maybe not. Lets look at a couple of examples:

Wheat Harvest:
While harvesting wheat the operator does a Quick Kill and learns that the material is laying on the grain pan and sieve pretty level. This is good because the cleaning system is running level. Wheat is dry and as it moves back on the grain pan it tends to self level the mat of material. This is the way it is suppose to work.

Corn/Rice Harvest:
While harvesting these heavier, damper and high yielding crops the operator does a Quick Kill and learns that the right hand side of the grain pan and sieves are loaded heavier then the left side. This may let the cleaning fan air escape up the left hand side and let grain ride out the back on the right side. There are three ways of addressing this issue:

1. The correct way may be to change the position of the pinch point, moving the concave hanger to the right, moving the pinch point to the left. This may effect how other crops are handled.
2. Changing modules around to provide more opening on the left side and less opening on the right side. This will effect the loading of the grain pan
3. Off set the cleaning system levelness, titling it to the left. From the cab display the operator can program in an OFF SET number **"+"**= up on the right side and **"-"**= up on the left side. By changing the levelness, raising the right side, the grain will move more to the left as it moves back on the grain pan and sieve. This may help to eliminate right side grain loss and high tailings. Here if a little is good a lot is better **IS NOT TRUE**. Start with adjustments of 0.2, experience has shown you do not want to exceed 1.0. This adjustment will not effect the systems calibration, if the setting is put back to 0.0, the system will be back to the calibrated setting.

SELF-LEVELING SYSTEM

LEVELING SYSTEM, CON'T

ACTUATION MOTOR POTENTIOMETER ADJUSTMENTS

If the actuation motor can not be calibrated, the readings are out of range or the shaft has been turned, the unit will require resetting. The unit should work as long as the sensor reading is between 0.5V fully retracted to 4.5V fully extended.

1. Start with the combine LEVEL, checking at the front axle.
2. Make sure the grain pan is LEVEL.
3. Check the voltage from the actuator on the cab display unit under the DIAG>CLEANING>SIEVE ANG SEN screen. The voltage should be between 2.5 and 3V, if not the actuator's potentiometer will require adjusting.
4. Remove the pin from the actuator so that the shaft may be rotated.
5. Using an Ohm meter determine the resistance of the actuator potentiometer by connecting across the GRAY and GREEN wires (connector X088 terminals A and B), it should read approximately 10K.
6. Connect the Ohm meter across the YELLOW and GRAY wires (terminals C and A), and adjust the potentiometers reading to approximately 5K. The actuator's shaft will have to be rotated until it bottoms out to turn the potentiometer. The shaft may have to be rotated IN or OUT to make the correction.
7. Re-center the shaft until the retaining pin will slip into place.

GRAIN HANDLING

TAILINGS/REPROCESSOR/BEATER SPEED

REFERENCE:

Electrical Schematic Frame: 20

KEY COMPONENTS:

display, Tailing RPM Sensor (B-39), CCM1 and CCM2

The tailings speed is monitored by the CCM1 and places a speed message on the data bus for the display to alert the operator when the speed is below 450 RPM. The CCM1 connector X019 terminal J2-37 supplies 8V to the sensor terminal 2. The sensor is supplied a return ground from terminal 1 to the CCM1 connector X019 terminal J2-14. When the sensor senses metal the sensors output changes. See Specification page for readings. The sensor also incorporates an indicator lamp that is lit when there is NO presence of metal.

SENSOR ADJUSTMENT

The sensor is adjusted so the air gap between the sensor and the target metal is approximately 2-3mm.

GRAIN HANDLING

TAILINGS VOLUME SENSOR

REFERENCE:

Electrical Schematic Frame: 20 and 27

KEY COMPONENTS:

Display, Tailing Volume Sensor (R-29), CCM2

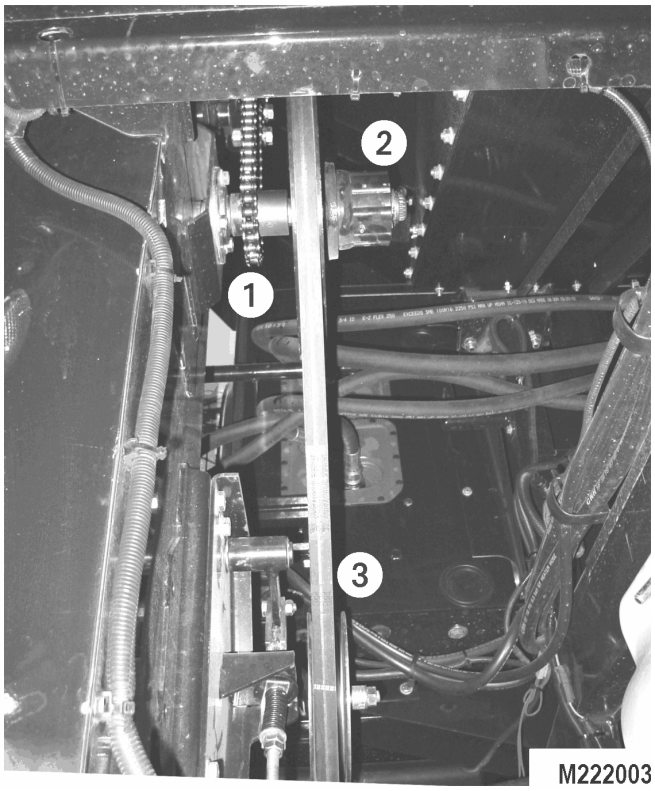
The tailing volume is monitored by the CCM2 and places a message on the data bus for the display to show the operator if the volume exceeds the set point. The CCM2 connector X016 terminal J2-31 supplies 8V to the sensor terminal 1. The sensor is supplied a return ground from terminal 3 to the CCM2 connector X016 terminal J2-14. The potentiometer's signal wire terminal 2 is directed back to the CCM2 connector X017 terminal J3-22. The CCM2 places the actuator position on the data bus for the display to display.

SENSOR ADJUSTMENT

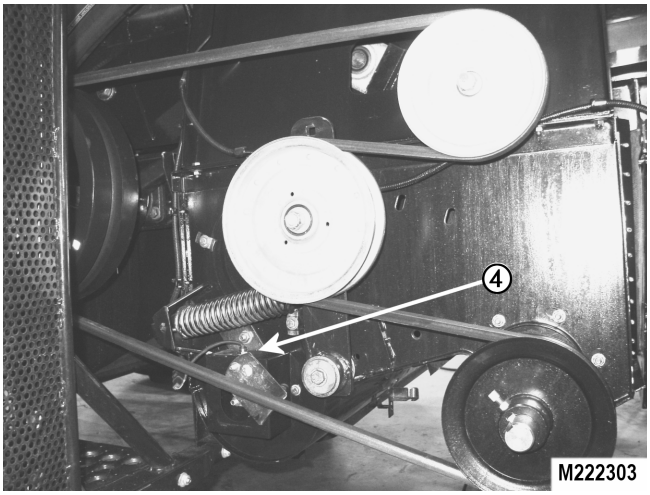
The machines should be operated in the field until the machine performance is to the operator's acceptance. The position of the tailing volume sensor should be noted and monitored for any changes during the harvesting operation.

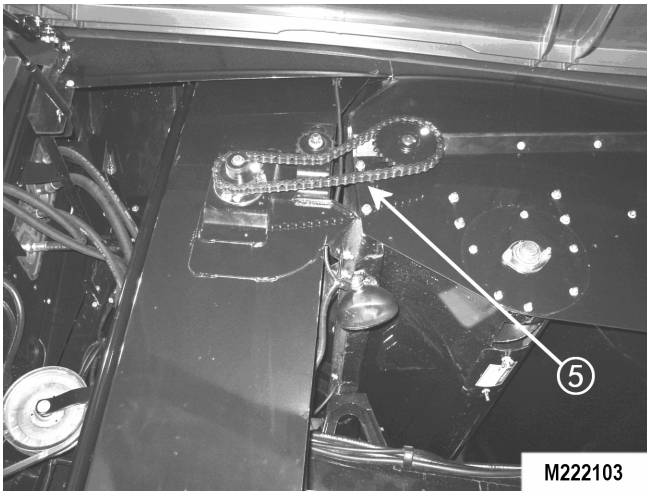
GRAIN HANDLING

CLEAN GRAIN ELEVATOR DRIVE



1.	Driven Chain for Elevator
2.	Elevator Pin Type Slip Clutch
3.	Elevator Drive Belt
4.	Elevator Speed Sensor
5.	Bubble Up Auger Drive Chain





GRAIN HANDLING

CLEAN GRAIN ELEVATOR RPM SENSOR

REFERENCE:

Electrical Schematic Frame: 20

KEY COMPONENTS:

Display, Elevator RPM Sensor (B-08), CCM1

The elevator speed is monitored by the CCM1 and places a speed message on the data bus for the cab display to alert the operator when the speed is reduced by 20%. The CCM1 connector X019 terminal J2-28 supplies 8V to the sensor terminal 2. The sensor is supplied a return ground from terminal 1 to the CCM1 connector X019 terminal J2-14. The sensor is a Hall Effect sensor that when it senses metal will cause the voltage to change. See Specification page for readings. The sensor also incorporates an indicator lamp that is lit when there is NO presence of metal and the contacts are closed.

SENSOR ADJUSTMENT

The sensor is adjusted so the air gap between the sensor and the target metal is approximately 2-3mm.

RESIDUE MANAGEMENT

STRAW CHOPPER RPM

REFERENCE:

Electrical Schematic Frame: 23

KEY COMPONENTS:

Display, Chopper RPM Sensor (B-10), CCM2

The chopper speed is monitored by the cab display, and will alert the operator when the speed is below 80% of high idle RPM. The sensor is also required because the chopper may be operated in one of two different speeds, and while changing the speed could accidentally be placed in NEUTRAL. The CCM2 connector X016 terminal J2-38 directs an 8 V to the sensor terminal 2. The sensor is supplied a return ground from terminal 1 to the CCM2 connector X016 terminal J2-14. The sensor is a Hall Effect sensor that when it senses metal, the voltage will change. See Specification page for readings. The sensor also incorporates an indicator lamp that is lit when there is NO presence of metal and the contacts are closed.

SENSOR ADJUSTMENT

The sensor is adjusted so the air gap between the sensor and the target metal is approximately 2-3mm.

If the chopper speed is not reached within 2.5 seconds, the engagement will abort and the operator will be instructed to disengage the separator. This protection is part of the “Auto Feed Cut Off” logic. If the Auto Feed Cut Off is disabled so will the beater/chopper protection be disabled.

RESIDUE MANAGEMENT

STRAW CHOPPER STATIONARY KNIFE POSITION SENSOR

REFERENCE:

Electrical Schematic Frame: 21

KEY COMPONENTS:

Display, Knife Position Sensor B-92, CCM3

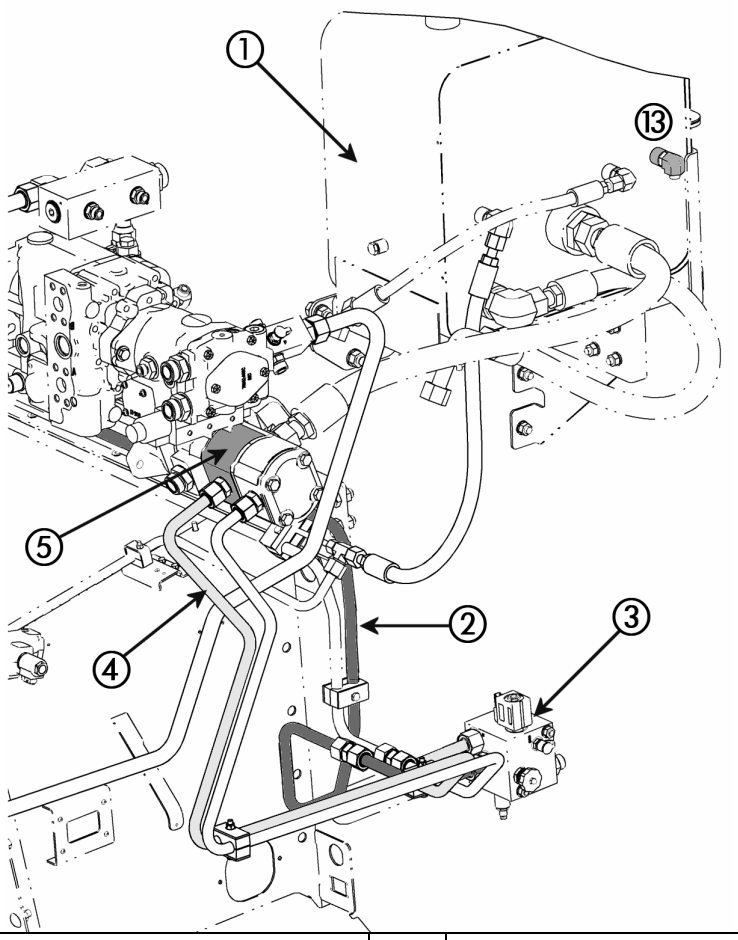
The chopper stationary knife bank must be lowered out of the residue flow when harvesting corn. The CCM3 will direct a 5V signal from connector X013 terminal J2-38 to the position sensor B-92 terminal 2. The sensor is supplied a return wire at terminal 1, which is directed back to the CCM3 connector X013 terminal J2-14.

SENSOR ADJUSTMENT

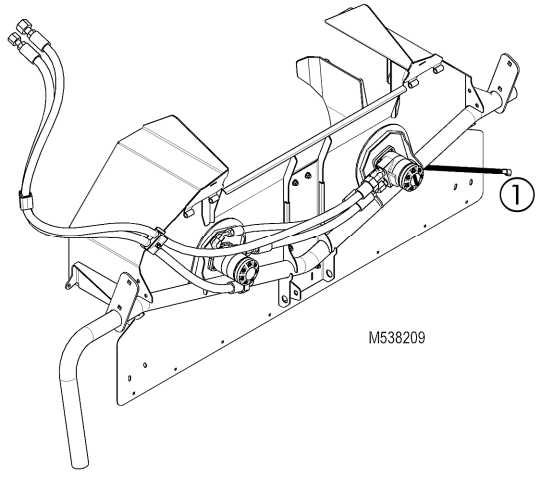
The sensor is adjusted so the air gap between the sensor and the target metal is approximately 2-3mm.

RESIDUE MANAGEMENT

SPREADER DRIVE COMPONENTS



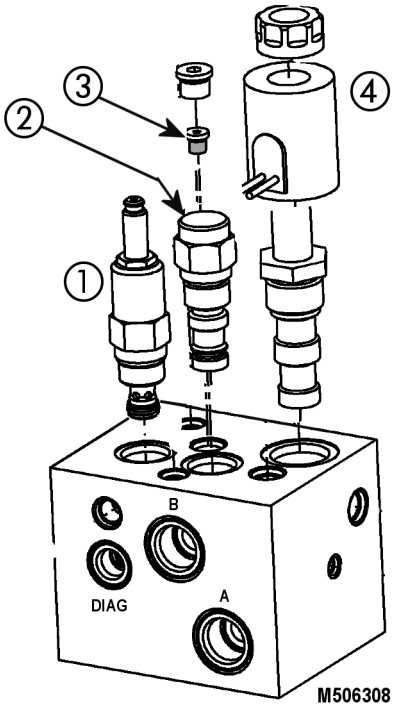
1.	Reservoir Tank	4.	Supply to Valve
2.	Return From Spreader Valve and To Rotary Air Screen Valve	5.	Spreader Pump
3.	Spreader Valve	13.	Case Drain From Left Spreader Motor

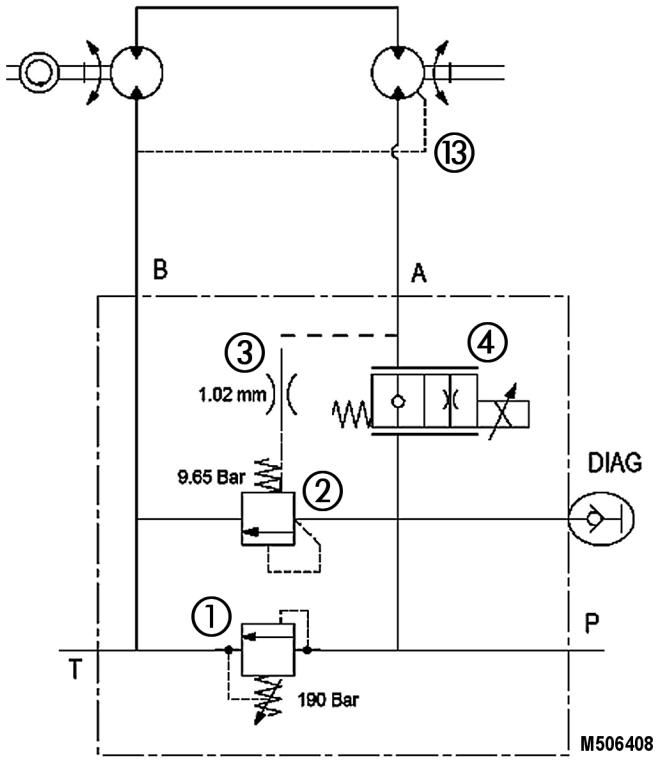


1. Spreader Speed Sensor

RESIDUE MANAGEMENT

SPREADER DRIVE SCHEMATIC





1.	Circuit Relief Valve
2.	Pressure Compensating Valve
3.	Pilot Line and Damping Orifice
4.	Spreader Solenoid
13.	Motor Case Drain Line
A	To Left Motor
B	Return From Right Motor
DIAG.	Diagnostic Port
P.	Valve “IN” from Pump
T.	Valve “OUT” to Rotary Air Screen

RESIDUE MANAGEMENT

CONTROL VALVE OPERATION

REFERENCE MATERIAL:

General Hydraulic Section for the “Spreader Pump Supply and Return”
Hydraulic Schematics

KEY COMPONENTS:

Spreader valve, Spreader Solenoid, Relief Valve, Pressure Compensating Valve, and Spreader Motors

IMPORTANT: The spreader valve is supplied by the spreader/rotary air screen gear pump, since it is a gear pump and an open center circuit the oil flow CAN NOT be stopped at any time.

SPREADER NOT RUNNING, “SEPARATOR DIS-ENGAGED”

When the separator switch is in the **OFF** position, the spreader drive is not required, so the spreader drive solenoid (4) will be de-activated. The full spreader pump flow will be diverted through the pressure compensating valve (3) to the tank port “T” and onto the rotary air screen valve. Since there is NO flow through the spreader drive solenoid there will NOT be any pressure directed through the pilot line to the spring end of the pressure compensating valve (2) and the valve will open.

SPREADER RUNNING, “SEPARATOR ENGAGED”

When the operator moves the separator switch to the **ON** position, the CCM2 directs a power supply to the spreader drive solenoid (4). The solenoid will shuttle against the spring, directing oil flow out work port “A” to the left spreader motor and through the pilot line (3) to the spring end of the pressure compensator valve (2). At this time the pressure compensator valve is monitoring the supply pressure “P” from the spreader pump and the motor work pressure (3). Since the pressure compensating valve is monitoring both pressures the spring becomes the controlling factor on when the valve opens, maintaining the pressure differential across the solenoid valve. By maintaining the pressure differential the solenoid valve will maintain a given flow rate regardless of the operating pressure.

The supply pressure “P” is monitored at the circuit relief (1), if the system pressure should increase above 190 bar (2755 PSI) it will open diverting the flow to the rotary air screen port “T”.

RESIDUE MANAGEMENT

SPREADER POSITION SENSOR

REFERENCE:

Electrical Schematic Frame: 23

KEY COMPONENTS:

Display, Spreader Position Sensor (B-11), CCM1

The spreader position is monitored by the CCM1 to prevent the spreader from operating when moved to the storage position (UP), the spreader must be in the operating position (DOWN) to run. The CCM1 connector X020 terminal J3-37 directs a 8V to the sensor terminal 2. The sensor is supplied a return ground from terminal 1 to the CCM1 connector X019 terminal J2-14. The sensor is a Hall effect sensor that when it senses metal will cause the voltage to change. See Specification page for readings. The sensor also incorporates an indicator lamp that is lit when there is NO presence of metal.

When the sensor is sensing metal the spreader operation will be stopped.

RESIDUE MANAGEMENT

SPREADER ENGAGEMENT / SPEED CONTROL

REFERENCE:

Electrical Schematic Frame: 23

KEY COMPONENTS:

Display, Fuse F-45, Spreader RPM Sensor (B-55),

SPREADER DISENGAGED

When the separator switch is placed in the OFF position, a message is placed on the data buss for the CCM1 to disengage the spreader solenoid. The CCM1 will stop the power from connector X019 terminal J2-15, stopping the spreader operation.

SPREADER ENGAGED

When the separator switch is placed in the ON position, a message is placed on the data buss for the CCM1 will:

- Monitor the spreader's position signal to determine its position.
- Recall the last spreader speed request to determine how to activate the spreader solenoid. The CCM1 will directed a PWM power out connector X19 terminal J2-15 to the spreader solenoid terminal 1. The solenoid is provided a return ground from terminal 2 back to the CCM1 connector X019 terminal J2-14.
- Monitor the spreader's actual speed to determine if the requested speed as been reached. The spreader speed is monitored by the CCM2 and places a speed message on the data bus for the display and CCM1 to use. The motor speed should be approximately 320 – 750 RPM. The fuse-45 supplies 12V to the sensor terminal A. The sensor is supplied a return ground from terminal C to the CCM2 connector X016 terminal J2-14. The sensor's B terminal is supplied 8V from the CCM2 connector X016 terminal J2-28. The sensor is a Hall effect sensor that when it senses metal will cause the voltage to change. When not see metal voltage will approximately 6.3V and with metal it drops to approximately 1.3V. See Specification page for readings.
- The operator may change the spreader speed from the right hand console by pressing the spreader speed control switch. When the switch is pressed, a 12V signal is sent to the RHM connector X029 terminal 13 for speed increase or terminal 4 for speed decrease.

SENSOR ADJUSTMENTS

The spreader speed sensor is mounted in the right hand motor. There is NO adjustment.

TROUBLE SHOOTING



Wait a minute, how can I trouble shoot a system that incorporates mechanical drives, electrical circuits and hydraulic circuits?

The most challenging part of repairing any operation is determining which part of the operation has failed as quickly as possible, but without overlooking any possibilities. Your first test must be able to verify whether the problem is in the electrical circuit, hydraulic circuit or the mechanical components.

First verify if a fault code is being displayed. If so, follow the explanation associated with the fault code. If not, make your first test with a voltmeter where electrical power converts to mechanical power, “The Solenoid”, to verify voltage is being supplied and a ground provided.

- ✓ If voltage and ground is supplied, the electrical circuit is not the main problem. Look at the hydraulic or mechanical circuit.
- ✓ If voltage and/or ground is not being supplied, then you must fix the electrical circuit first before moving on to the hydraulic and/or mechanical circuits.
- ✓ What other components are supplied the same hydraulic supply that is supplying the separator drive circuits? Are they working? Check regulated pressure.
- ✓ Check for stuck control spools, plugged orifices, open relief valves, etc.

CASE IH AGRICULTURE

AGRICULTURAL EQUIPMENT SERVICE TRAINING

7120 - 9120 SERIES AXIAL-FLOW COMBINE


M263605

SECTION 74 UNLOADING SYSTEM

Form 5175 1/2010

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RACINE, WI 53404
U.S.A.

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Keep an eye out for symbols, which will alert you to special information.



Wait a Minute... This symbol will preface a frequently asked question.



REMEMBER: This ;symbol will preface a tip that may be worth remembering.



IMPORTANT: This symbol will preface a tip that you should definitely not ignore.

SPECIFICATIONS

MECHANICAL SPECIFICATIONS

HYDRAULIC SPECIFICATIONS

COMPONENT	PRESSURE
Control Pressure	320±15 PSI (22±1 bar)
Lubrication Pressure	50 PSI (3.5 bar)
Swing Cylinder Pressure	3100 PSI (214 bar)
Hydraulic Drive - Tank Cross Augers	Approximately 2500 psi (172 bar)
Pre MY2010 Swing Auger Barrel OD	62 mm
MY 2010 Swing Auger Barrel OD	70 mm

ELECTRICAL SPECIFICATIONS

COMPONENT	SUPPLY VOLTAGE	WORKING RANGE	RESISTANCE: OHMS AT 70°F (25°C)	NORMAL POSITION
Unloading Auger Clutch Solenoid	Battery		6.4 ohms	
Unloading Auger Swing Solenoids	Battery		6.8 ohms	
Signal Valve Solenoid	Battery		7.5 ohms	
Unloader Engage Switch Unloader Swing Switches	Battery	"OL" OFF position Less then 2 Ohms when "Pressed"		Momentary N/O
Saddle Sensor	8V Open Circuit V.	No Metal 3.9V (light ON) Metal 4.8V (light OFF)		
Grain Level Sensors		A-C = 250 Ohms A-B = 500 Ohms no GRAIN A-B = 250 Ohms with GRAIN		
Grain Tank Cover Actuator Motor		A-B = 1-5 Ohms		
Grain Tank Cover Solenoid	12V	7 ohms		
Cross Auger Pressure Sensor (PFC Pump Pressure)	5V	A = 5V B = 0.5-4.5V C = ~0.5V		
Cross Auger Valve Solenoid		6-6.5 ohms		

INTRODUCTION

Once the grain has been harvested and transported to the grain tank by the clean grain elevator it must be transported to the grain wagon/truck for hauling.

The grain tank will hold the grain until full and provide a warning to the operator before it becomes overfilled. There are two grain tank level sensors to provide a ¾ FULL and a FULL indication for the operator and possibly for the grain wagon operator.

The unloading system is adjustable as to the amount of grain that may flow into the tank cross auger due to the load that different crops may put on the system. For engagement there is a wet clutch mounted in the PTO gearbox that provides the drive.

The system is protected by a shear bolt set-up on the main drive sprocket.



Wait a Minute... What about unloading auger length? At the time of the printing of this manual the following is true:

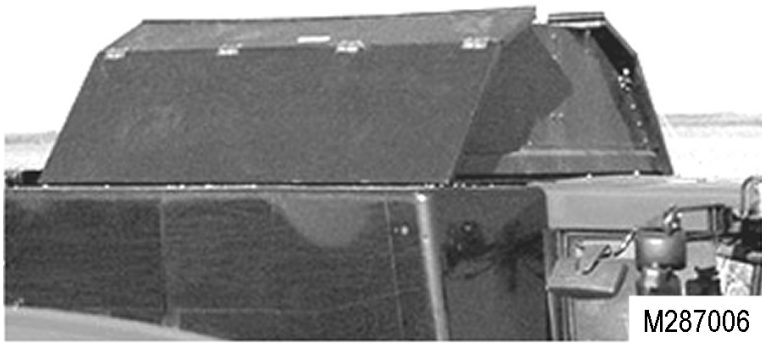
	Advertized Length from the center of the machine to the discharge point on a horizontal plane from the top of the cab (reduce 3 inches for the Mid-Range) machines.		
Unloading Tube Length	No Extension	Extension 36”	Extension 52”
16.5 ft	21ft 11in		
16.5 ft		24ft 10in	
16.5 ft			26 ft 2in

GRAIN TANK COVER OPERATION, (ELECTRICAL)

GRAIN TANK COVERS

The Europe machines may be equipped with grain tank covers that will prevent foreign material from entering the grain tank when not harvesting.

The covers may be OPENED or CLOSED with a rocker switch that is mounted in the overhead switch panel next to the air conditioning controls. The switch is a two position detented switch.



OPEN

When the switch is placed into the **OPEN** position, the actuator will open the covers if the Road Mode switch is in the Field Position.

Messages

The operator will be alerted on the display to **OPEN** the covers if the separator is engaged while the covers are closed.

GRAIN TANK COVER OPERATION

GRAIN TANK COVERS, CON'T

CLOSE

When the switch is placed into the **CLOSED** position the actuator will close the covers IF:

- The separator is NOT running

Messages

The operator will be alerted on the display to close the covers IF:

- Ground speed exceeds 15 Kph
- The Road Mode switch is moved to the Road Mode position



IMPORTANT: The cover movement may be stopped by pressing the yellow EMERGENCY stop button located on the MFH.



IMPORTANT: Do not try to close the covers while there is grain in the tank.

GRAIN TANK COVER OPERATION, (HYDRAULIC)

HYDRAULIC OPERATED GRAIN TANK COVERS

All machines may be ordered with the optional hydraulically operated grain tank covers. They will help to prevent foreign material from entering tank when the separator is not operating. Due to the bubble up auger also being raised and lowered with the covers, the separator should NEVER be operated while the grain tank covers are closed.



OPEN

When the switch is placed into the **OPEN** position, the actuator will open the covers if the Road Mode switch is in the Field Position.

Messages

The operator will be alerted on the display to **OPEN** the covers if the separator is engaged while the covers are closed.

IMPORTANT: The cover movement may be stopped by pressing the yellow EMERGENCY stop button located on the MFH.

IMPORTANT: Do not try to close the covers while there is grain in the tank.

GRAIN TANK COVER OPERATION, (HYDRAULIC)

HYDRAULIC OPERATED GRAIN TANK COVERS, CON'T

HOW IS THE OPERATION INFLUENCED

The grain tank cover circuit shares it functions with two other circuits:

- The electrical portion of the cover valve is shared with the concave OPEN/CLOSE circuit. The circuit is defaulted to the cover's operation and a relay must be tripped for the concaves to move. The CCM1's output will be used for both operations.
- The hydraulic portion of the circuit is shared with the unloading auger swing circuit. The CCM2 uses the same outputs for both operations.

Concave/Cover Influence

Whichever command was received by the CCM1 first will continue to operate. An alarm message will be displayed. For the function that was not completed, its control switch will require recycling.

Unloader Swing/Cover Influence

The unloading auger MUST be in the saddle for the covers to operate. If the cover switch is toggled with the unloading auger out of the saddle, the covers will not move. By placing the auger back into the saddle will not activate the covers, the switch will require recycling.

Rear Ladder

The rear ladder must be in the UP positions for the covers to operate.

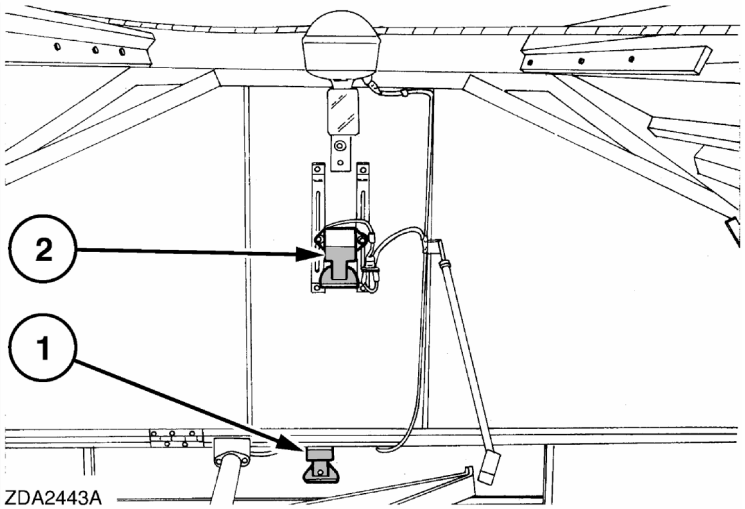
Grain Tank Level Sensor

If either of the grain tank level sensor are activated the covers circuit will not activate.

REMEMBER: A failure of the tank level, ladder or saddle sensor can prevent the cover circuit from operating.

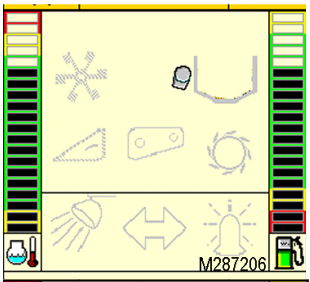
UNLOADING SYSTEM OPERATION

GRAIN TANK LEVEL SENSORS

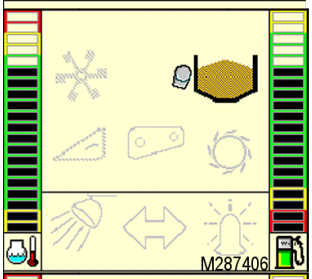


1.	Lower, ¾ Full Sensor
2.	Upper, Full Sensor

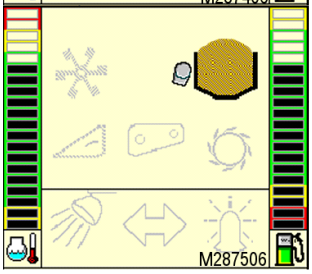
DISPLAY MESSAGES



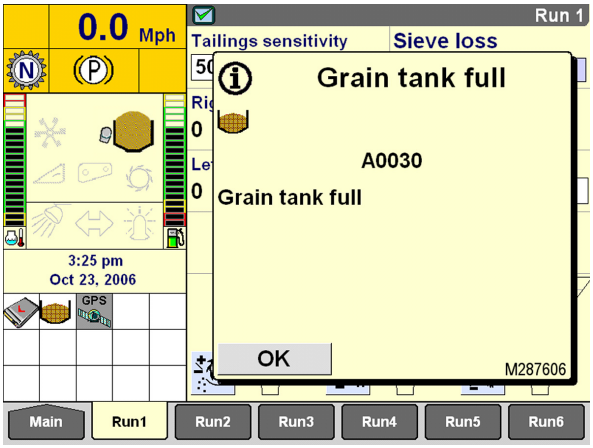
Grain Tank Empty



Grain Tank ¾ Filled



Grain Tank Full, (Flashing)



Grain Tank Alert

Due to the size and position of the grain tank it is impossible for the operator to monitor the progress of the filling of the tank. There are two sensors mounted inside the grain tank to provide the operator with indicators as to the level of the grain within the grain tank. The indicators are influenced by the position that the separator switch is in, **ON or OFF**.

UNLOADING SYSTEM OPERATION

GRAIN TANK LEVEL SENSORS, CON'T

¾ FULL Indicator, (Lower Sensor #1)

When the grain has reached the level of the lower sensor, the 3/4 **Bin FULL** indicator appears on the display. An alarm and tone will alert the operator.

Optional Beacon Lights, Separator Engaged (ON)

If equipped with the optional beacon lights they will be activated continuously as long as the field lights are **NOT** turned **ON**. If the field lights are turned **ON** the beacons will only be activated for approximately 10 seconds.

FULL Indicator, (Upper Sensor #2)

When the grain has reached the level of the upper sensor, the **Bin FULL** indicator will appears, if the separator is engaged (**ON)** an audible alarm will sound and a message will be displayed on the Display unit.

Optional Beacon Lights, Separator Engaged (ON)

If equipped with the optional beacon lights they will be activated continuously as long as the field lights are **NOT** turned **ON**. If the field lights are turned **ON** the beacons will only be activated for approximately 10 seconds.

Both sensors are adjustable to provide for fine tuning when the indicators are activated.

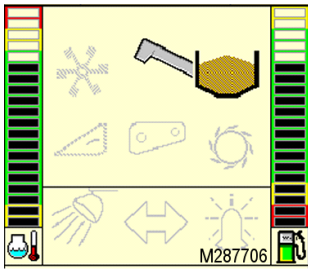
UNLOADING SYSTEM OPERATION

UNLOADING AUGER SWING

The unloading auger swing operation is used to position the unloading auger for transferring the grain from the combine tank to the grain hauling equipment.

The unloading auger swing operation is influenced by the position of the Road Mode Switch and the auger engagement operation.

When the unloading auger is NOT in the saddle an **UNLOAD** indicator on the display will be activated,



Road Mode Switch

When the road mode switch is in the ROAD mode (indicator lamp ON), the unloading auger can only be swung **IN** to the saddle and the unloading auger clutch will NOT engage.

Unloading Auger Engaged (ON)

When the auger is running the unloading auger will ONLY swing as long as the operator is pressing the switch.

Unloading Auger Dis-Engaged (OFF)

When the auger is NOT running the unloading auger will travel fully **OUT** or **IN** with only one press of the swing switch. When traveling **OUT** the valve will stay activated for a total of 15 seconds. When traveling **IN** the valve will stay activated until the saddle switch has been activated or for 15 seconds.

REMEMBER: When ground speed exceeds 10 MPH (15 Kph) the display will request that the operator returns the unloading auger to the home position.

UNLOADING SYSTEM OPERATION

UNLOADING AUGER ENGAGEMENT

The unloading drive and control system may be equipped in two different drive types:

Standard on all machines: The complete unloading system will be driven from a common clutch and drive chain.

Rice machines or as optional: The vertical and unloading tube will be driven from a common clutch and drive chain, while the grain tank cross augers will be driven with a hydraulic motor. The motor operation may be controlled independently from the rest of the unloading system.

UNLOADING SYSTEM OPERATION

MECHANICALLY DRIVEN SYSTEM

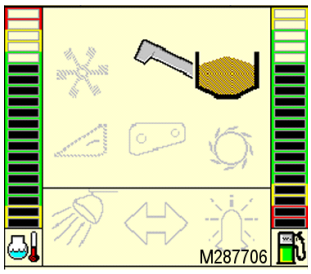
The unloading auger engagement operation is used to transfer the grain from the combine tank to the grain hauling equipment.

The unloading auger engagement operation is influenced by the position of the Road Mode Switch and the auger tube saddle sensor. The road mode switch MUST be in the FIELD position and the saddle sensor MUST be sensing that the auger is NOT in the saddle before the unloading auger clutch will engage.

Engaged

To engage the unloading auger the operator will press and release the auger engagement switch located on the MFH. The auger clutch will remain engaged until the operator disengages it.

When the auger is engaged the **UNLOAD** indicator appear on the display. will change to a flashing lamp.



Dis-Engaged

The auger may be dis-engaged in one of four methods:

1. By press the engagement button the second time.
2. By moving the auger into the saddle.
3. By pressing the Road Mode switch to the ROAD position.
4. By pressing the EMERGENCY stop button.

When unloading on the go, every effort should be made to completely empty the horizontal auger before shutting down the unloading drive. If wet heavy grain is left in the unloading system, the shear bolt may fail the next time the unloading system is engaged. It may help to place the slow down sprocket on the front grain tank cross auger.

UNLOADING SYSTEM OPERATION

UNLOADING AUGER ENGAGEMENT

CROSS AUGER SPEEDS

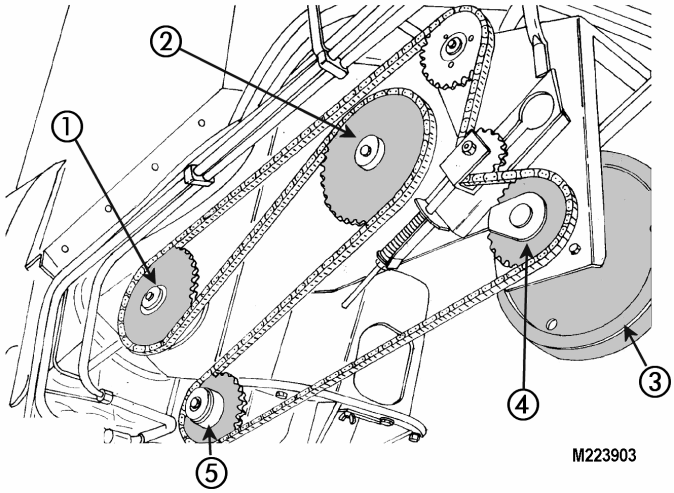
The cross speed may be changed by changing the front and rear auger driven sprockets. For most crops the standard high speed sprockets are fine. There are slow down sprocket available through parts for:

- Damp or hard to move crops where shear bolt breakage may be occurring.
- Crops that may easily experience damage

Function	Front Auger	Rear Auger	Drive Sprocket
Normal Operation	38T	43T	25T
Rice or Slow Speed (Normally installed with the extended wear package)	47T	47T	25T

REMEMBER: The slow down sprockets will increase the unloading time, as the grain tank will be unloaded at a slow rate.

1.	Front Tank Cross Auger
2.	Rear Tank Cross Auger
4.	Drive Sprocket and Sheer Bolt



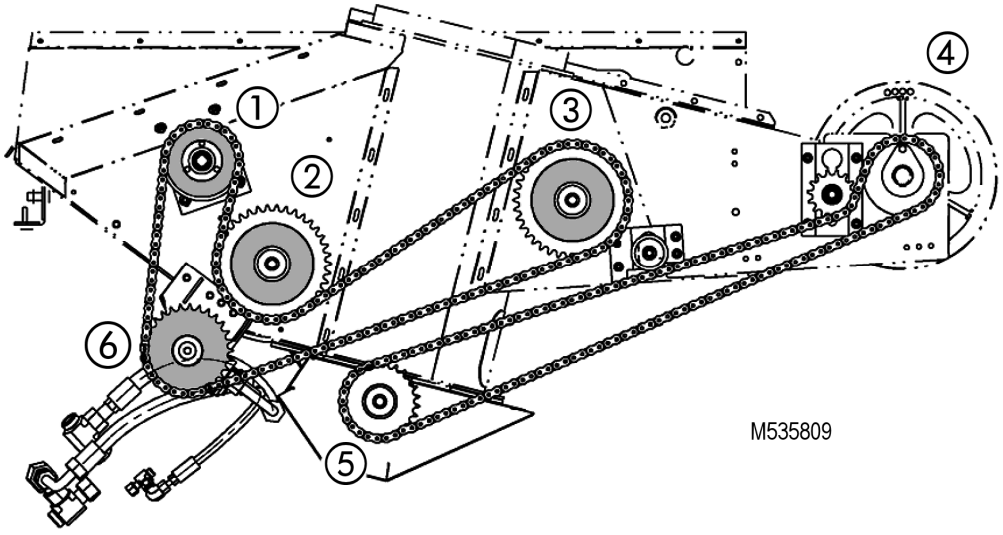
UNLOADING SYSTEM OPERATION

MECHANICAL / HYDRAULIC DRIVEN SYSTEM

The vertical and unloading tube portion of the unloading system will operate and be controlled the same way as the mechanical system was. The grain tank cross augers will or may be controlled using the SHIFT+UNLOAD buttons located on the MFH.

This will permit the cross augers to be shut down, letting the unload tube to clean out; this will relieve the weight in the tube and the start up load the next time the unloading system is started.

Unload Button	Shift Button	
X		**Unloading System NOT Running**: Engages Unloading operation with a 2 second delay on the cross auger start up
X	X	**Unloading System NOT Running**: Engages Unloading operation only, leaving the cross augers idle
X		**Unloading System Running**: Disengages the unloading operation
X	X	**Unloading system running**: The cross augers will STOP operating. The unload tube will continue to operate.
X	X	**Unloading system running**: The cross augers will START operating.



1.	Chain Idler	4.	Vertical and Unloading Auger Drive Belt & Chain Drive
2.	Front Cross Auger	5.	Vertical & Horizontal Auger Driven
3.	Rear Cross Auger	6.	Cross Auger Hydraulic Motor

UNLOADING SYSTEM OPERATION

MECHANICALLY / HYDRAULICALLY DRIVEN SYSTEM

The hydraulic cross auger kit is NOT intended to provide for faster unloading rates, in fact it will reduce the unloading rates is almost all cases. The standard unloader drive system is rated at approximately 3 bu./second, the hydraulic cross auger drive unload rate is rated at approximately 2.6-2.8 bu./second. This is a peak flow rate.

Following are some additional guide lines on troubleshooting the unloading rate:

- Verify the cross auger sprockets:

Function	Front Auger	Rear Auger
Cross Auger Sprockets	38T	38T

- Verify unload rate using a scale wagon in a measured time span. The weighing needs to be accurate; 2.4 bu/sec verses 2.6 bu/sec is the difference between falling short and meeting expectation of the current system.



IMPORTANT The measured time must NOT include the start-up and shut-down. The measured time should only include the system at peak flow rate.

UNLOADING SYSTEM OPERATION

MECHANICAL / HYDRAULIC DRIVEN SYSTEM

HOW TO ADJUST AUGER COVERS

The operator should start by:

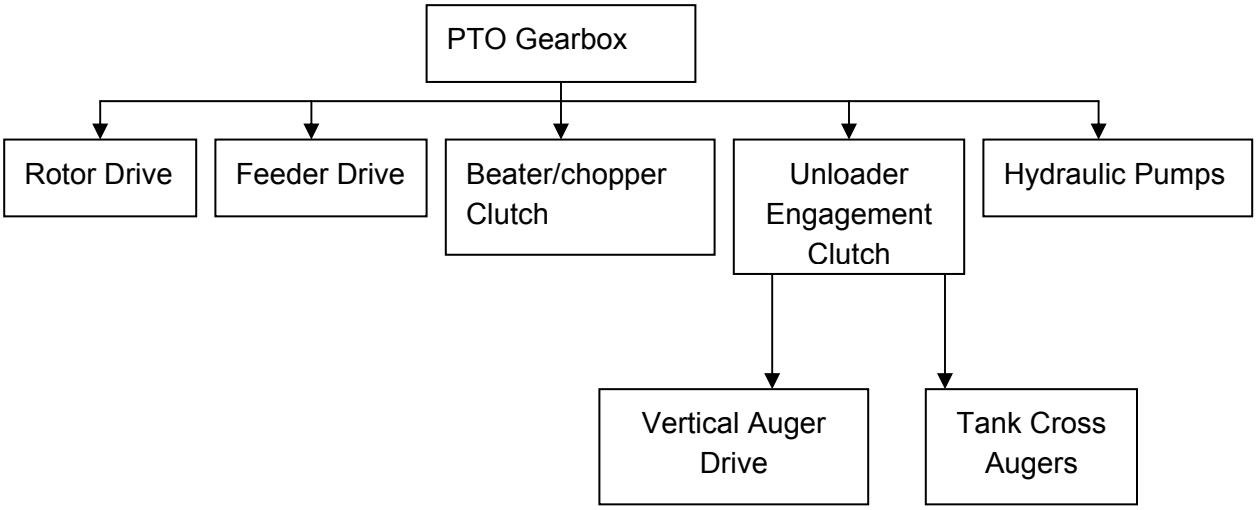
1. Verify that the cab display software will display the PFC pump pressure sensor. To make this check navigate by pressing the: BACK>COMBINE INFO>HYDRAULIC and look for “PFC PUMP PRESSURE” read out. The display unit will require software version 21.6 or higher, this can be verified by navigating BACK>DIAGNOSTIC>VERSION. Also the CCM2 software will need to be 32.9.6 or higher, this can be verified by navigating BACK >DIAGNOSTIC>CAN.
2. Raise the front and rear auger covers to the third set of holes (3L and 3R) from the bottom, this would be for left and right hand ends.
3. Harvest a half tank of grain, only a half tank the first time to verify the auger operation.
4. Unload the tank while STATIONARY. Monitor the required drive pressure. The purpose for unloading while stationary is to assure no other circuit is controlling the PFC pump.
5. Repeat step 4 with a full tank of grain.

With the drive pressure reading, the operator may start to make adjustments to the auger covers. The system should remain at approximately 2500 PSI. If the pressure is low the covers could be raised, increasing the unloading rate. If the pressure is high the covers should be lowered, decreasing the unloading rate.

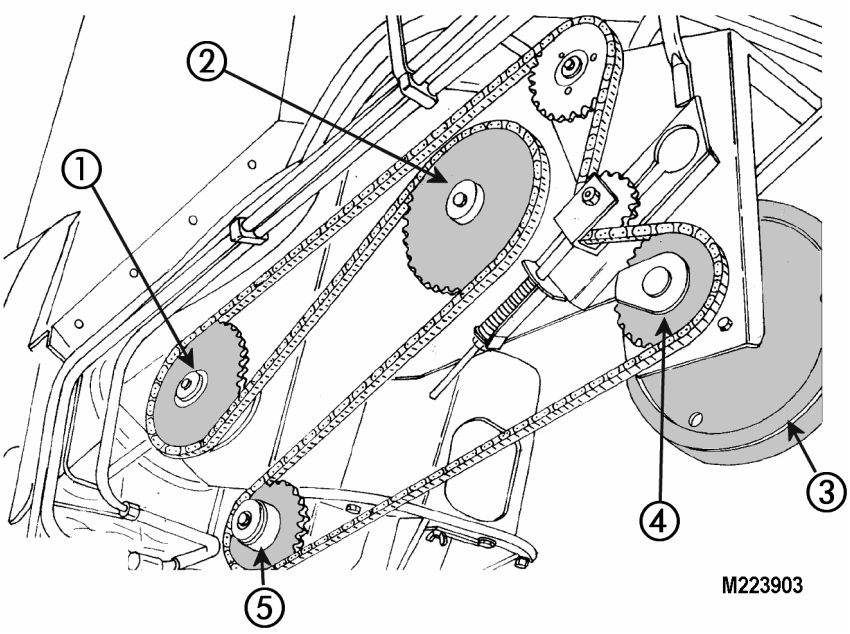


IMPORTANT Unload rate is proportional to the output of the PFC pump. Remember that the Low Pressure Standby and High Pressure Standby MUST be correct.

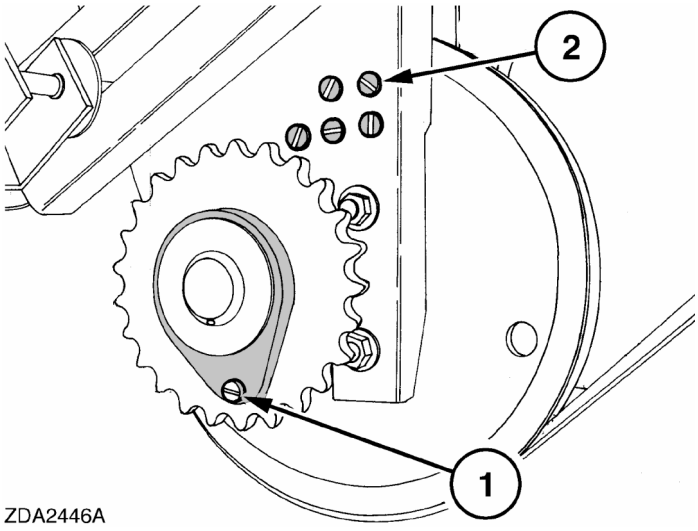
SYSTEMS MECHANICAL POWER FLOW



SYSTEMS MECHANICAL POWER FLOW



1.	Front Tank Cross Auger	4.	Drive Sprocket and Shear Bolt
2.	Rear Tank Cross Auger	5.	Vertical Auger Drive
3.	Driven Pulley		

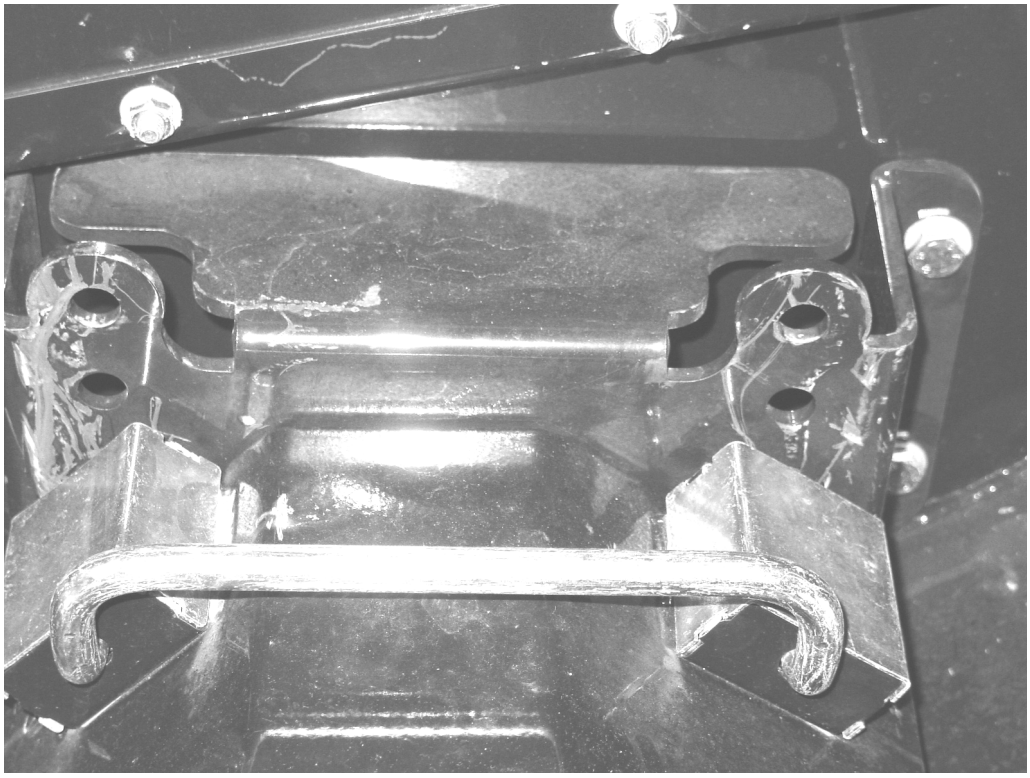


1.	Shear Bolt
2.	Spare Shear Bolts

IMPORTANT: always shut off the engine before replacing the sheer bolt.

The unloading system is driven from the Unloader Clutch, which is located in the PTO gearbox. From the clutch the power is transmitted by a double V-Belt to the driven pulley (3), where the power is transferred to the chain driver sprocket and shear bolt. The chain is used to drive the two grain tank cross augers, the vertical and horizontal auger drive gearbox.

SYSTEMS MECHANICAL POWER FLOW

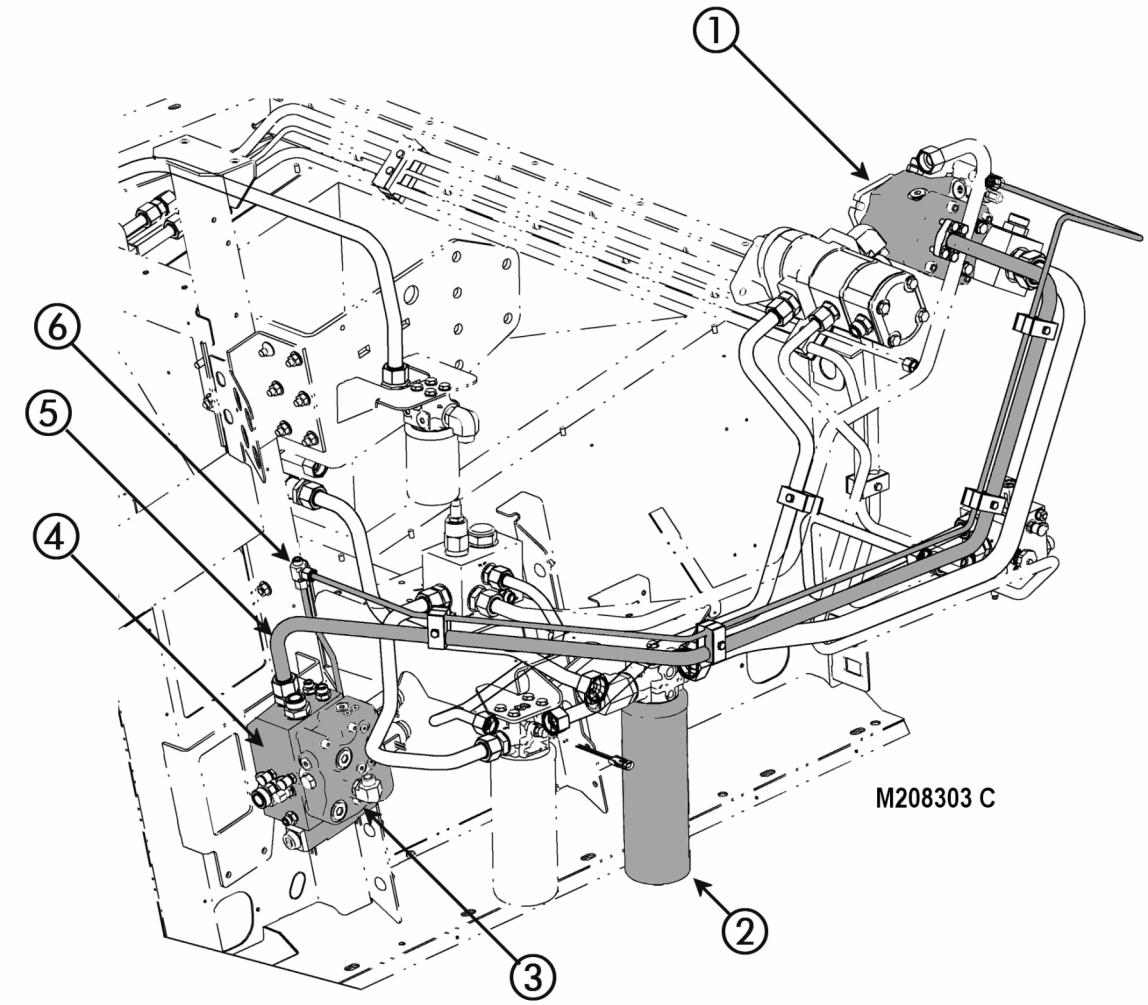


With the variety of different crops that may be harvested with the Axial-Flow combine it may require adjusting the vertical auger's intake volume to limit the load on the system. The two tank cross augers cover may be raised to increase the grain volume being feed to the vertical auger or lowered to limit the volume. Normally the wetter or heavier the grain the more it should be restricted. When experiencing shear bolt problems lower the covers to restrict the grain flow.

REMEMBER: To prevent binding of the cover during adjustments, only move the cover one hole at a time. If one end is moved two or more holes the opposite end may be put in a bind.

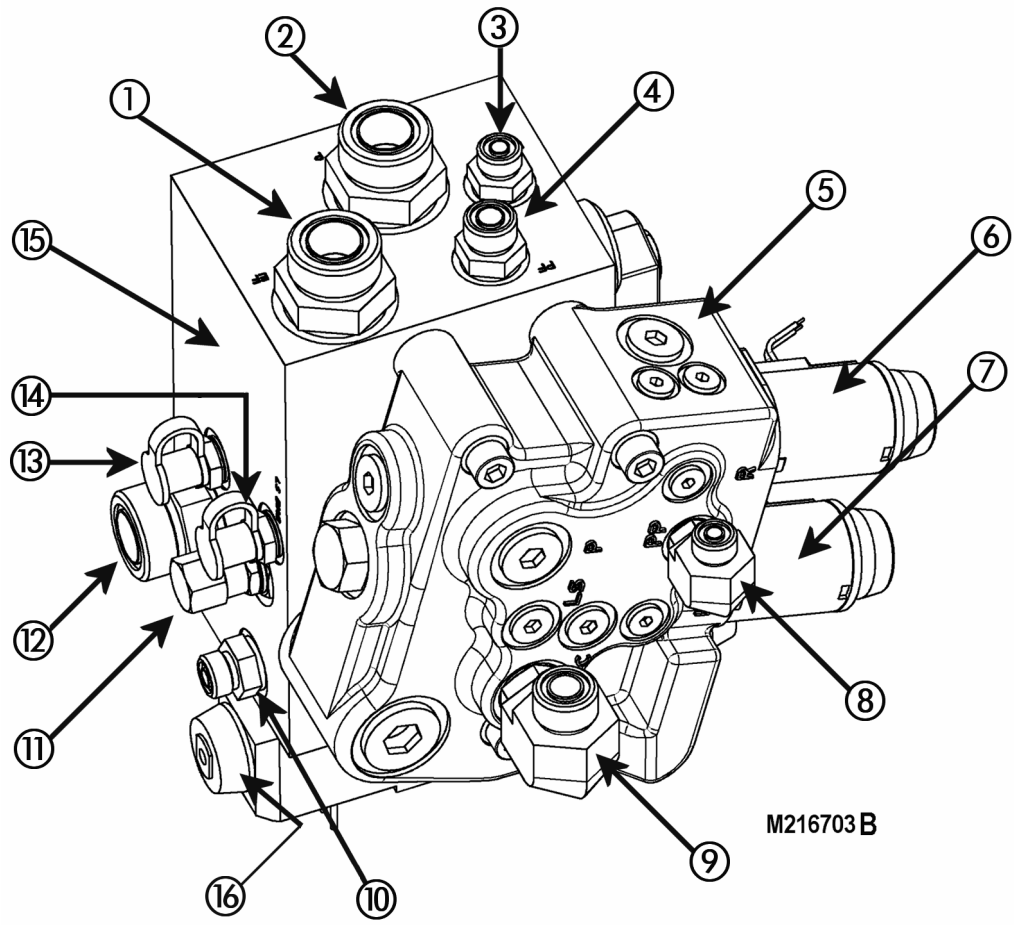
REMEMBER: When a machine is equipped with the hydraulic cross auger drive, the cover settings will be determined by monitoring the hydraulic drive motor pressure on the cab display.

HYDRAULIC COMPONENTS



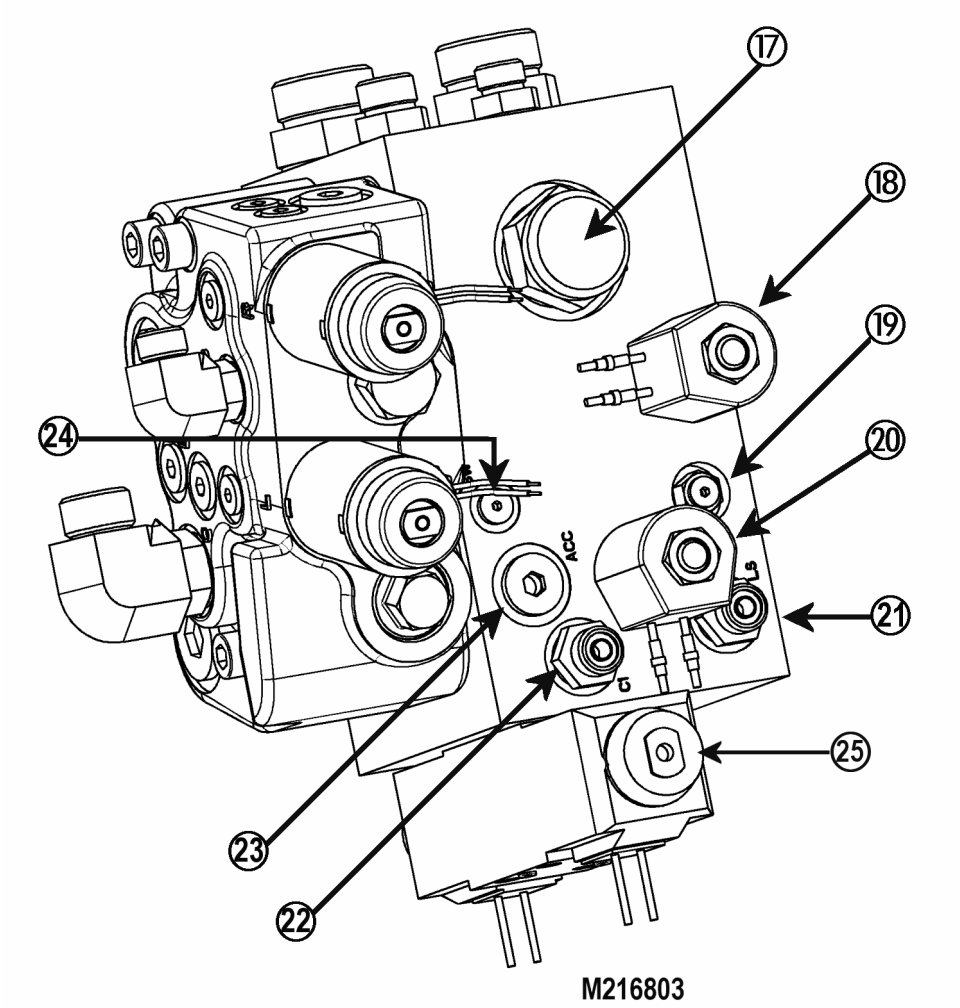
1.	PFC Pump and Compensator	4.	Main Valve Manifold
2.	Return Filter	5.	Main Supply
3.	Header Lift Valve	6.	Signal Line to PFC Pump

MAIN VALVE



2.	From PFC Pump	13.	Pump Pressure Test Port
3.	From Steering Hand Pump Signal	14.	Signal Line Test Port
10.	Unloading Auger Retract	15.	Main Stack Manifold
12.	Tank Port	16.	Unloading Auger Extend Solenoid

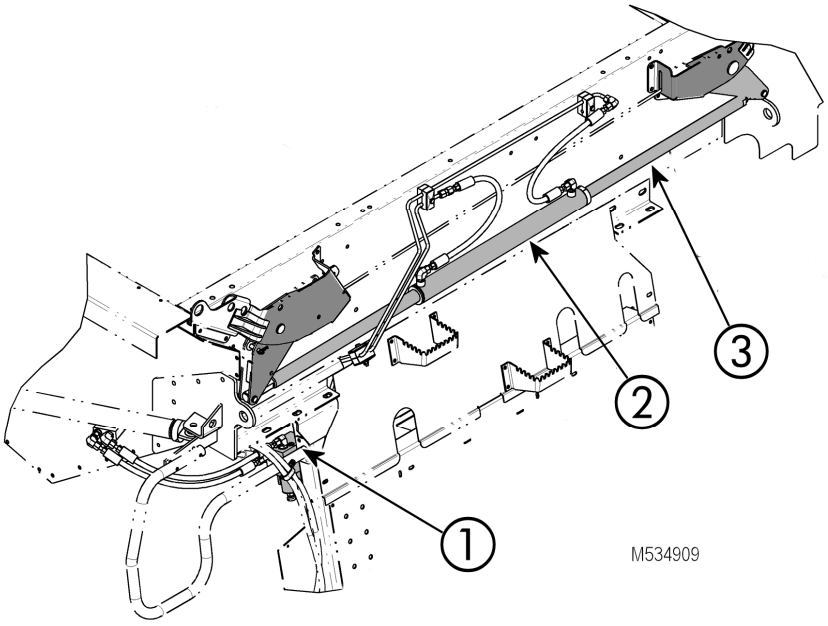
MAIN VALVE



18.	Signal Valve	22.	Unloading Auger Extend
19.	Check Valve and Bleed Orifice	25.	Unloading Auger Retract Solenoid
21.	Signal To PFC Compensator		

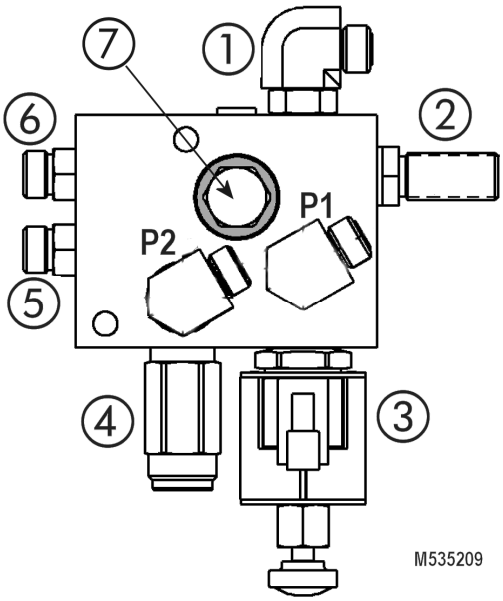
HYDRAULIC GRAIN TANK COVERS

COVER ACTUATING ASSEMBLY



1.	Cover Hydraulic Valve	3.	Ram End
2.	Cover Cylinder		

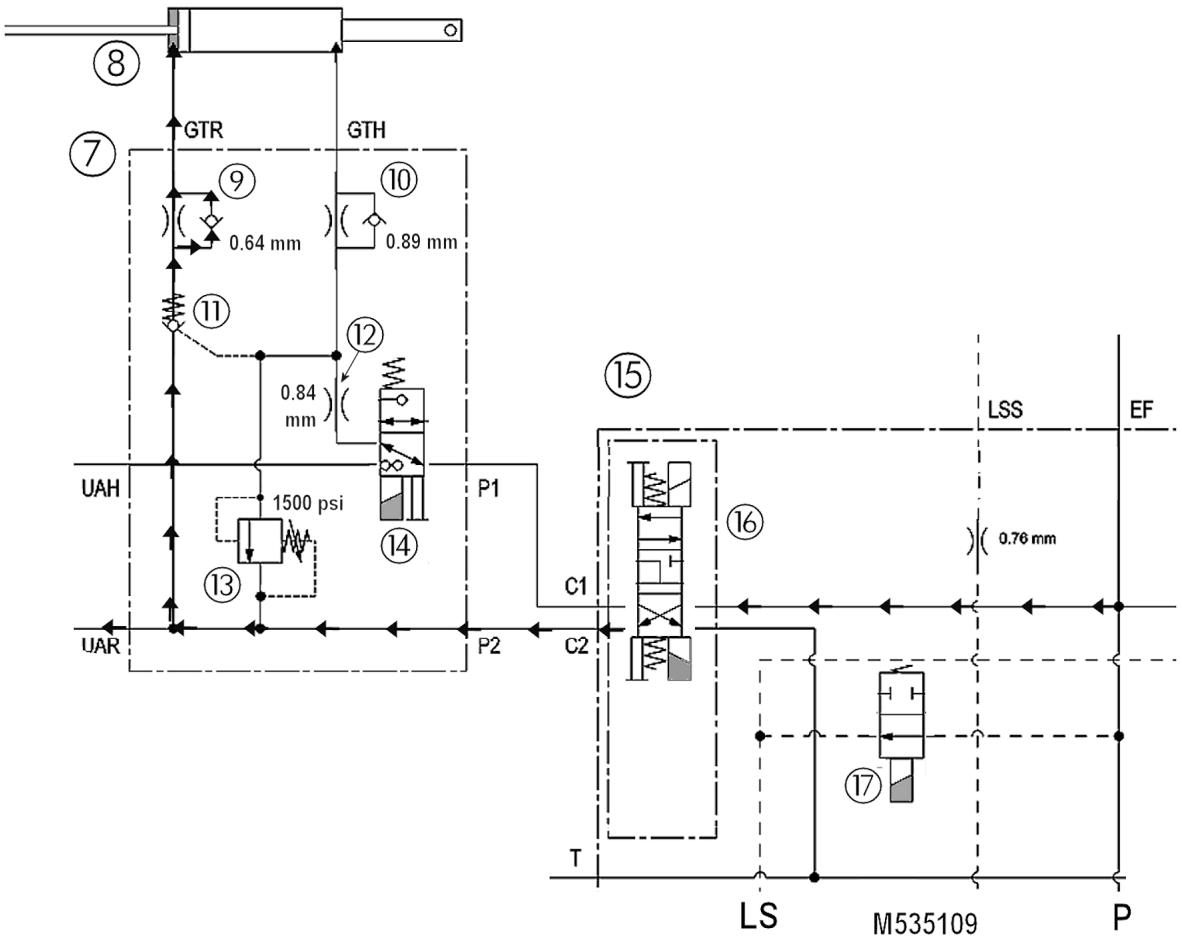
COVER VALVE



1.	Port ”UAH”, Auger Swing OUT Supply Port
2.	Port ”UAR”, Auger Swing IN Supply Port
3.	Cover Solenoid
4.	Cover ”CLOSING” Relief Valve
5.	Port ”GTH”, Base End & Orifice Plate (0.035”), Groove faces towards valve
6.	Port ”GTR”, Ram End & Orifice Plate (0.025”), Groove faces away from valve
7.	Pilot Operated Load Check Cartridge
P1	Cover ”OPEN” Supply Port
P2	Cover ”CLOSE” Supply Port

HYDRAULIC GRAIN TANK COVERS

COVERS OPEN



7.	Cover Valve	C1	Auger Cylinder Piston Port
8.	Cover Cylinder	C2	Auger Cylinder Rod Port
9.	One-Way Flow Control Orifice	LS	Signal Port To Compensator
10.	One-Way Flow Control Orifice	P	PFC Pump Supply
11.	Pilot Operated Load Check	P1	Supply Port to OPEN
12.	Flow Control Orifice	P2	Supply Port to CLOSE
13.	Cover Relief Valve	UAH	Pass Through Ports For Auger Swing
14.	Cover Solenoid	UAR	Pass Through Ports For Auger Swing
15.	Main Valve	T	Tank Return
16.	Auger Swing Valve		
17.	Signal Valve		

HYDRAULIC GRAIN TANK COVERS

COVERS OPEN

REFERENCE MATERIAL:

General Hydraulic Section for “PFC Pump Operation”
Hydraulic Schematics

KEY COMPONENTS:

Grain Tank Cover Valve, Auger Swing Valve & Signal Valve

OPERATION

The grain tank cover operation diverts the normal fluid flow away from the auger swing circuit and directs it to the cover cylinder. The valve solenoid (14) incorporates a manual override for troubleshooting purposes.

IMPORTANT: The normal auger swing circuit must be operational for the grain tank cover circuit to operate.

OPERATION

When the cover control switch is pressed to the OPEN position there will be three solenoids activated.

Signal Valve, “ACTIVATED”

The signal valve (17) will be activated in order to create a signal to the PFC pump, placing it at high-pressure stand-by. This action will provide the auger swing valve (16) with high pressure fluid.

Auger Swing Valve, “IN”

The auger IN solenoid (16) will be activated, forcing the spool to move UP, in order to direct fluid to the cover valve (7). Fluid will be directed out port “C2” to “P2”. The fluid will also be free to flow out port “UAR” to the swing cylinder. The auger will not move due to the return port “UAH” for the auger cylinder being blocked by the cover valve solenoid (14).

HYDRAULIC GRAIN TANK COVERS

COVERS OPEN, CON'T

Cover Valve, "OPEN"

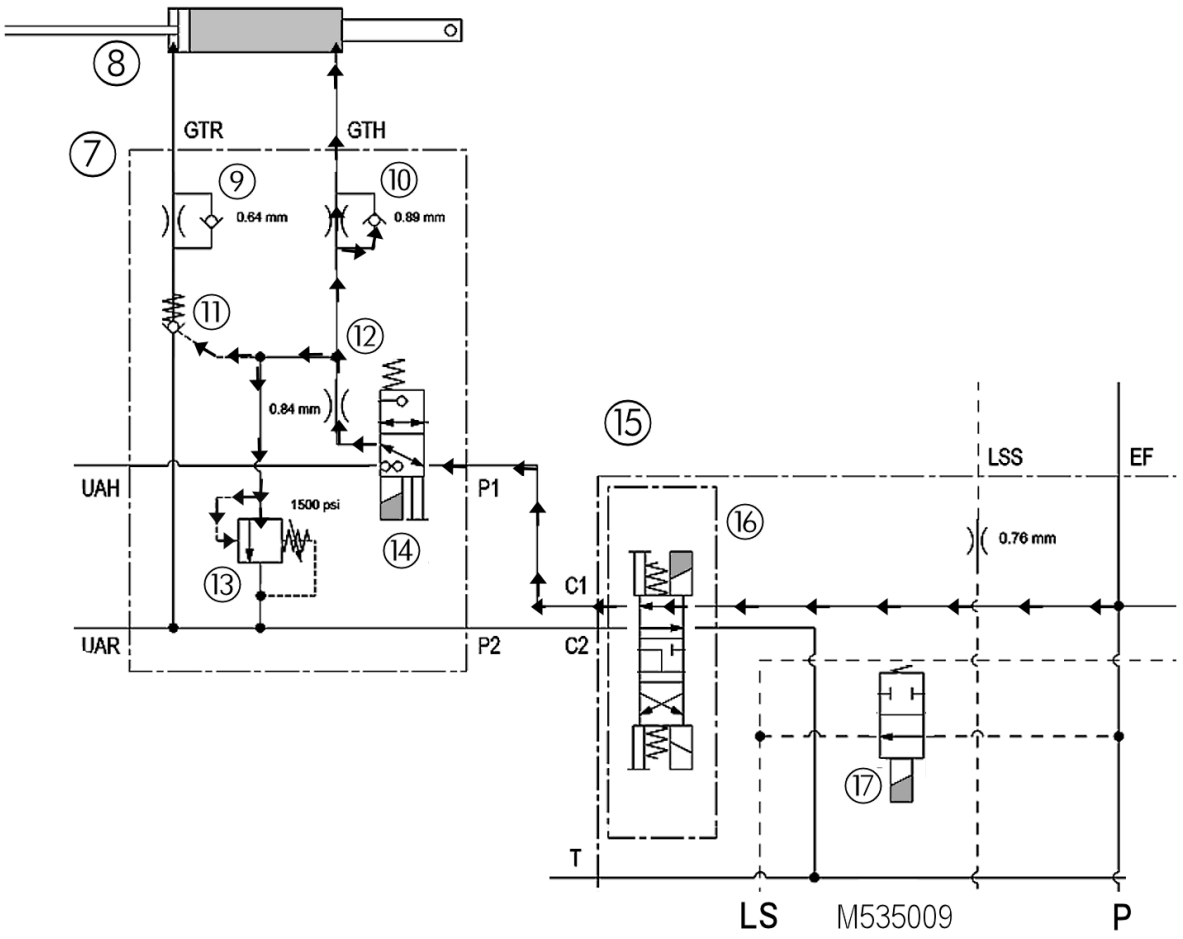
The cover solenoid will be activated, forcing the spool to move UP, connecting port "P1" with the base end of the cylinder port "GTH".

The fluid that is supplied at port "P2" is directed to the pilot operated load check (11) forcing it OFF it seat. The fluid continues to the one way flow control orifice (9), forcing it OFF is seat; the orifice provides no restriction in this direction. The fluid flows out port "GTR" to the ram end of the cylinder, causing it to retract and opening the covers.

The return flow from the cover cylinder will enter the valve at port "GTH". The fluid continues to the one way flow control orifice (10), forcing it OFF is seat, the orifice provides no restriction in this direction. The fluid continues to the fixed flow control orifice (12) which may limit the return flow due to the large displacement of the base end of the cylinder verses the ram end; but its main function would be to limit the amount of fluid returning from the cylinder when the covers go over center; which due to the weight of the covers could cause the cylinder to cavitate; allowing the covers to OPEN very quickly.

HYDRAULIC GRAIN TANK COVERS

COVERS CLOSE



7.	Cover Valve	C1	Auger Cylinder Piston Port
8.	Cover Cylinder	C2	Auger Cylinder Rod Port
9.	One-Way Flow Control Orifice	LS	Signal Port To Compensator
10.	One-Way Flow Control Orifice	P	PFC Pump Supply
11.	Pilot Operated Load Check	P1	Supply Port to OPEN
12.	Flow Control Orifice	P2	Supply Port to CLOSE
13.	Cover Relief Valve	UAH	Pass Through Ports For Auger Swing
14.	Cover Solenoid	UAR	Pass Through Ports For Auger Swing
15.	Main Valve	T	Tank Return
16.	Auger Swing Valve		
17.	Signal Valve		

HYDRAULIC GRAIN TANK COVERS

COVERS CLOSE

OPERATION

When the cover control switch is pressed to the CLOSE position there will be three solenoids activated.

Signal Valve, "ACTIVATED"

The signal valve (17) will be activated in order to create a signal to the PFC pump, placing it at high-pressure stand-by. This action will provide the auger swing valve (16) with high pressure fluid.

Auger Swing Valve, "OUT"

The auger OUT solenoid (16) will be activated, forcing the spool to move DOWN, in order to direct fluid to the cover valve (7). Fluid will be directed out port "C1" to "P1". The auger will not move due to the cover spool (14) blocking the flow to the auger swing cylinder port "UAH"

Cover Valve, "CLOSE"

The cover solenoid will be activated, forcing the spool to move DOWN, connecting port "P1" with the base end of the cylinder port "GTH".

The fluid that is supplied at port "P1" is directed through the flow control orifice (12). The fluid will be directed to accomplish three tasks:

Flows through a pilot line to the circuit pressure relief valve (13), which is set at 1500 psi. The relief will limit the closing force, protecting the bubble-up auger and covers from damage. Since the relief is after the flow control orifice there will be very little fluid that will need to flow through it if and when it opens.

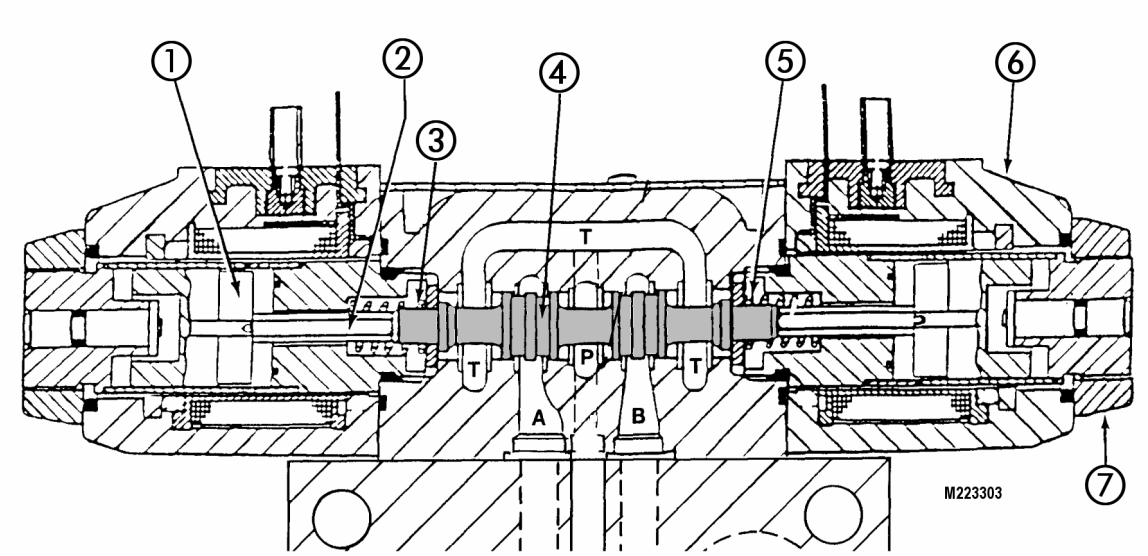
Flows through the pilot line to the pilot operated load check (11), forcing it off it seat. This will open the return path from the ram end of the cylinder.

Flows to one way flow control orifice (10) forcing it ON its seat, the flow will be forced through the orifice. Since this orifice is larger than orifice (12) is should have little effect on the operation. The flow will continue out port "GTH" to the base of the cover cylinder, forcing it to extent, closing the covers.

The return flow from the cover cylinder will enter the valve at port "GTR". The fluid continues to the one way flow control orifice (9), forcing it ON is seat. The orifice may limit the amount of fluid returning from the cylinder when the covers go over center; which due to the weight of the covers could cause the cylinder to cavitate allowing the covers to close very quickly.

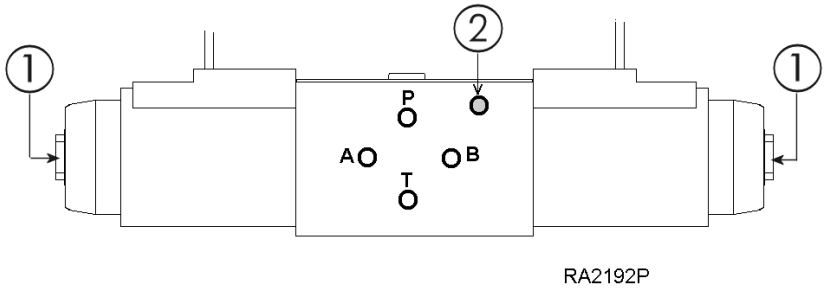
AUGER SWING VALVE

AUGER SWING VALVE



1.	Armaturer	5.	Centering Spring
2.	Pin	6.	Solenoid
3.	Center Spring	7.	Cab
4.	Spool		

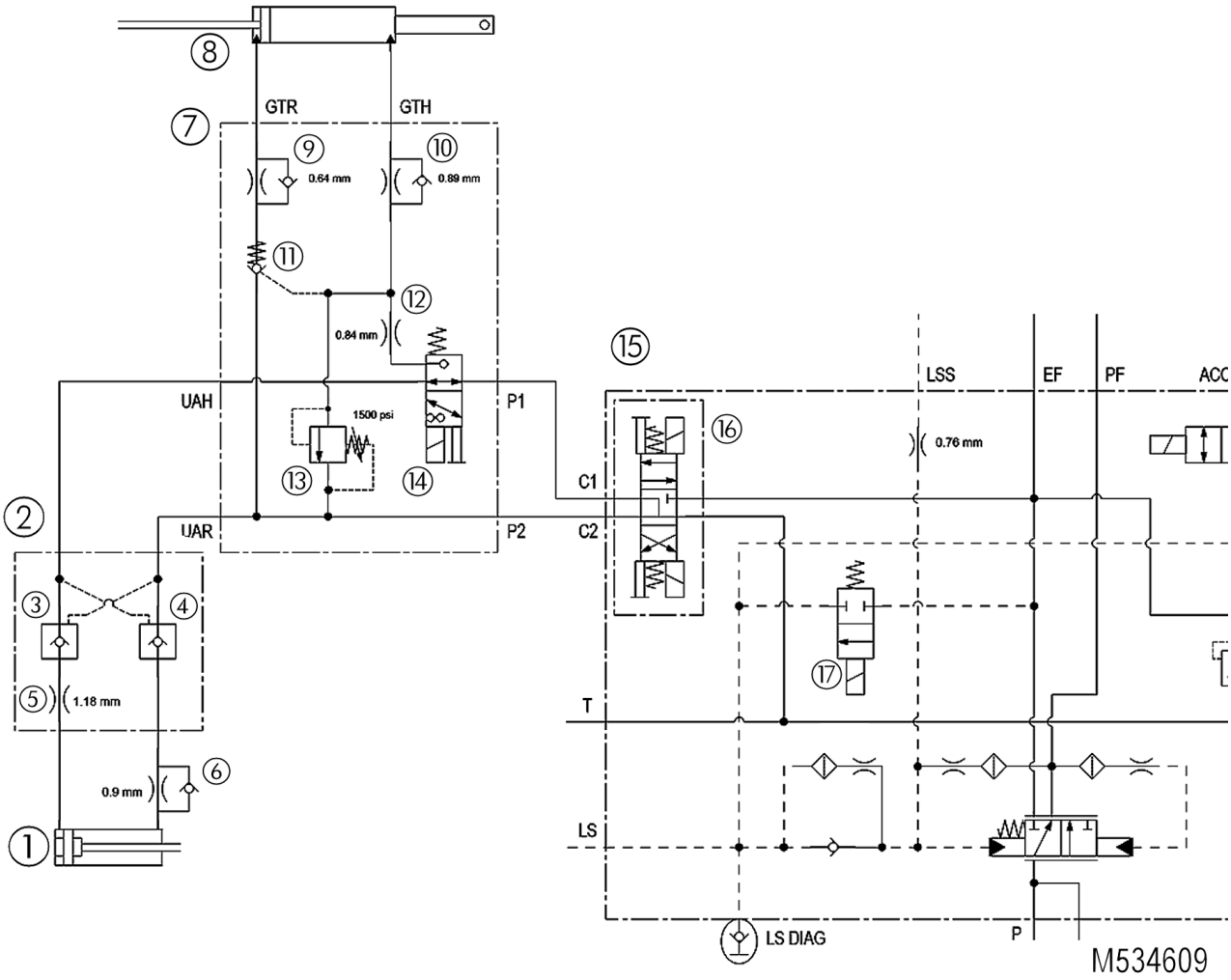
MOUNTING SURFACE ALIGNMENT DOWEL PIN



1.	Manual Override Pins	A	Work Port
2.	Alignment Dowel Pin	B	Work Port
		P	Supply From PFC
		T	Return to Tank

AUGER SWING VALVE

HYDRAULIC SCHEMATIC



1.	Auger Swing Cylinder	C1	Auger Cylinder Piston Port
2.	Load Check Valve Body	C2	Auger Cylinder Rod Port
3.	Pilot Operated Load Check	EF	Hydraulic To Feeder Valve
4.	Pilot Operated Load Check	LS	Signal Port To Compensator
5.	Flow Control Orifice	LSS	Steering Signal Port
6.	Floating Flow Control Orifice	P	PFC Pump Supply
15.	Main Valve	T	Tank Return
16.	Auger Swing Valve		
17.	Signal Valve		

Optional Grain Tank Cover

7	Optional Grain Tank Cover Valve	P2	Grain Tank Cover Cylinder Rod Port
P1	Grain Tank Cover Cylinder Piston Port	UAH	Auger Cylinder Piston Port
		UAR	Auger Cylinder Rod Port

AUGER SWING VALVE

AUGER SWING VALVE OPERATIONS

REFERENCE MATERIAL:

General Hydraulic Section for “PFC Pump Operation”
Hydraulic Schematics

KEY COMPONENTS:

Auger Swing valve & Signal Valve

OPERATION

The unloading auger swing valve (16) contains two solenoids and a spring-centered spool. This valve uses direct acting solenoids to shift a spring-centered spool to control the direction of oil flow, and incorporates manual overrides for troubleshooting purposes.

The Signal Valve (17) will be used to control the operation of the PFC pump.

NEUTRAL

When in neutral, the springs on each end of the control spool will center the spool in the auger swing valve (16). This blocks the flow from the supply passage “P” and directs both work ports “C1 & C2” to the tank port “T”. Oil is trapped in the cylinder by the pilot-operated check valves (3 & 4). The pilot-operated check valves are used to prevent the unloading auger from drifting during combine operation.

AUGER SWING VALVE

AUGER SWING VALVE OPERATIONS, CON'T

UNLOADING AUGER EXTEND

The signal valve (17) and auger extend solenoids (16) must be energized to extend the unloading auger. A switch located on the Multi-Function handle is used to energize the solenoids.

Signal Valve

When the switch is moved into the extend position the signal valve solenoid is energized, connecting the pump supply pressure line "P" with the signal line "LS". The pressure in the signal line is directed to the compensator to tell the PFC pump to tilt the swash plate, to create flow and placing the pump on high-pressure stand-by.

Swing Valve

The auger swing solenoid is activated, pushing the spool DOWN. The spool will direct the PFC pump flow out port "C1" to the load check valve block (2). ***See cylinder operations later.***

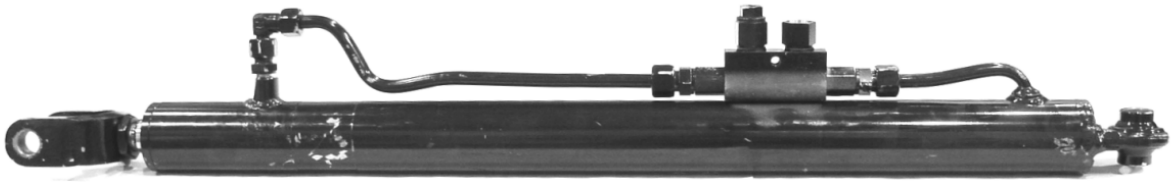
REMEMBER: If the machine is equipped with the optional grain tank covers, the cover valve (7) will act as a pass through valve for ports "P1 & UAH" and "P2 & UAR".

UNLOADING AUGER RETRACT

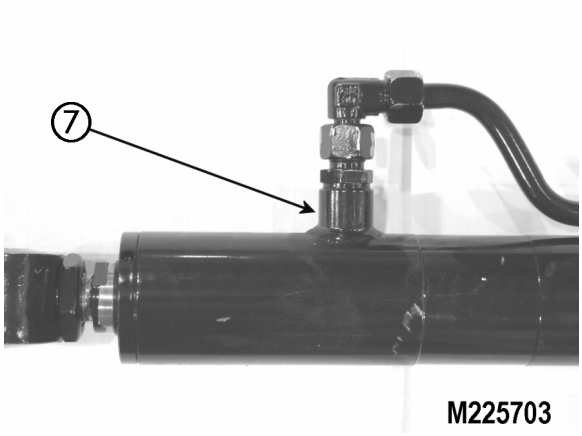
To retract the unloading auger the signal valve and auger retract solenoids must be energized. A switch located on the Multi-Function handle is used to energize the solenoid. When the auger is retracted, the valve will function the same as when in the extend position; the only difference is that the spool (16) will shift in the opposite direction.

AUGER SWING CYLINDER

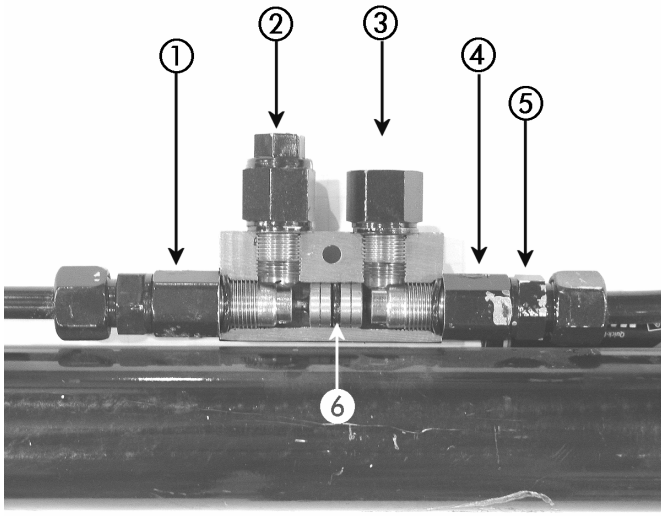
CYLINDER AND LOAD CHECKS



M225903



M225703



M225803 A



M226003

1.	Ram End Load Check	6.	Unloading Piston
2.	Ram End Supply	7.	One-Way Floating Orifice
3.	Base End Supply	9.	Retract Deceleration Orifice
4.	Base End Load Check	10.	Extend Deceleration Orifice
5	Base End Orifice		

AUGER SWING CYLINDER

HYDRAULIC - AUGER CYLINDER OPERATIONS

REFERENCE MATERIAL:

Auger Swing Valve Operation"
Hydraulic Schematics

KEY COMPONENTS:

Swing Cylinder, Load Check Block, Orifices

AUGER SWING VALVE IN NEUTRAL

The cylinder is held at the desired location by two load checks (1 and 4) located at the cylinder in the load check block. The load checks prevent any uncommanded auger drifting **IN** or **OUT**. Both check valves are ported back to the tank port "T" through the swing valve.

AUGER SWING CYLINDER EXTENDING (OUT)

The flow into the load check valve block port (3) will wash the load check (4) open and the pilot piston (6) will force check (1) open so that oil can flow to and from the swing cylinder. The oil flows out of the load check block, through a 1.18mm (0.046") orifice (5) to the base end of the swing cylinder. In the extend position, the unloading auger will extend at a slow rate of speed for the first portion of the swing. Then as the piston moves past the internal orifice (9) on the base end, the unloading auger will speed-up. As the cylinder is extended the return oil from the ram end of the cylinder is directed out through a 0.9 mm (0.035") speed control orifice (7). Since the orifice at port (7) is smaller then port (5) the speed is controlled by the orifice (7).

As the unloading auger reaches the end of its travel, the piston will move past the outlet port, forcing the return oil to pass through the deceleration orifice (10).

AUGER SWING CYLINDER

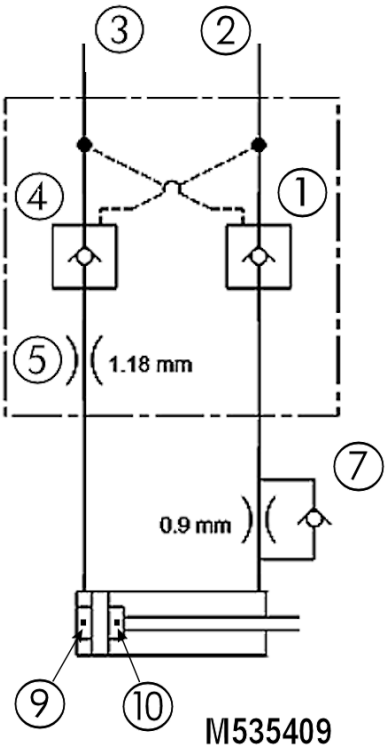
HYDRAULIC - AUGER CYLINDER OPERATIONS, CON'T

AUGER SWING CYLINDER RETRACT

In the retract position, the unloading auger will return at a slow rate of speed for the first portion of the swing. Then as the piston moves past the internal orifice (10) on the rod-end, the unloading auger will speed-up. The flow into the load check valve block port (2) will wash the load check (1) open and through a pilot line the unloading piston (6) will force check (4) open so that oil can flow to and from the swing cylinder. The oil flows out of the load check block, through a one-way floating orificed check valve (7) to the ram end of the swing cylinder. As the cylinder is retracted the return oil from the piston end of the cylinder is directed through a 1.18mm (0.045") speed control orifice (5).

As the unloading auger reaches the end of its travel, the piston will move past the outlet port, forcing the return oil to pass through the deceleration orifice (9).

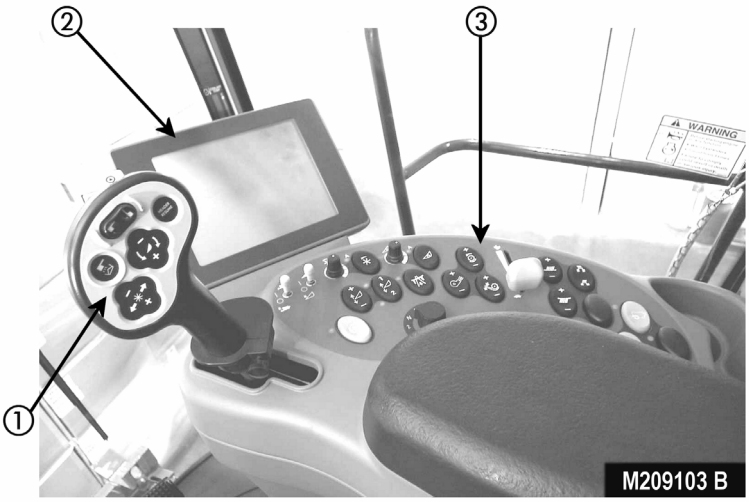
CYLINDER SCHEMATIC



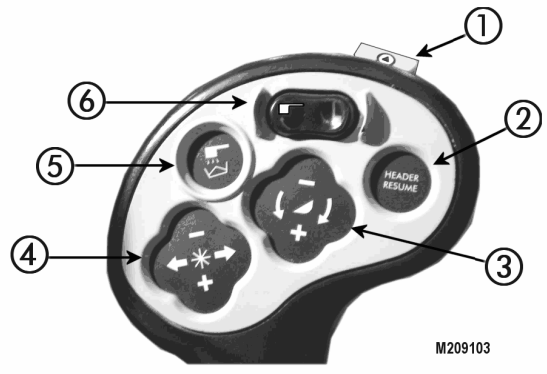
1.	Ram End Load Check, "IN"
2.	Retract Supply Port
3.	Extend Supply Port
4.	Base End Load Check, "OUT"
5.	Base End Orifice
7.	One-Way Floating Orifice
9.	Retract Deceleration Orifice
10.	Extend Deceleration Orifice

REMEMBER: The swing cylinder was changed at pin Y9G206710 to provide a larger piston area on the ram side, providing more power to seat the unloading tube in the saddle. The cylinder may be measured to identify them, the previous cylinder has a barrel OD of 62 mm and the new cylinder is 70 mm.

OPERATOR'S CONTROLS



OPERATOR CONTROL CENTER	
1.	Mulit-Function Handle, MFH
2.	Integrated Cab Display Unit, ICDU
3.	Right Hand Console, RHC

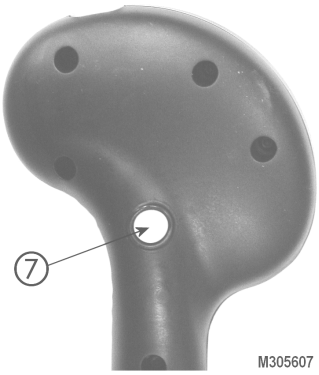


MULTI-FUNCTION HANDLE

1.	Emergency Stop Switch
2.	Resume
3.	Header Raise/Lower Tilt Right/Left
4.	Reel Raise/Lower, Fore/Aft
5.	Unloader Engagement
6.	Unloader Swing



RIGHT HAND CONSOLE (RHC)



2.	Road Mode Switch
7.	Shift Button, S-82

OPERATOR'S CONTROLS



1. Grain Tank Cover Switch

The grain handling system includes the control and monitoring of the grain tank covers, unloading auger clutch and unloading auger swing circuits. All the operations are controlled with:

Emergency Stop Switch, S-75

The emergency stop switch provides the operator ONE switch that may disengage multiple functions. When the switch is pressed the feeder house will be stopped, tank cover movement will be stopped and the unloading auger engagement will be disengaged.

Located: On the Multi-Function Handle.

Road Mode Switch, S-12

The road mode switch is used to prevent accidental engagement of certain field operations. When press to the **ON** position, the indicator lamp is lit, the auto header function will not work, the separator nor feeder will engaged, the grain tank covers will not open and the unloading auger will not swing out or engage. Certain field lamps will also be inoperable.

Located: In the Right Hand Console.

Separator Engagement Switch, S-30

The separator engagement switch is used to signal the RHM to activate the Rotor and Beater/Chopper drives. This also changes how the beacon lights functions during grain tank full indication.

Located: In the Right Hand Console.

Grain Tank Cover Switch, S-42

The operator uses the grain tank cover switch to OPEN or CLOSE the tank covers.

Located: In the overhead switch panel.

OPERATOR'S CONTROLS

Unloading Auger Swing Switch, S-72

The operator uses the unloading auger swing switch to control the position of the unloading auger, for transferring grain or storage. Its operation may be influenced by the auger engagement and road mode switch.

Located: In the Multi-Function Handle.

Unloading Auger Engagement Switch, S-73

The operator uses the unloading auger engagement switch to control the unloading auger clutch. Its operation may be influenced by the position of the auger and road mode switch.

Located: In the Multi-Function Handle.

Shift Switch, S-82

The operator uses the shift switch to change the functionality of the unloading engagement switch. Using the SHIFT+UNLOADING switch combination, the grain tank cross augers may be disengaged or reengaged.

Located: In the Multi-Function Handle.

CIRCUIT SENSORS

Grain Tank Cover Position Sensor, B-47

The grain tank sensor is used to activated the indicator on the display whenever the covers are **OPEN**.

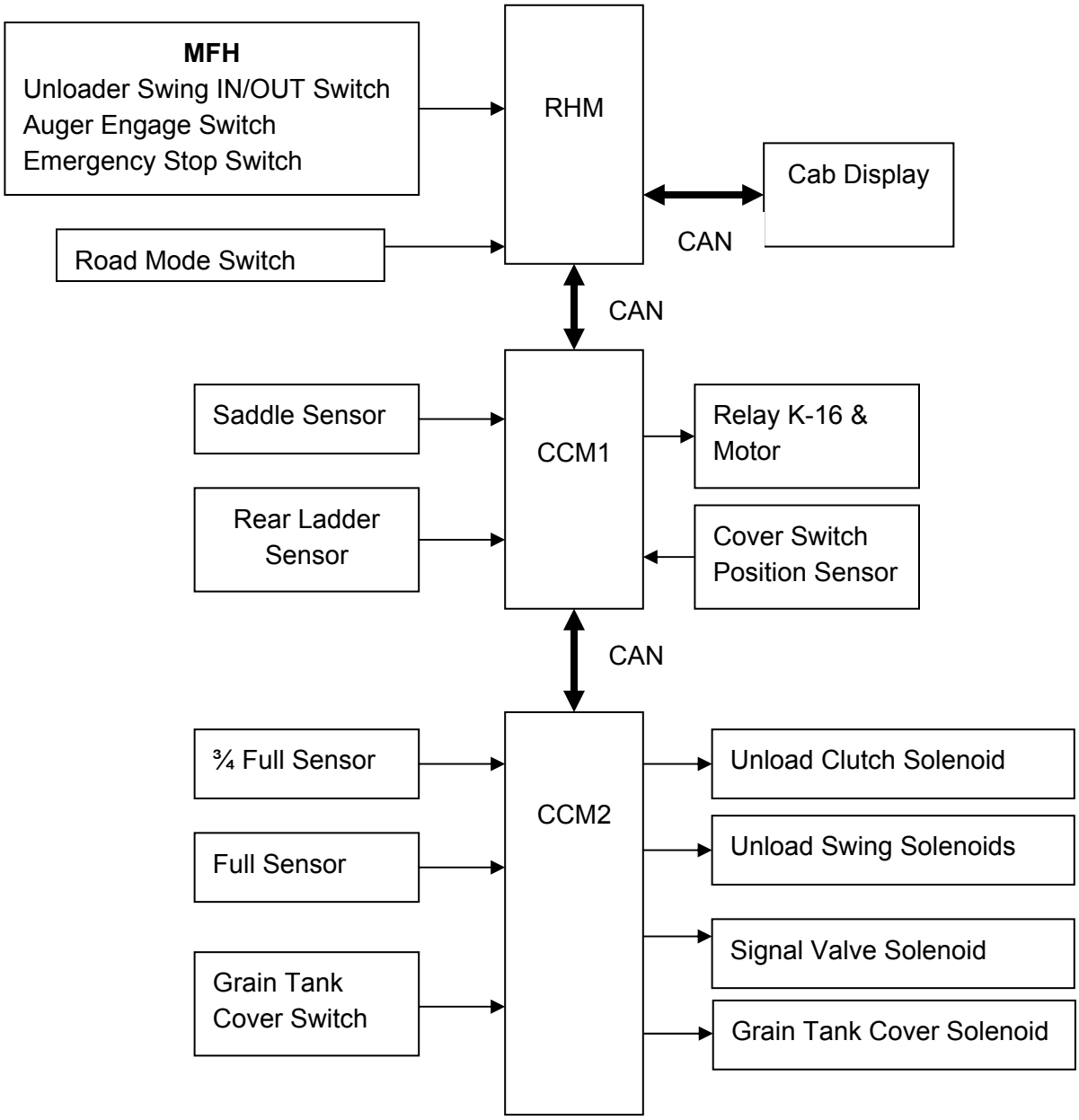
Located: Grain tank

Saddle Sensor, B-38

The saddle switch is used to determine when the unloading auger is IN / OUT of the saddle. The signal will disengage the auger swing valve once the auger has reached the extreme IN position and to permit the engagement of the unloading auger when OUT of the saddle. The saddle switch also effects the unloading tube work light. The unloading tube must be out of the saddle before the tube light MAY be activated.

Located: At the unloading auger saddle

ELECTRICAL FLOW CHART



ELECTRICAL OPERATION

GRAIN TANK COVERS, "ELECTRIC ACTUATOR"

REFERENCE MATERIAL

Electrical Frames: 17, 22

KEY COMPONENTS:

Grain Tank Cover Switch S-42, CCM1, CCM2, Relay K-16, Actuator Motor M-12, Tank Position Sensor B-47

OPERATION

The grain tank cover motor and concave position motor use the same pin outputs from the CCM1 controller. The system is defaulted to the cover motor operation by relay K-16.

OPENING

The cover switch S-42 is supplied 12V from fuse F-49 at connector X125 terminal 2. When the switch is detented to the OPEN position there is a connection from terminal 2 out terminal 3 to the CCM2 connector X015 terminal J1-03. This signals the CCM2 to place a message on the data bus for the CCM1 to power the cover actuator to OPEN the covers.

If the Road Mode switch is in the FIELD position the CCM1 will direct power that it receives from fuse F-24 at connector X019 terminal J2-11 out connector X019 terminal J2-21 to the cover/concave relay K-16 terminal 3. Relay K-16 is NOT activated so the power is directed out terminal 4 to the actuation motor M-12 connector X289 terminal A. The motor is provided a ground out terminal B back to the CCM1 connector X019 terminal J2-1. The motor will continue to run for 60 seconds OR until the amperage draw increases above 18 amps for 10 seconds.

The cover position sensor B-47 terminal 2 is supplied 8V from CCM1 connector X020 terminal J3-38 and a ground return from terminal 1 to the CCM1 connector X019 terminal J2-14. When the sensor is moved away from metal the voltage at the CCM1 terminal J3-38 will change (greater then 5.6V) to provide a signal. The CCM1 will place a message on the data bus for the display to activate the indicator when the separator is NOT engaged.

ELECTRICAL OPERATION

GRAIN TANK COVERS, CON'T

CLOSING

When the switch is detented to the **CLOSED** position there is an open connection terminal 2 out terminal 3. The lack of a voltage signal to the CCM2 connector X015 terminal J1-03 signals the CCM2 to place a message on the data bus for the CCM1 to power the cover actuator to CLOSE the covers.

The CCM1 will direct power that it receives from fuse F-24 at connector X019 terminal J2-11 out connector X019 terminal J2-1 to the motor terminal B. The CCM1 will provide a ground from terminal J2-21 to the cover/concave relay K-16 terminal 3. Relay K-18 is NOT activated so the ground is directed out terminal 4 to the actuation motor M-12 connector X289 terminal A. The motor will continue to run for 60 seconds OR until the amperage draw increases above 18 amps for 10 seconds.

The cover position sensor B-47 terminal 2 is supplied 8V from CCM1 connector X020 terminal J3-38 and a ground return from terminal 1 to the CCM1 connector X019 terminal J2-14. When the sensor is moved close to metal the voltage at the CCM1 terminal J3-38 will change (less then 5.6V) to provide a signal. The CCM1 will place a message on the data bus for the display to de-activate the indicator lamp when the separator is NOT engaged.

ELECTRICAL OPERATION

GRAIN TANK COVERS, "HYDRAULIC CYLINDER"

REFERENCE MATERIAL

Electrical Frames: 17, 22

KEY COMPONENTS:

Grain Tank Cover Switch S-42, CCM1, CCM2, Relay K-16, Cover Closed Sensor B-47, Signal Valve L-43, Cover Valve Solenoid L-77, Auger Swing Solenoids L-03 & L-04.

OPERATION

The grain tank cover valve and concave position motor use the same pin outputs from the CCM1 controller. The system is defaulted to the cover valve operation by relay K-16.

The cover switch is only a two position switch; it will either be in the OPEN or CLOSE position.

Opening

RHM

The RHM will place a message on the data bus as to the system's mode of operation; "ROAD" or "HARVEST" mode. The RHM will also place a message on the data bus as to the status of the "EMERGENCE" switch.

CCM2

The CCM2 will place a message on the data bus as to the status of the cover switch. The cover switch S-42 is supplied 12V from fuse F-49 at connector X125 terminal 2. When the switch is detented to the OPEN position there is a connection from terminal 2 out terminal 3 to the CCM2 connector X015 terminal J1-03. When this signal is received the following series of events will take place:

- The CCM2 will place a message on the data bus to open the grain tank covers.
- If the system's mode is "HARVEST" mode, the CCM2 will direct power out connector X017 terminal J3-12 to the signal valve terminal 1 to activate the PFC pump. The solenoid is provided a chassis ground from terminal 8. This will place the PFC pump on high pressure standby.
- The CCM2 will direct power out connector X016 terminal J2-6 to the unloading auger swing IN solenoid terminal 2, this will direct pump flow out to the grain tank cover valve. The solenoid is provided a chassis ground from terminal 9.

ELECTRICAL OPERATION

GRAIN TANK COVERS, CON'T

OPENING, con't

CCM1

- CCM1 will direct power that it receives from fuse F-24 at connector X019 terminal J2-11 out connector X019 terminal J2-21 to the cover/concave relay K-16 terminal 3. Relay K-16 is NOT activated so the power is directed out terminal 4 to the cover solenoid L-77 terminal 1. The solenoid is provided a return out terminal 2 back to the CCM1 connector X019 terminal J2-1. This will divert the pump flow from the unloading auger swing circuit to the grain tank circuit.

The grain tank cover circuit will be power until one of two conditions are met:

1. The system will remain power for approximately 35 seconds, there is NO position sensor. At the end of this period the solenoids will be deactivated, putting the system back to NEUTRAL.
2. The system will remain power unless the EMERGENCE switch is pressed. The covers will stop and remain at the current position. The cover switch would need to be cycled to regain operation.

If the separator is not engaged, a grain tank cover OPEN indicator will be activated. This would be activated from the cover CLOSED sensor.

REMEMBER: The cover valve solenoid L-77 is always activated 0.2 seconds before the auger swing circuit.

ELECTRICAL OPERATION

GRAIN TANK COVERS, CON'T

Closing

CCM2

The CCM2 will place a message on the data bus as to the status of the cover switch. The cover switch S-42 is supplied 12V from fuse F-49 at connector X125 terminal 2. When the switch is detented to the CLOSED position there is NO connection (open circuit) from terminal 2 out terminal 3. Since there is NO signal to the CCM2 connector X015 terminal J1-03, the controller will place a message on the data bus to close the covers. When this signal is received the following series of events will take place:

- If the system's mode is "HARVEST" mode, the CCM2 will direct power out connector X017 terminal J3-12 to the signal valve terminal 1 to activate the PFC pump. The solenoid is provided a chassis ground from terminal 8. This will place the PFC pump on high pressure standby.
- The CCM2 will direct power out connector X016 terminal J2-16 to the unloading auger swing OUT solenoid terminal 3, this will direct pump flow out to the grain tank cover valve. The solenoid is provided a chassis ground from terminal 10.

CCM1

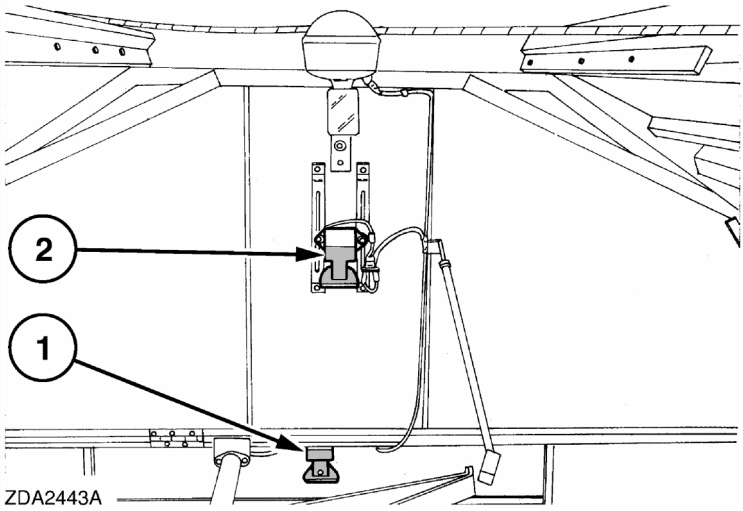
- CCM1 will direct power that it receives from fuse F-24 at connector X019 terminal J2-11 out connector X019 terminal J2-21 to the cover/concave relay K-16 terminal 3. Relay K-16 is NOT activated so the power is directed out terminal 4 to the cover solenoid L-77 terminal 1. The solenoid is provided a return out terminal 2 back to the CCM1 connector X019 terminal J2-1. This will divert the pump flow from the unloading auger swing circuit to the grain tank circuit.

The grain tank cover circuit will be power until one of three conditions are met:

1. The system will remain power until the cover CLOSED sensor is activated, putting the system back to NEUTRAL.
2. If the sensor should fail or the covers move to slowly, the system will remain power for approximately 35 seconds. At the end of this period the solenoids will be deactivated, putting the system back to NEUTRAL.
3. The system will remain power unless the EMERGENCE switch is pressed. The covers will stop and remain at the current position. The cover switch would need to be cycled to regain operation.

ELECTRICAL OPERATION

GRAIN TANK LEVEL SENSORS



REFERENCE MATERIAL

Electrical Frames: 22, 27

KEY COMPONENTS:

¾ Full Switch S-28, Full Switch S-29, (both switches are identical) CCM2

OPERATION

The two switches are connected in series, so the resistance through the circuit increases as each switch is activated. The CCM2 is monitoring the signal voltage, which varies with the increase or decrease of resistance. With an empty grain tank both switches are in their N/C position, providing the least amount of resistance between the supply voltage and the return to ground, hence the signal voltage will be low.

GRAIN TANK EMPTY

The circuit is supplied with a 5V power supply from the CCM2 connector X016 J2-31 to the ¾ FULL switch terminal A. The power is directed through a 250 ohm resistor to the return terminal B. The signal wire terminal C is monitoring the voltage after the resistor back to the CCM2 connector X016 terminal J2-22. The return from the ¾ FULL switch is directed to the B terminal of the FULL switch, where it pass through a 250 ohm resistor and out terminal A back to the CCM2 connector X016 terminal J2-14 for a ground. Terminal C on the FULL switch is not used. As you can see the 5V supply is passing through 2-250 ohm resistors, one in each switch, and the signal wire is monitoring the voltage after the first one. The signal wire will have approximately 2.5V at this time.

ELECTRICAL OPERATION

GRAIN TANK LEVEL SENSORS, CON'T

GRAIN TANK ¾ FULL

When ONE of the switches is pressed, opens, the voltage is forced to flow through a SECOND resistor to terminal B. Due to the increased resistance between the signal wire and the return to the CCM2 the voltage will increase. The approximate voltage will be 3.3V, which the CCM2 see at connector X016 terminal J2-22 and places a message on the data bus for the display to illuminate the ¾ FULL symbol and to flash a ¾ full alarm for 4 seconds.

GRAIN TANK FULL

When BOTH of the switches are pressed, opens, the voltage is forced to flow through a SECOND resistor to terminal B in each switch. Due to the increased resistance between the signal wire and the return to the CCM2 the voltage will increase. The approximate voltage will be 3.7V, which the CCM2 see at connector X016 terminal J2-22 and places a message on the data bus to display the BIN FULL symbol and for the display to display a message sound alarm.

ALARM

The alarm may or may not be activated depending on the following conditions:

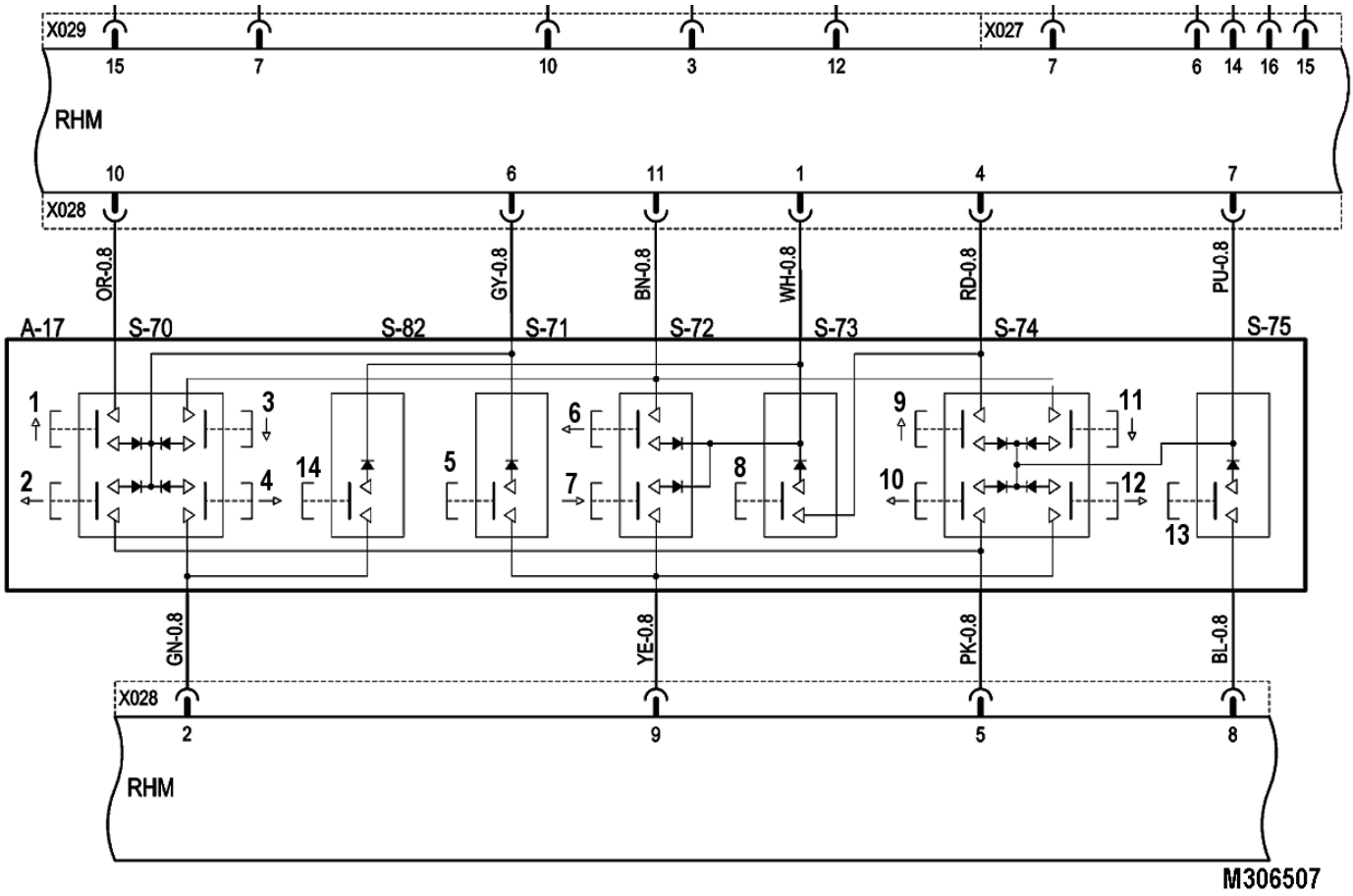
- If the separator switch is not in the ON position the alarm will NOT be activated, only the indicator will illuminate.
- ¾ full: If the separator switch is in ON position the indicator symbol will activated and an alarm tone.
- Full: If the separator and feeder switches are in the ON position, and traveling forward the indicator lamp will activate and an alarm.

GRAIN TANK SERVICE LAMP

The grain tank service lamp illuminates the grain tank so that the operator may note the progress of grain filling the tank and quality of the grain. This lamp is protected by a heat sensor so when it is submerged in the grain it will automatically turn OFF. Use the correct replacement lamp to prevent additional heat build up. A GE 892 bulb may be used to gain a little more wattage with out risk.

ELECTRICAL OPERATION

MULTI-FUNCTION HANDLE



Switch	Function
1	Header RAISE
2	Header Tilt LEFT
3	Header LOWER
4	Header Tilt RIGHT
5	Resume
6	Unloader Swing OUT
7	Unloader Swing IN

Switch	Function
8	Unloader Auger Clutch ON/OFF
9	Reel RAISE
10	Reel FORWARD
11	Reel LOWER
12	Reel AFT
13	Emergency STOP
14	Shift Button

ELECTRICAL OPERATION

ELECTRICAL - AUGER SWING OPERATION

REFERENCE MATERIAL:

Electrical schematic frames 22, 11, 26, 07
Electrical section for an in-depth explanation on the MFH handle.

KEY COMPONENTS:

Auger Swing Switch (S-72), CCM1, CCM2, Multi-Function Handle (MFH), Solenoid L-03 and L-04, Right Hand Module (RHM), Saddle Switch (B-38), Road Mode Switch (S-12), Signal Valve Solenoid (L-43).

SWING OUT

When the operator commands the unloading auger to swing **OUT** by momentarily pressing the Auger Swing Switch (S-72) located on the MFH the following events take place:

- The RHM is supplying power to the swing switch from connector X028 terminal 11 and 9 to the MFH respectively to supply switch S-72.
- When the swing switch (S-72) is closed, that power supply is directed from terminal 11 and to the RHM terminal 1. Diodes prevent back feeding into other circuits.
- When the RHM grounds terminal 1 and it detects the voltage drop on terminal 11, it knows that the swing OUT switch is closed.
- The RHM places a message on the data bus to activate the auger swing **OUT** solenoid (L-04) and signal valve solenoid (L-43).
- The CCM2 checks the Road Mode switch (S-12) to determine if the auger can be swung out. If the Road Mode switch is in the ROAD mode position the auger will not be permitted to swing **OUT** and a message will be displayed on the display.
- The CCM2 will direct 12V power out connector X017 terminal J3-12 to the signal valve terminal 1 and connector X016 terminal J2-16 to the **OUT** solenoid (L-04) terminal 3. A chassis ground is provided at ground point #2.
- When the auger leaves the saddle the saddle sensor (B-38) will signal the CCM1. The CCM1 will place a message on the data bus and the RHM will command the display to activate the UNLOAD out indicator.

Unloading Auger Engaged (ON)

When the auger is running the unloading auger will ONLY swing as long as the operator is pressing the switch.

Unloading Auger Dis-Engaged (OFF)

When the auger is NOT running the unloading auger will travel fully **OUT** or **IN** with only one press of the swing switch. When traveling **OUT** the valve will stay activated for a total of 15 seconds. When traveling IN the valve will stay activated until the saddle switch has been activated or 15 seconds.

ELECTRICAL OPERATION

ELECTRICAL - AUGER SWING OPERATION, CON'T

SWING IN

When the operator commands the unloading auger to swing **IN** by momentarily pressing the Auger Swing Switch (S-72) located on the MFH the following events take place:

- The RHM is supplying power to the swing switch from connector X028 terminal 11 and 9 to the MFH to supply switch S-72.
- When the swing switch (S-72) is closed, that power supply is directed from terminal 9 and to the RHM terminal 1.
- When the RHM grounds terminal 1 and it detects the voltage drop on terminal 9 it knows that the swing **IN** switch is closed.
- The RHM places a message on the data bus to activate the auger swing **IN** solenoid (L-03) and the signal valve solenoid (L-43).
- The Road Mode switch has NO effect on the auger swinging in.
- The CCM2 will direct power out connector X017 terminal J3-12 to the signal valve terminal 1 and connector X016 terminal J2-6 to the **IN** solenoid terminal 2. A chassis ground is provided at ground point #2.
- When the saddle switch detects the auger has returned to the saddle, the CCM1 connector X020 terminal J3-38 will sense a voltage change. The CCM1 will place a message on the data bus to de-activate the UNLOAD indicator on the display and the swing **IN** solenoid (L-03).

Unloading Auger Engaged (ON)

When the auger is running the unloading auger will ONLY swing as long as the operator is pressing the switch.

Unloading Auger Dis-Engaged (OFF)

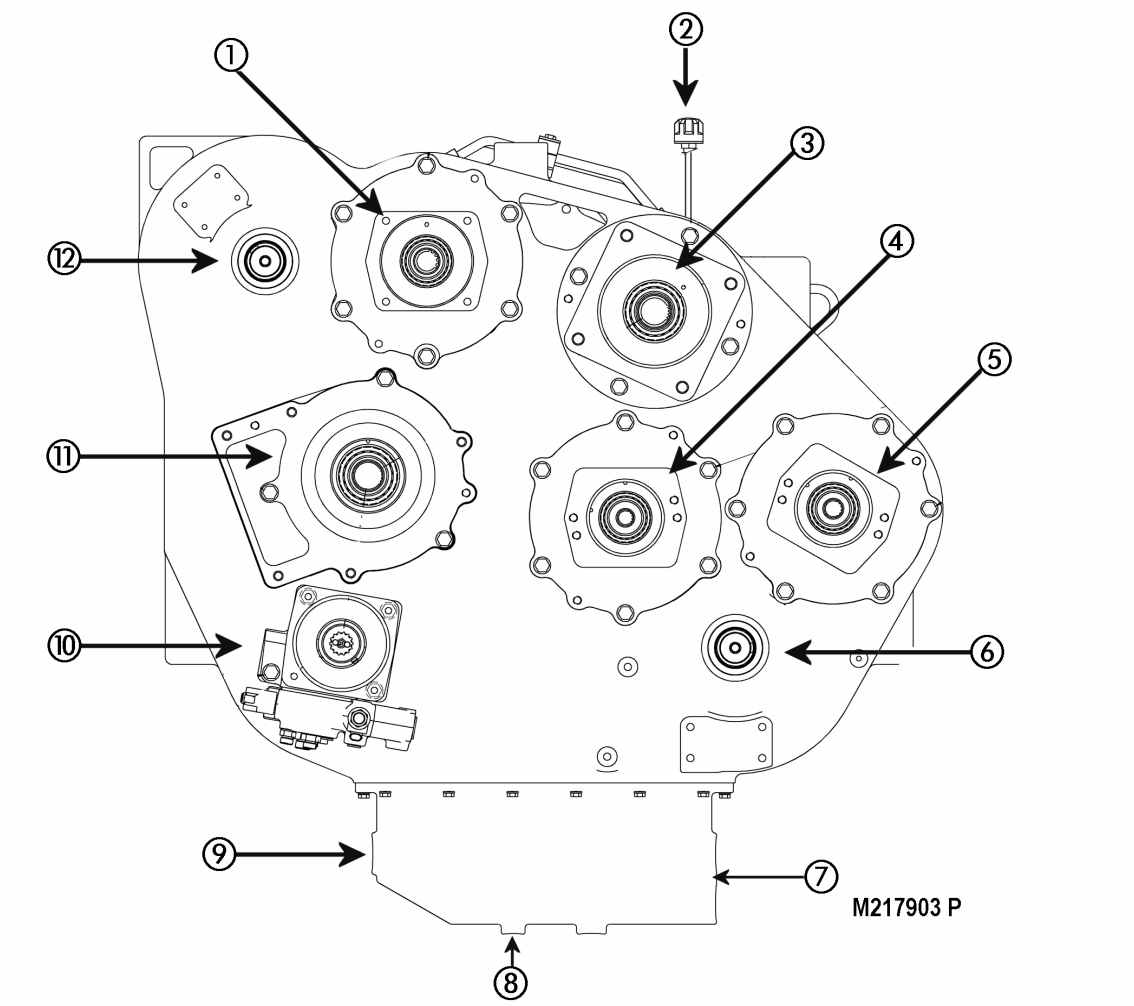
When the auger is NOT running the unloading auger will travel fully **OUT** or **IN** with only one press of the swing switch. When traveling **OUT** the valve will stay activated for a total of 15 seconds. When traveling **IN** the valve will stay activated until the saddle switch has been activated.



IMPORTANT: The **IN** switch will cancel out the swing **IN** and **ENGAGEMENT** operations UNLESS the switch has failed. If the switch has failed the swing **IN** and **ENGAGEMENT** operations will be cancelled out after a 15-second time period, the same as the swing **OUT** operation was.

UNLOADING AUGER CLUTCH

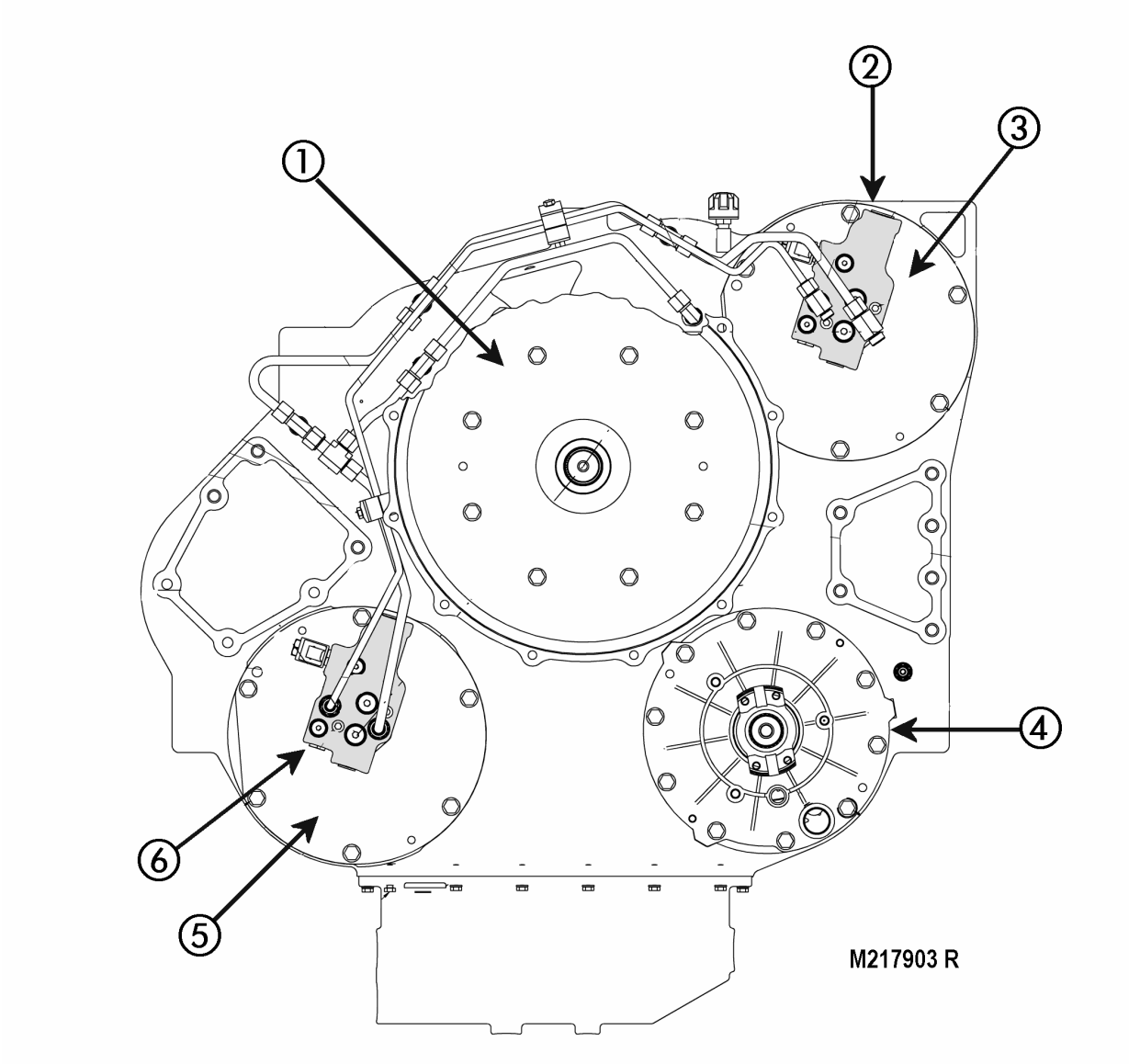
PTO GEARBOX FACING OUT



1.	Feeder/Rotor Pump Drive	7.	Supply/Return Port
2.	PTO Gearbox Breather	8.	Drain Plug
3.	Hydrostatic Pump Drive	9.	Feeder Drive Drain
4.	Gear Pump Drive	10.	Rotor Drive
5.	PFC Pump Drive	11.	Feeder Drive
6.	Beater/chopper Clutch Drive	12.	**Unloader Clutch Drive**

UNLOADING AUGER CLUTCH

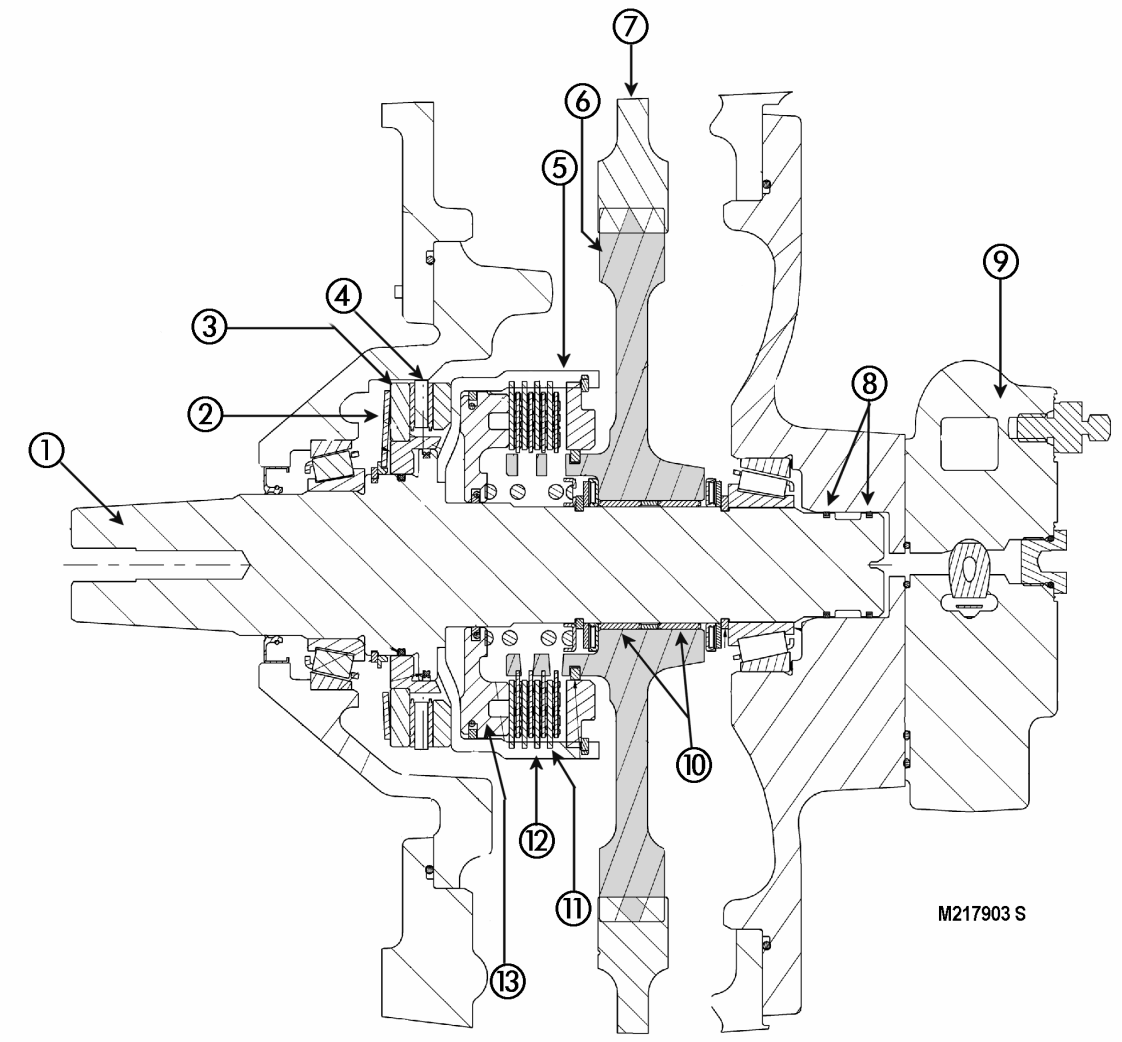
PTO GEARBOX ENGINE SIDE



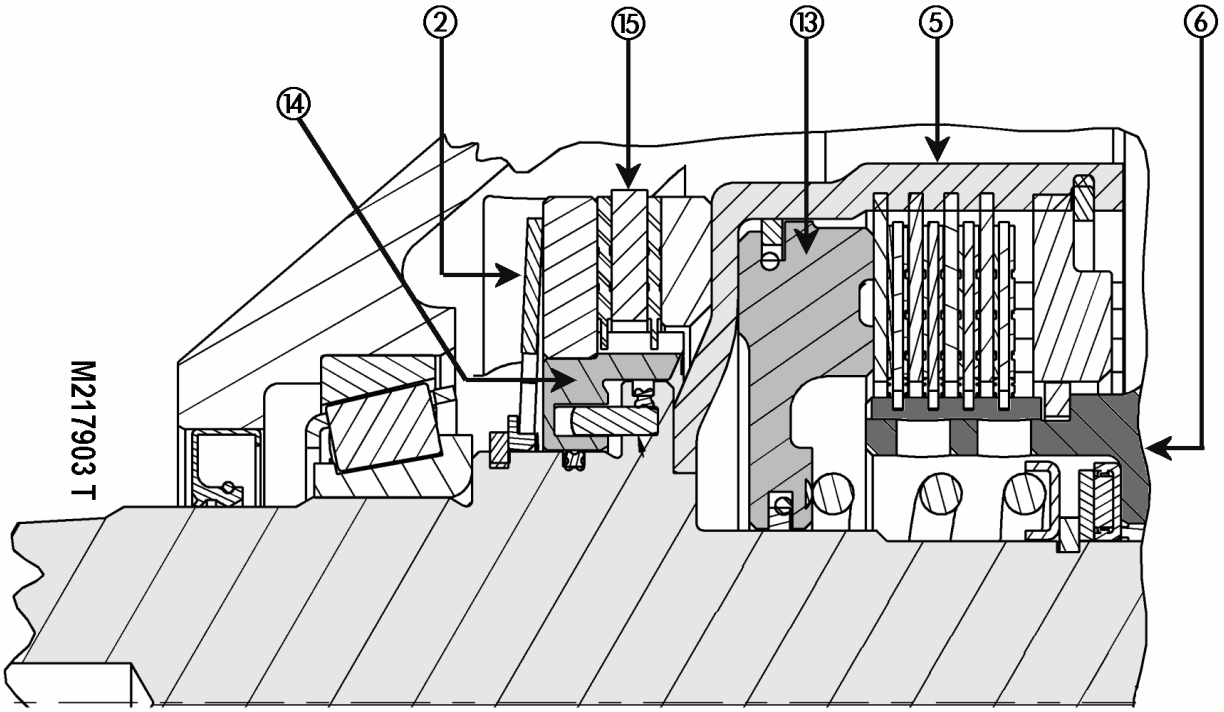
1.	PTO Gearbox Input Shaft	4.	Rotor Drive Unit
2.	Unloading Auger Clutch Valve	5.	Beater/chopper Clutch
3.	Unloading Auger Clutch	6.	Beater/chopper Clutch Valve

UNLOADING AUGER CLUTCH

UNLOADING AUGER CLUTCH



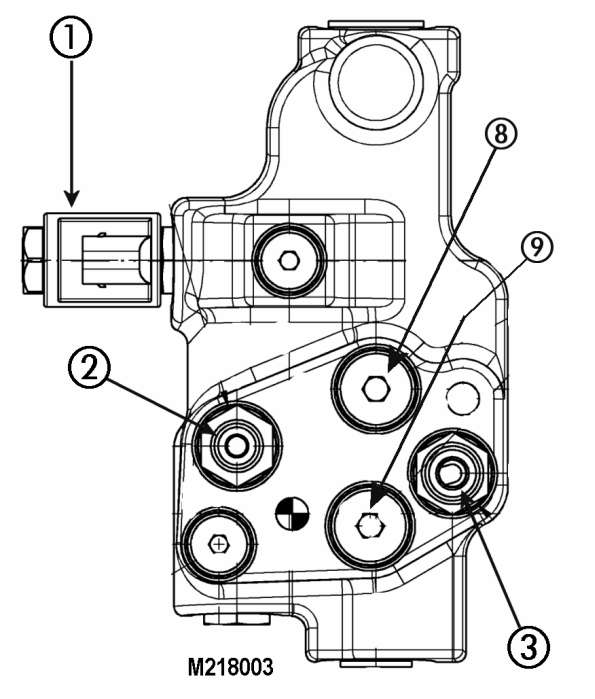
UNLOADING AUGER CLUTCH

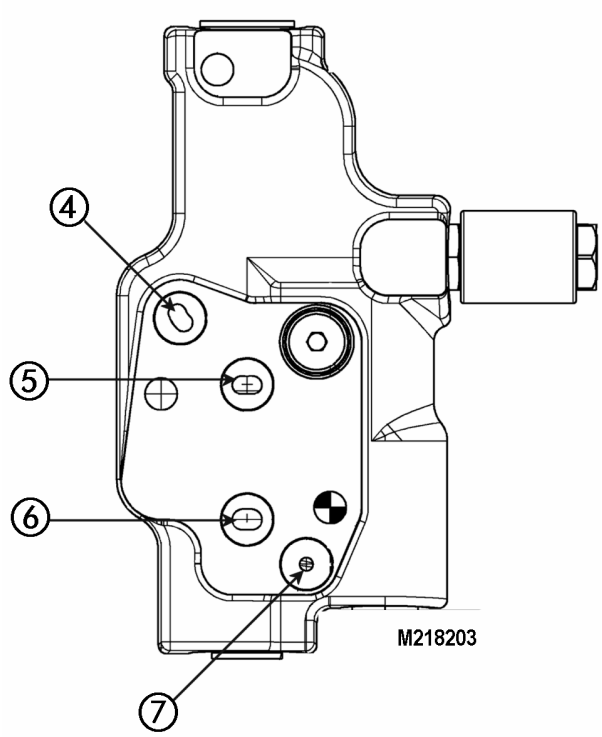


1.	Output Shaft	6.	Clutch Driven Gear	11.	Clutch Plates, (8)
2.	Spring, Bellevue Washer	7.	PTO Drive Gear	12.	Clutch Plates, (8)
3.	Friction Plate, Brake	8.	Sealing Rings, Piston	13.	Clutch Piston
4.	Steel Plate	9.	Clutch Control Valve	14.	Brake Piston
5.	Clutch Pack	10.	Needle Bearings	15.	Brake Pack

UNLOADING AUGER CLUTCH

UNLOADING AUGER VALVE

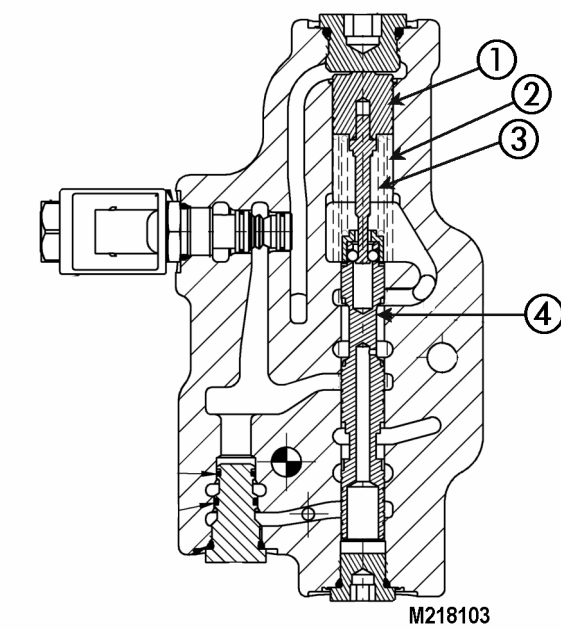


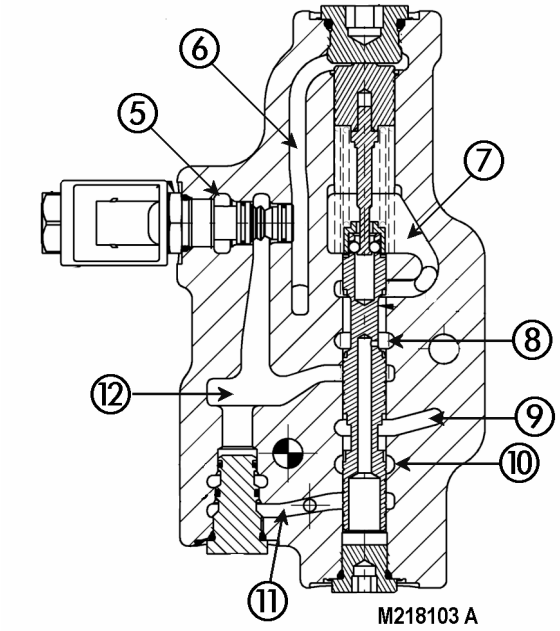


1.	Clutch Solenoid	6.	Lubrication Port
2.	Control Pressure Supply	7.	Tanks
3.	Lubrication Supply	8.	Plugged Clutch Test Port
4.	Tank	9.	Plugged Lube Test Port
5.	Clutch Port		

UNLOADING AUGER CLUTCH

UNLOADING AUGER VALVE

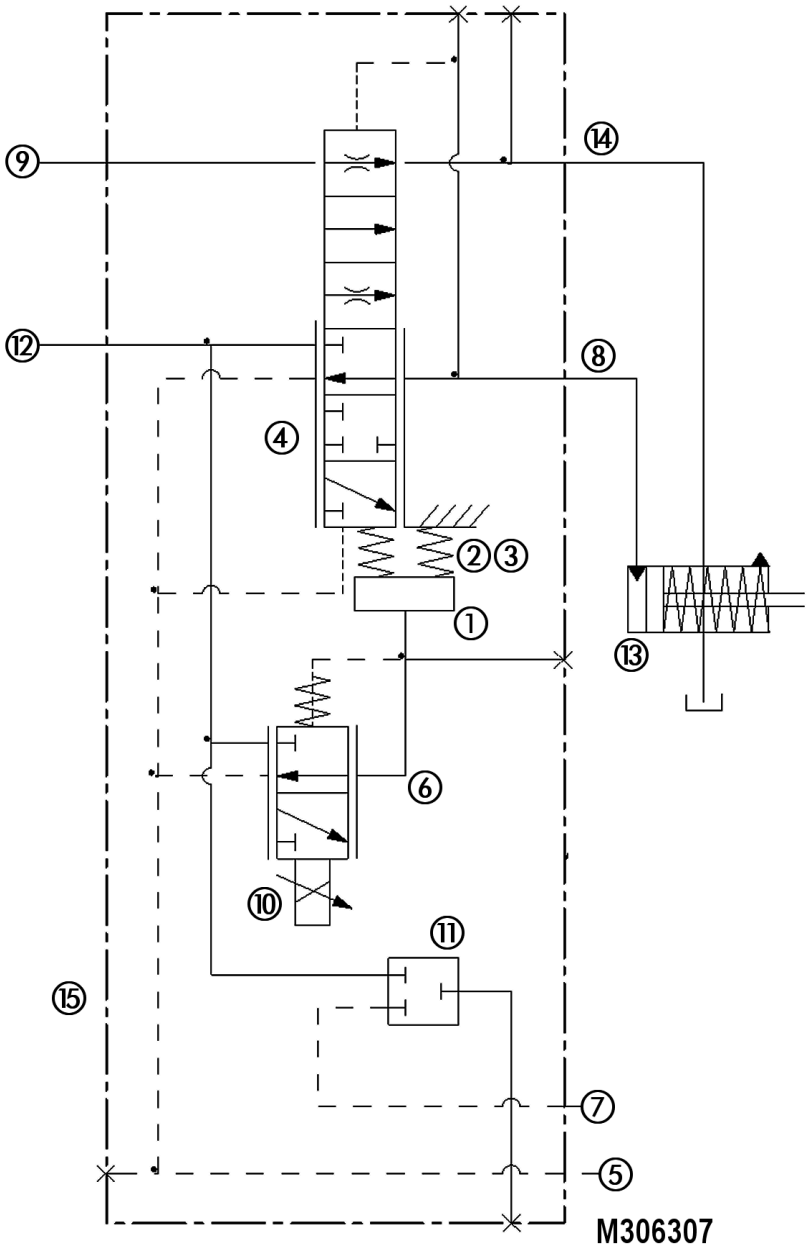




1.	Modulator Piston	7.	Tank
2.	Preload Spring, (spring)	8.	Clutch Port
3.	Modulation Spring, (spring)	9.	Lubrication Supply
4.	Modulation Spool	10.	Lubrication Port
5.	Tank	11.	Tank
6.	Modulation Port	12.	Control Pressure Supply

UNLOADING AUGER CLUTCH

HYDRAULIC SCHEMATIC



1.	Modulation Piston	9.	Lubrication Supply
2.	Pre-Load Spring, (outer)	10.	Clutch Solenoid
3.	Modulation Spring	11.	Solenoid Port Plug
4.	Modulation Spool	12.	Control Pressure Supply
5.	Tank	13.	Clutch
6.	Modulation Port	14.	Lubrication Port
7.	Tanks	15.	Valve
8.	Clutch Port		

UNLOADING AUGER CLUTCH

HYDRAULIC - CONTROL VALVE OPERATIONS

REFERENCE MATERIAL:

General Hydraulic Section for “Control Pressure”
Hydraulic Schematics

KEY COMPONENTS:

Unloading valve, Clutch assembly

OPERATION

Unloading Auger Dis-Engaged

When the unloading auger control switch is pressed to **STOP** the operation, the solenoid is de-activated. The supply pressure (12) is blocked at the solenoid (10) and the main control spool (4).

1. Lube oil (9) is directed through the main spool to port (14) and out to the clutch pack to lubricate bearings, clutches and cooling. The spool lands and orifice passages in the PTO gearbox restrict the lube flow.
2. The clutch and brake pistons are permitted to drain back to the tank at port (5).
3. The brake spring (2) engages the brake plates (15) to prevent the drive from creeping.

Unloading Auger Engaged

When the unloading auger control switch is pressed to **START** the operation, solenoid (10) will be activated by PWM. The solenoid will direct modulated supply pressure to the end of the modulation piston (1). As pressure builds, the piston moves against the force of both the inner and outer modulator springs (2 & 3). As the piston moves toward the spool, the inner spring causes the main spool (4) to shift. As the main spool moves, the lube port (14) is unrestricted to permit additional lube flow during clutch lockup.

The main spool will close off the clutch drain port and begin directing control pressure to the clutch and brake pistons through port (8). As the pressure is directed to the clutch pack, it is also directed through an orifice hole in the side of the spool to the base of the spool, a signal port. As the pressure builds in the clutch pack the pressure also begins to move the main spool back towards the modulating springs, reducing the pressure on the clutch pack. This modulation takes place until the solenoid has been fully powered and the main spool is held fully down.

When the main spool is completely moved down, the lube passage again becomes restricted.

UNLOADING AUGER CLUTCH

ELECTRICAL - AUGER CLUTCH OPERATION

REFERENCE MATERIAL:

Electrical schematic frames #22, #11

KEY COMPONENTS:

Auger Engagement Switch (S-73), CCM2, Multi-Function Handle (MFH), Solenoid L-08, Right Hand Module (RHM), Saddle Switch (B-38), Emergency Stop Switch (S-75), Road Mode Switch (S-12)

UNLOADING CLUTCH ENGAGED

When the operator engages the unloading clutch drive by momentarily pressing the switch (S-73) located on the MFH the following events take place:

- The RHM is supplying power to the unloader engagement switch from connector X028 terminal 4 to the MFH to supply switch S-73.
- When the unload engagement switch (S-73) is closed, that power supply is directed out to the RHM terminal 1.
- When the RHM grounds terminal 1 and it detects the voltage drop on terminal 4, it knows that the unload engagement switch is closed.
- The RHM commands the display to FLASH the UNLOAD indicator lamp.
- The RHM places a message on the data bus to activate the unloading auger clutch.
- The CCM1 checks the saddle sensor (B-38) to determine if the unloading auger is in the saddle and places a message on the data bus when it is **OUT** of the saddle.
- The CCM2 will proceed with activating the unloading auger clutch. The CCM2 will direct PWM power out connector X016 terminal J2-4 to the clutch solenoid terminal A. A ground is provided by the CCM2 terminal J2-20 to the solenoid terminal B.

The clutch will be modulated over a three second period in order to start the unloading system smoothly.

UNLOADING AUGER CLUTCH

ELECTRICAL OPERATION, CON'T

UNLOADING CLUTCH DIS-ENGAGED

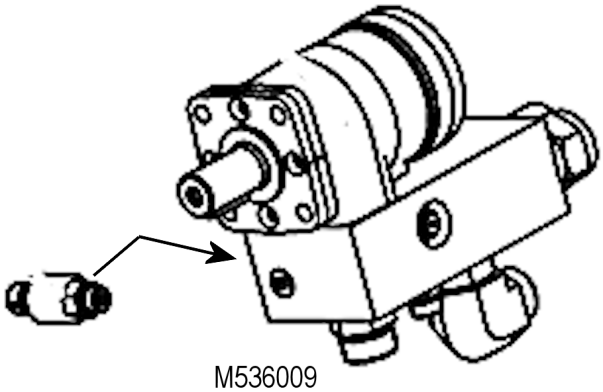
When the operator dis-engages the unloading clutch drive by momentarily pressing the switch (S-73) located on the MFH the following events take place:

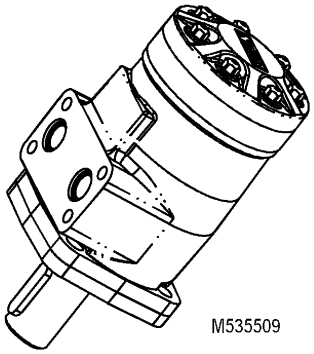
- The RHM is supplying power to the unloader engagement switch from connector X028 terminal 4 to the MFH to supply switch S-73.
- When the unload engagement switch (S-73) is closed, that power supply is directed out to the RHM terminal 1.
- When the RHM grounds terminal 1 and it detects the voltage drop on terminal 4, it knows that the unload engagement switch is closed a SECOND time.
- The RHM commands the display to stop FLASHING the UNLOAD indicator lamp.
- The RHM places a message on the data bus to deactivate the unloading auger clutch.
- The CCM2 will stop the power that was being directed out connector X016 terminal J2-4 to the clutch solenoid terminal A.

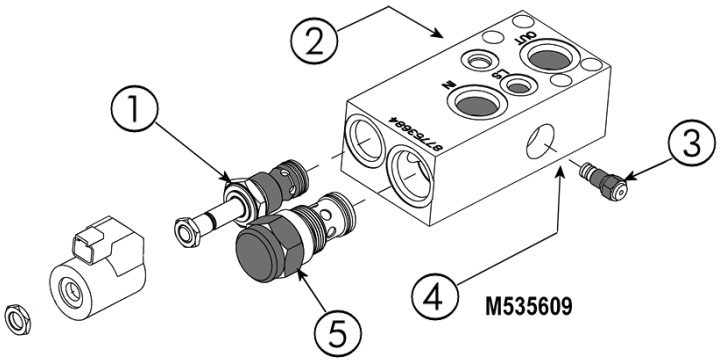
The unloading clutch will stop driving and the mechanical brake will be spring applied to prevent the drive from creeping.

HYDRAULIC CROSS AUGER OPERATION

TANK CROSS AUGER VALVE



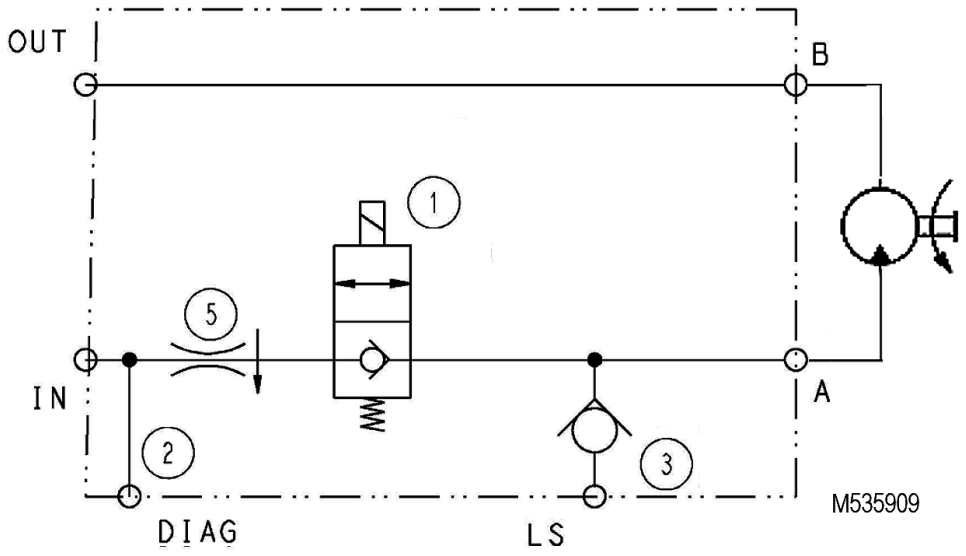




Cross Auger Drive Motor	1.	Control Cartridge, L-72
	2.	Diag Port = Pressure Sensor
	3.	Signal Check
	4.	Work Ports “A” & “B” (on back side)
	5.	Pressure Flow Compensating Cartridge
	OUT	Return to Tank
	IN	Supply from PFC
	LS	

HYDRAULIC CROSS AUGER OPERATION

CROSS AUGER VALVE SCHEMATIC



1.	Control Cartridge, L-72	OUT	Return to Tank
2.	Diag Port = Pressure Sensor	IN	Supply from PFC
3.	Signal Check	LS	Signal Line to PFC Pump
5.	Pressure Flow Compensating Cartridge		Work Ports “A” & “B” (on back side)

HYDRAULIC CROSS AUGER OPERATION

HYDRAULIC - CROSS AUGER OPERATIONS

REFERENCE MATERIAL:

General Hydraulic Section for “PFC” Pump Operation
Hydraulic Schematics

KEY COMPONENTS:

Horizontal Cross Augers, Auger Valve, PFC Pump

OPERATION

Unloading Auger Dis-Engaged

When the unloading auger control switch is pressed to **STOP** the operation, the solenoid (1) is de-activated. The spool is returned to the OFF position by a centering spring.

Unloading Auger Engaged

When the unloading auger control switch is pressed to **START** the operation, solenoid (1) will be activated by PWM. The valve cartridge will be pushed down allowing full PFC pump pressure to flow out port “A” to the auger drive motor. The compensating cartridge (5) will be used to limit the system flow to approximately 18 gpm (68 lpm).

The drive pressure will also be:

1. Directed through the signal check valve (3) and out port “LS” to control the PFC pump compensator. This will control the pumps output flow and pressure.
2. Directed through port “DIAG” to the circuit pressure switch (2). The pressure will be displayed on the cab display unit to assist the operator in adjusting the cross auger covers.

HYDRAULIC CROSS AUGER OPERATION

ELECTRICAL - CROSS AUGER OPERATION

REFERENCE MATERIAL:

Electrical schematic frames # 22

KEY COMPONENTS:

Unloader Engagement Switch (S-73), CCM2, Multi-Function Handle (MFH), Cross Auger Solenoid L-72, Pressure Sensor B-91, Shift Switch S-82

UNLOADING CLUTCH ENGAGED

When the operator engages the unloading drive by momentarily pressing the unloader engagement switch (S-73) located on the MFH, after a 2 seconds delay, the CCM2 will direct power out connector X016 terminal J2-8 to the cross auger valve solenoid L-72 terminal A. The solenoid is provided a chassis ground at terminal B. The grain tank cross augers will begin to operate.

If the operator should hold the SHIFT button (S-82) while momentarily pressing the unloader switch S-73, the CCM2 will disengage the cross auger solenoid L-72 until the operator reengages it by holding the SHIFT+UNLOADER once again.

Refer to auger operating condition earlier in this chapter.

The PFC pump sensor is supplied 5V from the CCM2 connector X016 terminal J2-31 to the sensor terminal B. The sensor return terminal A is directed to the CCM 2 connector X017 terminal J3-18. The sensor's signal wire, terminal C, is directed to the CCM2 connector X016 terminal J2-29. The sensor may be monitored on the cab display as PSI.

TROUBLE SHOOTING



Wait a minute, how can I trouble shoot a system that incorporates mechanical drives, electrical circuits and hydraulic circuits?

The most challenging part of repairing any operation is determining which part of the operation has failed as quickly as possible, but without overlooking any possibilities. Your first test must be able to verify whether the problem is in the electrical circuit, hydraulic circuit or the mechanical components.

First verify if a fault code is being displayed. If so, follow the explanation associated with the fault code. If not, make your first test with a voltmeter where electrical power converts to mechanical power, “The Solenoid”, to verify voltage is being supplied and a ground provided.

- ✓ If voltage and ground is supplied, the electrical circuit is not the main problem. Look at the hydraulic or mechanical circuit.
- ✓ If voltage and/or ground is not being supplied, then you must fix the electrical circuit first before moving on to the hydraulic and/or mechanical circuits.
- ✓ What other components are supplied the same hydraulic supply that is supplying the rotor drive circuits? Are they working? Check regulated pressure.
- ✓ Check for stuck control spools, plugged orifices, open relief valves, etc.

AUTOMATIC CROP SETTINGS (ACS)

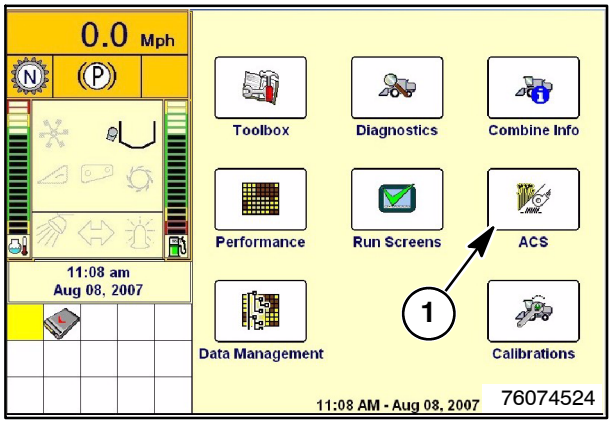
(Display Software Version 16.0.*.*)

General Information

The Automatic Crop Settings (ACS) system allows the combine operator to preset machine settings for different crop types or conditions. These settings, saved under a “Work Condition” label, can later be recalled instantly as needed. For each crop type, up to 40 unique work conditions can be created.

Setup and Activation of the ACS

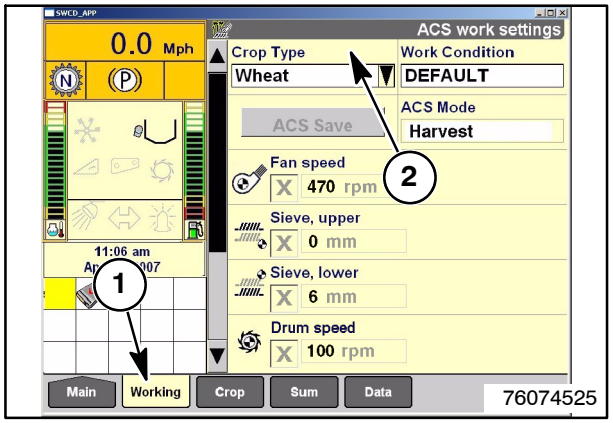
1. From the Main page, select the ACS icon, 1.



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2. In the ACS work settings window, select the “Working” tab, 1.
3. Select “Crop Type”, 2. A pop-up window appears with a selection of crops. Select the desired crop from the list.

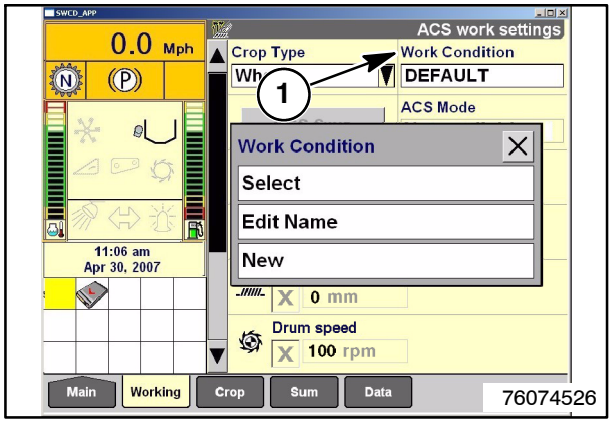
NOTE: *If the desired crop type is not listed, navigate to Main>Data Management>Filter> Filter Crop List and make it available.*



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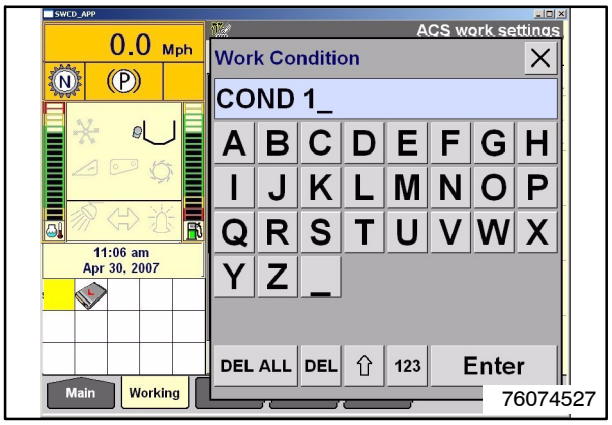
4. Select “Work Condition”, 1. A pop-up appears. Pick “Select” to select an existing condition or “New” to create a new condition. Pick “Edit Name” to change the name of the current work condition.

NOTE: *A Work Condition defines the settings of operational parameters, e.g., fan speed, concave opening, etc., for a given field or crop condition. The operator sets the parameters as needed, then saves them in ACS, giving the Work Condition a unique name. When the operator selects a saved Work Condition later, ACS will adjust the operating parameters accordingly. In Default, preset factory parameters apply.*



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5. To set up a new work condition, select “New.” A pop-up keypad appears. Enter a unique name. Press “_” for a space. Press “123” to bring up the numerical keypad. Press “Enter” when entry is complete.



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ACS Mode Selection

Each work condition can have two ACS modes: Harvest and Headland.

6. To activate the Headland mode, press the Shift, 1, and Header Resume, 2, buttons simultaneously. The header will raise just above the Max Working Height and the ACS will go into the Headland mode.

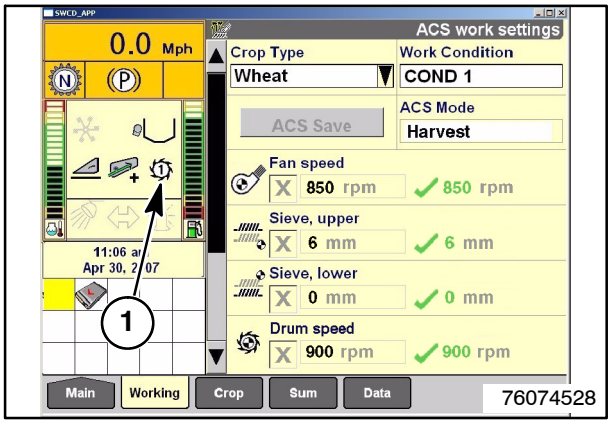
7. Press the Header Resume button, 2, to return to Harvest mode. The header will automatically lower to cut height.



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8. In Harvest mode, the numeral” 1”, 1, is present in the status window. In Headland mode, an “H” is present. When the thresher is engaged, a toothed wheel circles the “1” or “H.”

9. Press the square box next to each parameter to be controlled by ACS. An “X” in the box indicates the parameter will be used by ACS.



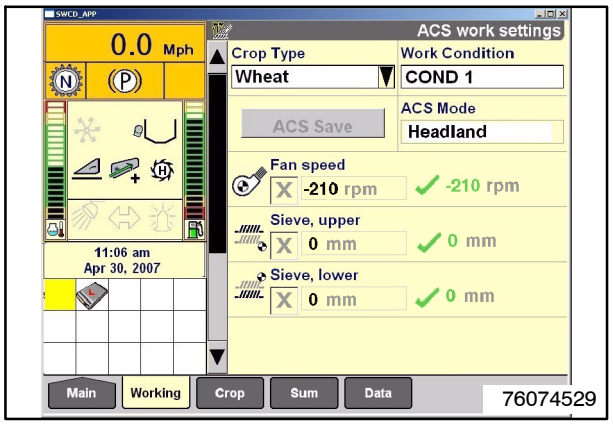
86

The available parameters in Harvest mode are:

- Fan speed
- Rotor speed
- Concave opening
- Sieve opening, upper
- Sieve opening, lower

The available parameters in Headland mode are:

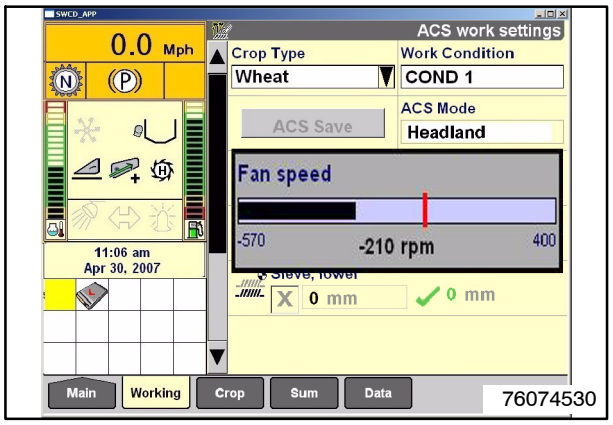
- Fan speed
- Sieve opening, upper
- Sieve opening, lower



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10. Parameters may be adjusted to suit a given work condition. These adjustments may be made from rocker switches on the RHC. When the rocker switch is pressed, a window pops up on the screen, showing the value being adjusted. In the example below, the fan speed is being set.

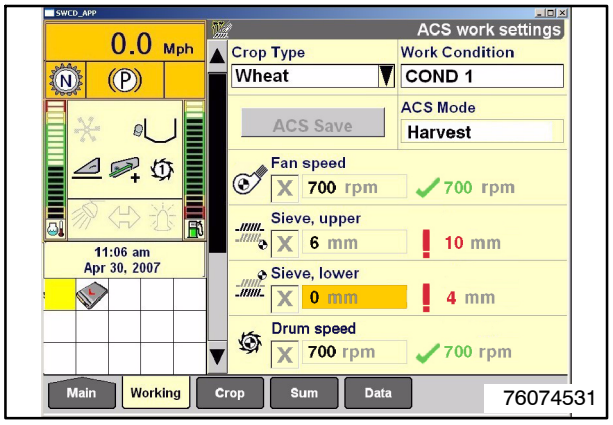
NOTE: *The settings for the Headland mode are "delta" settings, i.e., they are difference settings relative to the Harvest mode. In the previous example, the fan speed is set to -210 rpm. This indicates that the fan speed set for Harvest mode is to slow down by 210 rpm when Headland mode is selected.*



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11. The green check marks and green values to the right of the parameter windows indicate that the value of the parameter agrees with the value stored in ACS for the current work condition. If the value does not agree with that of ACS, it appears in red, with a "!". This is the case when a parameter has been changed but not yet saved. In this case, the "1" or "H" in the status window will blink.

12. If satisfied with the new settings, press "ACS Save." The mode indicator in the status window will stop blinking and the parameters will appear to the right in green with a green check mark.

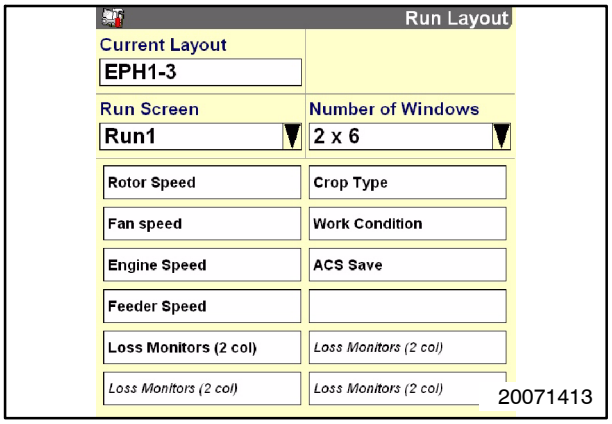


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Operating the ACS from a Run Screen

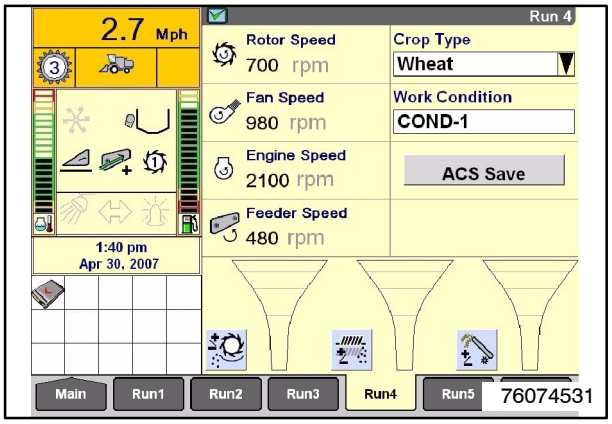
ACS controls can be placed on a Run screen.

13. From the Main page, select Toolbox>Layout.
14. If not previously done, select “Current Layout” and select or create a layout.
15. Choose a Run Screen for the ACS controls. Select “Crop Type,” “Work Condition,” and “ACS Save.”
16. Navigate to Main>Run Screens and select the Run Screen where the ACS controls were placed.



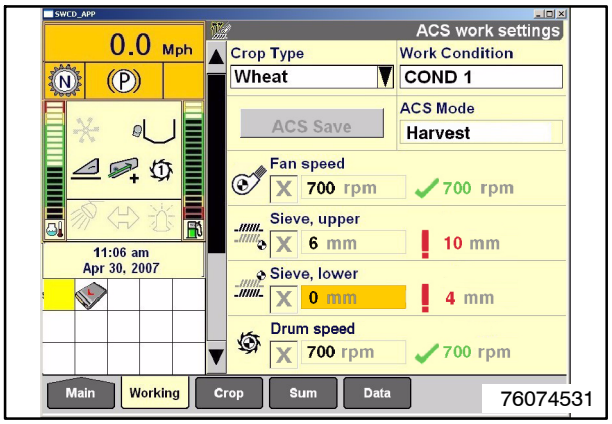
90

17. The operating parameters can be changed on the Run Screen for the current Crop Type and/or Work Condition.
18. To save the new machine settings after adjusting the machine for current conditions, press the “ACS Save” button. The settings will be saved to the active operating mode: Harvest or Headland.



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19. If it is desired to check the new settings against the ACS-stored settings before saving them, navigate Main>ACS>Working. Settings that are new, but unsaved, show up in red numerals with a red “!”.



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Other tabs in ACS work settings

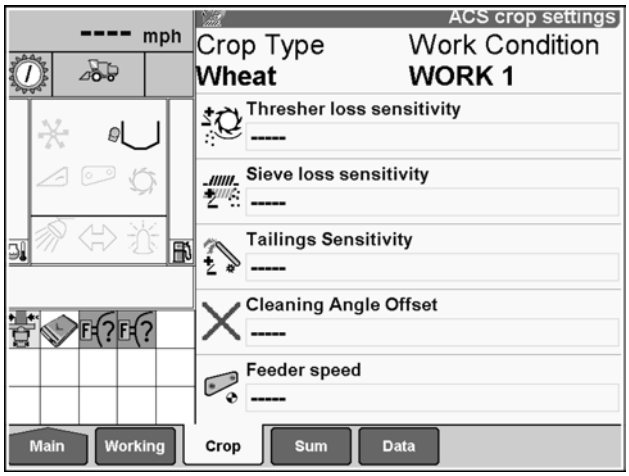
Crop – Gives all the parameter values associated with each of the crop types.

Sum – This gives a summary of the various Work Condition settings, providing an offline method of viewing them for reference. It also compares the Harvest and Headland settings for each Work Condition.

Data – Shows the work settings for a given Work Condition compared with the Default settings.

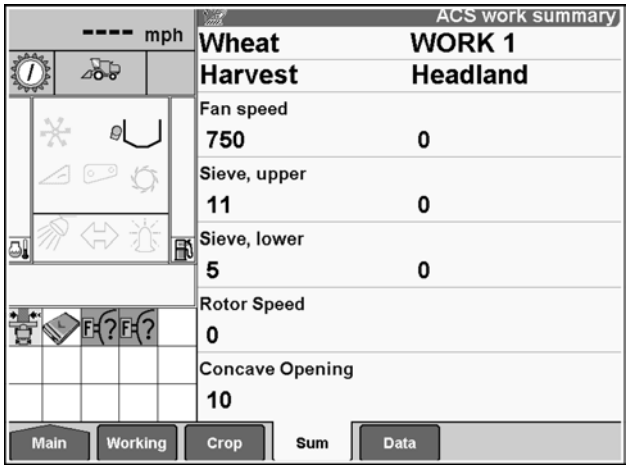
Other tabs in ACS work settings

Crop - Gives all the parameter values associated with each of the crop types.



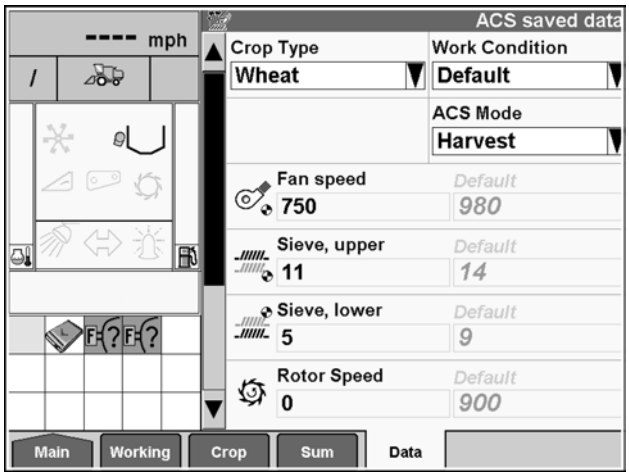
20090402A 22

Sum - This gives a summary of the various Work Condition settings, providing an offline method of viewing them for reference. It also compares the Harvest and Headland settings for each Work Condition.



20090403A 23

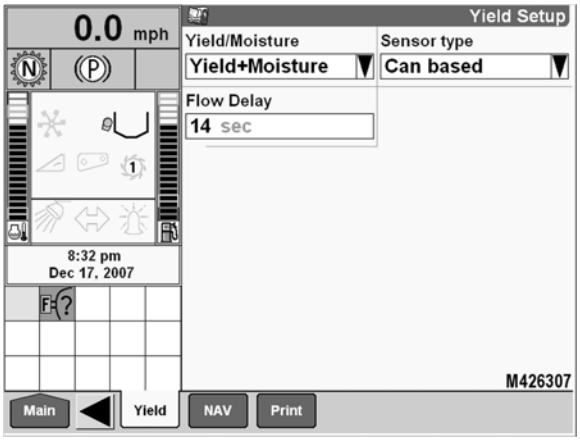
Data - Shows the work settings for a given Work Condition compared with the Default settings.



20090404A 24

CAN Base Flow Sensor

The grain flow sensor for MY08 was changed from a sensor that required the YIMU for the CAN interface to a sensor with an internal controller. This eliminates the YIMU, eliminates the sensor CALIBRATION number and requires the sensor to be configured as a CAN based sensor.



Status Light

The new sensor has a status LED that provides information as to the condition of the sensor.

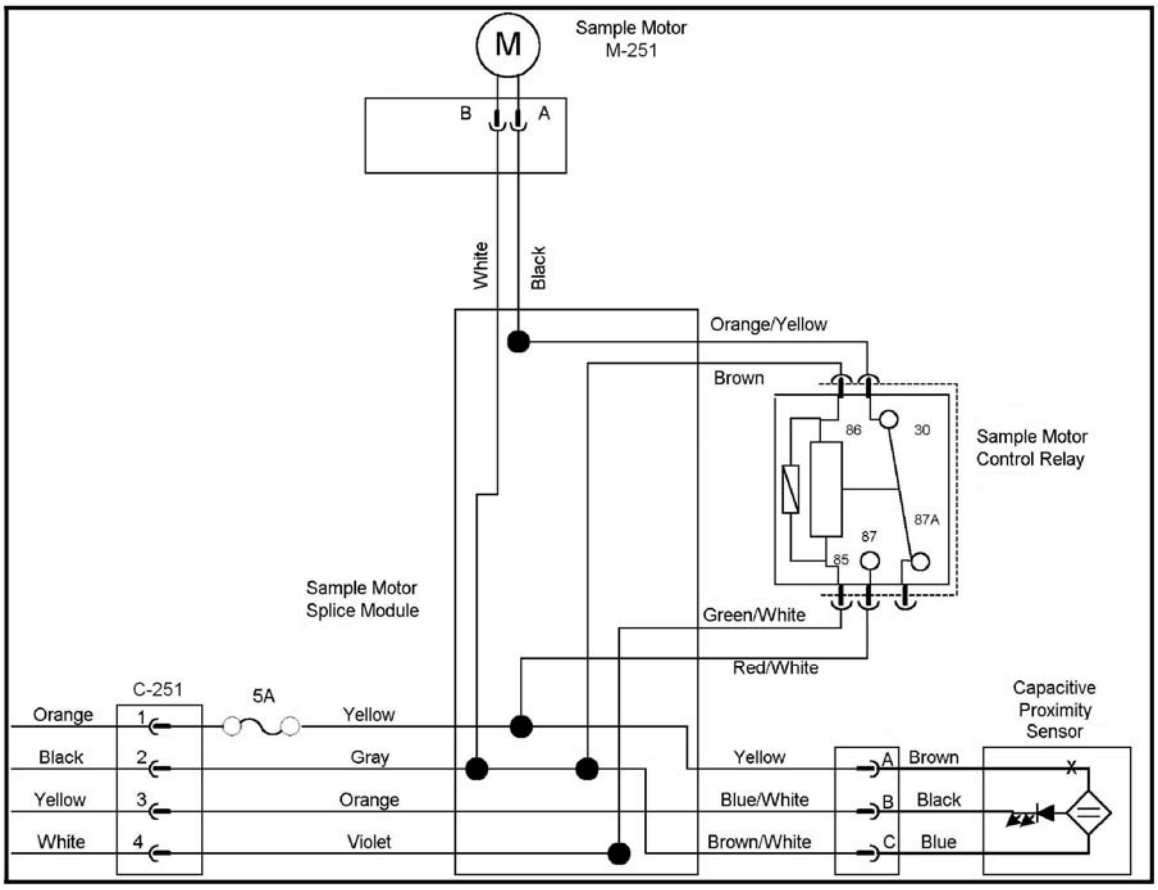
LED State	Condition Represented
Off	No power
Flashing 1 Hz Green	Normal operation
Flashing 1 Hz Yellow	CAN bus errors detected (error active/passive state)
Solid Yellow	CAN bus off
Solid Red	Hardware or Initialization Failure
Flashing 1 Hz Red	Firmware Download in Process
Flashing Fast Red	Firmware Download Error

The remaining YIMU functions will be handled by the CCM3 controller.

Sheet 58A

Midrange Upgrade Axial-Flow Combine (5088, 6088, 7088)
Supplement to Electrical Schematic 87473396 Sheet 58 - Precision Farming

Bypass unit detail (see M-251 on Sheet 58)



When the keyswitch is ON:
The Cab Power Relay provides 12vDC to the Sample Motor Relay pin 87 (C-251-1) via a 5A inline fuse on the sensor side of C-251. (This fuse is NOT shown on the combine electrical schematic.) This voltage cannot pass through the open relay, so it waits there. This voltage also supplies the Bypass Proximity Switch pin A, and is grounded through the proximity switch pin C.

When the CXCM detects an incoming separator_on signal on the primary vehicle CAN bus (indicating that the separator is ON):
The CXCM supplies 8vDC from C-018-14, through C-251-3, through the Bypass Splice Module, to the Bypass Proximity Switch pin B. This voltage is not grounded when the proximity switch is open (not covered by a solid column of grain). This creates an 8vDC potential that is sensed by the CXCM (C-018-14). When the proximity switch closes (indicating a full grain chamber with grain covering the proximity switch), the signal voltage collapses as it is grounded to the proximity switch pin C. The CXCM senses this change from 8vDC to 0vDC; this signals the CXCM to provide 12vDC from C-019-5 to the Sample Motor Relay pin 85 (C-251-4). This voltage closes the relay (pin 30 to pin 87) and allows the 12vDC from the Cab Power Relay (see above) to flow through the relay to the bypass motor Pin A, through the motor, and to ground through the bypass motor Pin B. The motor turns the bypass auger to remove the existing grain sample and allow new grain to enter the grain chamber. This ensures that fresh grain is continually sampled by the moisture sensor. When the grain level in the grain chamber drops below the proximity switch, the proximity switch opens and the 8vDC signal is no longer grounded. The CXCM senses that the 8vDC potential has returned; and removes power to the Sample Motor Relay pin 85. This opens the relay and turns off the motor.

When the CXCM detects the loss of the incoming SEPARATOR_ON signal (indicating the separator switch is moved from ON to OFF):
The CXCM provides 12vDC to the Sample Motor Relay pin 85 for approximately 35 seconds. This allows the bypass motor to turn to clean out the grain chamber. This minimizes rust, corrosion, frozen grain in the sample chamber, etc.

When the CXCM does not detect an incoming SEPARATOR_ON signal (indicating that the separator is OFF):
No voltage is provided to the proximity switch, Pin B, or to the bypass motor relay, Pin 85. The bypass system therefore does not work when the separator is OFF. *The separator must be ON to troubleshoot the bypass system.*

Connecting GPS Receivers to Case IH Yield Monitors

Prepared by CNH Technical Support Services

Version 3.0
14AUG2009



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CNH America LLC

Important Notice

The information contained in this document is believed to be complete and accurate as of the date printed on the cover page. Case IH reserves the right to update, edit, or otherwise alter the information contained herein at any time, without liability.

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Introduction

Case IH Advanced Farming Systems yield monitors offer industry-leading accuracy and reliability, with a proven history of collecting the data farmers and ranchers need to make informed decisions about their agricultural operations. Adding a Case IH DGPS receiver to an AFS yield monitor system allows the operator to record spatial data along with yield and moisture values.

This guide provides information about connecting DGPS receivers to all models of Case IH AFS yield monitors, from the venerable “black box” monitor to the cutting-edge AFS Pro600 color touchscreen display.

Case IH recommends setting up and testing GPS receiver connections prior to the start of field operations. This allows any issues to be resolved without causing downtime in the heat of the harvest season.

The Case IH AFS Customer Support Center is also available to answer technical questions regarding this document, DGPS receiver installations, in-field AFS performance, or any other aspect of the Case IH AFS yield monitor system. Contact the AFS Customer Support Center at 888-CASE-AFS (888-227-3237), or click the “Customer Support” link at our website:

http://www.caseih.com/afs

Connecting GPS Receivers



Case IH 1600 Series Combines

Connecting an AFS Receiver to an AFS Yield Monitor
-- 1600 Series Combine --

9-Pin to Flat-5 Adapter
#87302445
(or #249547A1)

AFS Receiver
(representative image)



Power +

Ground –

3-Pin Male (may be used to supply power to receiver)

9-Pin Female

9-Pin Male

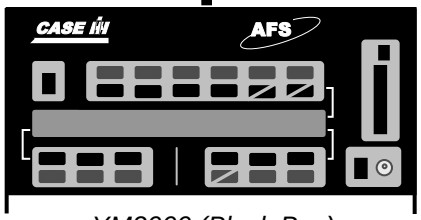
5-Pin Male

Distribution Cable
#224715A2*

5-Pin Female

Display Harness
#234482A1

Standard Power/Data Cable
#277885A1



YM2000 (Black Box)



Power + **Ground**

12-Pin Female

9-Pin Female

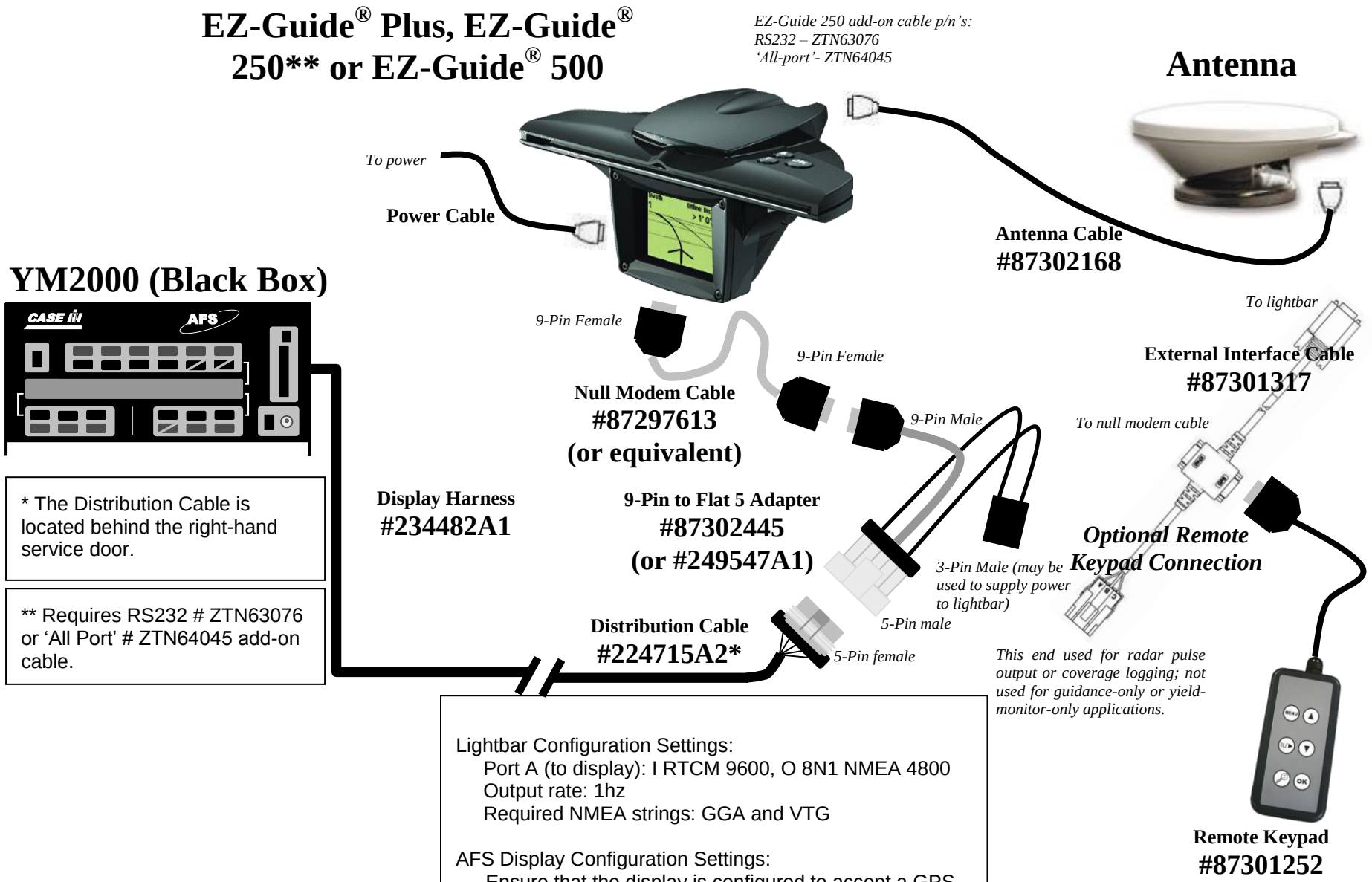
When installing a 162, or 252 / 262 receiver, use power/data cable #87298129. The #277885A1 cable is not used.

AFS Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800
- Output rate: 1hz
- Required NMEA strings: GGA and VTG

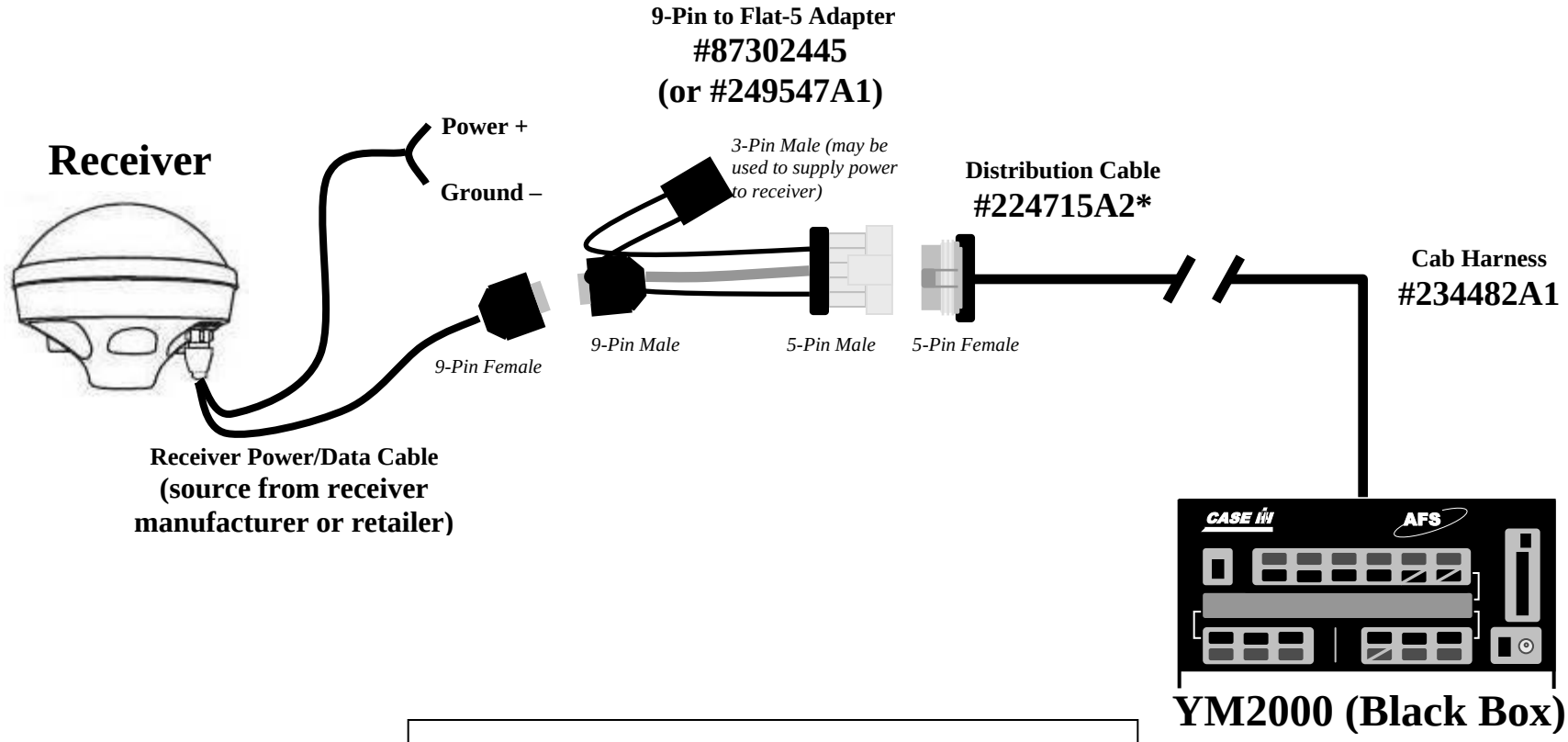
AFS Display Configuration Settings:
- Ensure that the display is configured to accept a GPS signal, per the display operator's manual.

* The Distribution Cable is located behind the right-hand service door.

Connecting an EZ-Guide® Plus / EZ-Guide® 250 / EZ-Guide® 500 Lightbar to an AFS Yield Monitor
-- 1600 Series Combine --



Connecting a Generic GPS Receiver to an AFS Yield Monitor
-- 1600 Series Combine --



Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800
- Output rate: 1hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept a GPS signal, per the display operator's manual.

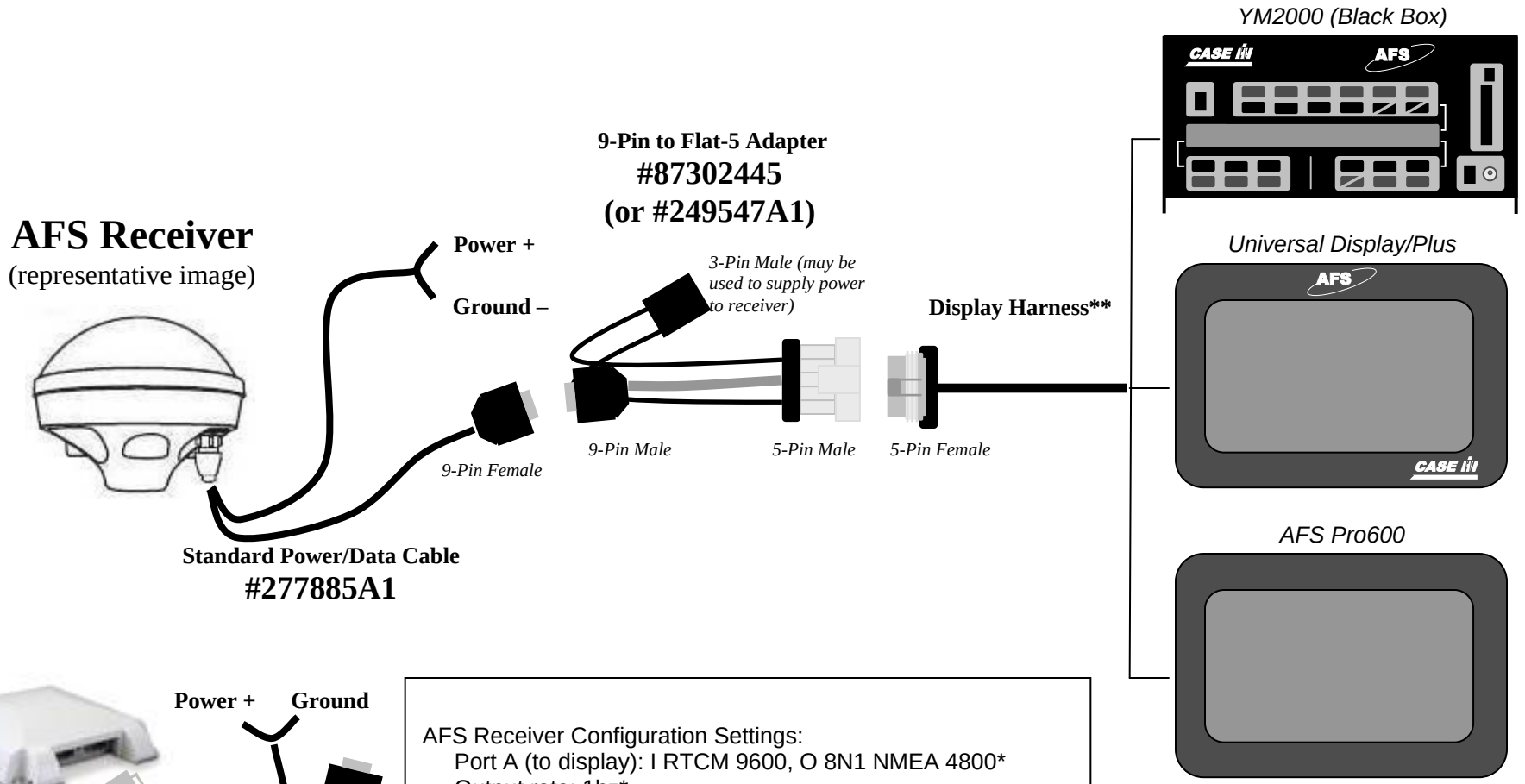
* The Distribution Cable is located behind the right-hand service door.

Connecting GPS Receivers



Case IH 2100/2300 Series Combines

Connecting an AFS Receiver to an AFS Yield Monitor
-- 2100 or 2300 Series Combine --



When installing a 162, or 252 / 262 receiver, use power/data cable #87298129. The #277885A1 cable is not used.

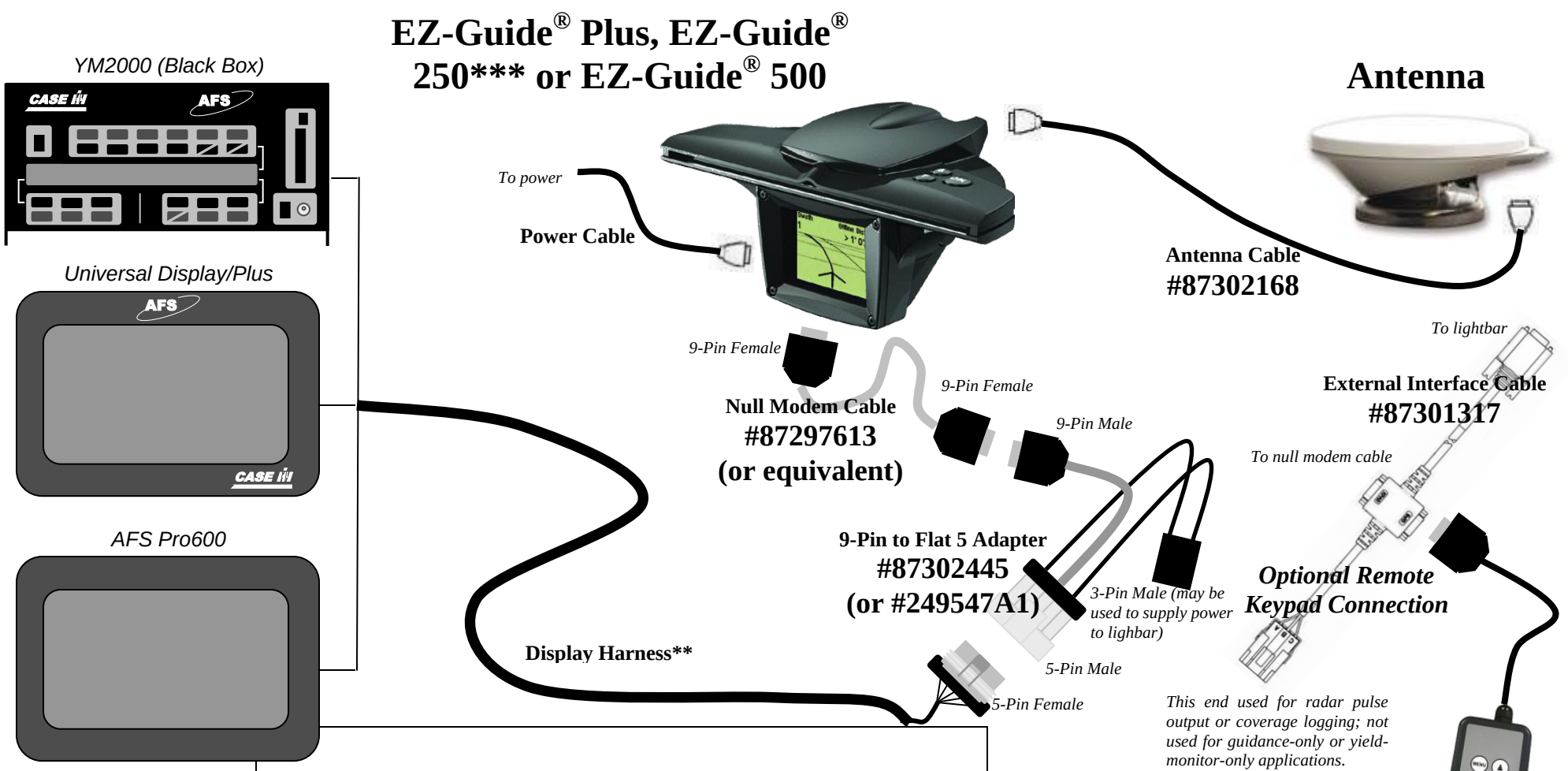
AFS Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800*
- Output rate: 1hz*
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept a GPS signal, per the display operator's manual.

*For all color display software, the receiver baud rate can be up to 38400bps, and the output rate can be 1hz or 5hz.

** On <MY2000 combines, cable 87302445 will connect to the combine on the YMIU harness behind the right-hand service door. On ≥MY2000 combines, cable 87302445 connects to the combine inside the cab, in front of the fuse panel in the right-hand console.

Connecting an EZ-Guide® Plus / EZ-Guide® 250 / EZ-Guide® 500 Lightbar to an AFS Yield Monitor -- 2100 or 2300 Series Combine --



*** Requires RS232 # ZTN63076 or 'All Port' # ZTN64045 add-on cable.

Lightbar Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800*
- Output rate: 1hz*
- Required NMEA strings: GGA and VTG

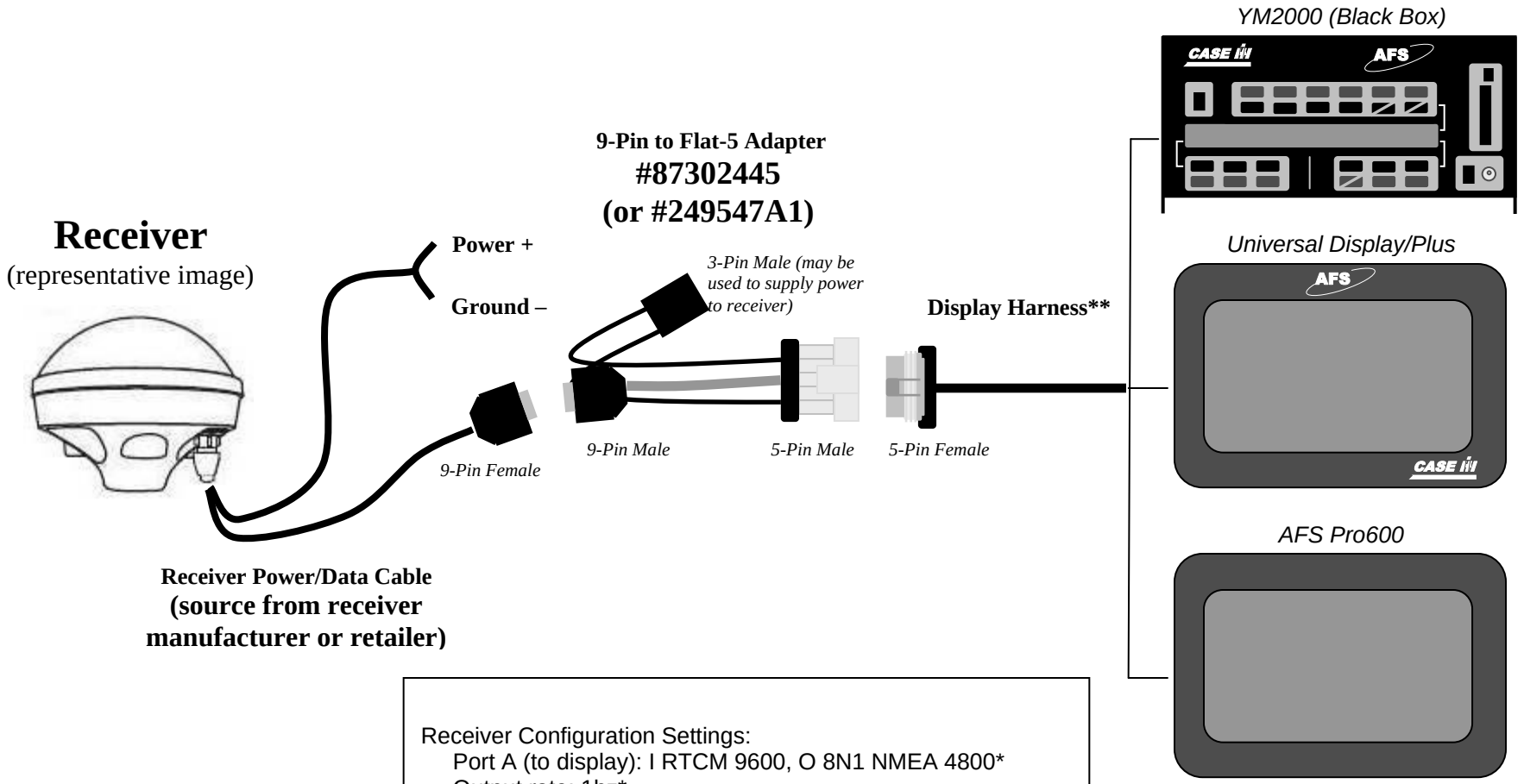
AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

*For all color display software, the receiver baud rate can be up to 38400bps, and the output rate can be 1hz or 5hz.

** On <MY2000 combines and <u>all</u> black box yield monitor systems, cable 87302445 will connect to the combine behind the right-hand service door. On ≥MY2000 combines, cable 87302445 connects to the combine inside the cab, in front of the fuse panel in the right-hand console.

Reviewed 8/3/09

Connecting a Generic GPS Receiver to an AFS Yield Monitor
-- 2100 or 2300 Series Combine --



Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800*
- Output rate: 1hz*
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept a GPS signal, per the display operator's manual.

*For all color display software, the receiver baud rate can be up to 38400bps, and the output rate can be 1hz or 5hz.

** On <MY2000 combines, cable 87302445 will connect to the combine on the YMIU harness behind the right-hand service door. On ≥MY2000 combines, cable 87302445 connects to the combine inside the cab, in front of the fuse panel in the right-hand console.

Connecting GPS Receivers



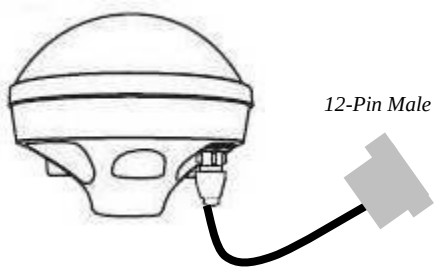
Case IH 2500 Series Combines

Connecting an AFS Receiver to an AFS Pro600 Yield Monitor
-- 2500 Series Combine, CAN Installation --

AFS Receiver



162, 252 or 262



12-Pin Male

When installing an AFS antenna / receiver with the 12-pin , round-style connector, an additional adapter harness p/n 87383158 is required.

2500 Series Factory GPS Install Harness
#87382719

YMIU Harness
#87383497*

Cab harness
#87384930

2-Pin Female
2-Pin Male
Power/Gnd
12-Pin Female
RS-232
4-Pin Female
(Not Used)
CAN IN
CAN OUT
4-Pin Male
4-Pin Female
(disconnected from active terminator)
4-Pin Female
Active Terminator

AFS Pro600

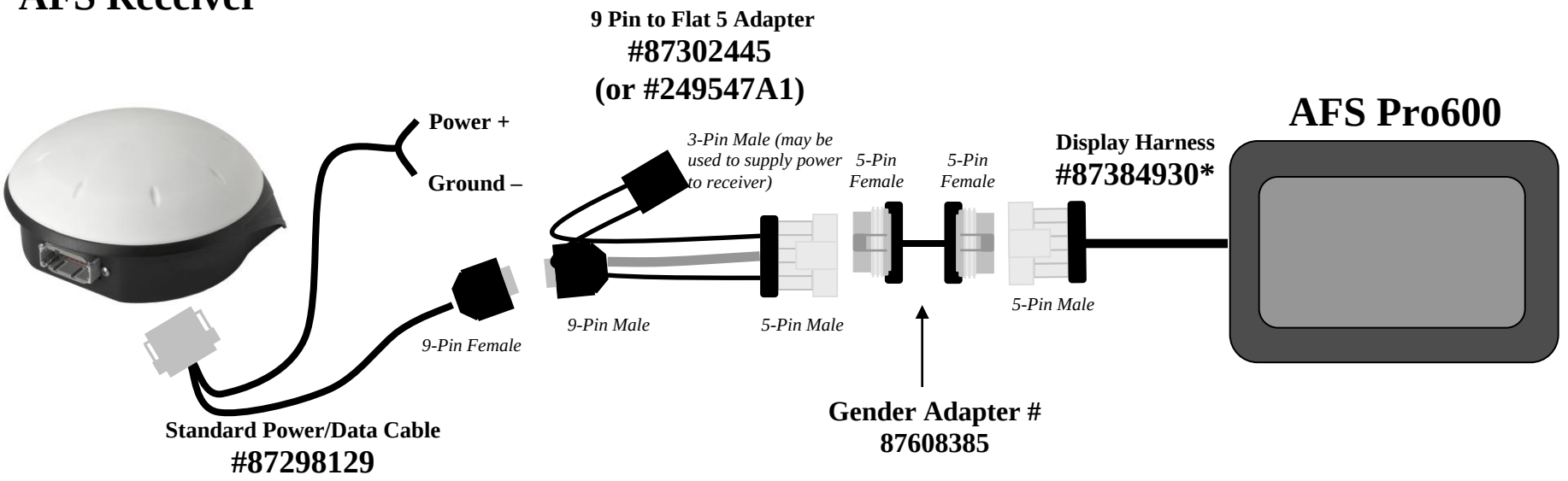
AFS Receiver Configuration Settings:
No configuration is required for CAN installations

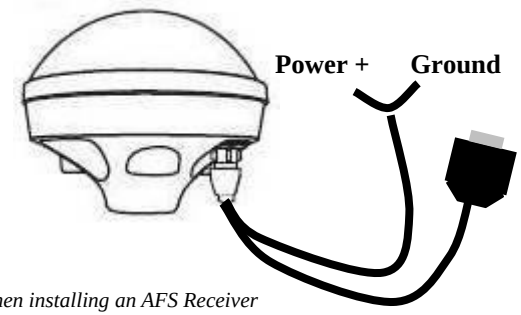
AFS Display Configuration Settings:
Ensure that the display is configured to accept a CAN GPS signal, per the display operator's manual.

* To install a GPS receiver on the combine CAN bus, disconnect the YMIU harness #87383497 from the Active Terminator behind the right-hand service door. Locate the CAN OUT connector on the GPS harness #87382719, and connect it to the Active Terminator. Then connect the Active Terminator connector on the YMIU Harness #87383497 to the CAN IN connector on the GPS harness #87382719. Finally, connect the 2-pin Power/Ground connectors on each harness. Connect the GPS harness #87382719 to the receiver as shown to complete the installation.

Connecting an AFS Receiver to an AFS Pro600 Yield Monitor
-- 2500 Series Combine, Serial (RS-232) Installation --

AFS Receiver





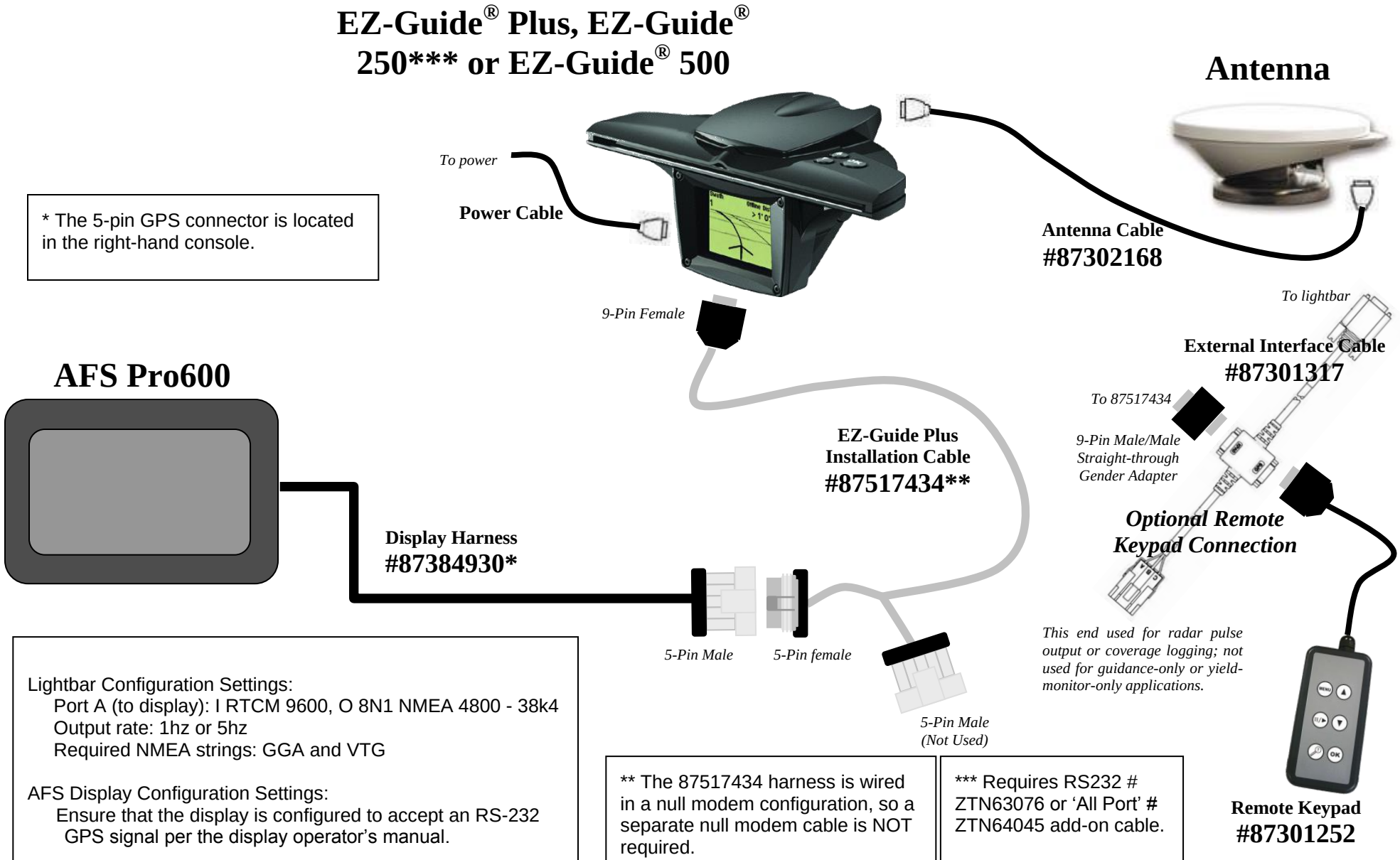
When installing an AFS Receiver with the round, 12-pin style connector, use power/data cable #277885A1.

AFS Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept a serial GPS signal, per the display operator's manual.

* The 5-pin GPS connector is located in the right-hand console.

Connecting an EZ-Guide® Plus / EZ-Guide® 250 / EZ-Guide® 500 Lightbar to an AFS Pro600 -- 2500 Series Combine --



* The 5-pin GPS connector is located in the right-hand console.

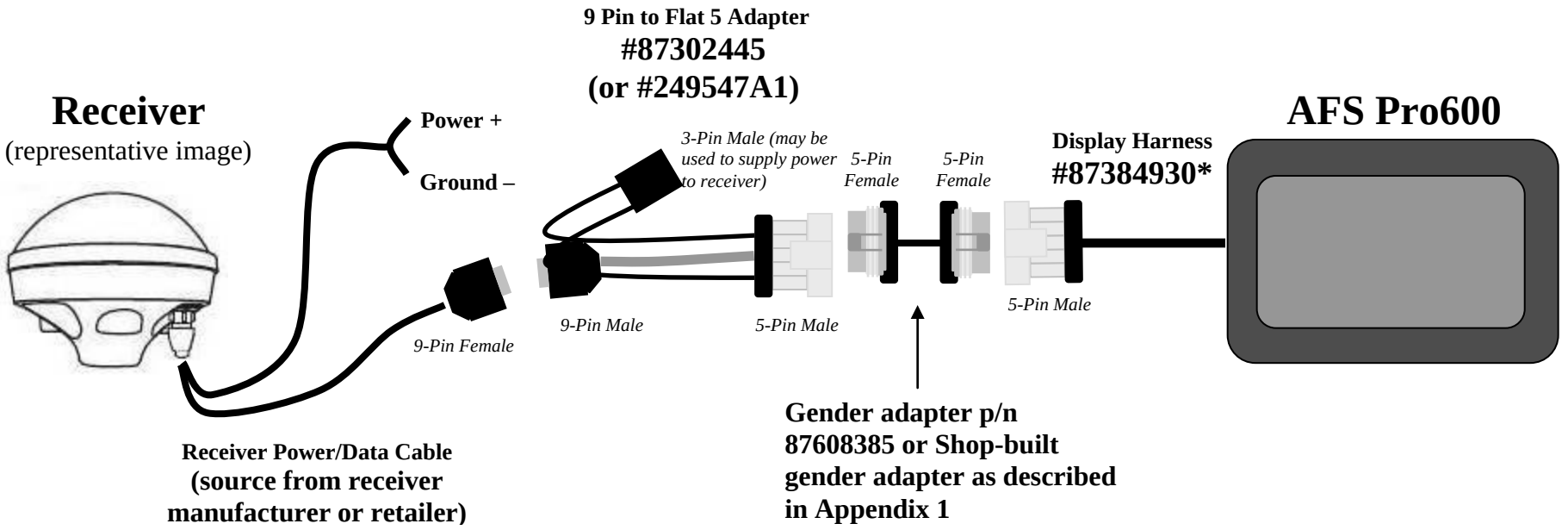
Lightbar Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

** The 87517434 harness is wired in a null modem configuration, so a separate null modem cable is NOT required.

*** Requires RS232 # ZTN63076 or 'All Port' # ZTN64045 add-on cable.

Connecting a Generic GPS Receiver to an AFS Pro600 Yield Monitor
-- 2500 Series Combine --



Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept a serial GPS signal, per the display operator's manual.

* The 5-pin GPS connector is located in the right-hand console.

Connecting GPS Receivers

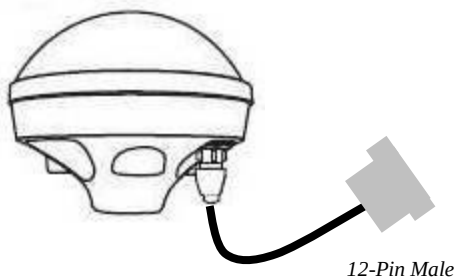


Case IH 88 Series Combines

Connecting an AFS Receiver to an AFS Pro600 Yield Monitor
-- 5088/6088/7088 Combine, CAN Installation --

AFS Receiver
(representative image)





When installing an AFS receiver with a 12-pin round style connector, adapter harness #87383158 is required.

AFS CAN GPS Install Harness
#87550514



Right hand side chassis harness (C167)



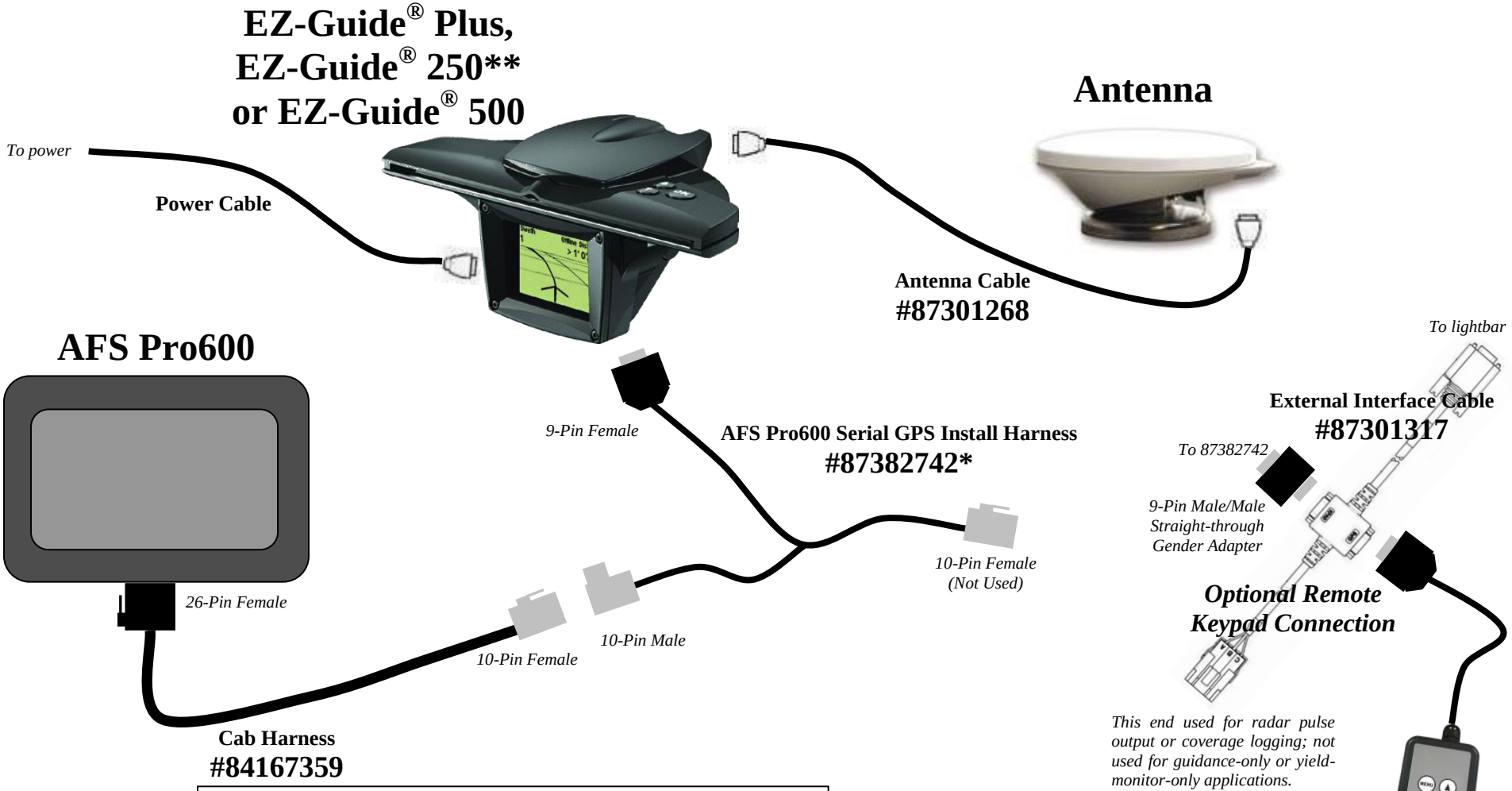
AFS Pro600



AFS Receiver Configuration Settings:
No configuration is required for CAN installations

AFS Display Configuration Settings:
Ensure that the display is configured to accept a CAN GPS signal, per the display operator's manual.

Connecting an EZ-Guide® Plus / EZ-Guide® 250 / EZ-Guide® 500 Lightbar to an AFS Pro600 -- 5088 / 6088 / 7088 Combine --



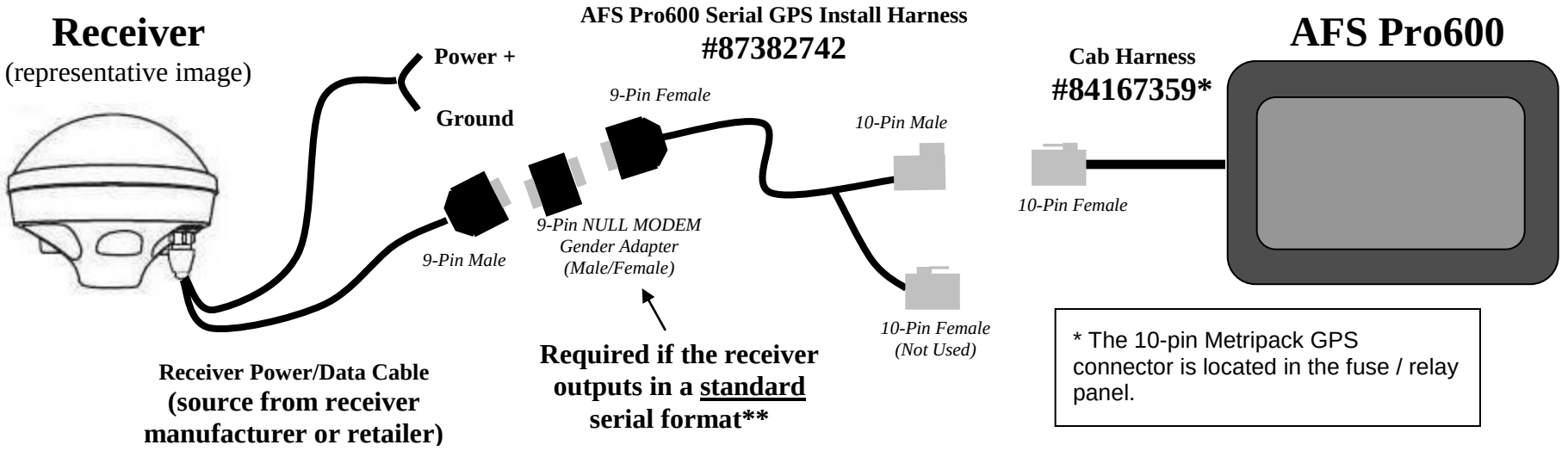
Lightbar Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

* The 87382742 harness is wired in a null modem configuration, so a separate null modem cable is NOT required.

** Requires RS232 # ZTN63076 or 'All Port' # ZTN64045 add-on

Connecting a Generic GPS Receiver to an AFS Pro600 Yield Monitor
-- 5088 / 6088 / 7088 Combine --



* The 10-pin Metripack GPS connector is located in the fuse / relay panel.

Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

** The 87382742 harness is wired in a null modem configuration. This means that pins 2 and 3 are crosslinked (reversed). Pin 2 is Receiver Receive (Rx) and Pin 3 is Receiver Transmit (Tx).

If the 87382742 harness is used with a receiver that outputs data in a standard serial format (Pin 2 is Receiver Tx and Pin 3 is Receiver Rx), a null modem cable or adapter is required to reverse the null in the 87382742 harness, creating the equivalent of a standard serial cable.

If the 87382742 harness is used with a receiver that outputs data in a null modem format, the null modem adapter is not used.

Connecting GPS Receivers



Case IH AFX8010 Combines

Connecting an AFS Receiver to a Monochrome AFS Yield Monitor
-- AFX8010 Combine PIN HAJ105105 – HAJ105179, CAN Installation --

AFS Receiver
(representative image)





There is no option to install a 162 / 252 / 262 receiver on the AFX8010 combine CAN bus.

GPS Cable
#87109277

4-Pin Male

4-Pin Female

Main Frame Harness

Universal Display Plus



AFS Receiver Configuration Settings:
No configuration is required for CAN installations

AFS Display Configuration Settings:
Ensure that the display is configured to accept a CAN GPS signal, per the display operator's manual.

* The 4-pin Deutsch GPS connector is located on the inside front wall of the grain tank.

Connecting an AFS Receiver to a Monochrome AFS Yield Monitor
-- AFX8010 Combine PIN HAJ105180 - HAJ109999, CAN Installation --

AFS Receiver
(representative image)





There is no option to install a 162, 252 or 262 receiver on the AFX8010 combine CAN bus.

GPS Cable
#87281699

4-Pin Female

Main Frame Harness

4-Pin Male

Universal Display Plus



AFS Receiver Configuration Settings:
No configuration is required for CAN installations

AFS Display Configuration Settings:
Ensure that the display is configured to accept a CAN GPS signal, per the display operator's manual.

* The 4-pin Deutsch GPS connector is located on the inside front wall of the grain tank.

Connecting an AFS Receiver to a Monochrome AFS Yield Monitor
-- AFX8010 (≤MY06) Combine, RS-232 Installation --

AFS Receiver Configuration Settings:
Port A (to display): I RTCM 9600, O 8N1 NMEA 4800
Output rate: 1hz
Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

AFS Receiver
(representative image)



Power +

Ground

Standard Power/Data Cable
#277885A1

Universal Display Plus



12-Pin Female

To Combine CAN bus

9-Pin Male

9-Pin to Flat 5 Adapter
#87302445
(or #249547A1)

3-Pin Male (may be used to supply power to receiver)

5-Pin Male

5-Pin Female

Not Used

Universal Receiver Transfer Kit
#84083373

Not Used

Not Used

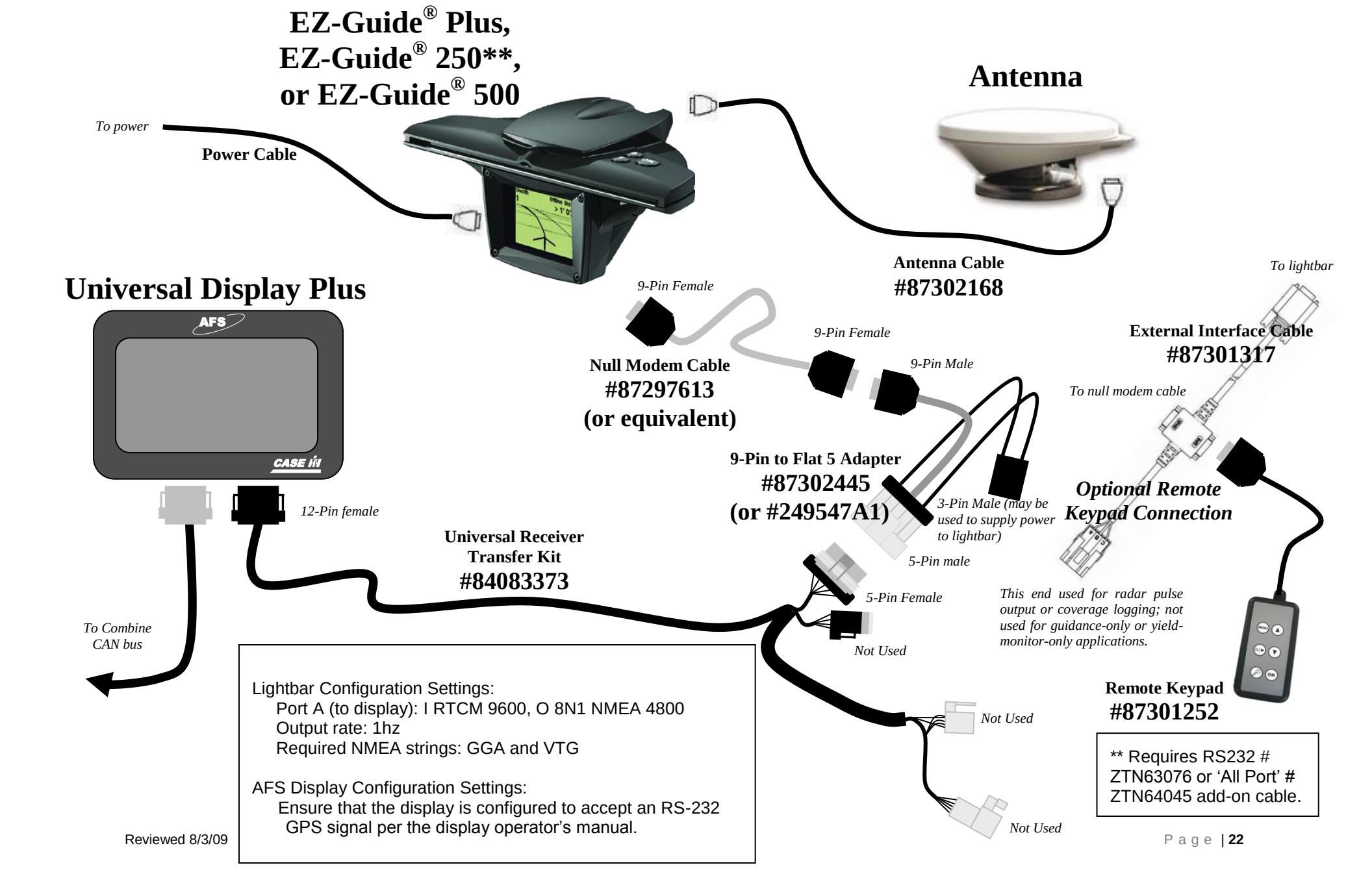


Power +

Ground

When installing a 162, 252 or 262 receiver, use power/data cable # 87298129. The #277885A1 is not used.

Connecting an EZ-Guide® Plus / EZ-Guide® 250 / EZ-Guide® 500 Lightbar to an AFS Yield Monitor (AFX8010 (≤MY06) Combine with Monochrome Touchscreen)



Lightbar Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800
- Output rate: 1hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

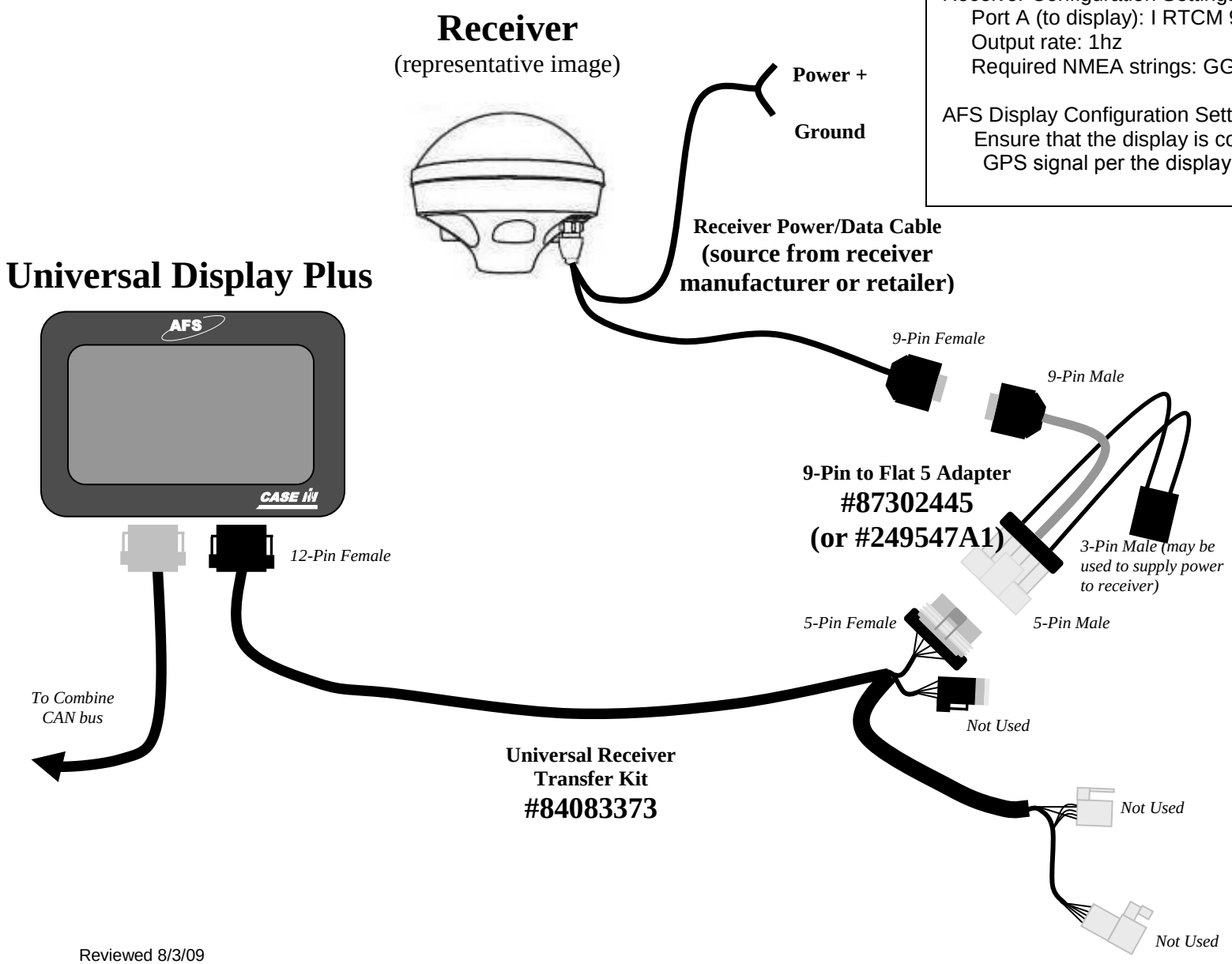
** Requires RS232 # ZTN63076 or 'All Port' # ZTN64045 add-on cable.

Reviewed 8/3/09

Connecting a Generic Receiver to a Monochrome AFS Yield Monitor
-- AFX8010 (≤MY06) Combine --

Receiver Configuration Settings:
Port A (to display): I RTCM 9600, O 8N1 NMEA 4800
Output rate: 1hz
Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.



Connecting GPS Receivers



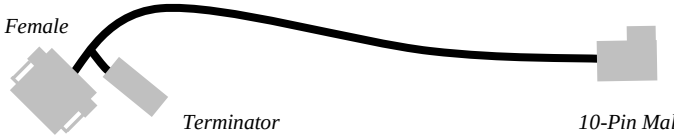
Case IH Axial-Flow 7010/8010 Combines

Connecting an AFS Receiver to an AFS Pro600 Yield Monitor
-- AFX8010 (≤MY06) and Axial-Flow (≥MY07) 7010/8010 Combine, CAN Installation --

AFS Receiver
(representative image)



AFS Pro600 CAN GPS Install Harness
#87382741

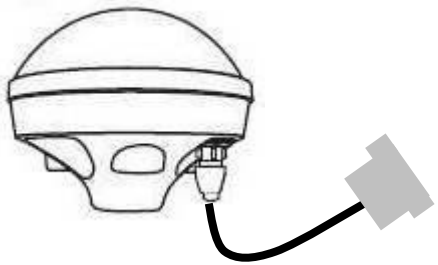


Display Harness*



AFS Pro600





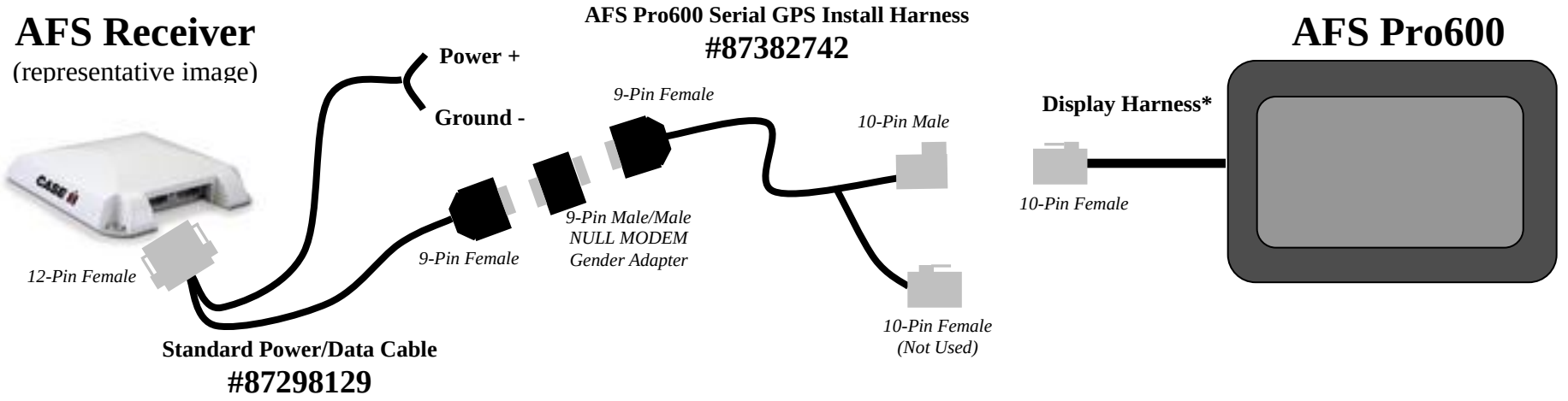
When installing an AFS receiver with a 12-pin round connector, use adapter harness #87383158.

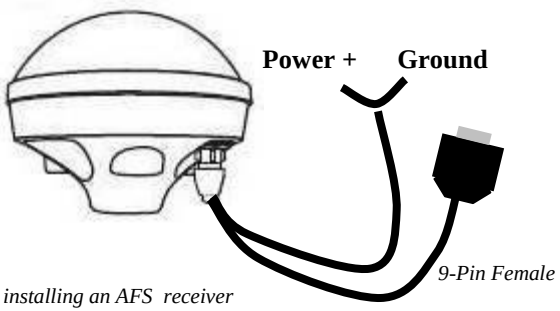
AFS Receiver Configuration Settings:
No configuration is required for CAN installations

AFS Display Configuration Settings:
Ensure that the display is configured to accept a CAN GPS signal, per the display operator's manual.

* The 10-pin Metripack GPS connector is located at the rear of the right-hand console. The connector should be routed through a hole in the bottom of the console, so that it hangs below the console.

Connecting an AFS Receiver to an AFS Pro600 Yield Monitor
-- AFX8010 (≤MY06) and Axial-Flow (≥MY07) 7010/8010 Combine, RS-232 Installation --





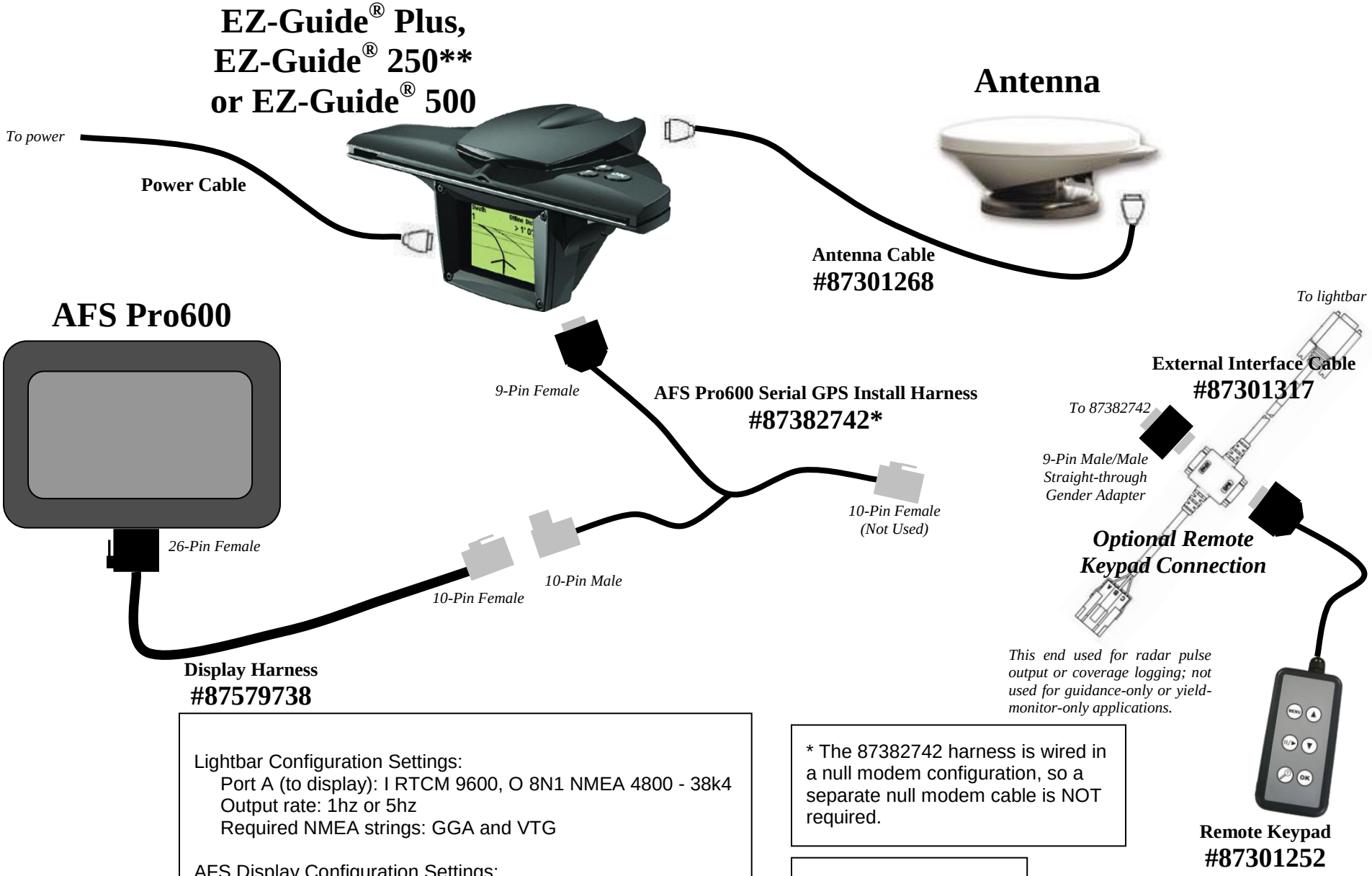
When installing an AFS receiver with a 12-pin round connector, use power/data cable #277885A1.

AFS Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

* The 10-pin Metripack GPS connector is located at the rear of the right-hand console. The connector should be routed through a hole in the bottom of the console, so that it hangs below the console.

Connecting an EZ-Guide® Plus / EZ-Guide® 250 / EZ-Guide® 500 Lightbar to an AFS Pro600 -- AFX8010 (≤MY06) and Axial-Flow (≥MY07) 7010/8010 Combine --



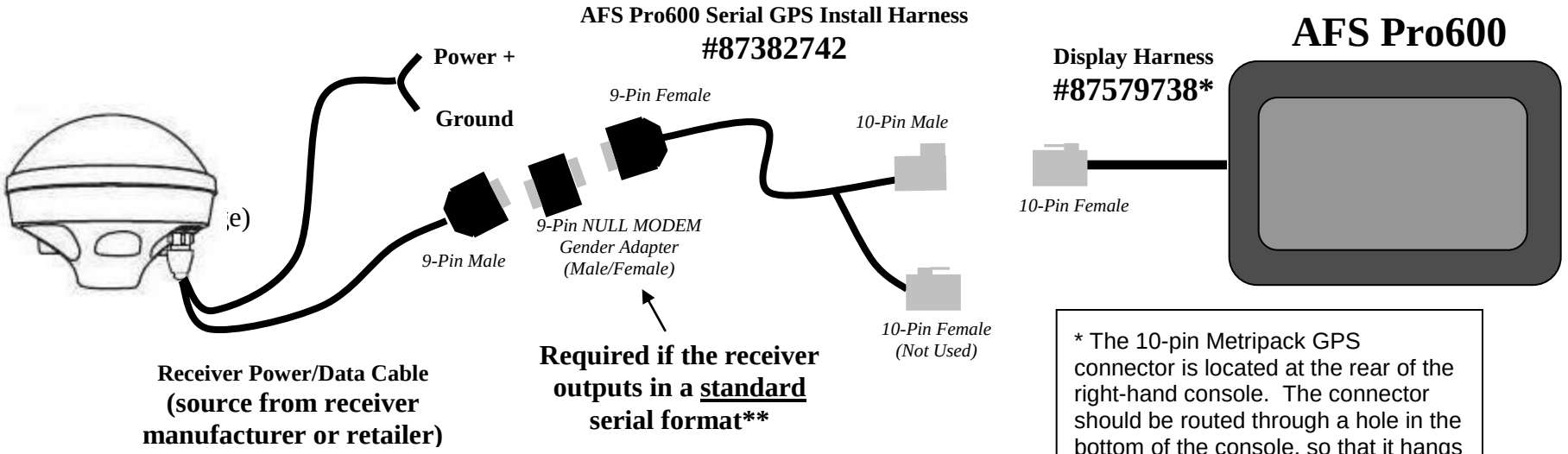
Lightbar Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

* The 87382742 harness is wired in a null modem configuration, so a separate null modem cable is NOT required.

** Requires RS232 # ZTN63076 or 'All Port' # ZTN64045 add-on

Connecting a Generic GPS Receiver to an AFS Pro600 Yield Monitor
-- AFX8010 (≤MY06) and Axial-Flow (≥MY07) 7010/8010 Combine --



* The 10-pin Metripack GPS connector is located at the rear of the right-hand console. The connector should be routed through a hole in the bottom of the console, so that it hangs below the console.

Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

** The 87382742 harness is wired in a null modem configuration. This means that pins 2 and 3 are crosslinked (reversed). Pin 2 is Receiver Receive (Rx) and Pin 3 is Receiver Transmit (Tx).

If the 87382742 harness is used with a receiver that outputs data in a standard serial format (Pin 2 is Receiver Tx and Pin 3 is Receiver Rx), a null modem cable or adapter is required to reverse the null in the 87382742 harness, creating the equivalent of a standard serial cable.

If the 87382742 harness is used with a receiver that outputs data in a null modem format, the null modem adapter is not used.

Connecting GPS Receivers



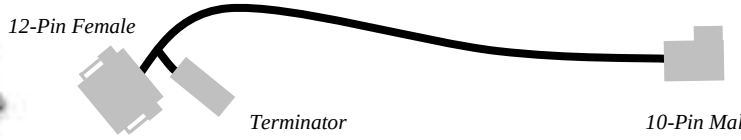
Case IH Axial-Flow 20 Series Combines

Connecting an AFS Receiver to an AFS Pro600 Yield Monitor
-- Axial-Flow 7120 / 8120 / 9120 Combine, CAN Installation --

AFS Receiver
(representative image)



AFS Pro600 CAN GPS Install Harness
#87382741



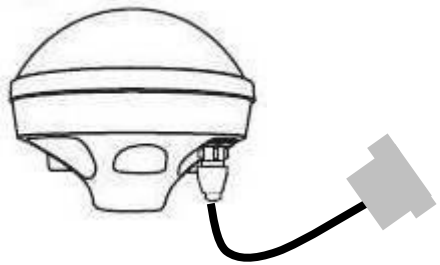
Display Harness*



AFS Pro600



12-Pin Male



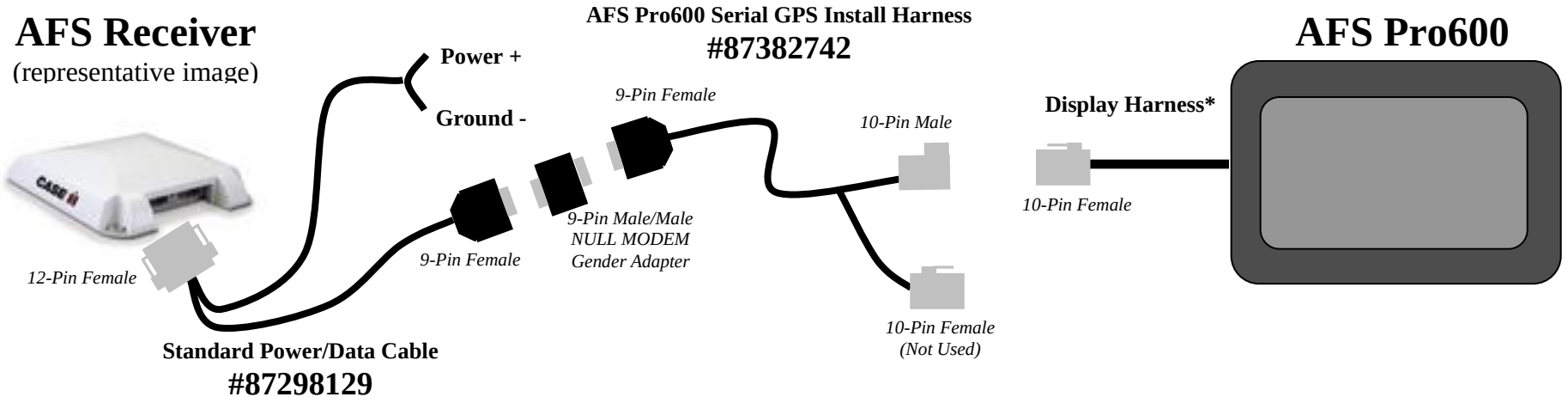
When installing an AFS receiver with a 12-pin round connector, use adapter harness #87383158.

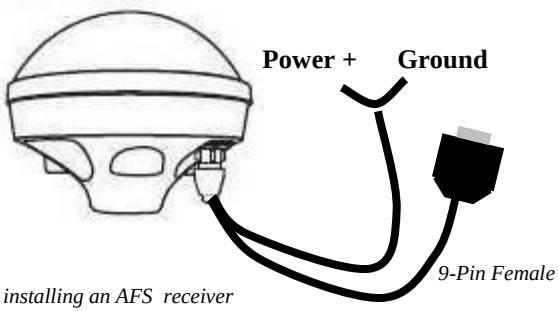
AFS Receiver Configuration Settings:
No configuration is required for CAN installations

AFS Display Configuration Settings:
Ensure that the display is configured to accept a CAN GPS signal, per the display operator's manual.

* The 10-pin Metripack GPS connector is located at the rear of the right-hand console. The connector should be routed through a hole in the bottom of the console, so that it hangs below the console.

Connecting an AFS Receiver to an AFS Pro600 Yield Monitor
-- Axial-Flow 7120 / 8120 / 9120 Combine, RS-232 Installation --





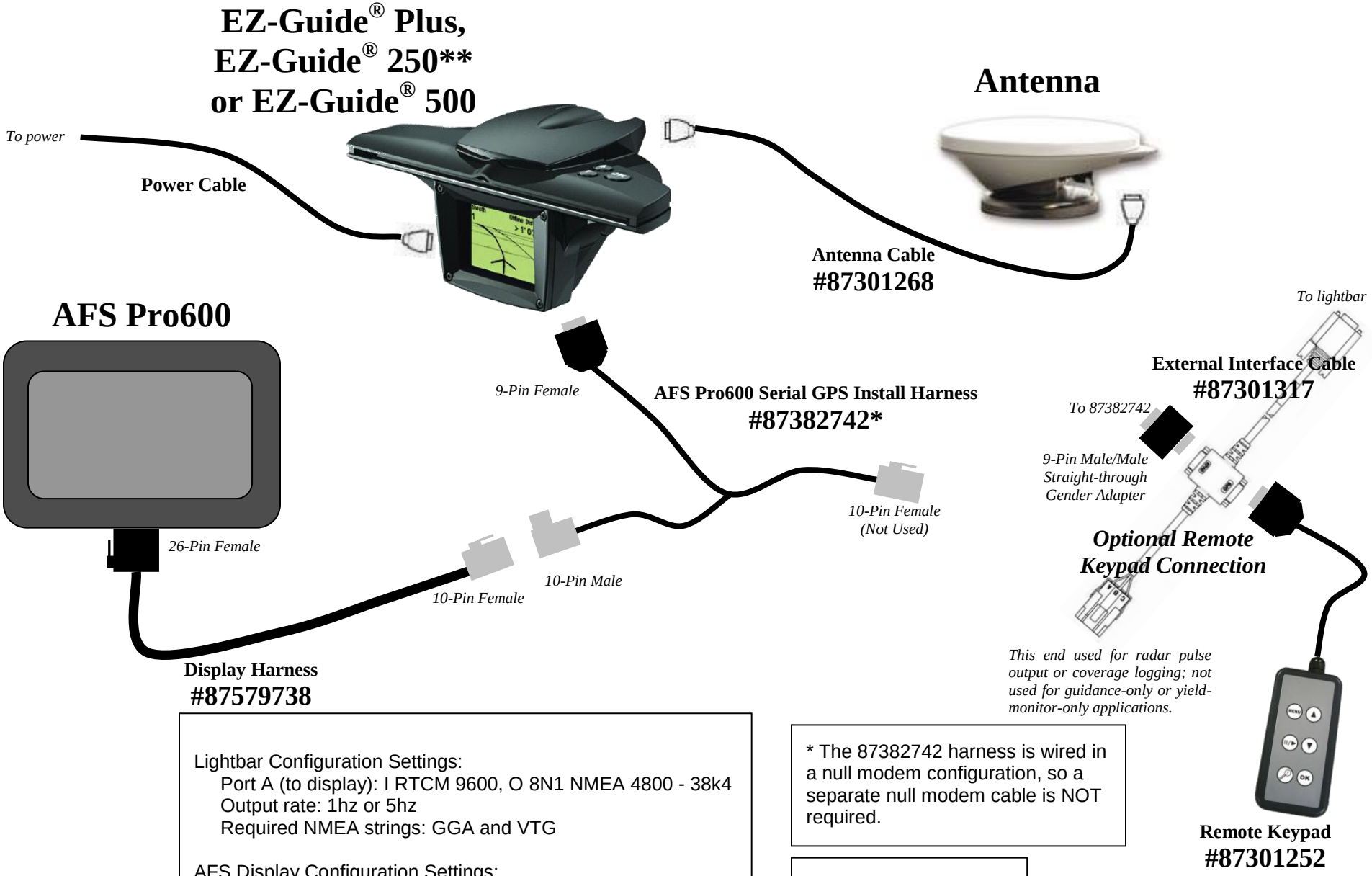
When installing an AFS receiver with a 12-pin round connector, use power/data cable #277885A1.

AFS Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

* The 10-pin Metripack GPS connector is located at the rear of the right-hand console. The connector should be routed through a hole in the bottom of the console, so that it hangs below the console.

Connecting an EZ-Guide® Plus / EZ-Guide® 250 / EZ-Guide® 500 Lightbar to an AFS Pro600 -- Axial-Flow 7120 / 8120 / 9120 Combine --



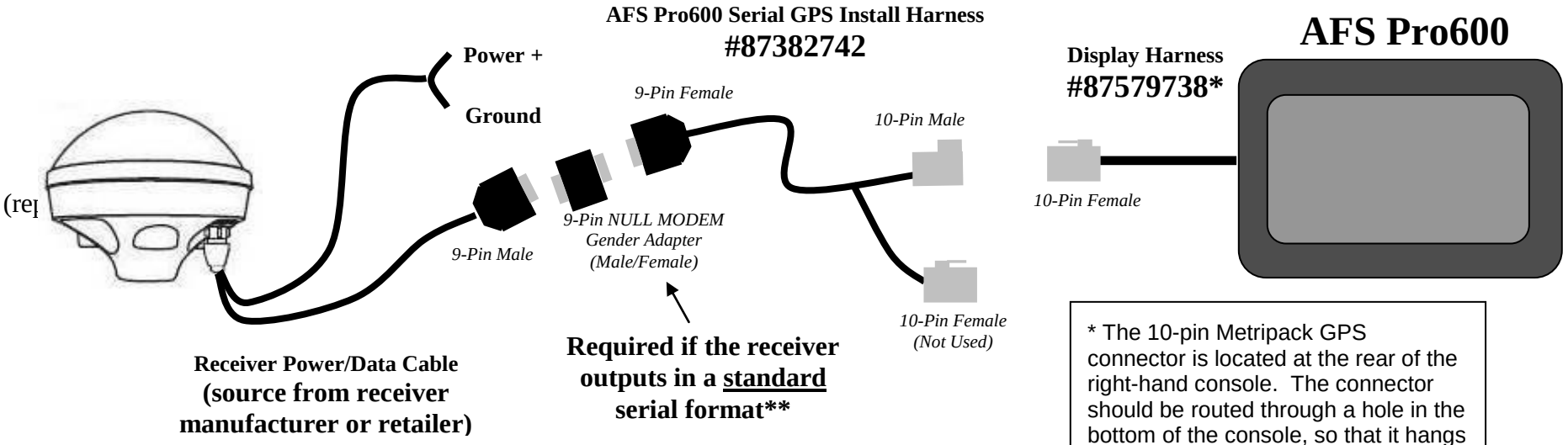
Lightbar Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

* The 87382742 harness is wired in a null modem configuration, so a separate null modem cable is NOT required.

** Requires RS232 # ZTN63076 or 'All Port' # ZTN64045 add-on

Connecting a Generic GPS Receiver to an AFS Pro600 Yield Monitor
-- Axial-Flow 7120 / 8120 / 9120 Combine --



* The 10-pin Metripack GPS connector is located at the rear of the right-hand console. The connector should be routed through a hole in the bottom of the console, so that it hangs below the console.

Receiver Configuration Settings:
- Port A (to display): I RTCM 9600, O 8N1 NMEA 4800 - 38k4
- Output rate: 1hz or 5hz
- Required NMEA strings: GGA and VTG

AFS Display Configuration Settings:
- Ensure that the display is configured to accept an RS-232 GPS signal per the display operator's manual.

** The 87382742 harness is wired in a null modem configuration. This means that pins 2 and 3 are crosslinked (reversed). Pin 2 is Receiver Receive (Rx) and Pin 3 is Receiver Transmit (Tx).

If the 87382742 harness is used with a receiver that outputs data in a standard serial format (Pin 2 is Receiver Tx and Pin 3 is Receiver Rx), a null modem cable or adapter is required to reverse the null in the 87382742 harness, creating the equivalent of a standard serial cable.

If the 87382742 harness is used with a receiver that outputs data in a null modem format, the null modem adapter is not used.

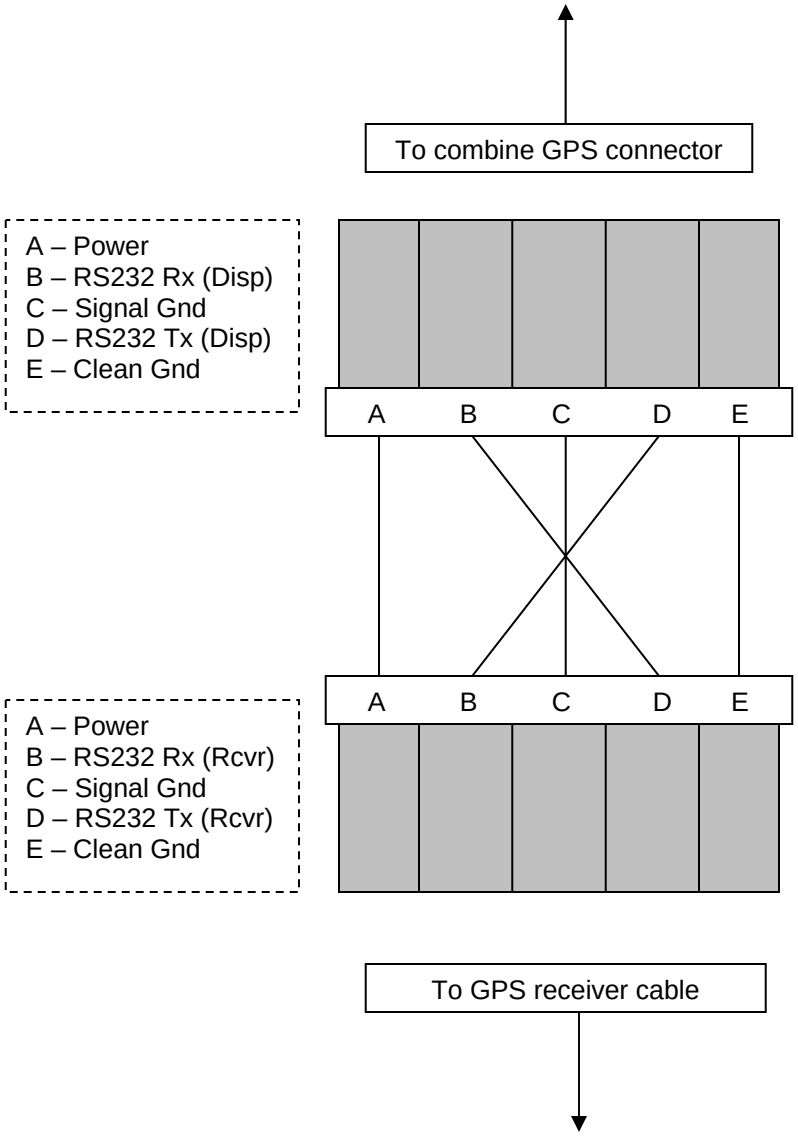
Appendix

1. Female/Female 5-pin Gender Adapter for 2500 Series Combines
2. Color Display, 26-pin Tyco Connector Pinout
3. Universal Display (Plus), 12-pin Deutsch Connector (black) Pinout
4. AFS GPS Adapter Cable (87302445/249547A1) Pinout
5. Trimble Receivers, 12-pin Round Connector Pinout
6. Axial-Flow 7010/8010 Combine, 10-pin Metripack GPS Connector Pinout
7. 1600, 2100, and 2300 series combines, 5-pin Female Metripack
8. 2500 series combines, 5-pin Male Metripack
9. AFS 162/252/262 Pinout

Background:

The flat 5-pin Metripack (Packard) GPS connector in the right-hand console on MY2007 2500 series combines, is a male connector (female connector body, with pins). This is different from the GPS connector on 2100 and 2300 series combines; the Metripack connector on these machines was female (male connector body, with sockets).

To allow existing GPS installation cables, with male Metripack connectors, to be used on 2500 series combines, an adapter must be used to mate the two male connectors. The diagram below shows the correct pinouts and component part numbers required to assemble this adapter. Note that pins B and D are crosslinked (reversed).



REQUIRED COMPONENTS

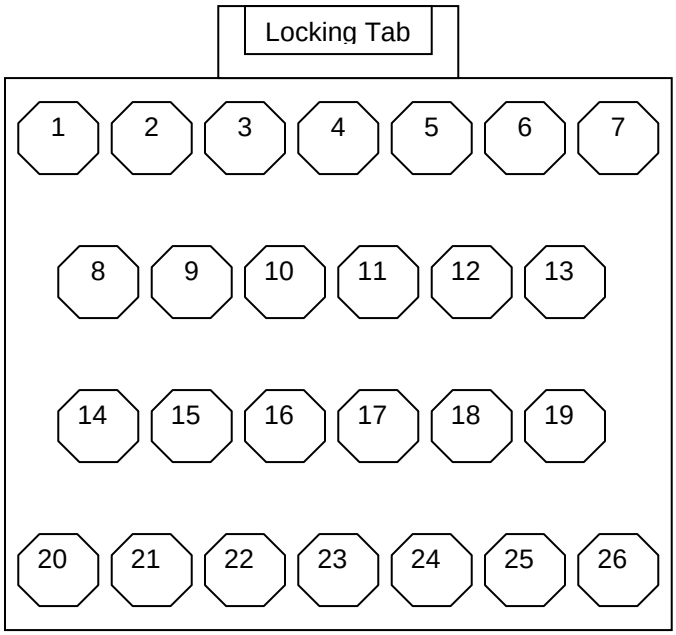
Quantity Required	CNH Part Number *(Metripack Part Number)*	Description
2	182081A1 *(12084891)*	female connector plug
2	182082A1 *(15300017)*	TPA clips
10	182149A1 *(12077411)*	MAS socket terminal
You will also need appropriate lengths of 18ga stranded wire.		

Revised 10/10/07

Color Display Connector Pinouts

26-pin Male Tyco (AMP) Connector (all color displays)

1 – CAN 1 HI
2 – CAN 1 LO
3 – Rotary Knob 1 (softkey only)
4 – Rotary Knob 2 (softkey only)
5 – CAN 2 HI
6 – CAN 2 LO
7 – not used
8 – not used
9 – RS232 TX (Disp)
10 – RS232 RX (Disp)
11 – not used
12 – not used
13 – Unswitched B+
14 – Clean Ground
15 – Switched B+
16 – not used
17 – Home Switch (softkey only)
18 – Esc Switch (softkey only)
19 – Enter Switch (softkey only)
20 – 5v supply output
21 – USB 5v B+ (softkey only)
22 – USB + (softkey only)
23 – USB - (softkey only)
24 – USB Ground (softkey only)
25 – not used
26 – not used

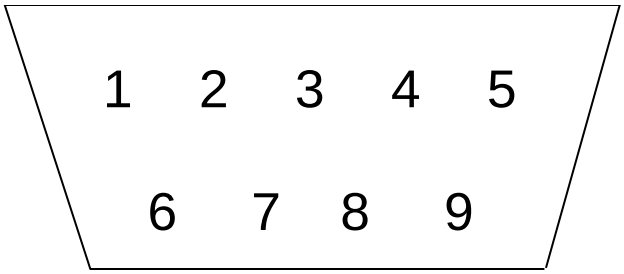


Seal Side of the HARNESS CONNECTOR
(Pin Side of the DISPLAY CONNECTOR)

Harness connector part number: 87410948
Female terminal (socket) part number (.8mm^2): 87410950
Plug part number (for unused cavities): 87452847

9-pin (DE9) Male Connector (color touchscreen displays only)

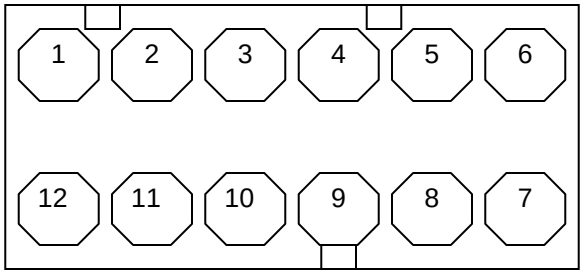
(female connector body
with male terminals (pins))
1 – not used
2 – RS232 Tx (Rcvr)
3 – RS232 Rx (Rcvr)
4 – not used
5 – not used
6 – not used
7 – not used
8 – not used
9 – not used



Pin Side of the DISPLAY CONNECTOR

12-pin Male Deutsch Connector used for GPS input on all monochrome touchscreen displays

(female connector body with male terminals (pins))
1 – not used
2 – RS232 Tx (Disp)
3 – RS232 Rx (Disp)
4 – RS232 Ground
5 – not used
6 – not used
7 – not used
8 – not used
9 – not used
10 – not used
11 – not used
12 – not used

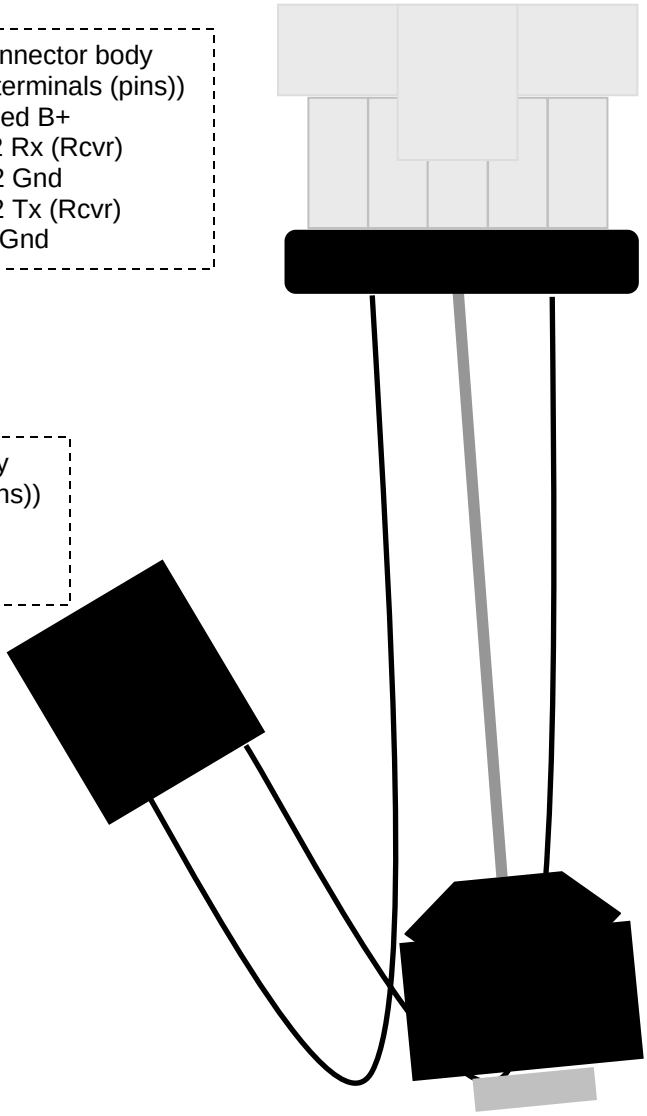


Pin Side of the DISPLAY CONNECTOR
(Seal Side of the HARNESS CONNECTOR)

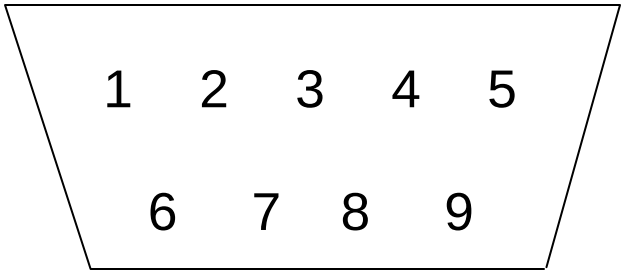
87302445 (249547A1)
9-pin to flat 5-pin AFS GPS adapter cable

(female connector body
with male terminals (pins))
A – Switched B+
B – RS232 Rx (Rcvr)
C – RS232 Gnd
D – RS232 Tx (Rcvr)
E – Clean Gnd

(female connector body
with male terminals (pins))
A – Switched B+
B – Unused (plug)
C – Clean Gnd



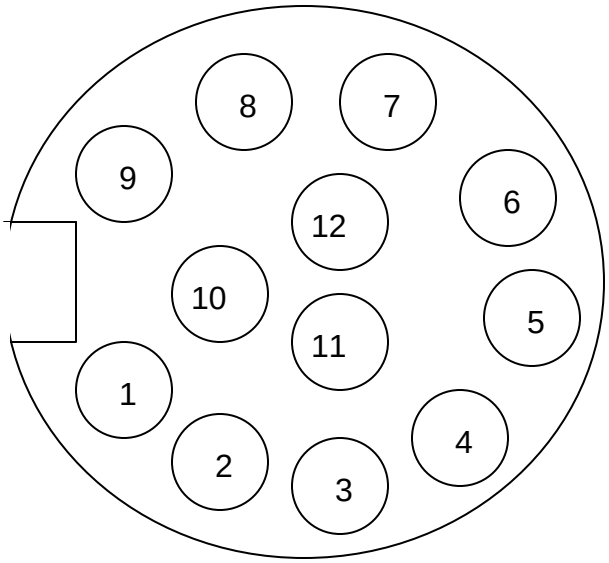
(female connector body
with male terminals (pins))
1 – not used
2 – RS232 Tx (Rcvr)
3 – RS232 Rx (Rcvr)
4 – not used
5 – RS232 Ground
6 – not used
7 – not used
8 – not used
9 – not used



Pin side (looking at the pins)

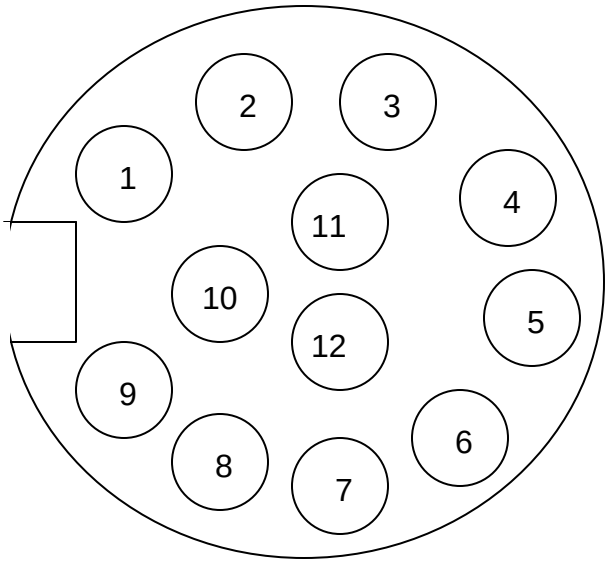
Trimble/AFS Receiver Pinouts

Many Trimble and Case IH GPS receivers are equipped with one or two round 12-pin connectors. Pinouts for these connectors are below.



View from socket side on the harness connector
(front side, looking at the terminals)

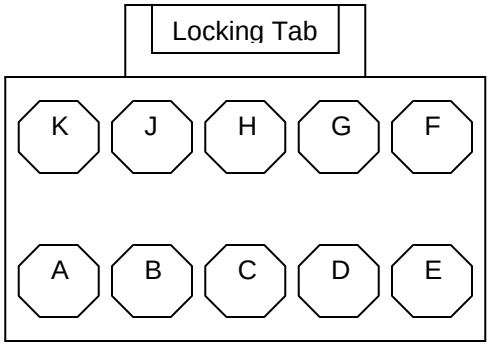
1 – Event In
2 – RS232 Tx (Rcvr)
3 – RS232 Rx (Rcvr)
4 – Chg Ctrl
5 – RS232 Ground
6 – DSR
7 – Power On
8 – CTS
9 – Charge
10 – B+ In
11 – Ground
12 – PPS



View from solder cup side on the harness connector
(back side, looking at the rubber overmold)

10-pin Female Metripack Connector
GPS input on MY2007+ Axial-Flow 7010/8010 Combines
RS232-A input on MY2009+ 88 Series Combines

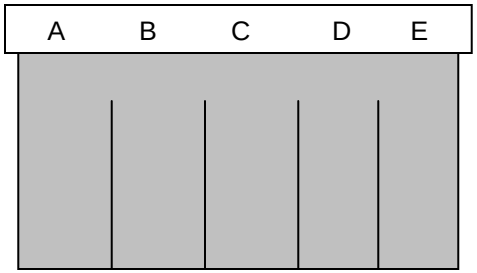
(male connector body with
female terminals (sockets))
A – Switched B+
B – Clean Ground
C – CAN2 HI
D – CAN2 LO
E – RS232 Tx (Rcvr)
F – RS232 Rx (Rcvr)
G – PPS out
H – RS232 Ground
J – CAN1 HI
K – CAN1 LO



Terminal Side of the COMBINE CONNECTOR
(Seal Side of the GPS RECEIVER HARNESS CONNECTOR)

5-pin Female Metripack Connector
Used for GPS input on 1600, 2100, and 2300 series combines

A – Power
B – RS232 Rx (Disp)
C – Signal Gnd
D – RS232 Tx (Disp)
E – Clean Gnd



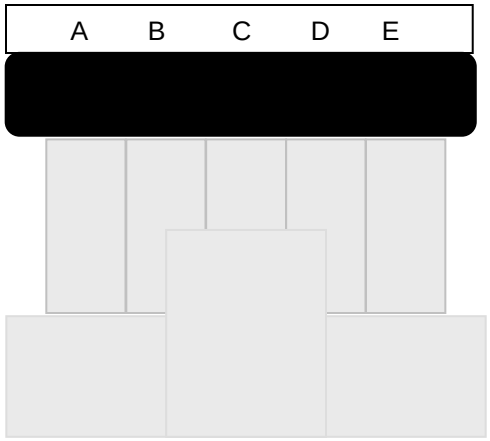
To GPS receiver cable



Revised 09/18/07

5-pin Male Metripack Connector
Used for GPS input on 2500 series combines

A – Power
B – RS232 Rx (Disp)
C – Signal Gnd
D – RS232 Tx (Disp)
E – Clean Gnd

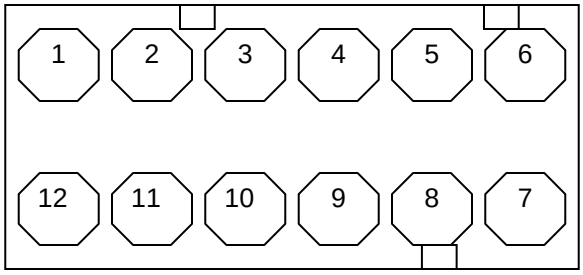


To GPS receiver

AFS162/252/262 Receiver Pinout

The AFS 162 receiver is equipped with one rectangular Deutsch connector.
The AFS252/262 receiver is equipped with two rectangular Deutsch connectors.

(female connector body with male terminals (pins))
1 – CAN HI
2 – RS232 Tx (Rcvr)
3 – RS232 Rx (Rcvr)
4 – PPS out
5 – RS232 Ground
6 – RTS
7 – not used
8 – CTS
9 – not used
10 – Switched B+ (12v)
11 – Clean ground
12 – CAN LO



Pin Side of the RECEIVER CONNECTOR
(Seal Side of the HARNESS CONNECTOR)

END OF DOCUMENT