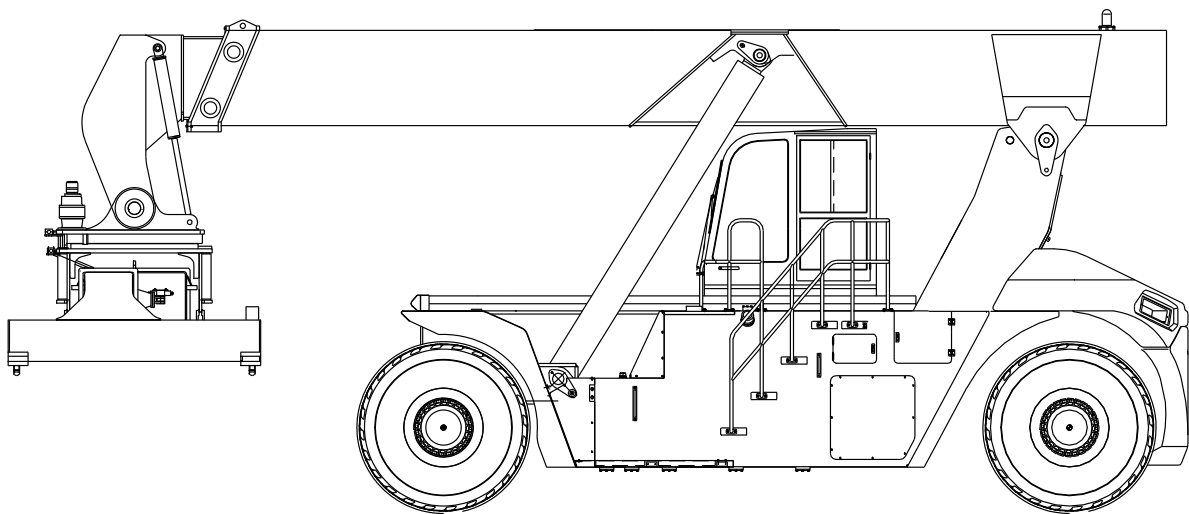


Container Reach Stacker

MAINTENANCE AND OPERATION MANUAL

CRS450Z5
(Z-CCZ5)
(Z-DCZ5)



DALIAN FORKLIFT CO., LTD.

版 本 号: 2014-001

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To the owner of this Model CR50Z5 Container Reach Stacker Maintenance and Operation Manual

Before allowing the operator of this stacker to start and operate the stacker,

1. Give this Manual to the operator and let him keep it. Ask him to thoroughly read this Manual in order to safely and properly operate the stacker.
2. The operator must thoroughly read this Manual and completely understand the content before he is allowed to start and operate this machine.
3. In addition, before starting the engine, the operator must
 - 3.1 Check all rating plates provided on this machine, and read and understand the content;
 - 3.2 Check for any persons in the working zone and let them leave;
 - 3.3 Learn how to operate all control levers and other operation controls provided in the operator's cab and be skillful in operation before being allowed to start operating the stacker.

The user or owner of this model of container reach stacker has the obligation to ask the operator to read and understand this Manual and follow the instructions in this Manual in operation of this stacker. Furthermore, the operator should obey the local safety rules and regulations.

Importance:

To keep safe and trouble-free operation of the machine you bought, you must strictly observe the instructions of this Manual when performing lubricating oil refilling and maintenance operations, which is the important precondition.

Some maintenance items listed in this Manual need using special tools and require maintenance persons to have necessary professional knowledge and skills.

Failure to follow the instructions in this Manual in refilling lubricating oil and performing maintenance will be certainly lead to serious consequences.

The manufacturer (Dalian General Forklift Truck Works) may not foresee specific maintenance procedures used by users and thus can not foresee dangers that may occur in operations. Therefore, our advice in this Manual may not be complete. For this reason, before using any special procedures or tools other than those specified in this Manual for inspection, maintenance of the stacker, the user must judge whether it may cause injury to the operator and others and damage to the parts of the machine or not to confirm that no dangers will not occur.

Data in this Manual may be subject to changes without notice.

Questionnaire about Vehicle Use

Vehicle description		Model	
Manufacturer		Product No.	
User		Person receiving questions (name & position)	
Vehicle service hours		Daily service hours	
Accumulated service hours		Load type	
1	Does the vehicle performance meet the service requirements?	Satisfied ☐	Moderate ☐ Not satisfied ☐
2	Your suggestion about improvements?		
3	Is it easy to operate?	Good ☐	Moderate ☐ Poor ☐
4	Your suggestion about improvements?		
5	What's the strongest point of this vehicle?		
6	Give your comment on the overall reliability.	Good ☐	Moderate ☐ Poor ☐
7	What's the biggest problem?		
8	Give your comment on the engine reliability.	Good ☐	Moderate ☐ Poor ☐
9	Has it been repaired? For what?		
10	Give your comment on the torque converter and transmission reliability.	Good ☐	Moderate ☐ Poor ☐
11	Have they been repaired? For what?		
12	Give your comment on the drive axle reliability.	Good ☐	Moderate ☐ Poor ☐
13	Have they been repaired? For what?		
14	Give your comment on the steering system reliability.	Good ☐	Moderate ☐ Poor ☐
15	Has it been repaired? For what?		
16	Give your comment on the hydraulic system (cylinders, pumps and valves) reliability?	Good ☐	Moderate ☐ Poor ☐
17	Have they been repaired? For what?		
18	Give your comment on the operating mechanism reliability.	Good ☐	Moderate ☐ Poor ☐
19	Has it been repaired? For what?		
20	It is easy to perform the overall maintenance?	Convenient ☐	Moderate ☐ Inconvenient ☐
21	What parts are maintained uneasily?		
22	Are there any serious defects with the vehicle?		
23			
Time		Questioner	

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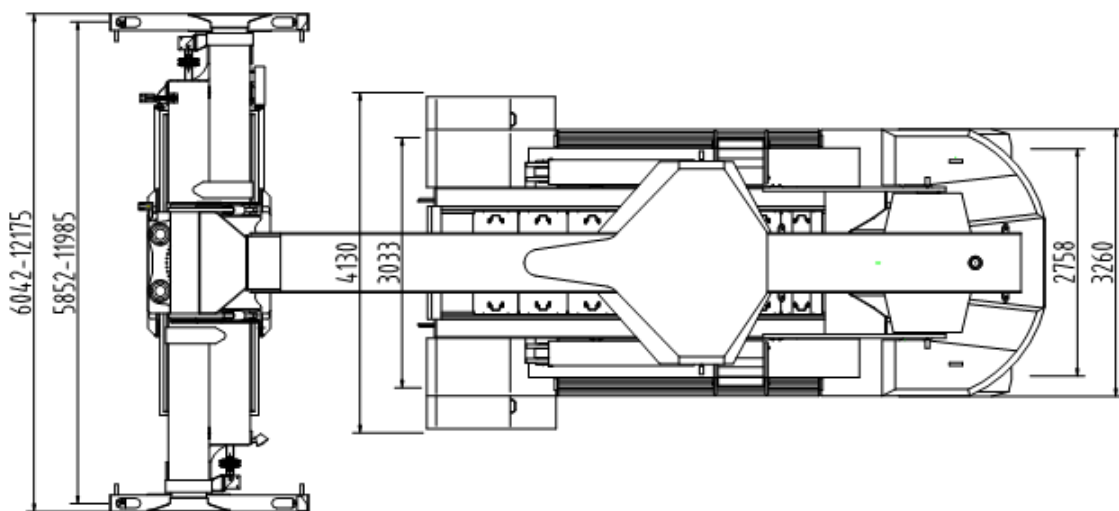
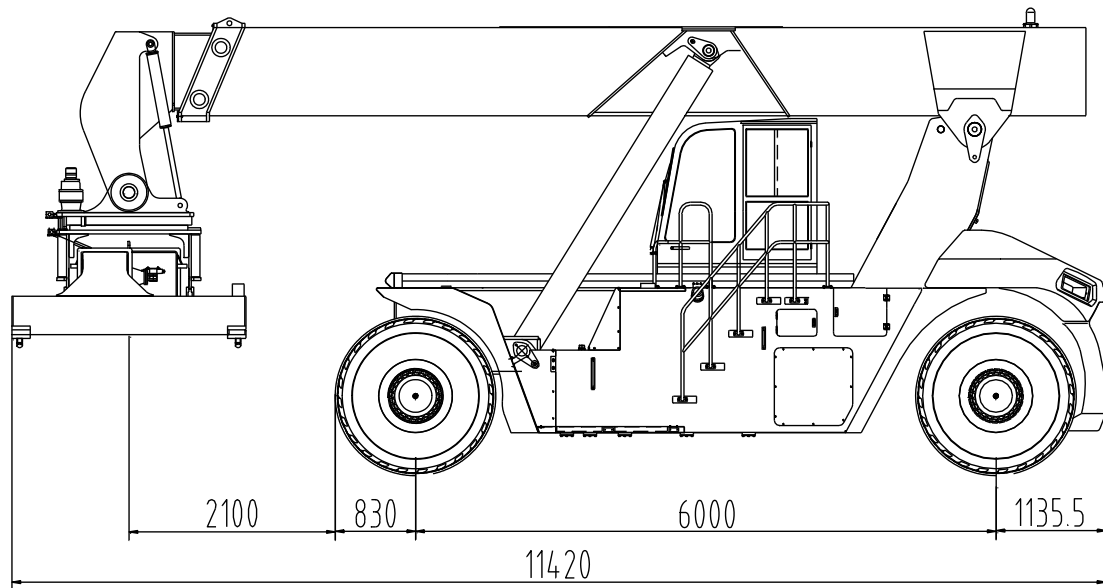
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Precaution:

Only trained and qualified persons are allowed to drive, maintain and repair this container reach stacker. Improper operation, maintenance and repair of the stacker may cause serious hazard to the operator and environment!

I. Technical Data

External Dimensions of Model CRS450Z5 Container Reach Stacker



Outside View of the Spreader

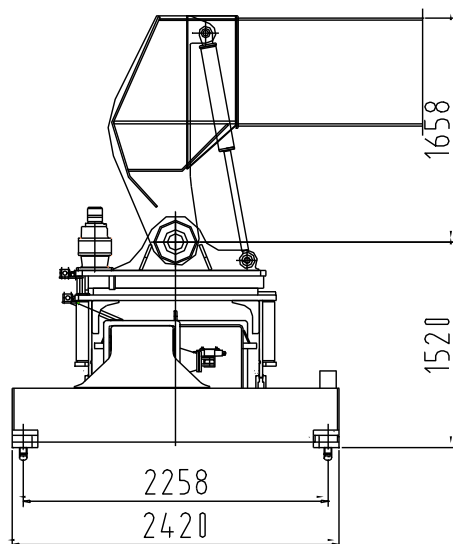
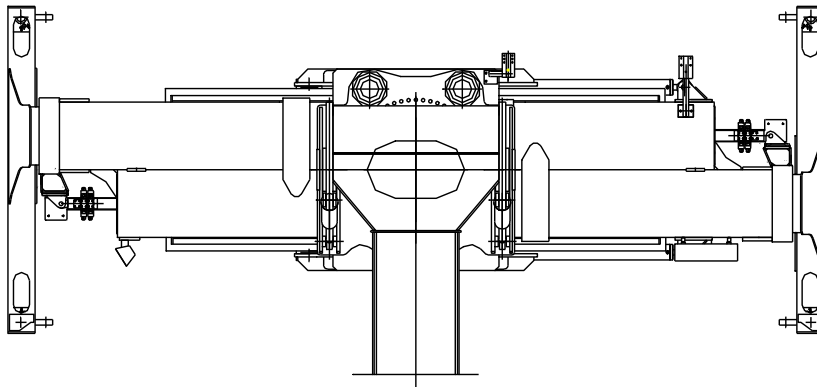
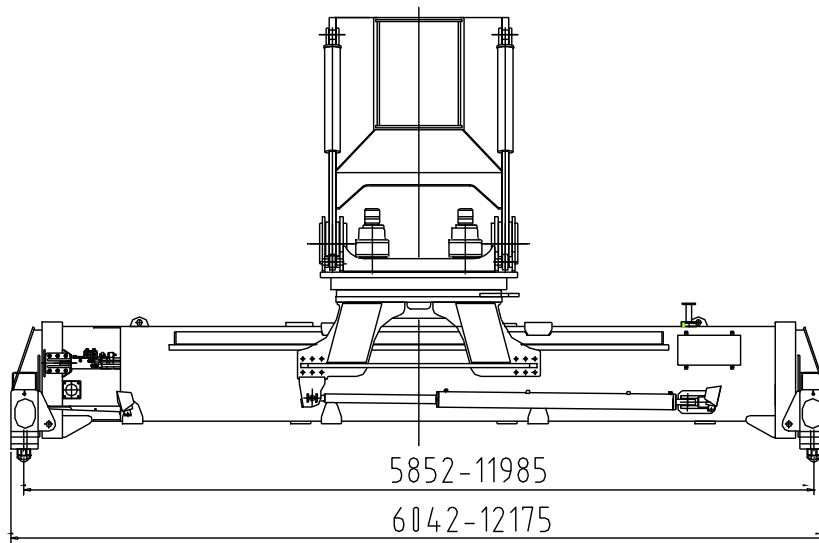
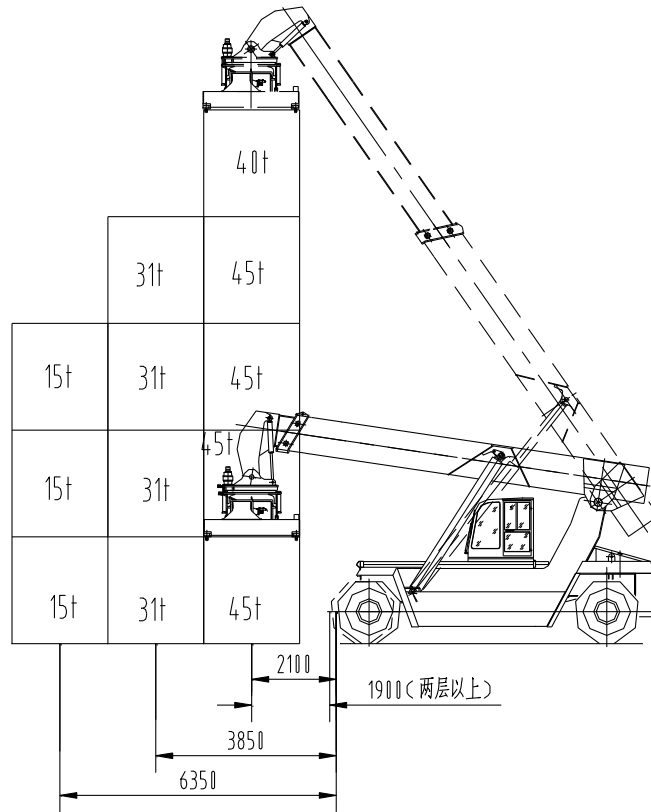


Diagram of the Rated Lifting Capacity of

Model CRS450Z5 Container Reach Stacker

Load characteristics



Indications on rating plate

REACH STACKER					
MODEL	CRS450Z5	RATED CAPACITY	45000	kg	
DEADWEIGHT	73000	kg	LIFT HEIGHT	15100	mm
SERIAL NO.		EQUIPMENTS CODE	Z-CCZ5/Z-DCZ5		
MANUFACTURE LICENSE SERIAL NUMBER		TS2410409-2016	DATE		
DALIAN FORKLIFT CO.,LTD.					
No.18 Yingxiang Street,Ganjingzi District,Dalian,China					

1. Basic performance parameters

Model: CRS450Z5

External dimensions of the vehicle:

Length (mm)	11420
Width (mm)	4,130
Height (mm)	4,650

Rated lifting capacity/front row pitch (t/mm) (under the spreader):

a. First row (t/mm)	1 – 4 layers	45/1,900
	5 layers	40/1,900
b. Second row (t/mm)	4 layers	31/3,850
c. Third row (t/mm)	3 layers	15/6,350

Max. lifting height (mm) 15100

Min. ground clearance (mm) 360

Driving speed (no load), forward/backward (km/h):

Position 1	3.5/3.5	Position 2	8.5/8.5
Position 3	15/15	Position 4	25/25

Wheel base (mm) 6,000

Wheel tread (mm)

Tread front	3,033
Tread rear	2,758

Turning radius (mm) 8,200

Lifting speed (no load/heavy load) (mm/s) 340/240

Lowering speed (no load/heavy load) (mm/s) 300/250

Gradeability (no load/heavy load) (%) 30/15

Braking length (20 km at no load/10 km at heavy load) (m) $\leq 7 / \leq 3.5$

Engine:

a. Model	Cummins QSM11	Volvo TAD952VE
b. Type	6-cylinder 4-stroke turbo-charged engine with central water cooling	
	6-cylinder 4-stroke turbo-charged engine with central water cooling	
c. Displacement (cc)	10,800	9360
d. Rated power/Rated speed (kW/rpm)	250/2100	242/2100
e. Max. torque (N-m/rpm)	1674/1400	1700/1300
f. Deadweight (kg)	981	1065
g. Cylinder bore (mm)	120	120
h. Stroke (mm)	147	138

Transmission (including torque converter):

- a. Manufacturer DANA (QSM11)
DANA (TAD952VE)
 - b. Model and type 14.7HR36432, stationary shaft type
15.5TE27418, stationary shaft type
 - c. Number of speeds (forward/backward) 4/4
 - d. Gear shift type APC122 full automatic power gear shift
APC200 full automatic power gear shift
 - e. Speed ratio (forward/backward)
- | | | | |
|-------------|-------------|------------|-------------|
| 14.7HR36432 | | | |
| Position 1 | 5.814/5.814 | Position 2 | 2.422/2.422 |
| Position 3 | 1.379/1.379 | Position 4 | 0.784/0.784 |
| 15.5TE27418 | | | |
| Position 1 | 5.07/5.07 | Position 2 | 2.42/2.42 |
| Position 3 | 1.38/1.38 | Position 4 | 0.78/0.78 |

Drive axles:

- a. Manufacturer KESSLER + CO
- b. Model D102 PL341/528-NLB8460
- c. Speed ratio Total 26.35
Wheel reduction gear 2.12 Final drive 12.43
- d. Service brake, built in drive axle, totally-enclosed multi-disc wet type
- e. Parking brake, caliper-disc type

Steering axle:

Transversal cylinder steering axle type
 Inside steer angle (on each side) 67.75°
 Steering cylinder: Cylinder bore × rod dia. × stroke (mm) 180×110×551

Tires:

Inflation pressure 1.1 Mpa
 Front wheels 4/18.00 – 25 – 40 PR
 Rear wheels 2/18.00 – 25 – 40 PR

Spreader:

Model 817
 Manufacturer ELME
 Application: 20' ~ 40' international standard containers
 Width (mm) 6,042
 Slew angle (°) +95 ~ -185
 Lateral shifting to left/right (mm) ± 800
 Deadweight (kg) 8,800

Boom

The boom is of the welded box design, with the special molded nylon slide blocks inside, which is easy to manufacture, install and maintain and can be

replaced in regular inspections.

Luffing angle: $0 \sim 60^\circ$

Luffing cylinder: Cylinder bore $\times$ rod dia. $\times$ stroke (mm) $250 \times 200 \times 2,706$

Extention cylinder: Cylinder bore $\times$ rod dia. $\times$ stroke (mm) $180 \times 140 \times 7,172$

Deadweight

73 tons (including the spreader of 8.6 tons)

II. Transporting and Lifting

For hauling other vehicles, the speed should not exceed 10 km/h and the hauling distance not exceed 1 km.

In general, towing container reach stackers is not allowed. In case the stacker can not be driven and is parking at a place where it may obstruct production, set the shift control lever of transmission to the neutral position while releasing the parking brake. Start the engine and tow the stacker to a place where it would not obstruct production. (See the section of towing in the operation instructions for the transmission.)

Notice:

After the vehicle is restored, make sure resetting the parking brake.

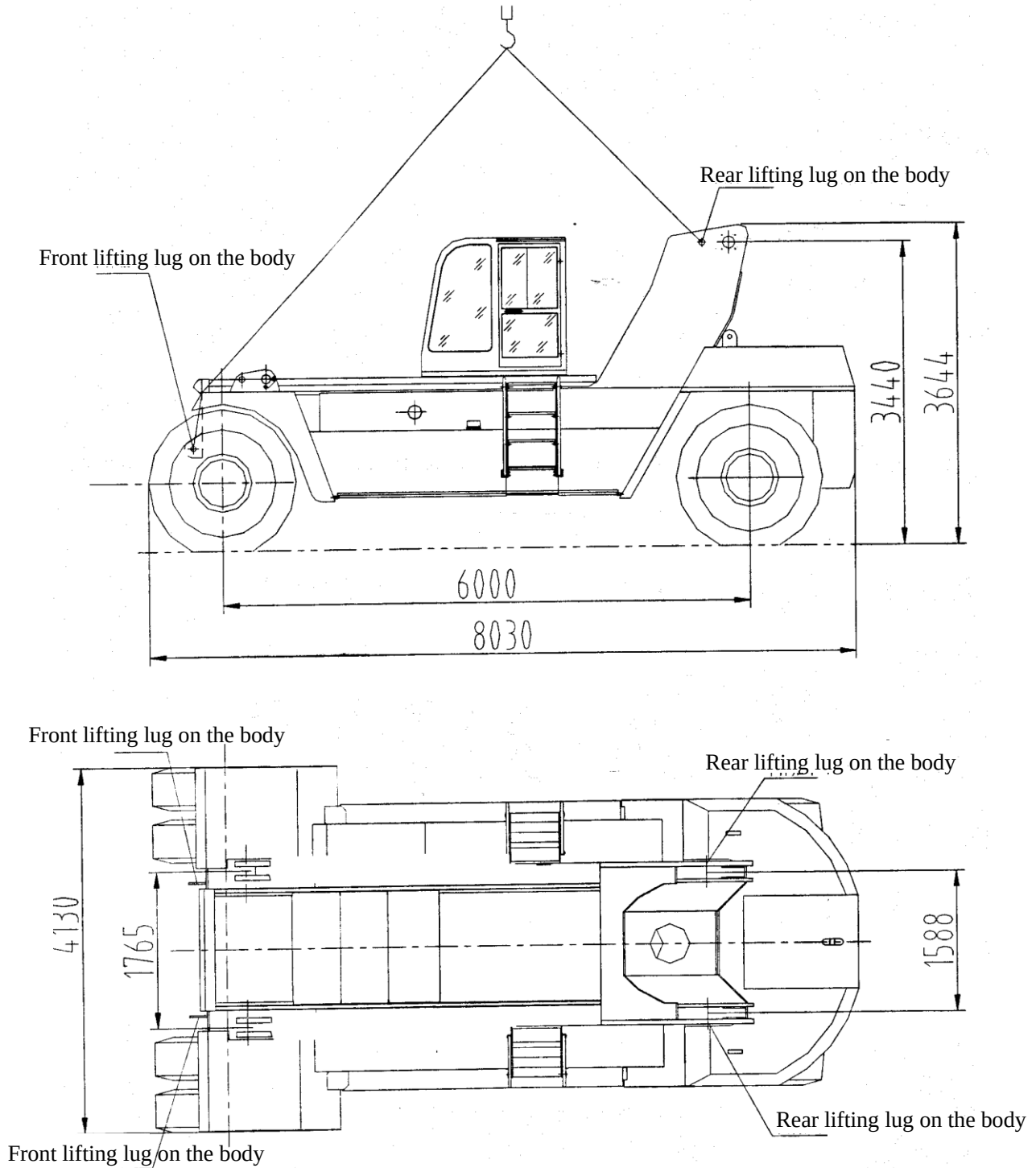
Never tow the container reach stacker with the shift control lever of transmission not at the neutral position. Otherwise, the transmission may be damaged.

Towing the container reach stacker in a long distance may cause insufficient supply of lubricating oil to the transmission, resulting in damage.

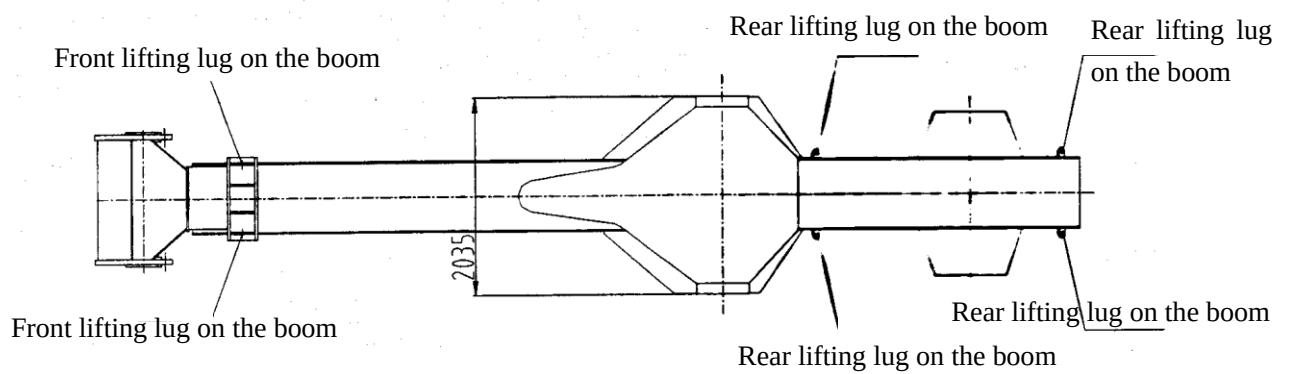
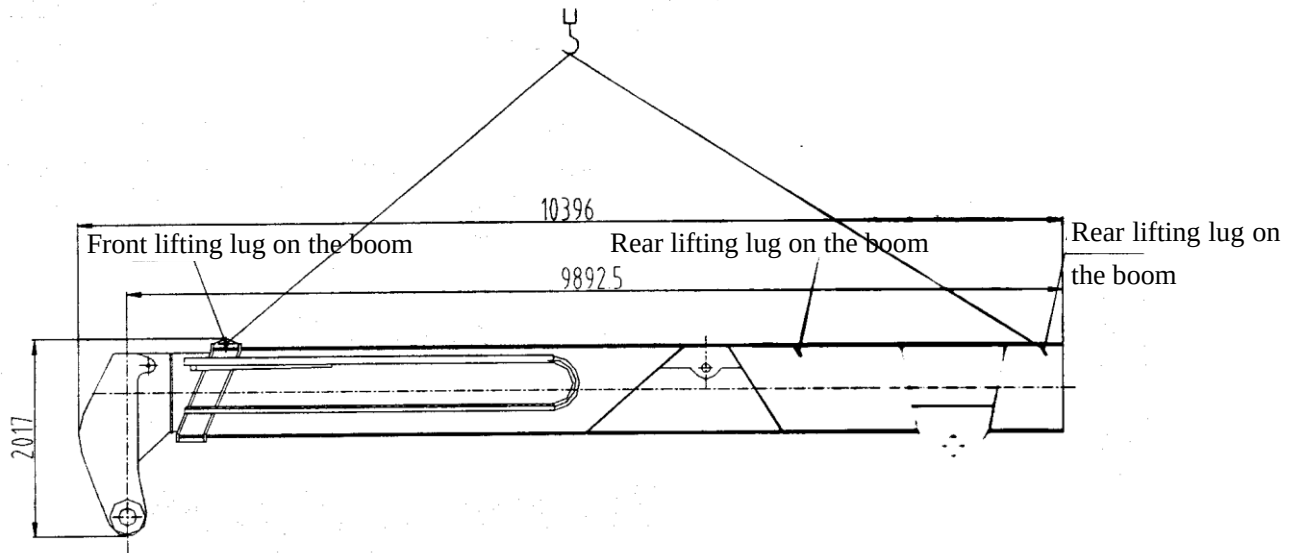
For transporting in a long distance, transport it as a whole or disassemble it into four parts for transport as instructed below:

- a. Remove the pins connecting the spreader and the damping cylinder and connecting the spreader and the boom, and related hydraulic piping and electrical components. Remove the spreader.
- b. Place the bracket in front of the stacker and put the boom onto the bracket. Remove the pin connecting the luffing cylinder and the boom. Hold lifting the boom by cranes. Remove the related hydraulic piping, electric wiring and the pin connecting the boom and the vehicle frame. Lift away the boom.
- c. Remove the supporting shaft under the luffing cylinder. Remove the luffing cylinder.

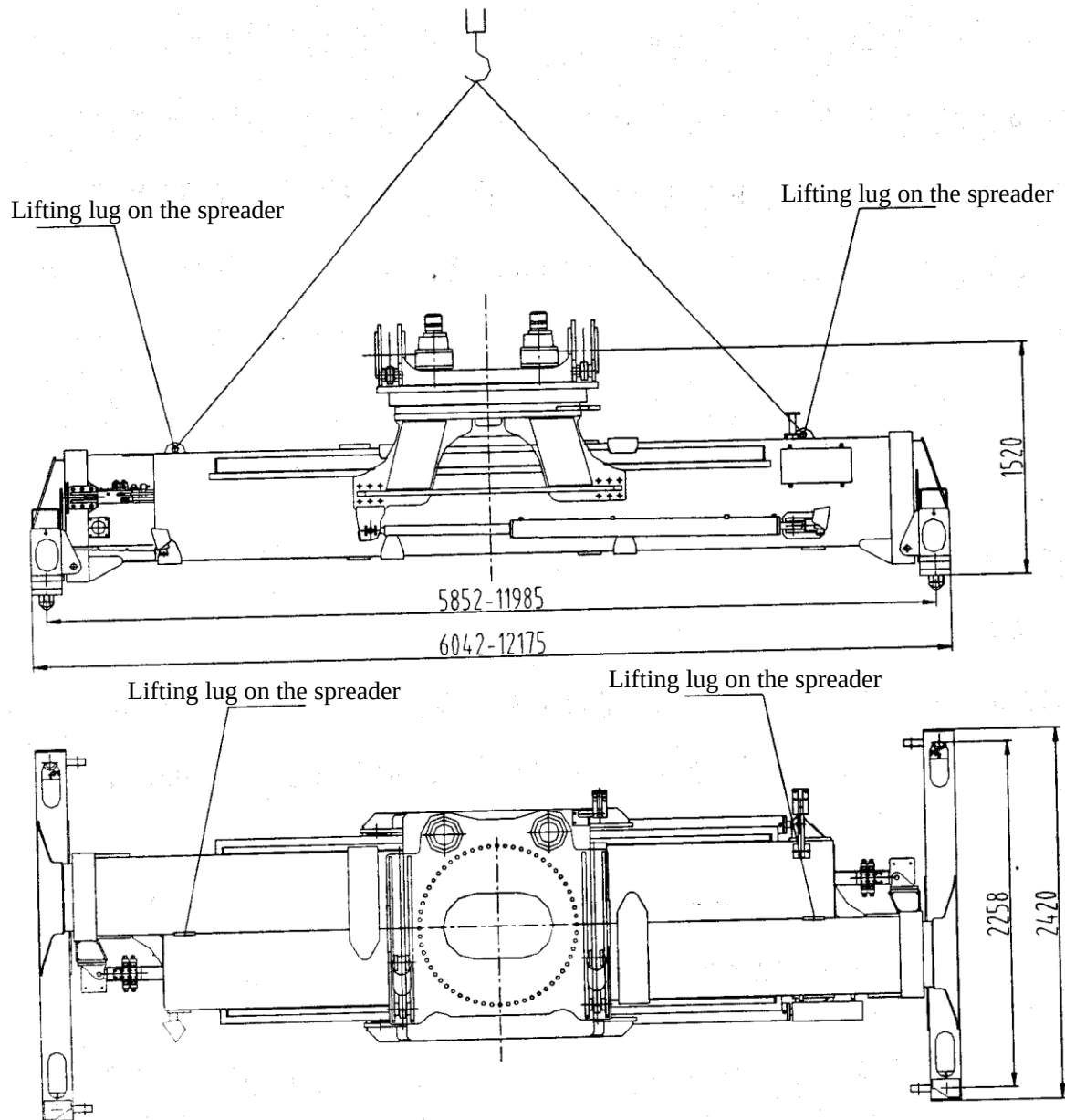
Lifting diagram:



Deadweight: 50,000 kg



Deadweight: 14,200 kg



Deadweight: 8,600 kg

III. Operating and Driving

1. Description of the mechanical part

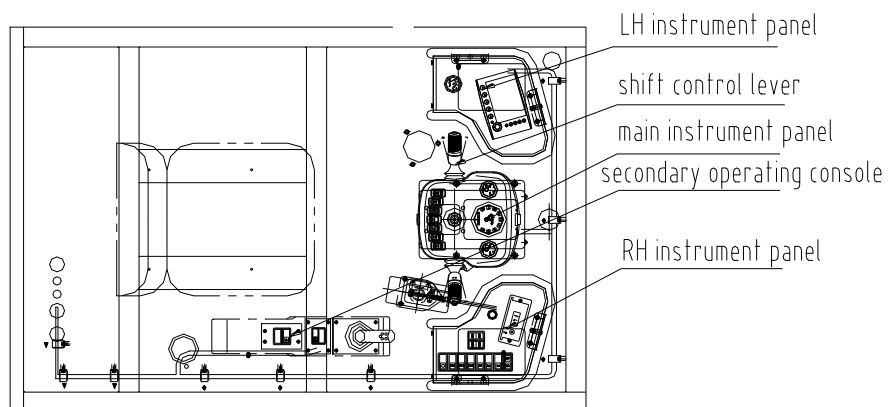
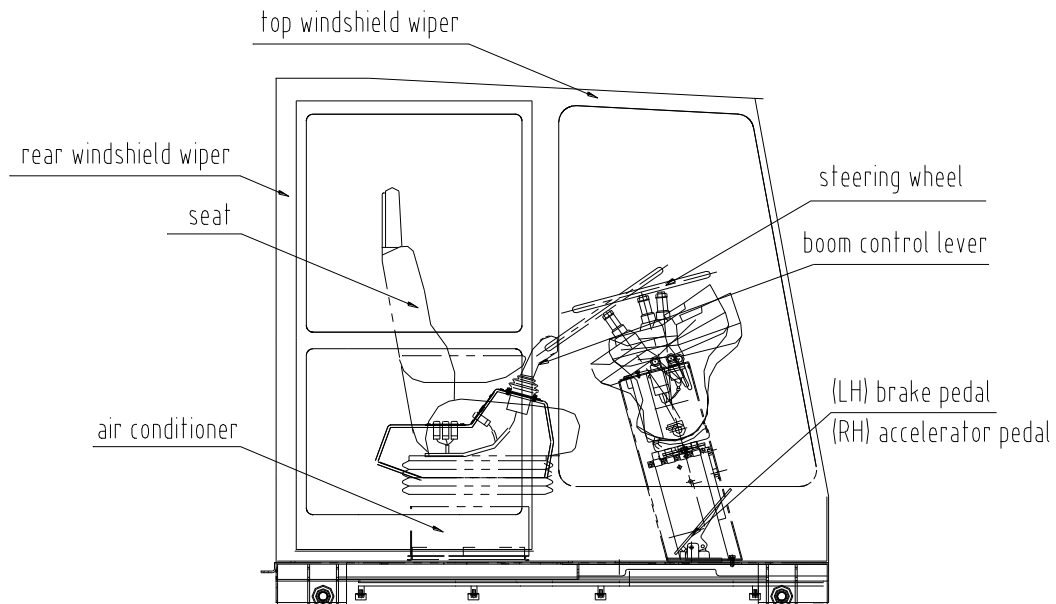
Model CRS450Z5 container reach stacker is designed to lift 20' – 40' international standard containers for container lifting and stacking operations in wharves, container yards, container stations and so on. This machine is better than forklift trucks for its providing a broader field of vision, flexible and easy operation, high stability and high utilization of yard space and also allowing picking operations over containers. It is very good for container loading and unloading in medium- and small-scale harbors, railway freight stations and container stations, and can also be used as the auxiliary equipment in large-scale container terminals.

The container reach stacker is comprised of three parts, i. e. the chassis, the telescopic boom, and the container spreader. The chassis consists of the engine, the transmission with power gear shift, the front axle, the rear axle, the steering system, the operator's cab, the vehicle frame, the counterweight and the wheels. The telescopic boom consists of the extension cylinder, the luffing cylinder and the boom. The container spreader consists of the slewing gear, the telescopic boom, extension cylinder, the damping cylinder, the laterally-shifting cylinder and the twist-lock cylinder.

Model CRS450Z5 container reach stacker is equipped with the slewable telescopic container spreader for 20' – 40' international standard containers. In lifting containers, the stacker can take an angle to the container. If the lifting load is not very high, the spreader can be swung so that the container and the vehicle are in line when going through narrower passages. Furthermore, picking operations over containers can be realized and reach as far as the third row. [See the Diagram of the Rated Lifting Capacity of Model CRS450Z5 Container Reach Stacker.]

2. Operator's cab and controls

A. Layout of the operator's cab



3. Operating instructions

Only persons who have been trained and obtained the driver's qualification can operate this container reach stacker.

The operator should well rest before operating and is strictly prohibited to wear slippers or be barefoot in working.

A. Before operating

Check fuel, lubricating oil in the engine, lubricating oil in the transmission and hydraulic oil for being sufficient. The working level should be at 3/5 – 4/5 of the level indicator range on the oil tank.

Check the cooling medium for being sufficient.

Check the battery electrolyte for being sufficient.

Check the tire inflation pressure for normality.

Check the tire nuts for any looseness. The tightening torque is 498-565 N-m for the drive axle and 490-588 N-m for the steering axle. Perform daily check in the run-in period and weekly check later.

Check for any oil or water leakage or electrical leakage.

Check the twist locks for spreader for any abnormalities such as looseness, deformation and cracks.

Check all limit switches for normality.

Check all parts for any looseness and abnormalities.

Notice:

The engine check should be performed after ten minutes from the engine stop.

B. Starting the engine

Before starting the engine, confirm the shift control lever at the neutral position (N position). Check the parking brake (hand brake) for safety and all operation switches at the neutral position. Clockwise turn the key switch. Release the key switch as soon as the engine is started. One starting should not last for more than 15 seconds. In case the engine can not be started, wait for one minute before restarting. In case starting for successive three times is unsuccessful, find the cause.

Keep idling for a while after starting. Observe all gauges and instruments. In case of any abnormality, immediately find the cause. Never race it at a high speed.

Before the water temperature in the engine rises to 60°C, never perform sudden acceleration and full-load operation.

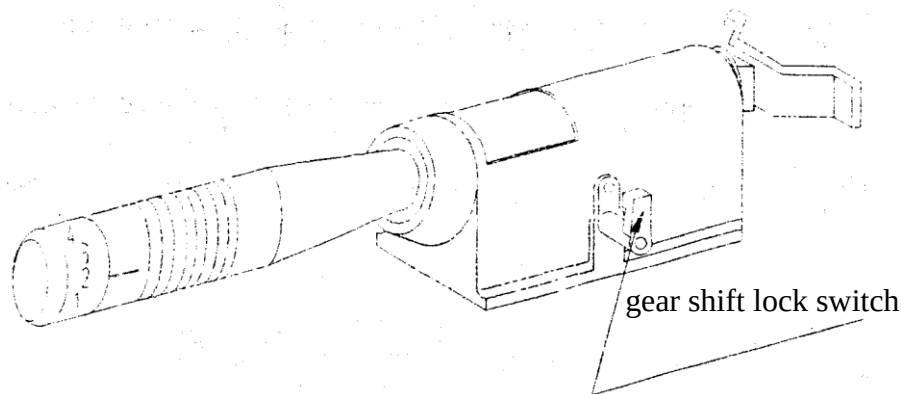
C. Vehicle driving

This container reach stacker can be driven at four forward speeds and four backward

speeds. The vehicle is driven at the second speed automatically when it is started.

Before starting the vehicle, be sure warning others with the horn while releasing the parking brake.

Turn the gear shift lock switch to the not locked position before starting the vehicle and then perform gear shifting forward or backward.



Performing direct shifting forward or backward is allowed if the speed is lower than 4 km/h. The transmission is provided with the buffer for gear shifting.

For the container reach stack, steering is performed through the rear axle and the body is wider. Therefore, take care when steering and bring the vehicle tail moving outward.

When the vehicle is running on a slope, never let it coast at neutral position. When the vehicle is going down the hill, the engine speed should not be lower than 1,200 rpm to avoid lack of oil in the transmission.

If the engine is still engaged with the transmission and keeps running, do not shut down the engine.

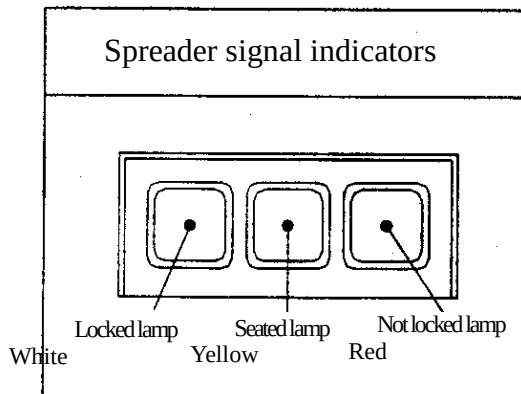
D. Container stacking and picking operations

The container reach stack is large in size. Take care when performing container stacking and picking operations. Keep a low speed when driving and notice any obstructions and persons nearby.

Container picking operation:

Place the spreader on the top of the container. Insert the four twist-locks respectively into the corner casting holes of the container. When the yellow one of the three-color indicators on the spreader lights up, the yellow in-place indicator in the operator's cab lights up, indicating that the four twist-locks have been inserted in place and the ejector pins ejected. In this case, press the lock-up switch to turn the twist-locks by 90° to lock up the container. In case anyone of the ejector pins has not been ejected, the yellow

indicator does not light and the twist locks are protected both electrically and mechanically from being turned. After the container is locked up, the white one of the three-color indicators on the spreader lights up and the green locked lamp in the operator's cab lights up. The mechanical indication sign on the spreader turns by 90° accordingly, indicating that the twist-locks have been locked. (For details of the indicators in the operator's cab, see the electrical system diagram and the layout diagram of instrument panel.) Now the container can be lifted.



In case anyone of the twist-locks is not inserted in place, the white indicator does not light up and the automatic safety device in the electrical system protects the container from being lifted.

Container stacking operation:

For container stacking operation, when the yellow indicator on the spreader lights up, the yellow in-place indicator in the operator's cab lights up, indicating that four ejector pins on the spreader have been ejected. In case anyone of the ejector pins is not ejected, the yellow indicator does not light and the twist locks are protected both mechanically and electrically from being turned. After the yellow indicator lights up, press the release button to release the twist locks. The red not locked lamp on the spreader lights up and the green not locked lamp in the operator's cab lights up. The twist-lock indication sign (yellow) is back-turned by 90°, indicating that all the twist locks have been opened and the spreader can be lifted up.

In case the red not locked lamp on the spreader does not light, the green not locked lamp in the operator's cab does not light, and the twist-lock indication sign (yellow) is not back-turned by 90°, it indicates that the twist locks have not been released fully and not opened completely and the automatic safety device in the electrical system protects the spreader from being lifted up.

It is especially noted that special care should be taken in container picking. Make sure ensuring that the safety devices for the spreader and the vehicle are working normally. Damage to any part may cause accidents and should be restored immediately. Never work with the faulty equipment. Otherwise, any consequences so caused should be the liability of the operator.

E. Lifting

Before lifting the container, confirm that the container load falls within the load capacity indicated on the load characteristic chart. (For details, see Diagram of the Rated Lifting Capacity of Model CRS450Z5 Container Reach Stacker.) For lifting heavy containers, never lift it to the height once. Hesitate for a while when the container is 100 mm off the ground. Continue going up when everything is all right.

The container should not be lifted too high but just over obstructions. When driving with lifting the container, keep the load as low as possible with the minimum extension length under the precondition of not blocking the operator's line of sight to ensure safe driving. When the container is lifted to a higher position, avoid driving at a high speed or suddenly applying brake.

F. Vehicle parking

After the vehicle is shutdown and parked, turn the shift control lever to the neutral position. Turn off the hand brake. Leave the engine running at idle for one to two minutes until the engine is shut down. (It is shut down electrically. Simply turn off the key.) Turn off the mains switch to avoid self-discharge of the battery.

Avoid long parking the vehicle on a slope. If it is unavoidable, set wood wedges at the wheels to stop the vehicle from coasting.

IV. Maintenance

Please use the brands recommended in writing by Dalian General Forklift Truck Works in selecting fuel, lubricating oil, working fluid and coolant, and use the parts of OEM. For maintenance of key parts of the vehicle, such as engine, transmission, drive axle and spreader, perform in accordance with the respective operation, maintenance instructions.

1. Maintenance in the run-in period

The container reach stacker should work at medium or lower load in the run-in period. After the container reach stacker is operated for the first 100 hours, make sure taking the run-in maintenance.

Maintenance description

Change the engine oil.
Replace the strainer of oil filter.
Replace the strainer of fuel filter.
Change the transmission oil.
Change the lubricating oil in the drive axle.
Check and adjust the valve clearance.
Check the coolant volume and refill it fully.
Clean or replace the air filter.
Clean or replace the filter strainers in the hydraulic system.
Clean or replace the transmission oil filter strainer.
Check and adjust the pretension of the V-belts.
Check and tighten the air intake and exhaust ducts.
Check the battery electrolyte.
Drain off sewage in the fuel tank.
Check bolts at all connections for any looseness.
Check the tire bolts for any looseness.
Check the twist locks for spreader for any looseness, deformation, cracks and other defects.
Check the eject pins for spreader twist locks for being intact.
Check the mechanical part for any oil leakage, water leakage and electrical leakage.
Refill grease for the whole vehicle according to the lubricating chart.
Check the service brake and the parking brake.
Check all electrical instruments for being working normally.

2. Oil and grease application

Fuel, oil or grease	Oil and grease description	Performance grade	Viscosity class						
			Ambient temperature, °C						
			-30	-20	-10	0	10	20	30
Fuel	Diesel oil		-20#				0#		
Engine oil	TRI #10000	API Class CG-4 or CF-4	SAE10W-30						
			SAE15W-40						
			SAE5W-30						
Drive axle oil	Fuchs Mobil automobile gear oil HD 80W-90								
Transmission & torque converter oil	Mobil hydro-drive 424		SAE10W-30						
Hydraulic oil	32/46 anti-wear hydraulic oil		SAE5W		SAE10W				
Brake fluid	Fuchs ZF20W-40								
Lubricating grease	Universal lithium base grease for automobiles		L-XCCHA2						
Engine coolant	Mobil non-freezing oil	ASTM D3306							

Anti-freezing fluid	Ambient temperature, °C	-39	-30	-25	-20	-15	-10
	Anti-freezing fluid concentration, %	55	50	45	40	35	30

The oil and grease of above brands are filled in this vehicle at factory. Other oils can be selected depending on the performance grades. For details, see the maintenance manuals for the related parts. However, oil and grease application must be in accordance with the instructions in the maintenance manuals for engine, transmission and drive axle.

※※ The oil characteristics vary from brand to brand. Therefore, make sure using the same brand!

Oil application volume for the whole vehicle

Unit: L

Item	Volume
Fuel tank capacity	~ 900
Hydraulic oil	~ 1150
Anti-freezing fluid for engine	~ 48
Transmission and torque converter	~ 54
Drive axle	~ 110
Engine	~ 60
Brake fluid	~ 160

3. Maintenance

Item	Maintenance interval					
	Daily	200 h	600 h	1,200 h	2,400 h	At least 1 year
Engine (For details, see the operation instructions for diesel engine.)						
Transmission with power gear shift						
Check the level and quality of oil in the transmission.	☆					
Change the transmission oil.				☆		☆
Replace the oil strainer for transmission.			☆			
Clean the feed oil strainer.				☆		☆
Check for any oil leakage.	☆					
Front axle (drive axle)						
Check the level and quality of oil in the differential and the hub.		☆				
Change the lubricating oil in the differential and the hub.				☆		
Adjust the parking brake, if necessary.			☆			☆
Check the wear status of the brake friction discs.				☆		☆
Check and tighten the connecting bolts and screws.		☆				☆
Check and tighten the hub nuts.		☆				
Rear axle (steering axle)		☆				
Check the steering cylinder.		☆				

Check all connections of the steering axle for being normal.	☆
Check and tighten the connecting bolts.	☆
Check all articulation points.	☆
Check and lubricate the hub bearings.	☆
Check and tighten the hub nuts.	☆
Tires	
Check the tire inflation pressure (9 bars).	☆
Check the wear status of tires.	☆
Tire commutation (depending on the condition).	☆
Hydraulic system	
Check the oil dipstick to examine the level and quality of hydraulic oil.	☆
Change the hydraulic oil and clean the oil tank.	☆ ☆
Replace the hydraulic oil strainer.	☆ ☆
Replace or clean the breather strainer.	☆ ☆
Check the hydraulic piping for any oil leakage.	☆
Check the pressure of the hydraulic system.	☆ ☆
Check the oil piping for braking system for any clogging.	☆
Check the accumulator for working normally.	☆
Boom	
Check and tighten the set bolts for luffing cylinder and extension cylinder.	☆
Check the boom rollers for any looseness.	☆
Lubricate the bearings of boom rollers.	☆
Check and tighten the set bolts of under support of the boom.	
Lubricate all articulation points.	
Container spreader	
Check the spreader twist-locks for any looseness, deformation and cracks.	☆
Check the interlocked ejector pins for free activation.	☆
Check and correct the guide plate for spreader.	☆
Check and tighten all connecting bolts.	☆
Clean and lubricate the telescoping boom for spreader.	☆
Lubricate the twist locks for spreader.	☆

Detach and check the twist locks for spreader.	☆ ☆
Clean and lubricate the slewing gear ring.	☆
Lubricate the slewing bearer.	☆
Check the wear status of the slewing gear ring.	☆
Check and lubricate the carrier rollers on the top frame.	☆
Others	
Check the operating functions of the electrical system.	☆
Check the operating functions of the safety devices.	☆
Refill oil to other fillers.	☆
Clean the fuel tank.	☆ ☆
Check the set bolts of the lower counterweight.	☆
Check the noise level at the operator's cab (85 dB).	☆ ☆
Check and tighten other connecting bolts.	☆

Table 1 Lubrication chart

Chassis, boom

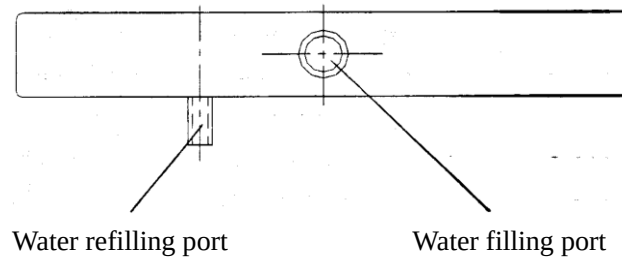
No.	Lubrication point	Quantity
1	The pin roll of the steadying cylinder for spreader	4
2	Articulated pin between the boom and the vehicle frame	2
3	Articulated pin between the vehicle frame and the luffing cylinder.	2
4	Articulated pin between the boom and the luffing cylinder.	2
5	Articulated pin of the extention cylinder for boom	1
6	Thrust bearings for the vertical shaft of steering axle	2
7	Steering axle hub	2
8	Articulated pin between the steering axle and the vehicle frame	2
9	Slide blocks between the extension section and basic section of boom	14 places
10	Connecting pin between the boom and the spreader	2

For lubrication details of the spreader, see the maintenance manual for the spreader.

Maintenance of the cooling system:

The water tank for this engine is of the expansion type. The filling port of such a water tank is very different from that of ordinary water tanks. Ordinary water tanks have the filling port directly connected to the water chamber and therefore water filling is very smooth. For expansion type water tanks, the filling port is connected to the water chamber via a Ø8 air duct. Therefore, filling water through the filling port would be very slow. Please note it to avoid misjudgment that the water tank has been filled due to too low flow rate causing overheat of the engine.

No special drain port is provided to this engine. For details of water draining, see the operation instructions for the engine. Meanwhile, it is recommended to use the non-freezing fluid for cooling of the engine.



When it is necessary to change water for the water tank in maintenance, open the hose to the refilling port and refill water through the hose until water over flows at the refilling port, which is judged as the tank is filled.

Precautions for maintenance of the radiator:

1. Use non-freezing fluid for the radiator.
2. Never directly open the water tank cover when it is hot to avoid injury caused by vapor with pressure. To avoid injury by vapor, slowly unscrew the cover and never take it off until vapor is exhausted completely.
3. In case of overheat with the engine, never fill cold water into the radiator to avoid cracks developing on the cylinder head and the water jacket due to sudden cooling down.
4. Regularly clean the outside of radiator core. Clear off any foreign substances, such as dust and insects, adhered onto between radiator fins.
5. Clean off scale on the inside of water piping at intervals depending on the scale condition. Clean off at intervals of two years generally.
6. In case of any quality problem with the radiator, which is found within six months from the shipment date, keep it in visual intactness and send it to us for repair. Never repair it by yourself. We provide the “three guarantees”.

V. Description of the Construction

1. Engine

Model CRS450Z5 (Z-CCZ5) container reach stacker is installed with the QSM11 diesel engine produced by American Cummins Engine Inc. And model CRS450Z5 (Z-DCZ5) container reach stacker is installed with the TAD952VE diesel engine produced by Volvo Engine Inc.

Engine model	Cummins QSM11	Volvo TAD952VE
Air intake type	6-cylinder 4-stroke turbo-charged	engine with recooling
Displacement (cc)	10,800	9360
Rated power/Rated speed (kW/rpm)	250/2100	242/2100
Max. torque (N-m/rpm)	1674/1400	1700/1300
Deadweight (kg)	981	1065
Cylinder bore (mm)	120	120
Stroke (mm)	147	138
Cooling type	water cooling	

For details of diesel engine, see the Operation and Maintenance Manual for the Engine.

2. Drive system

2.1 Transmission

The 14.7HR36432-10 OR 15.5TE27418 stationary-shaft type transmission with power gear shift produced by American DANA is used.

2.1.1 Reduction ratio

Forward speed	Position 1	5.814/5.07	Backward speed	Position 1	5.814/5.07
	Position 2	2.422/2.42		Position 2	2.422/2.42
	Position 3	1.379/1.38		Position 3	1.379/1.38
	Position 4	0.784/0.78		Position 4	0.784/0.78

2.1.2 Transmission check and maintenance

Check

Check the oil level in the transmission.

After the engine is idling for two minutes, check the oil level in idling for being at the lower limit mark on the oil dipstick. When the oil temperature rises to 82°C - 93°C, the oil level should be at the higher limit mark on the oil dipstick.

The working oil temperature of the transmission should be 82°C - 121°C. The allowable max. transient oil temperature is 148°C. In case the working temperature is above 121°C, be sure shutting it down with the shift control lever placed at the neutral position. Leave the engine running at the speed of 1,200 – 1,500 rpm for two or three minutes and the oil temperature will go down rapidly to the normal value. If the oil keeps high

temperature, it can not be used. Find the cause and check for any oil leakage.

Lubricating oil changing

In order to drain off the used oil in the transmission, change lubricating oil when the transmission is hot. Follow the procedure below:

- ※ Keep the engine idling for several minutes and then shut it down.
- ※ Remove the drain plug at the bottom of oil pan to drain off used oil in the transmission.
- ※ Replace the drain plug after used oil is drained off.
- ※ Pull out the oil dipstick and fill new oil through the tube for oil dipstick.
- ※ Run the engine at idle for two minutes to exhaust air in the torque converter and the piping.
- ※ Check the oil level with the engine idling.
- ※ Run the transmission until the transmission oil temperature reaches the normal value 82°C - 93°C. Then check the oil for being at the specified level.

Replacing the strainer

- ※ Always replace the filter or strainer when changing lubricating oil, following the procedure below:
- ※ Clean the outside of the filter and ensure no foreign substances, oil and mud around the connection;
- ※ Drain off lubricating oil in the filter through the plug on the filter casing;
- ※ Unscrew the central screw and detach the filter;
- ※ Carefully clean the seal surface and the casing inside to ensure no foreign substances, oil and mud getting into the transmission;
- ※ Install and fix a new strainer securely;
- ※ Fill new oil and check for any leakage.

Notice

Never install and use damaged or polluted filters or strainers.

For details of the 14.7HR36432 stationary-shaft type transmission with power gear shift, see the Maintenance Manual for the Transmission.

2.2 Drive axle

The KESSLER+CO D102PL341/528NLB8460 axle made in Germany is used. It consists of the final drive, the differential, the axle shaft, the wheel reduction gear, the totally enclosed multi-disc wet type service brake, the caliper-disc type parking brake and the casing. The parameters are:

Transmission ratio: $i = 26.3$

Parking brake:

Model: PERROT 340 VI SAHR

Braking torque: 7,200 N-m (max)

Service brake:

Model: M-6/Carlisle

Braking torque: 100,000 N-m/side

Rim: 13.00-25

Wheel tread: 3,033

2.2.1 Maintenance of the drive axle

Checking the differential assembly and the wheel reduction gear for the condition of lubricating oil may be performed through the level control hole, i.e. the filling hole. It is normal that the oil level is at the lower edge of the control hole. Refill lubricating oil, if necessary.

Before changing lubricating oil, keep the stacker running for a while to bring the lubricating oil in the drive axle up to the normal temperature (so that used oil can be drained off completely). Then park the stacker on a level ground with the drain plug of the wheel reduction gear at the lowest position. Clean all lubrication points. Open the drain plugs (one drain plug respectively provided to the differential assembly and the wheel reduction gear) to drain off used oil. After that, carefully clean the drain plug and replace it. Fill the recommended new oil into the drive axle through the filling port until lubricating oil over-flows.

Notice

After filling is completed, do not replace the plug immediately. Wait for several minutes to observe whether the oil top goes down or not. In case it goes down, continue filling oil until the oil top is stable.

There is one brake at each end of the drive axle. Keep the friction discs and the brake disc surface away from oil during maintenance.

For details of KESSLER+CO D102PL341/528NLB8460 axle, see the Maintenance Manual for the Drive Axle and the Part List of the Drive Axle.

3. Steering axle

The transversal cylinder steering axle with the central connecting pin is used for the container reach stacker. It consists of the double-acting cylinder, the steering axle body, and the hub. The totally hydraulic powered steering is used featuring flexible and effortless operation and simple and compact construction.

Main parameters of the steering axle:

Load on the axle: 370 kN

Wheel tread: 2,750 mm

Steer angle: 67.75°/side

4. Wheels and tires

Installing the wheels

Clean the bolts and nuts. Check the thread for intactness. Apply anaerobic sealant onto the thread. Install wheels in the specified tightening order and with the specified torque. After installation, check the tightness of nuts not later than one day after operation.

Wheels

Inflated off-the-road tires are used for CRS450Z5 container reach stacker with 18.00-25-40PR tires for both the front wheels and for the rear wheels. As the vehicle speed rises, tires will be worn more and more. When running in summer, tire temperature rises more rapidly and may be very high, which should be noted especially. After running for a period, bring tire commutation to prolong the tire life.

Notice

Clear off any objects inserted between two tires, such as gravel and wood pieces. In case tire is adhered with grease or other lubricating oil, immediately clear it off to ensure safety.

5. Spreader

Swedish ELME Model “817” spreader is used. As the specialized container spreader manufacturer, ELME has a large number of customers all over the world and enjoys very high reputation. Model “817” spreader is designed for reach stackers to handle 20’ – 40’ international standard containers. The spreader is designed to use for two million cycles and manufactured fully in accordance with the following standards:

- DIN 15018, design class H2-H4;
- FEM, class U7-Q2-A7;
- IKH 4.30.01 (Pub. N o. 3)

Model “817” spreader is of the overhead telescopic type, and consists of the connecting frame, the slewing gear, the top frame, the under frame, the telescoping frames and the hydraulic cylinder.

For the spreader, the under frame, the telescoping frames LH and RH and the cross beams at both ends are in the box structure. The reinforcement plate designed to bear the impact of horizontal load and the special molded nylon slide blocks provided at the interface between the under frame and the telescoping frames LH and RH can well bear and absorb the load impact in horizontal direction and vertical direction.

The spreader is equipped with a slewing reducer providing the slew angle of 280° (i. e. +95°/-185°, at the slewing speed of 1 rpm). This unit is driven by a hydraulic motor and transfers power and load through a pair of reducers and a slewing bearer.

The telescoping frames LH and RH are driven by the extension cylinders LH and RH.

The two cylinders enable the telescoping frames to extend from 20' containers to 40' containers. With the oil flow rate of 80 l/m, the extending speed from 20' to 40' is 15 – 20 seconds. One end of the cylinder is connected to the under frame of the spreader and the other end to the telescoping frame. The special molded nylon slide blocks are provided as the support between the telescoping frame and the under frame, which ensures free sliding, minimizes deformation of the spreader, and makes replacement easier.

For minimizing the influence of environmental factors, such as wind and impact, on the spreader, the steadying device is provided for the spreader. The steadying device consists of two cylinders and the cross overflow valve. In case the spreader is shaking, the steadying cylinder is activated to lead oil flowing through the cross overflow valve and generating damp so that the spreader shaking can be stopped immediately. Thus the spreader can be stable when the vehicle is running or under severe working conditions. The two steadying cylinders are of the design with the supporting points in the rear. With this design, the rear twist locks (two close to the vehicle body) can be brought easily to position slightly lower than the front ones at any time. (Keeping the rear twist locks positioning lower than the front ones is very essential for the operator to safely and exactly bring the spreader in place.)

Lateral shift of the spreader is realized through the two laterally-shifting cylinders. One end of the laterally-shifting cylinder is fixed onto the under frame and the other end to the top frame. There are four slide blocks on the top frame of the spreader and the supporting beam for the under frame is hung onto the four slide blocks. While the laterally-shifting cylinders is extending or retracting, the under frame of the spreader is moving leftward or rightward on the four slide blocks of the spreader so that leftward or rightward moving the container is realized.

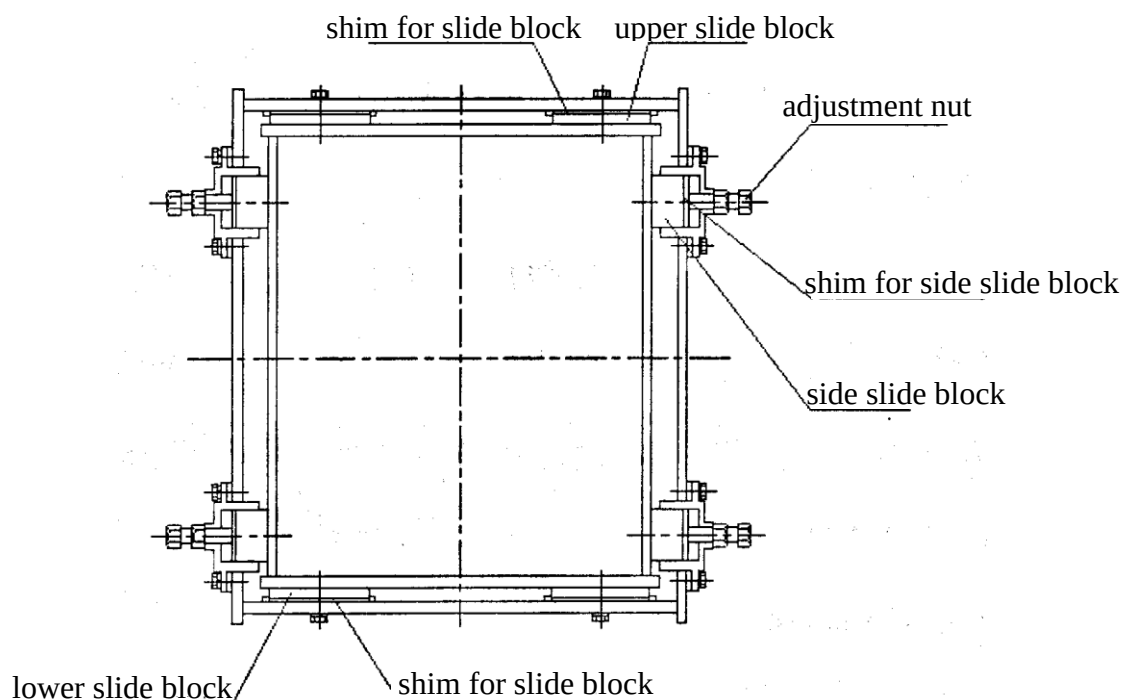
For details of the spreader operation and the part list, see the Operation Instructions for ELME “817” Spreader for Container Reach Stacker.

6. Boom system

The boom consists of the extension cylinder, the luffing cylinder, the inside and outside boom frames and the slide blocks. Both the inside boom frame and the outside boom frame are in the box structure and welded of four high-strength steel plates. The outside boom frame is the basic section. Its lower end is articulated with the supporting tripod on the vehicle frame. At its middle part, there is a bearing articulated with the luffing cylinder. The other end of the luffing cylinder is articulated with the front bearer on the vehicle frame. On the four inside walls in the front of the outside boom are the special molded nylon slide blocks installed to support the inside boom frame. The inside boom frame is telescopic with the head in the design of small box and connected to the connecting frame of the spreader. The four inside walls in the front of inside boom are installed with the special molded nylon slide blocks to support and prevent the inside boom frame from transversally swinging inside the outside boom frame.

Inside the telescopic frame is an extension cylinder installed to enable the boom to extend and retract. Luffing operation of the telescopic boom is driven by the two luffing cylinders. The hydraulic lock (the balancing valve block manufactured by PARKER) is provided to the filling port at the bottom of the cylinder. In case the high-pressure hose breaks out or is disconnected, the hydraulic lock will close the oil line and lock the cylinder so as to stop operation of the boom and ensure safety.

In case the boom is seized in operation, adjust the sidesway adjustment bolts to bring the inside boom frame at the middle position of the outside boom frame in horizontal direction, with a clearance of 1-2 mm between the inside boom frame and the slide blocks. In vertical direction, adjust the shims for slide block to ensure the clearance of 1-2 mm between the inside boom frame and the upper slide blocks, which can eliminate the problem of seizure. Furthermore, if the side slide blocks are too worn to be adjusted by the adjustment bolts but can not be replaced immediately, place shims under the side slide blocks to bring the side slide blocks in contact with the inside boom frame.



7. Hydraulic system

This hydraulic system is provided to drive and control luffing, extending and retracting

of the boom, laterally shifting, slewing, extending and retracting, twist-locking and steadying of the spreader, and steering and braking of the vehicle. For details of the hydraulic system, see the diagram of the hydraulic system (Fig. 1). The hydraulic system contains the following circuits:

- the hydraulic circuit for the boom telescoping and luffing;
- the hydraulic circuit for braking;
- the hydraulic circuit for the steering system;
- the hydraulic circuit for the spreader.

The whole hydraulic system is provided as two separate open systems. One system consists of the two main oil pumps 1 and 2 (variable plunger pumps) driven by the diesel engine, and is mounted at the inlet of the transmission. In this system, the main oil pump 1 feeds pressurized oil via the priority-pilot valve block with priority to the steering system, and merges with the flow from the main oil pump 2 to feed oil to the telescoping and luffing circuit for the boom and the hydraulic circuit for the spreader. The other system consists of the gear pump driven co-axially with the main oil pump 2. This gear pump feeds oil to the braking circuit and its cooling circuit.

(I) Hydraulic circuit for the boom telescoping and luffing

The circuit of the main oil pump 1 feeding oil goes through the check valve 16, turns to the priority valve block 7, merges with the main oil pump 2, and cuts through the main reversing valve 9, i. e. the electro-hydraulic proportional reversing valve with the pressure compensator. The electronic control lever outputs signals through the IQAN controller to control the electro-hydraulic proportional reducing valve integrated with the main reversing valve. The electro-hydraulic proportional reducing valve feeds oil at the pressure proportional to the operating angle of the electronic lever to control the opening of the main spool of the reversing valve. The output flow rate from the main reversing valve is controlled in proportion with the operating lever. The control oil for the electro-hydraulic proportional reducing valve is fed by the priority-pilot valve block 7.

The oil feeder in the priority-pilot valve block is provided to generate an oil source at the specified pressure and flow rate for the proportional reducing valve. It consists of one check valve, one reducing valve and one accumulator. The accumulator is used to provide the power oil with a certain flow rate to the pilot circuit for the main reversing valve. The air pressure of accumulator is 2.5 Mpa.

The balancing valve blocks 11 and 12 are respectively installed directly at the port of the load chamber (piston chamber) of the boom extension cylinder and luffing cylinder and used to lock the cylinders and control the speed of the cylinder when it goes down. The balancing valve block 11 is remotely controlled and the block 12 locally controlled. The differential circuit consisting of the solenoid valves S3, S6 and S8 and the plug-in valve is used to increase the speed of the boom luffing up and extending in lifting at no load. The solenoid valves S7 and S9 are energized upon the boom luffing down.

(II) Hydraulic circuit for braking

Fluid from the gear pump in the braking circuit flows through the high-pressure filter and is connected to the flushing valve block for brake 8. The flushing valve block for brake consists of the charging valve to accumulator, the check valve and the solenoid valve for parking brake S11. The charging valve to accumulator fills oil into the accumulator 18. When the pressure reaches the set value for the charging valve, the charging valve to accumulator relieves load to the gear pump in the braking circuit. The check valve is provided to prevent the pressurized oil stored in the accumulator 18 from returning into the oil tank at the main oil pump idling or stopping.

The inflation pressure of the accumulator 18 is 10 Mpa. Check for the inflation pressure of the accumulator in braking circuit once every three months and inflate it once every six months. Use special accumulator inflating tools for check and inflation.

1. Circuit for parking brake

The solenoid valve for parking brake controls the parking brake. The parking brake is of the hydraulic release and mechanical spring type. When the parking brake is applied, the solenoid for parking brake is energized and the pressurized oil in the accumulator 18 flows via the parking brake valve into the parking brake to get over the spring force and release the parking brake. Meanwhile, the pressure relay SW1 is activated and sends electrical signals to turn on the indicator for parking brake and cancel electrical interlocking, which makes it possible that the gear is engaged through the powered gear-shift transmission while the vehicle is running.

2. Circuit for service brake

The service brake is of the hydraulically braking and spring releasing type. For applying the service brake, depress the valve for service brake 20. The pressurized oil in the accumulator 18 flows via the valve for service brake into the service brake and gets over the spring force to realize service braking. The pressure relay SW3 is activated to send signals and turn on the indicator for service brake. The service brake feeds back the pressure to the service brake, by which the driver can feel and adjust the service braking force by means of the pedal.

(III) Hydraulic circuit for steering

The hydraulic circuit for steering consists of the priority-pilot valve 7, the steering gear 3 and the steering cylinder 36. Fluid output from the main oil pump 1 flows via the check valve 16 into the priority-pilot valve. The priority-pilot valve, which is mounted before the fully hydraulic steering gear, can depress any pulsation of the flow rate from the oil pump, which is caused by changes of the engine speed and may affect the flow rate to the steering gear, and can also keep balance of the operating force on the steering wheel and the steering speed.

The output flow rate for the main oil pump 1 is higher than the set value for the priority valve 7. When the pressure drop through the internal orifice of the priority valve is

higher than the set value ΔP (1.1 Pa), the overflow valve is opened and the over flow merges with the main oil pump 2 to feed oil to the hydraulic circuit for the boom telescoping and luffing. The same action is kept even when the pressure in the circuit for power steering is increased to the set overflow pressure of the overflow valve.

The overflow valve for the fully-hydraulic steering gear is set at the value for normal-close. One check valve is provided at the steering gear to protect the driver's hand from receiving any accident impact load from the steering gear. Furthermore, the steering valve contains the overflow valve and the makeup valve for absorbing impact of external load to prevent the steering cylinder from bearing any load of accident impacts and from cavitation erosion. Such a circuit has a higher applicability and is used widely.

(IV) Hydraulic circuit for the spreader

The main oil pumps 1 and 2 feed oil to the circuits for steering and for boom luffing and telescoping, and also to the hydraulic circuit for spreader. The reversing valve for spreader 21 is of the multiple-way type and respectively controls the extension cylinder, the twist-locking cylinder and the laterally shifting cylinder for the spreader. The reversing valves for spreader 38 and 41 respectively control the damping cylinder and the revolving motor for the spreader. The dual reversing valve for the laterally shifting cylinder and the revolving motor is controlled electro-hydraulically. The triple valve for lateral shifting, damping and slewing of the spreader contains the secondary overflow valve for preventing cavitation erosion. The pressure of the secondary overflow valve for cavitation erosion, the max. individual output flow rate of the dual reversing valve and the pressure of the pressure compensator are set to the technical data at factory.

The circuit for damping cylinder consists of the reducing valve 28, the safety valve 29 and two check valves. The set pressure of the reducing valve is 3 Mpa. The set pressure of the safety valve is 8 Mpa. When the vehicle is started, the spreader can be steadied by damping.

The oil feeding valve block for spreader is provided to send the working signal of spreader to the main oil pump. When any function of the spreader works, the interlocked solenoid valve S10 is activated to turn on the load sensing circuit to the main oil pump. The main oil pump adjusts the flow rate based on the oil pressure signal from the load sensing circuit.

(V) Oil tank and hydraulic oil

The hydraulic oil tank is installed on the left hand of the chassis, with the oil gauge and the air filter. The return oil filter 33 with the filtration accuracy of 10 μm is provided to the return line. The clogging indicator is installed to the return oil filter to warn the operator to replace the strainer in case the strainer is clogged. The oil tank for braking is installed on the right hand of the chassis to feed hydraulic medium especially to the braking system.

The oil level indicator is provided on the side of the oil tank by which the oil level of

the tank can be checked.

The hydraulic oil tank is filled with the 32/46 wear-resistant hydraulic oil. Check the oil inside the tank once every six months by visual check and oil analysis.

Visual check is performed to check the color and odor of hydraulic oil and determine if it is deteriorated. See the following table:

Table 1: Visual check of hydraulic oil

Symptom	Pollutant	Cause
The color becomes dark.	Oxygen	Too hot oil or improper oil changing.
Cream color	Water or air bubble	Water or air intrusion into oil.
Air bubble	Air	Air intrusion into the unsealed suction line.
Floating foreign substances or sediment	Solids	Components worn, or unclean piping, components or inside of the oil tank.
Oil and water separation	Water	Water intrusion into oil.

Oil analysis is to perform regular laboratory analysis of the hydraulic oil based on various indexes including viscosity, oxidation, moisture content, additives and cleanness and compare with the normal values to determine whether the hydraulic oil should be changed. Of these indexes, the major one is cleanness, which is expressed as the number and size of solids contained in hydraulic oil.

The cleanness requirement of hydraulic oil for this system is Class 8 or 9 to NAS1638, equivalent to Class 17/14 to ISO standard. See Table 2 and Table 3.

Table 2: Requirement in NAS1638

Cleanness class	Size of solids (μm)				
	5 ~ 15	15 ~ 25	25 ~ 50	50 ~ 100	> 150
7	32,000	5,700	1,012,	180	32
8	64,000	11,400	2,025	360	64
9	128,000	22,800	4,050	720	128

Note: Class 8 to NAS1638 refers to at least 64,000 solids in the size of 5 ~ 15 μm or at least 11,400 solids in the size of 15 ~ 25 μm contained in 100 ml of oil sample, and the like.

Table 3: Requirement in ISO (DIS4406, SAEJ1165)

Cleanness class	Solid size (μm)	
	> 5	> 15
16/13	16,000	8,000
17/14	125,000	
18/15	250,000	32,000

19/16	500,000	64,000
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Note: Class 17/14 to ISO refers to at least 130,000 solids greater than 5 μm or at least 16,000 solids greater than 15 μm contained in 100 ml of oil sample.

In operation of the system, the solids pollution class of hydraulic oil inside the oil tank should not exceed 18/15 to ISO, equivalent to Class 10 to NAS1638.

The oil changing indexes for the hydraulic system of this machine are:

Viscosity deviation: $\pm 10\%$

Increase of acid value: 0.1 ~ 0.25 mg KOH/g

Moisture content: $< 0.1\%$

Physical foreign substances: 5%

Specific gravity deviation at 15°C/4°C: 0.05

Sheet copper corrosion: unacceptable

Rust prevention: unacceptable

Ash: 0.05%

Interfacial tension deviation: 15 dyne/cm

Carbon residue: 0.05 ~ 0.10%

Off color (UNION class): above +2

Any hydraulic oil, of which the inspection result shows off-grade, should be changed immediately. Perform oil changing in the following procedure:

1. Open the flushing flange cover at the bottom of the oil tank and drain off oil from the tank and piping.
2. Open the cleaning port cover of the oil tank.
3. Clean the tank.
4. Replace the cleaning port cover and the flushing flange cover after cleaning is accepted.
5. Filling oil into the tank: Open the air filter cover on the top of the tank. Fill oil that has been filtered with a 5- μm strainer (filtration carriage) into the tank via the air filter to the full scale of the oil gauge. Note: Hydraulic oil filled into the hydraulic system must be filtered and has the same brand as the original one.

Fuchs ZF20W-40 oil is used for braking system and the inspection procedure is the same basically as that for the hydraulic oil.

(VI) Piping

Connections, steel pipes and rubber hoses for this hydraulic system basically are the product of American PARKER. Therefore, the quality of the whole pipeline can be

ensured. In operation of the machine, however, nuts and bolts at connections in the pipeline may be leaked due to looseness caused by impact and vibration in long operation. These should be tightened timely and corrected. Replace seal rings if necessary. Connection threads that are easy to be loose should be tightened with application of LOCTITE thread adhesive (code: 56931).

8. Safety and alarm devices

For the requirements of operations in container terminals and yards, this machine is provided with the following safety and alarm devices.

8.1 Overturn protector

The overturn protector works in such a ways that the pressure sensor attached onto the luffing cylinder for boom detects the real-time pressure of hydraulic oil in the lower chamber of the luffing cylinder and sends the pressure signal to the computer system in the operator's cab. The computer system judges whether the current operation status is safe or not through computation based on the measured pressure and by means of the related formula. In case it approaches the unsafe zone, the computer system will give alarm (at 95% of the threshold) by sounding the buzzer and displaying warning indications to warn the operator immediately to stop dangerous operations. In case the operator continues dangerous operations, the hydraulic solenoid valves S2, S6 and S8 will be energized to enable the boom to luff up or retract only instead of the operations of luffing down or extending disabled.

For details of other safety protections, see the operation instructions in Section 2 Operation and Sub-section 3 of the Operating and Driving section.

9. Electrical system

9.1 Main electric components technical parameters introduction

1. The main return circuit electrical components

S/N	Items	Contents	(Model)	(Remarks)
			CRS450Z5	
1	Battery	Model X Q'ty	(6-QW-200) × 2	
		Voltage	12	
		Capacity	200	
2	Starter	Model	ST 2026	
		Voltage	24	
		Power KW	8	
3	Generator	Model	EE 2036	
		Voltage V	24	

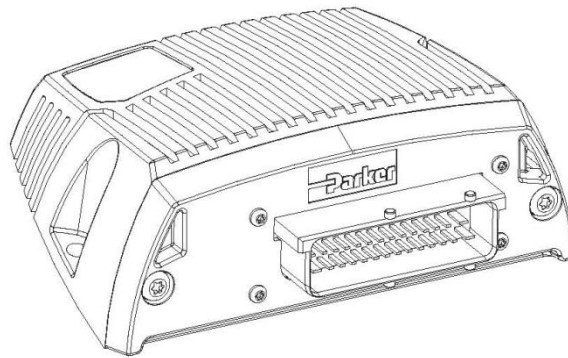
		ElectricCurrent A	100	
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2. List of Lamps

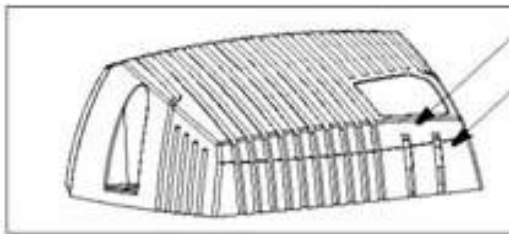
Type	Model	Q'ty	Color of Lamp cover	Power	Remarks
Front Combination Lamp	HD200×130-1 (L)	1	Colorless transparent	55W/50W	Working Lamp
		1	Colorless transparent	5W	Small Lamp
		1	Yellow	21W	Turning Lamp
	HD200×130-2 (R)	1	Colorless transparent	55W/50W	Working Lamp
		1	Colorless transparent	5W	Small Lamp
		1	Yellow	21W	Turning Lamp
Warning lamp	LET-118/DC24V	1	Yellow	35W	
Working Lamp	WD100×90/24V	6	Colorless transparent	70W	
Working Lamp	WD120×120/24V	2	Colorless transparent	70W	
Rear Combination Lamp	XH8-21/24V	2	Red	21W	Brake Lamp
		2	Yellow	21W	Turning Lamp
		2	Red	5W	Small Lamp
		2	White	10W	Reversing Lamp

3. IQAN-XA2 and IQAN-XS2 Expansion module

MDL2 extension module and the main controller are connected through via CAN bus communication, provide vehicle to control the hydraulic system, the power supply voltage are 24 v. The control system were used two extension module, IQAN - XA2 and IQAN - XS2 respectively.



Extension module are like the below picture with a total of two lights, one of the green power light; Another work for status LED light. At normal working enviroment, flashing yellow, when there is failure ,yellow and red light will flashing, through the following list can find the corresponding fault.



Yellow/Red, Status LED Light

Green, Power Light

- ① Normal working state: green light normally on, status LED flashing yellow lights, yellow lights flashing as following,

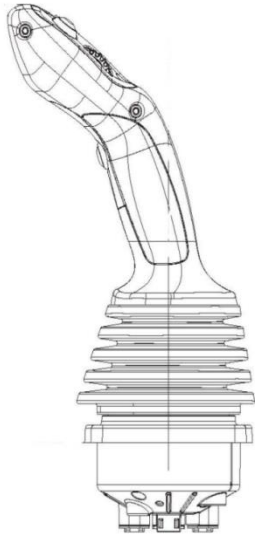


- ② Fault state, the state of LED lights flashing in the yellow and red, through the comparison table below can investigate the cause of failure

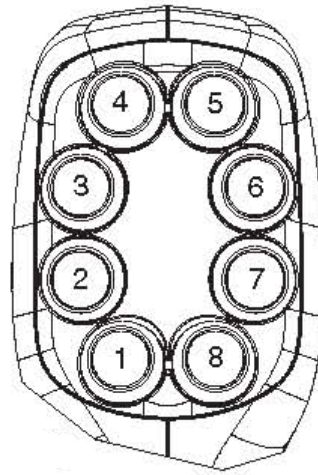
Error Code	Error Description	State LED blinking frequency	
		Red Light	Yellow Light
1:n	Error controlled by the main module		
2:n	Error controlled by the main module		
3:1	Can bus error		
3:2	Address Error		

4:1	Memorizer Error		
PE	Serious Error		

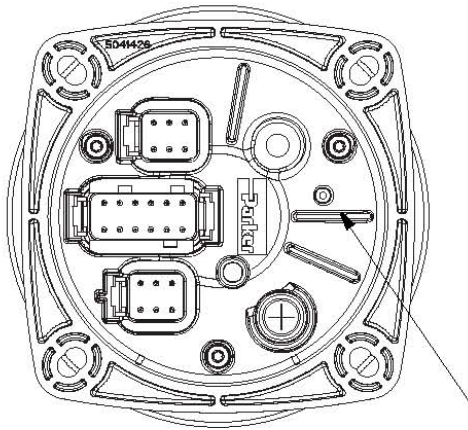
4. IQAN-LC5 Operating Handle



Operating Handle assembly



Front top of Operating Handle



Yellow/Red Status LED

Through CAN bus and the main operating handles communicate with MDL2 module .Control handle have a total of nine electric button, and 4 X Y axis direction of analog control signal .The operating handle have integration of a variety of functions , convenient for driver operating , reduce fatigue

Note: The operator should be familiar with all the buttons and handle direction control action before the operation, in order to avoid wrong operation (see the introduction of “work station”.)

The outside drawing of operating handle as shown below, the handle have only one state of LED lights, its normal working state and system failure is shown by state LED light to inform the operator that whether the handle is in normal state or in failure state, detail explanation refer to the following,

- ① Normal working state: LED flashing yellow lights, yellow lights flashing as following,



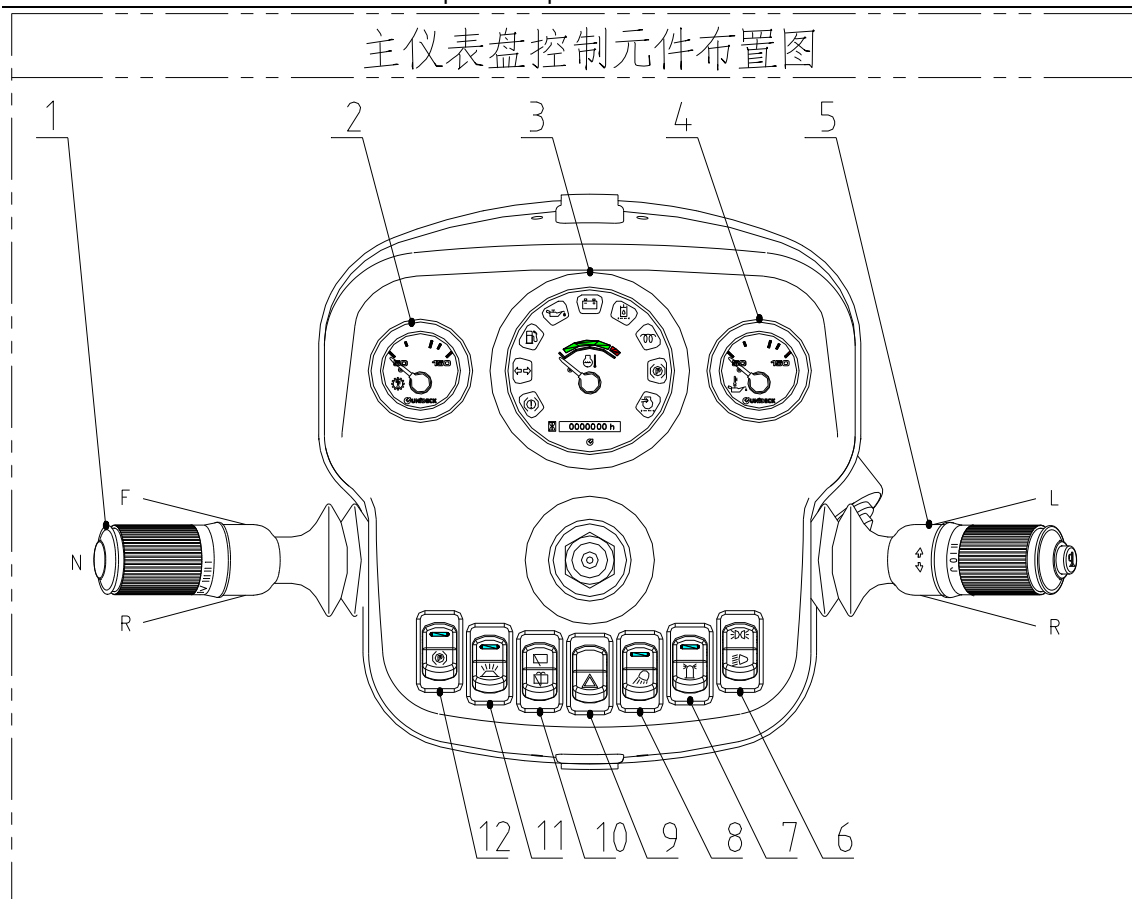
State LED flashing red lights, red light flashing as following,

- ② Fault state, the state of LED lights flashing in the yellow and red, through the comparison table below can investigate the cause of failure

Error Code	Error Description	State LED blinking frequency	
		Red Light	Yellow Light
1:1	VRFF Error		
3:1	Can Bus Error		
3:2	Address Error		
4:1	Internal Error		

9.2 Introduction the function of Work station components

1. Main dashboard introduction



Arrangement Diagram of the control element on the main dashboard.

1) Gear lever

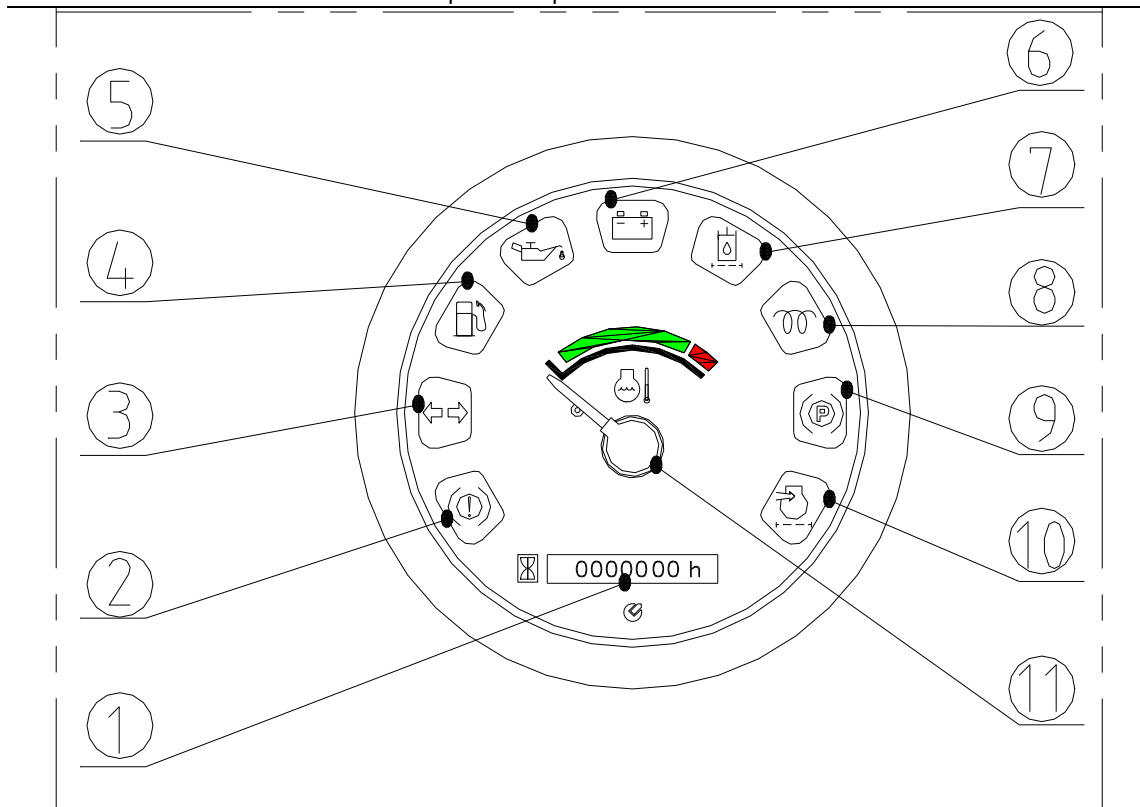
Forward direction of the handle is for the forward (F), back direction of the handle is retreat (R) and the rotation handle, make speed to reach the corresponding gear (I 、 II 、 III、 IV)

2) Transmission oil temperature gauge : display the oil temperature of the gearbox transmission

3) Indicator light and instrument

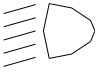
① Hour meter: when the engine start running, hour meter is start running also. The hour meter show the engine operation time hourly.

② Brake oil pressure too low alarm lamp: to test the brake system pressure, when pressure is lower than 110 bar, the indicator is on.(STOP)



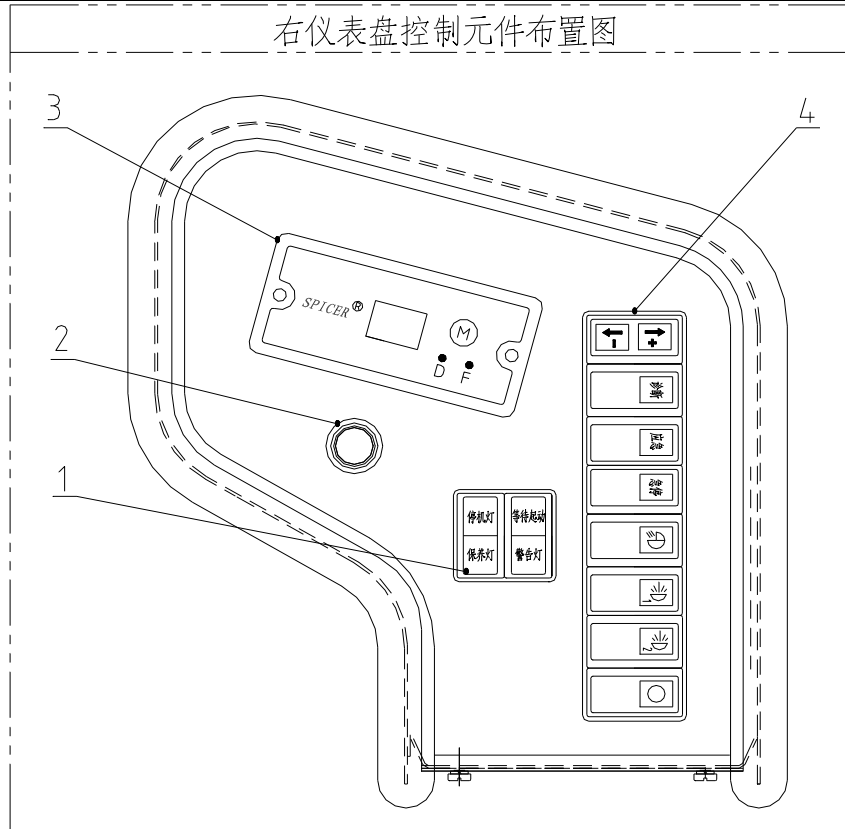
- ③ Turn signal control light(left/right): when the Steering switch is positioned in the left, right steering direction, indicating lamp intermittent flicker, color is green.
- ④ Low fuel indicator : when the residue of fuel oil is very little, this light is on.pls fill fuel oil.
- ⑤ Warning light of engine oil pressure: This light is indicator of the lubricate oil pressure. when the pressure is not enough the light is “red” , please turn off the engine and check for lubricate oil quantity and if there are some leakage, start the engine after trouble shooting.
- ⑥ Charging warning light: The light (Red) is on when the key on, this means the battery is charging for the system. When the engine working, and this light off, that means the generator is working, is charging for system and battery.
- ⑦ Warning light of hydraulic filter blocked: When the hydraulic filter blocked, this light is on, please change filter.
- ⑧ Preheating display light: when key is turned to preheating position, this light is on. Means the engine is on preheating position.
- ⑨ Parking brake display light: when hand parking barke is locked, this light is on. That means the vehicle is in position of parking brake.
- ⑩ Warning light of gear box filter blocked. When gear box filter blocked, this light on, please change filter.
- ,11 Water temperature indicator: show the temperature of cooling water in the

engine.

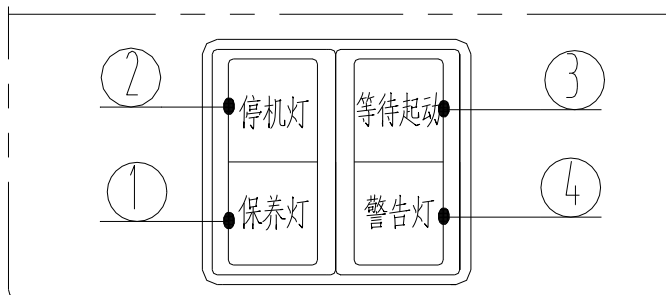
- 4) Oil temperature gauge of the engine:. Show the temperature of the engine oil.
- 5) Combination switch: there are four functions of the combination switch: Steering light, horn, front wipers, distance light. Details as following,
 - ①  Steering light: For control of left or right steering light.
 - ②  Horn switch: Press this button, the horn will sound.
 - ③  Front wipers switch: Turn this switch will control the speed of the wiper.
 - ④ Front distance light: lift this switch, can control the high beam of the headlight.
- 6) The headlight and small light switch.
 - ①  Turn the swift on this position, all the small light and instrument light will on.
 - ②  Turn the swift on this position, the low beam of headlight is on.
- 7)  Warning light switch : Turn to this position, the warning light on rear upper of the spreader will on.
- 8)  Rear light switch: Turn to this position. the light on the back will on.
- 9)  Emergency lamp switch: turn to this position. the vehicle front and rear light(4 lights) flashing at the same time, to remind the vehicle is on emergency parking station.
- 10)  Top/rear wiper switch: turn to this position, the top and rear wiper will controlled to work at the same time.
- 11)  Doom light switch in driver cabin: turn to this position, to control the working light of driver cabin.
- 12)  Parking brake light switch: turn to this position, P light is on, the vehicle is on the “brake” station, then make the transmission box on “N”gear.

2. The introduction of the right instrument control panel

右仪表盘控制元件布置图



1) Engine indication lamp



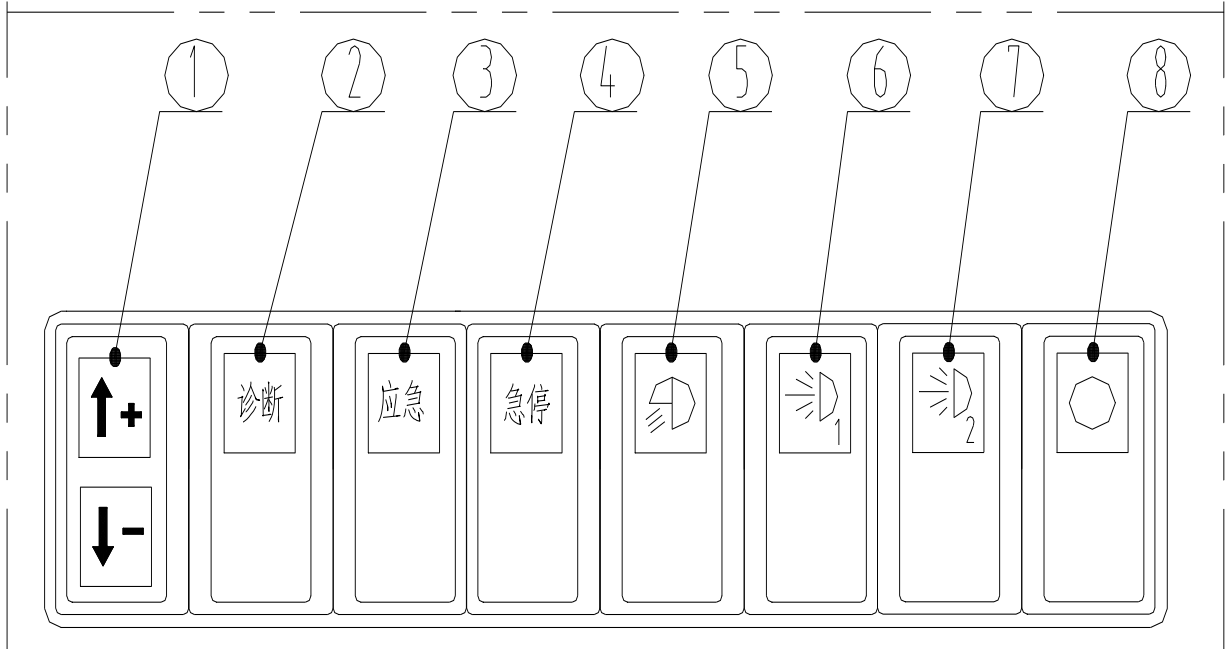
- ① The maintenance indicator: The maintenance indicator is on , remind the operator to maintain the engine.
- ② Stop light indicator: stop light indicator to provide emergency information to operator. These information requires the operator quick and right respond. Stop lights are also used to diagnose the fault code.
- ③ Active the heating order before starting. Provide heating grid automatic heating air inlet before the engine start. Heat the air intake in low temperature to provide engine start and reduce white smoke
- ④ Warning lights indicator: Warning light provides important information to operator. The operator is required to timely pay attention to these information. Warning lights are also used to describe the diagnostic trouble codes.

2) Transmission box fault alarm light: When the controller APC122 occurs fault, the

indicating light is on.

3) Gearbox display: this display monitor with the gear box controller APC122, display various information walking control.

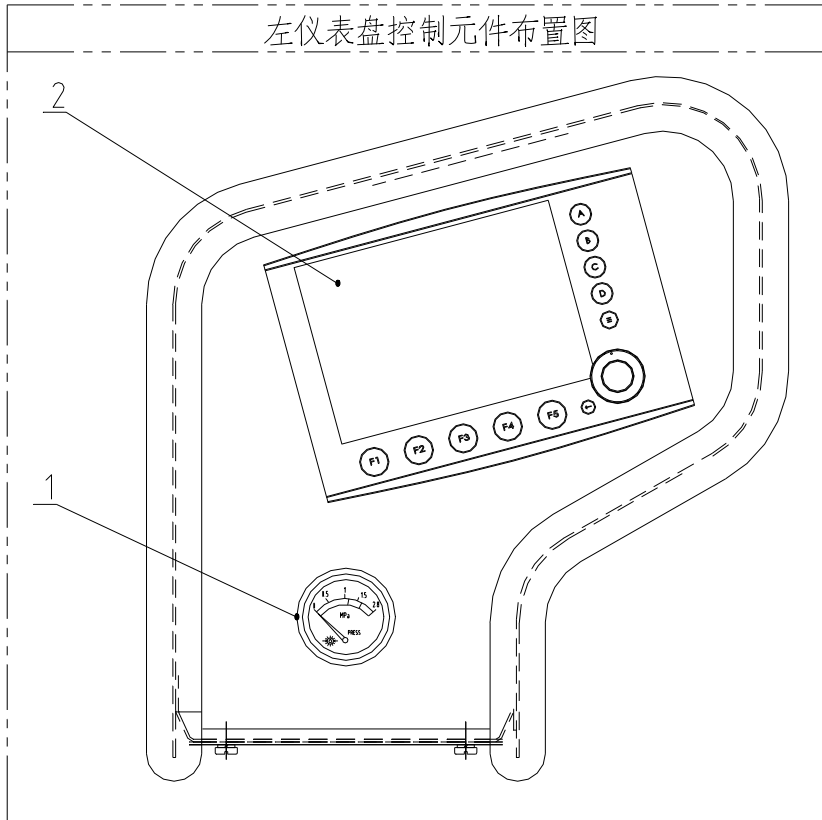
4) The combination switch group:



- ① Increment & decrement switch: when the engine is in diagnostic status, press the switch for the observation of fault code.
- ② Diagnosis switch: when engine failure, the operator need to press the switch to observe the fault code. Make the engine controller in diagnostic status.
- ③ Emergency switch: when the gear box controller fails, the vehicle can not move, pressing this switch, turn on the direction switch, vehicle will run at 1 speed, then the operator can drive the vehicle to the safe place to maintain the vehicle.
- ④ The emergency stop switch: this switch control the general power of hydraulic control system, pressing this switch will cut off the power (Controller, the module, the handle etc.). This switch is mainly used for cutting off the power supply when control system is in the situation of out of control .To prevent the accident occurs.
- ⑤ Spreader work light switch: this switch is used to control the work light of spreader..
- ⑥ Spreader arm work lamp ,1 switch: this switch to control the lights on spreader arm, about 2 on left and right, a total of 4.
- ⑦ Spreader arm work lamp ,2 switch: this switch to control the lights on spreader arm, 1 on left and right , a total of 2.
- ⑧ The general power control switch: this switch is used to control the general power switch (battery relay), press the switch, the power switch (battery relay) is closed, the general power is connected ; press again, the general power switch (battery

relay) disconnected, general power is disconnected. This switch is a touch switch, each time you press the time shall not exceed 1 second.

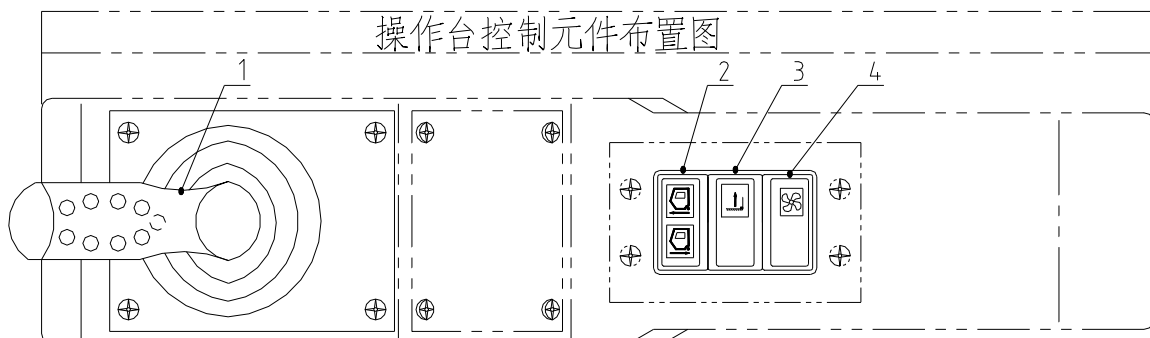
3. Left instrument panel introduction



(Left instrument control panel component layout)

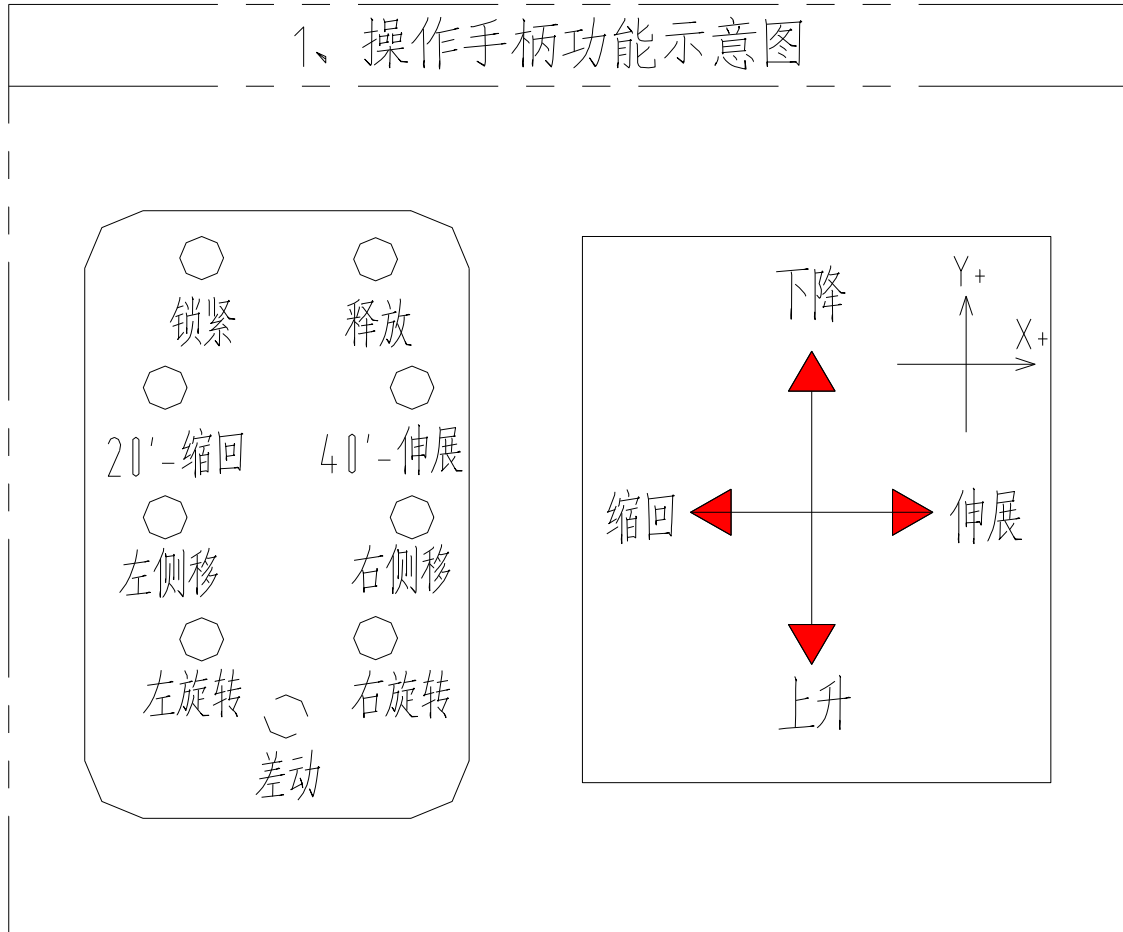
- 1) Gear pressure gauge: Display gearbox gear pressure value, the normal range is 0.5-1.5MPa, on the green area of the meter.
- 2) MDL2 display: MDL2 is used for showing the related information of vehicle, such as: parameters of engine and hydraulic control system.,equipment working state parameters, carry on communication through the Can bus and other modules of the vehicle, such as a handle, expansion module, engine controller , and an external analog signal and etc.

4. Operation panel partial instruction



(Operation panel control component layout)

- 1) Joysticks: used to control the arm lifting and telescopic action, at the same time control of each action, specific examples as below.



- 2) Schematic diagram of the control handle function

- a) The handle has 9 electric button, are used to control the action of different species

- ① Lock: Press this switch, lock close
- ② Release: press this switch, lock open
- ③ Back: press this switch, attachments motion from 40 feet to 20 feet
- ④ Extend: press this switch, attachments motion from 20 feet to 40 feet
- ⑤ The left shift: press this button, the whole attachment move to left side
- ⑥ The right side shift: press this button, whole attachment move to the right side
- ⑦ Rotate left: press this button, the attachment is rotated to the left
- ⑧ Right rotation: press this button, the attachment is rotated to the right
- ⑨ Differential: when unloaded, boom lift or extended, press this button, the speed of boom lifting or extending are accelerate

b) Handle bar along the X axis and Y axis direction of operation, the control action is explained as follows

① The boom lift: Along the negative direction of Y axis, as shown in the direction of the arrow

② The boom down: along the Y axis is the direction, as shown in the direction of the arrow

③ The boom retraction: along the negative direction of X- axis, as shown in the direction of the arrow

④ The boom extension: Positive direction along X axis, as below arrow direction diagram

c) The driver cabin mobile switch: Vehicle is in the “start” state, press this switch, cab will be moved forward and backward

d) The vertical lifting switch: press this switch, the operating handle (serial number 1) is in the lifting position, the lifting cargo will be hoist vertically

e) Fan switch: Fan control switch in cabin

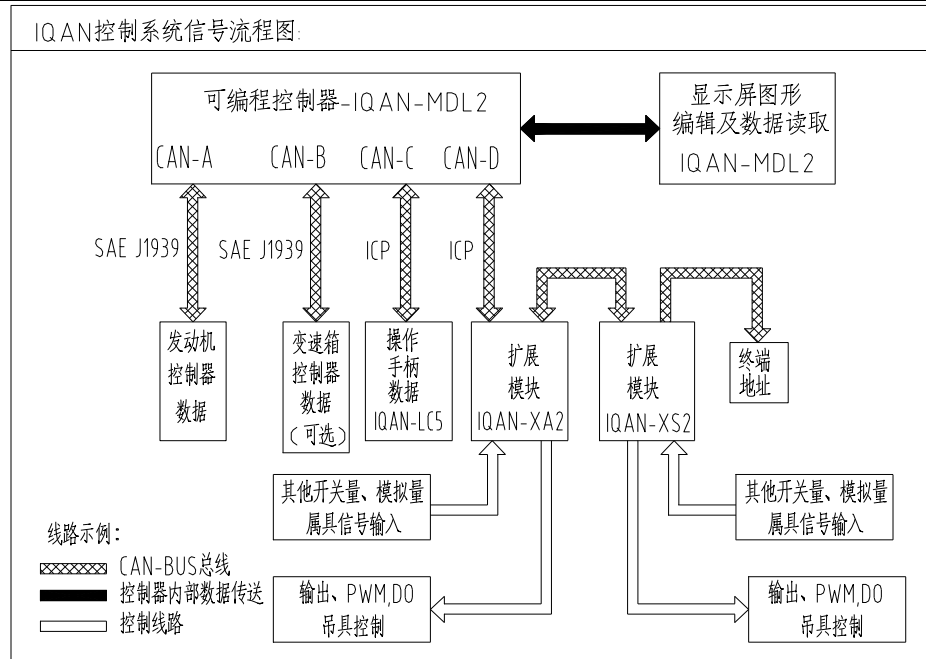
5. The main electric circuit control system instruction

1) IQAN control system instruction

① System: IQAN control system is mainly composed of the main controller IQAN-MDL2, IQAN-XA2 and IQAN-XS2 expansion module, the operating handle IQAN-LC5, gear box controller, engine controller, pressure sensor, angle sensor, length sensor, all kinds of switches and terminal address

② Signal process description: the whole system through the CAN bus network (two wires on both ends of the trunk line, and add a terminal address on both end) for information transmission, the main controller program, send and receive all kinds of instruction, for the signal to control the whole system

i. Signal simulation module to accept external switch signal, through the CAN bus communication with the main controller, the main controller programming, read data and sends an output command signal to the module



IQAN control system flow chart

The IQAN control system signal flow graph

Programmable controller

Display graphic editing and data reading

The engine controller data

The gear box controller data (optional)

The operating handle data

Expand module

Terminal address

Other switches, the analog spreader signal input

Output control, Spreader control

Route example

Can-bus controller and Internal data transfer

Control route

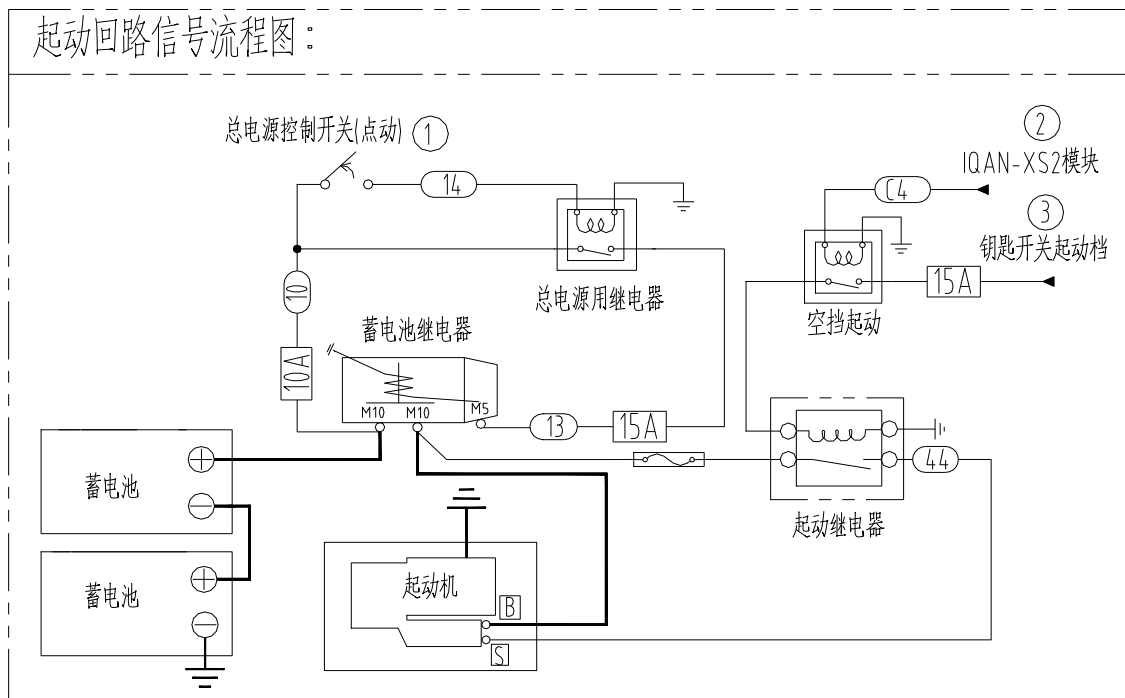
- ii. Communication of engine controller and main controller are through CAN bus, the main controller by J1939 communication protocol programming, read the engine parameter information, at the same time the fault code engine appeared through the display screen
- iii. Communication of gear box controller and main controller through CAN bus, the main controller by J1939 communication protocol programming, read the transmission parameter information, at the same time the fault code

transmission occurs through the display screen

- iv. Operating handle is a CAN bus handle, and the communication with main controller through CAN bus, the main control of programming according to the ICP communication protocol, send and receive all of the operating instruction

③ Control system of the electrical components, wiring and control in "CRS450Z5 vehicle electrical diagram"

2) Starting system circuit diagram



Main power supply control switch (point)

IQAN-XS2 module

Key switch start shift

Neutral startin

Main power relay

Battery relay

Battery

Starter

Start relay

- ① System composition: starting circuit mainly composed by battery, general power switch, battery relay, general power relay, neutral starting relay, starter relay, key switch, starter and other electrical components
- ② The description of start control
 - i. ① is general power switch. It is an inching switch. Press this button, the battery relay actuation, the main circuit is switched on from the battery power supply. The battery relay is disconnected after pressing the switch again; the main circuit is cut off
 - ii. ② is IQAN-XS2 module, system control extension module. The safety signal of permission to start is output by IQAN system logical judgment. The safety signal is that the handle is in neutral position and operating handle is in the middle position.
 - iii. ③ is starting key switch. Under the premise of connecting the power supplies and the safety signal permission, key switch turn to the position of “start”, start in neutral, relay attracts gathers, start relay closure, start the motor, then the engine starts.
- ③ Learn more on the control wiring of all electrical components in the starting system, referring to the vehicle electrical diagram

3) Moving control system

- ① System composition: Driving control system is composed of controller APC122, RD120 display screen, gear lever, electric relay, control valve, speed sensor, emergency switch and so on. It makes vehicles go forward and backward. There are four gears for each forward and backward
- ② The instruction of driving control. When the signal of handle was input into the controller APC122, at the same moment, the controller got the speed sensor of engine and turbine sensor to do comparison operation. The controller output control the control valve of the transmission. It controls the gear shift of transmission by the signal detection of speed sensor and internal arithmetic. The driving control system set up the emergency switch, with the internal fault of the controller. It controls the control valve of the transmission by relay transformation output, makes the vehicles to go to the safety place to maintain in the first shift
- ③ other instructions: The controller can read the trouble codes and relative detection information by the display of RD120. See the instruction of automatic gear shift APC122 for detail

Resistance

Controller

Control valve

break and out of gear switch

Starting key switch

APC power relay supply

Emergency relay

Emergency switch

6. The main display operation

There are a couple of display in the main display of Dalian reach stacker. There are parameter display, parameter setup, alarm display, I/O port view status and etc.. It also has Chinese and English conversion display setup to satisfy the customers need

The first display page: The start page, has icon, models and welcome words

The second display page: The main page, display the important specification of daily operation

The third display page: It displays the parameter of engine

The fourth display page: It displays working condition monitor of all the components of hydraulic system

The fifth display page: It displays the operating condition of spreader and other relative information.

- 1) Press the switch of general power supply, the power of the main display is switched on. It will get into the first display page, holding 5 seconds, into the second page.



The first page

Dalian forklift welcomed!

CRS450Z5 Container Reach Stacker

- 2) There are two ways to go into the second page: One is that holding 5 seconds, then into the second page. The other is pressing F2 KEY to go into the second page. The picture is as followings



The second page

Length 7767mm

Angle 27.57 degree

Center distance 9033mm

Height 9158mm

Weight -6.57 ton

L-length, display the length of the telescopic arm, in mm

A- Angle, display the lifting angle of the lifting arm, in degree

G-Center distance, display the distance between the center of the lifting container and front thread,in mm

H-Height, display the distance of the lock of the spreader and the ground, in mm

M-Weight, display the total weight of lifting container, in Ton

This page is the main display page in work; it will be helpful for operator to

monitor the situation of working load and running.

- 3) The third page can go into by pressing F2 key. It connects the controller of the engine by CAN bus, reads and displays the parameter of engine. It shows the diagram as followings



Engine cooling water Temp.: showing temperature of engine cooling water (°C).

Engine oil pressure: indicating engine oil pressure (KPa)

Engine Rev.: showing engine rotate speed (rpm)

Working time: indicating engine working time (hr)

System voltage: voltage of power for engine controller (V)

There are another two indicating lights, one is red lighting at engine cooling water temperature too high, signal  ; another one is red lighting at engine oil pressure too low, signal 

- 4) The 4th page layout will key in by press F3 key. It mainly indicates checking pressure of hydraulic system, scale electromagnetic valve input and output and its testing, help for repairing and maintenance of the equipment



- ① Left lifting cylinder pressure: showing the pressure of left lifting no plunger cylinder (Bar)
- ② Right lifting cylinder pressure: showing the pressure of right lifting no plunger cylinder (Bar)
- ③ Left lifting plunger cylinder pressure: indicating the pressure of left lifting plunger cylinder (Bar)
- ④ Extending valve S1: scale electromagnetic valve controls extending motion of the telescopic boom, indicating input signal and output signal
- ⑤ Retracting valve S2: scale electromagnetic valve controls the retracting motion of telescopic boom, indicating input and output signals
- ⑥ Lifting valve S4: scale electromagnetic valve, controls the lifting motion of the boom, indicating input and output signals
- ⑦ Lowering valve S5: scale electromagnetic valve controls the lowering motion of the boom, indicating input and output signals
- ⑧ S3: this electromagnetic valve is switch valve, controls quick function of boom extending motion
- ⑨ S6: this electromagnetic valve is switch valve, controls quick function of boom lifting.
- ⑩ S8: this electromagnetic valve is switch valve, controls quick function of boom lifting
- ,11 S7: this electromagnetic valve is switch valve, controls quick function of boom lowering

○,12 S9: this electromagnetic valve is switch valve, controls quick function of boom lowering

○,13 S10: this electromagnetic valve is switch valve, general oil supply valve for the spreader

○,14 S12: this electromagnetic valve is switch valve, general oil supply valve for cabin moving

○,15 S13: this electromagnetic valve is switch valve, controls the right rotation of spreader

○,16 S14: this electromagnetic valve is switch valve, controls the left rotation of spreader

Items○,8—— ○,16 indicate input, output status. (Green lighting means true, Green extinguished means false).

5) The 5th page layout will come out by press F4 key, Showing the working status and other information of the spreader



- ① Releasing: Indicate the status of lock head of spreader, lighting means opening up
- ② Twist lock: Showing the twist lock's status, lighting means locked up
- ③ In position: Showing if all lock heads into the holes of Container, lighting means all in position
- ④ Over loading (90%): Indicate the limited capacity 90% of Max. carry load on this

position, lighting means the load over the limitation

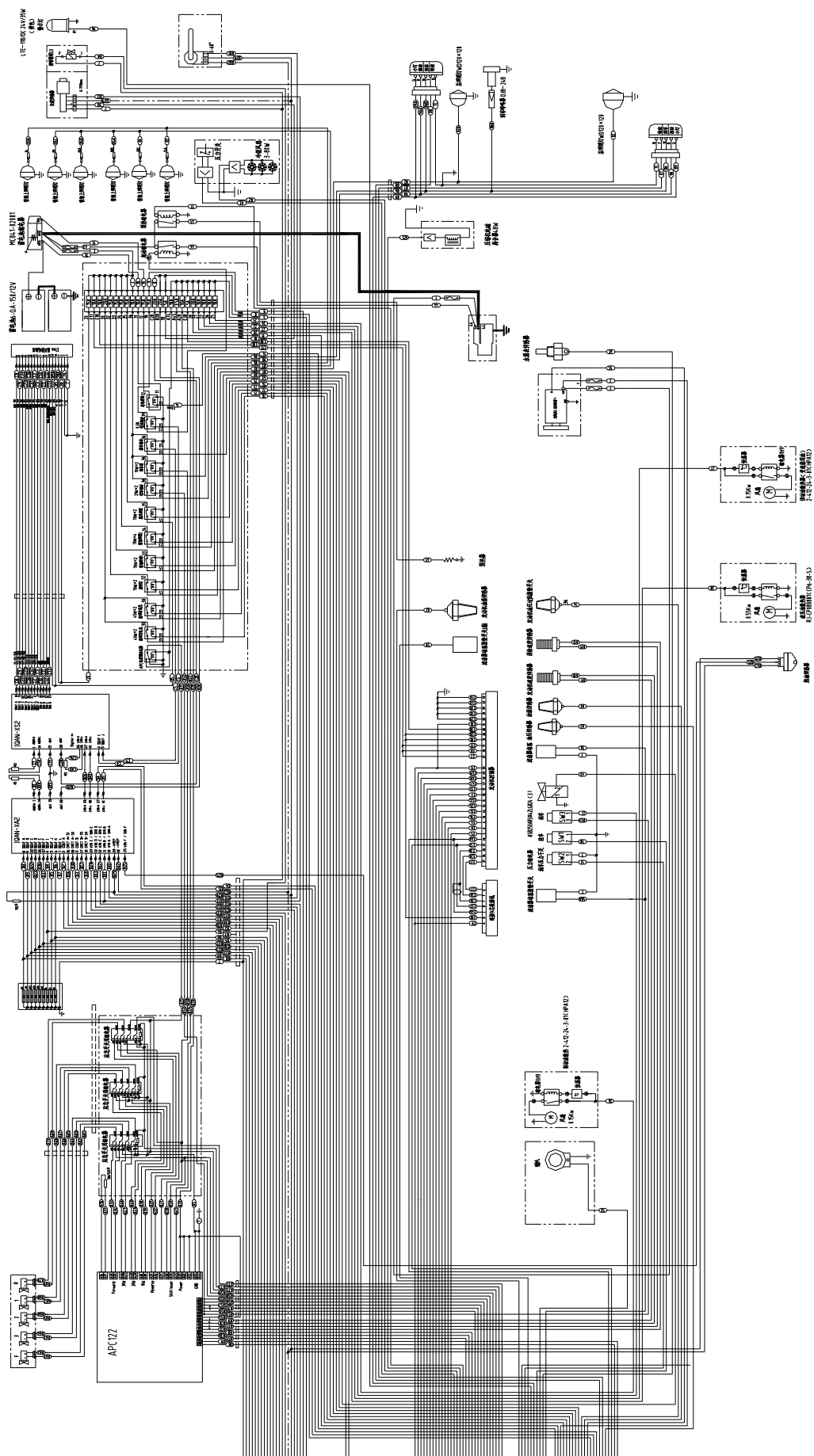
- ⑤ Over loading: Indicate the Max. carry load of this position, Lighting means the load reaching the Max. status.
- ⑥ Container work counting: Indicate counting number of carried container
- ⑦ Extending speed: Indicate the extending speed of the telescopic boom (m/s).
- ⑧ Lowering speed: Indicate the lowering speed of the boom (mm/s)

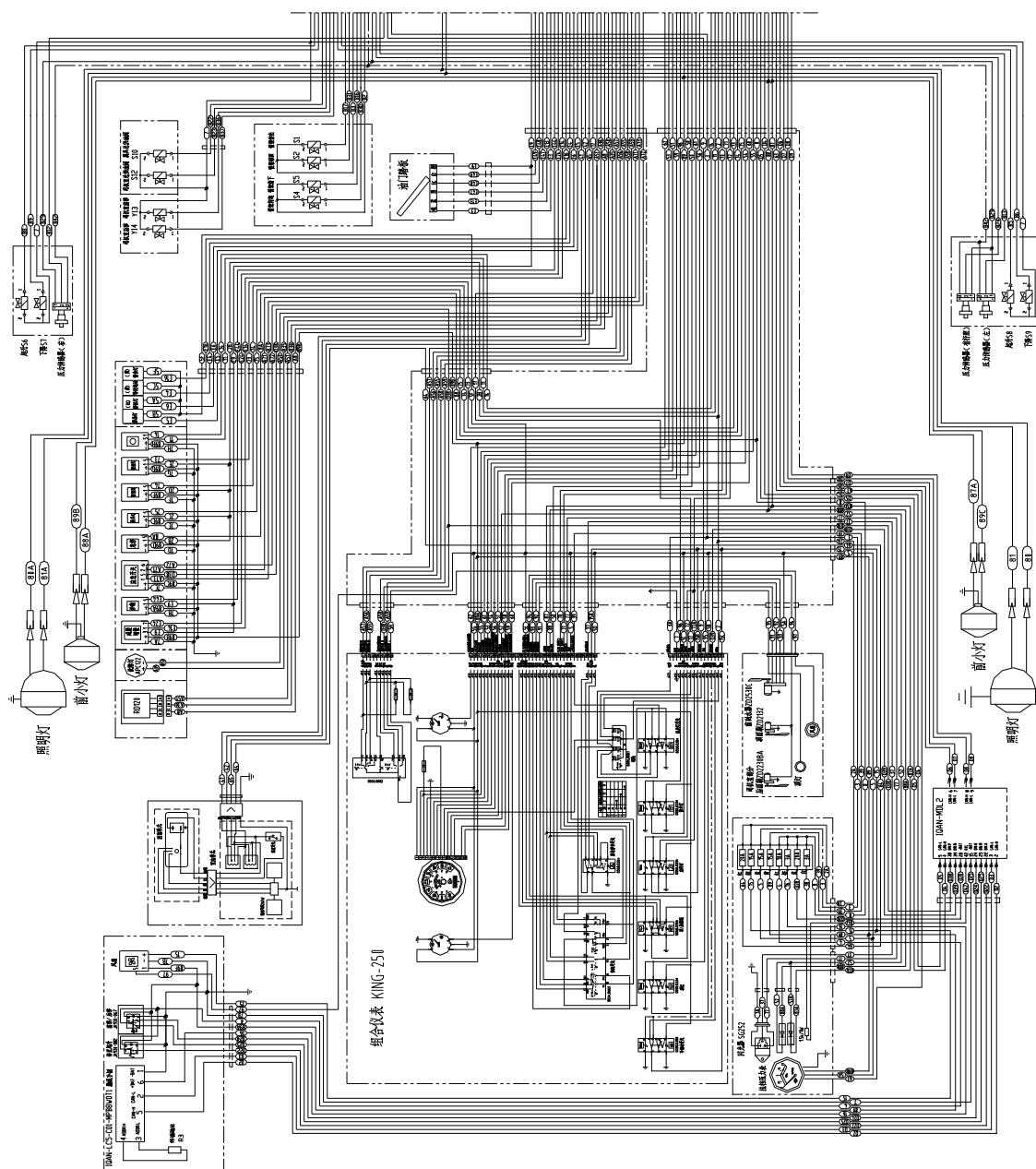
IMPORTANCE: The above each page display content may vary with the program development and upgrade, But it won't affect the using of the equipment.

Figure 1、hydraulic principle chart of the chassis

Figure 2、electric principle chart of the chassis







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