

Drawworks

Drawworks is of double-drum structure, main drum is used to make a trip and run casing while lifting and used to control bit weight during workover job.

. Technical data

Data sheet

Model		JC 250-S	
Type		Double drum	
Rated power		250kW	
Technical data		Main drum (LEBUS groove)	Sand drum
Drum body	Diameter mm	Φ344	Φ324
	Length mm	851	919
Brake rim	Diameter mm	Φ970	Φ970
	Width mm	260	210
	Cooling type	Water splashing	Water splashing
Clutch		ATD-224H (push disc)	ATD-124H
Brake band coverage		340°	340°
Diameter, wireline mm		Φ22	Φ16
Fastline pull kN		139	115.6
Hydromatic brake		122 hydromatic brake	

. Structure characteristics

Drawworks mainly consists of the following components:

- Main drum and brake system
- Sand drum and brake system
- Drawworks frame and guard shield
- Chain and guard shield
- Right angle gearbox

1. Main drum

It is composed of drum shaft, drum body, brake rim, clutch, sprocket and brake system, etc. Please see Fig. 1-1 (main drum).

- 1) Drum shaft is made of premium alloy steel, specially heat-treated with high strengthness and good toughness. Air lead swivel joint is installed on the drum clutch of shaft to control clutch.
- 2) Drum body, with integral LEBUS groove, winds and arranges the drilling line in order. A special groove is set on the wheel rib of drum body at the driller's side. Insert the drilling line into the groove after binding with wedge, and then slowly rotate the main drum to firm the drilling line.
- 3) Brake rim, water spraying cooled with high heat-radiating efficiency, can

effectively prevent brake rim from overheating and ensure reliable brake. The outer surface of brake rim is made of premium alloy steel, specially heat-treated with high strength and hardness. It is heat resistance and wear resistance with long service life.

- 4) Air push disc clutch, axial air-bag push clutch friction disc type, is air controlled easily & reliably and is associated with crown-O-matic mechanism. When the crown-O-matic valve (overroll valve) is activated, the clutch will be disengaged compulsively. The clutch features overload protection. When hook load exceeds preset load, the set air pressure pull of the air-bag is limited and the friction disc will slip, and then the hook will stop going up. Multi-friction disc group, featuring large driving moment and steady combination, relieves the impacting load when the drum starts up. Please see Fig. 1-2 (ATD224H air push disc clutch).
- 5) Hydromatic brake is of model 122 hydromatic brake system, mainly composed of hydromatic brake, water tank, switch pipings and control valves. It is used for decelerating when making a trip and running casing to ensure hook can fall down at uniform speed in load condition. The engagement of the hydromatic brake clutch is undertaken by the rotation of the air valve handle near the driller's console. When the temperature is lower than 0⁰C, add an amount of ethylene glycol in circulating softened water.
- 6) Cooling water circulating system is used for water spraying cooling of main drum brake rim and hydromatic brake. Water tank, filter and relief valve are placed on the carrier and transported with the carrier, which saves the transporting times. Please see Fig. 1-3 (circulating system).
- 7) Sprocket, 20A-3 (1-1/4), triple row chain profile, transfers the power to main drum.
- 8) Drum brake system is designed with mechanical brake handle friction tape type balance brake, which controls manual brake handle and impels the bell crank to pull the soft end of the brake band via lever transfer mechanism and then surrounds brake rim to decelerate or stop the drum. A balance beam mechanism is installed at the fixed end of brake band to balance the acting force of the left and right brake bands through adjustment and to make both the brake rims under the equal stress. Brake band has ratchet locking mechanism, by which brake band can be automatically locked after closing the ratchet and holding down the brake handle so as to lighten the driller's working strength. See Fig. 1-4 (Drum brake system).
- 9) Crown-O-matic mechanism. The bracket and crown saver valve (overroll valve) are installed on the drawworks frame above main drum. Crown saver valve can move along the bracket and drum axis. The length of the trigger of the crown saver valve can be adjusted. The hoisting height of the traveling block corresponds with the layers of the winding lines. The height of the traveling hook can be determined by adjusting the trigger of the

crown saver valve. The trigger will be activated when it touches the layers of the drilling lines wrapped on the main drum, Please see Fig. 1-5 (crown saver valve). A crown-O-matic cylinder is installed inside the drawworks frame. When the piston rod is connected with the regulating crank of main drum brake shaft, the regulating crank mechanism operates in single direction, Please see Fig. 1-6 (crown-O-matic cylinder). When the trigger of the crown saver valve touches the winding lines, open the valve core and the compressed air will enter into the crown-O-matic cylinder and quickly push the piston out. And then the regulating crank will impel the brake shaft to rotate and the emergent brake of the drum can be realized. Meanwhile, the signal of the air pressure will make the main drum clutch disengage quickly and the engine throttle will be reduced dramatically. The traveling hook will stop rising urgently to prevent from being collided with the crown.

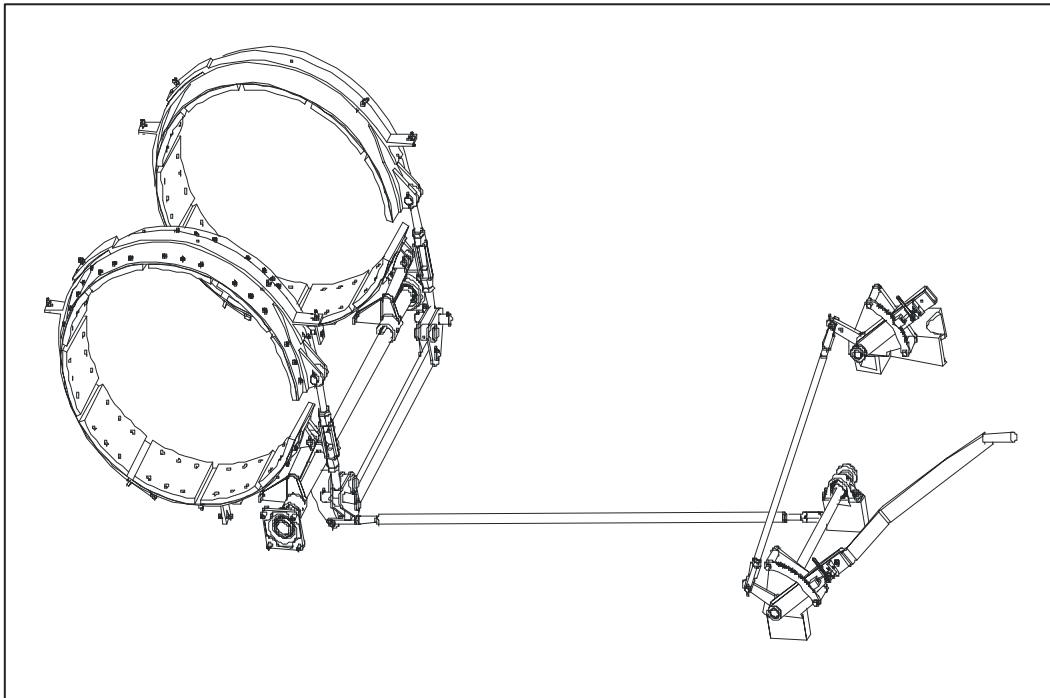


Figure 1-4 drum brake system assy.

2. Sand drum

Sand drum shall comprise of drum shaft, drum body, brake rim, clutch and brake system, etc. It is water spraying cooled, featuring adequate cooling and long service life, easy for maintenance. Please see Fig. 1-7 (sand drum) (E330- 04000000) “assembly drawing of the drum clutch”.

Drum shaft is made of premium alloy steel, specially heat-treated with high strength and good toughness.

Drum body, without rope groove.

Brake rim is water spraying cooled with simple structure.

Air push-disc clutch, multi-friction disc group, featuring large driving moment and steady combination, relieves the impacting load when the drum starts up.

Please see Fig. 1-8 (air push-disc clutch).

Double sprockets are of 24A-2 (1-1/2) double-row chains. The input sprocket transfers the power to the sand drum clutch and then the output sprocket transfers the power to the main drum.

Drum brake is of mechanical brake handle friction band type balance brake., which controls the manual brake handle. The brake band has ratchet locking mechanism and can be locked automatically after closing the ratchet and holding down the brake handle so as to relieve the driller's working strength.

3. Drawworks frame and top shield

Drawworks frame is of steel plate welding structure. At the bottom and both ends of the drawworks frame, there is welded with rectangular tube reinforced framework, high strength and light, to connect and support the main drum, sand drum, brake mechanism, chain guard shield, sand drum control box, etc. Please see Fig. 1-9 (drawworks frame and top shield).

Top shield is of independent hinged structure. Each brake rim is equipped with a separate shield, which is hinged with the drawworks frame. It is positioned with an insert plate without a bolt for convenient assembly and disassembly.

A bracket is installed on the top of the drawworks frame to fix the crown-O-matic valve (overroll valve). A crown-O-matic cylinder is fixed inside the drawworks frame with its piston rod connected with the regulating crank of the brake shaft. When the winding lines touches the operating rod of the crown-O-matic valve, the crown-O-matic valve will give a signal to activate the crown-O-matic cylinder quickly to push the brake shaft and brake urgently.

4. Brake system of drawworks

Brake system of main drum and sand drum is designed with hub band type balance brake system. It comprises of steel band, brake block, balance beam, crank shaft, retainer ring, adjusting screw rod, pull rod and brake handle, etc. The mechanical brake handle friction tape type balance brake unit controls manual brake handle and impels the bell crank to pull the soft end of the brake band via lever transfer mechanism and then surrounds brake rim to decelerate or stop the drum. A balance beam mechanism is installed at the fixed end of brake band to balance the acting force of the left and right brake bands through adjustment and to make both the brake rims under the equal stress. Please see Fig. 1-10 (brake system assembly).

5. Chains and shield

Chains are 2 groups of high-strength double-row roller chain 24A-110 (11/2), which transfer the power from the output shaft sprocket of right angle gearbox to the sprocket of main drum.

Chain shield is fully closed integral shield and equipped with air port, oil level gauge and drip pan, etc. Chain is splash lubricated and the drip pan can collect the lubrication oil splashed from the low-position chain end to lubricate the

high-position chain end.

6. Right angle gearbox

It comprises of input shaft, driving spiral bevel gear, output shaft, driven spiral bevel gear. Right angle gearbox can change the direction of power transfer and drive down as well. The output shaft is fitted with double-row gear sprocket for power output. Please see Fig. 1-11 (right angle gearbox).

. Operation instructions

Drawworks is one of main parts of the workover rig. It is the basic skill for the driller to operate the brake handle and all the control levers of the driller's console correctly and control the drawworks to operate the drilling and workover jobs. The operation instructions and trouble shooting of the drawworks are described in the following:

1. Check before operation

- 1) No loose of the fixed bolt, no crack of the brackets and no leakage of the guard shields.
- 2) Check if the wirelines are arranged orderly. No breakage is allowed and periodic lubrication should be performed.
- 3) Check if all the pneumatic and hydraulic control valves on the driller's console can operate correctly and flexibly. No leakage is allowed.
- 4) Check if all the pneumatic and hydraulic control pipelines are in good condition, without leakage, and the pneumatic swivel joint and two-way hydraulic swivel joint at both ends of the main drum shaft can rotate flexibly. No leakage is allowed for the pipelines and periodic lubrication of the swivel joints should be performed.
- 5) All the pressure gauges are sensitive and correct indication. The pressure of the air pressure gauge is 0.75 ~ 0.85Mpa. The rated pressure of the hydraulic pressure gauge is 14MPa.
- 6) Check if all the gauges in the drilling parameter instrument panel are sensitive and correct indication. When the traveling block stops without load, the needle of the weight indicator should point at 15kN.
- 7) Check and adjust the brake band. The remain thickness of the brake block after wear should be not less than 15mm. The circumferential clearance between the brake disc and brake rim is 4.5~5mm.
- 8) Check if the brake mechanism is flexible and reliable. Adjust the height of the brake handle with the level angle of 40~50 ° and then press down the brake handle to stop the drum.
- 9) Check cooling water system. The cooling water and circulating water pipelines of the main drum hydro-brake and brake rim are correctly connected with smooth loops. Water pump and radiator work normally. The circulating water tank has correct liquid level with clean water.

2. Operation instructions of brake handle

Manual mechanical brake handle increases acting force via lever transfer mechanism and impels the bell crank to pull the soft end of the brake band, and then surrounds the brake rim to decelerate or stop the main drum so as to regulate drill pressure, run drilling tools, control tripping speed and stop drilling tools.

Brake handle has a ratchet locking mechanism, by which brake handle can be automatically locked after closing the ratchet and holding down the brake handle so as to relieve the driller's working strength. Press down the brake handle, open the ratchet, slowly loose the brake handle, and then the brake of the main drum can be released.

During operating the brake handle, the operation of engine throttle and main drum combination valve should be coordinated simultaneously so as to assure stable tripping.

- 1) During pulling out, right hand operates brake handle, left hand control crank of main drum combination valve, pull the crank up; accelerate the engine rotate speed, main drum begins to rotate, and right hand loosen brake handle, traveling block rises; when hook buffer spring is compressed, accelerate throttle, engine rotate speed 1200 ~ 1800r/min, hook rise to pull out; when hook rises to top point, decelerate rising speed to prepare for braking. Crank of main drum combination valve is placed on the meso position, clutch of main drum breaks away; at the same time, right hand press brake handle to stop traveling block.
- 2) During running back, right hand operates brake handle, left hand control crank of main drum combination valve. When hook load is less than 300kN, crank of main drum combination valve is placed on the meso position, clutch of main drum breaks away; at the same time, right hand loosen brake handle to control fall speed of traveling block. When hook load is more than 300kN, employ hydrobrake to engage control valve of hydrobrake and decelerate fall speed of hook. When stand joint is close to rotary table, partly lock brake handle to relieve impact. When single stand is left 3-4m, decelerate fall speed, press brake handle to place elevator on rotary table.

Note:

- Before running, check crown-O-matic mechanism is sensitive and flexible.
- Concentrate during operation.
- Operation shall be steady.
- When hook load is more than 300kN, employ hydrobrake to decelerate fall speed of hook and reduce wear rate of main drum brake staple; at the beginning of hook falling, engage the hydrobrake in time; you mustn't engage hydrobrake during falling of hook.
- Check circulating cooling water system of main drum and

hydrobrake, water temperature and pressure meet technical requirements.

- Control falling speed to prevent failure of brake.

3. Driller operation specification

- 1) During running drill pipe, chose shelves and accelerate hoisting speed according hook load.
- 2) During engaging drum clutch, pull crank of main drum combination valve up to maximum extent of opening. Forbid clutch from long-term rotating during half-engaging.
- 3) During running, firstly leave clutch of drum, then press brake handle and brake rim.
- 4) Quickly run back brake, forbid controlling falling speed during half-braking.
- 5) When hook load is more than 200kN, engage hydrobrake softly.
- 6) Watch out working water temperature of circulating cooling water, not exceed 66 .
- 7) Forbid filling equipment with lubricant and grease.

4. Adjustment of drum brake system

Adjust brake staple in time in order to insure good performance of equipment.

- 1) Adjust clearance of brake band: clearance of brake band is bigger as a result of brake band wear. Adjustment method: after braking screw up all locking bolts of location ring. Then loosen bolts for 3 circles, clearance between brake band and brake rim is about 5mm.
- 2) Adjust running end of brake band: when locking brake band, correct state of running end of brake band as fig. 1-12A, braking performance is normal. When as fig. 1-13A, 1-13B, braking performance is not well, it has to be adjusted.
- 3) Adjust brake band balance: when locking brake band, correct state of dead end of brake band as fig. 1-12B, left and right brake bands work balanced, and the brake performance is normal. When as fig. 1-13C, double brake bands bear different force and cause eccentric wear to brake band. Braking force is not enough, you must adjust in time, adjustment method is as figure.
- 4) Adjust height of brake handle: brake band wrap angle enlarges, and brake handle brings down. Adjust height of brake handle in order to keep brake handle on the appropriate height.
 - Place drill tool on the rotary by means of wearing brake bands, take off load, loosen hook spring.
 - Place gearbox at neutral gear, drum combination valve on the meso position.
 - Regulate length of pull rod, optimal inclination of brake handle is 45 .

- After adjusting, perform brake test, hoist drill tool 1~2m.
- 5) Change brake block of brake band: when wear retain thickness of brake block closes to 15mm, you shall change all brake bands.

Note:

If fixed bolt head is contacted with brake rim, brake rim will slip, which causes serious incident and bodily injury.

. Trouble shooting

The common breakdown, the reason and troubleshooting for the drawworks are described in the following:

Common Breakdown, Reason & Troubleshooting

S/ N	Fault symptom		Possible reason	Troubleshooting method
1	Brake handle	Press to extreme lower position, fail to brake	Brake block wears seriously; Brake bands of two end are not balanced; Brake rim are polluted by oil; Brake handle is adjusted too low; Running end of brake band is adjusted improperly;	Change brake disc; Adjust to balance; Clean out oil pollution; Adjust height of brake handle; Adjust running end of brake band;
		When running to peak, hook doesn't lower, or lower slowly;	Clearance between brake band and brake rim is undersize; Friction between brake band and brake rim; Adjustment of brake handle is improper;	Adjust clearance of brake band; Check and repair brake band and brake rim; Adjust brake handle;
2	Clutch of drum	Not engage clutch of drum; Drum rotates;	Clearance of clutch friction disc is undersize; Clutch friction disc is clotted;	Adjust clearance of clutch friction disc; Change clutch friction disc;
		After unshackling drum clutch, drum still rotates;	Clearance of clutch friction disc is undersize; Clutch friction disc is clotted; Air circuit doesn't brake up thoroughly;	Adjust clearance of clutch friction disc; Change clutch friction disc; Check and repair air circuit and associated valves;

		When hoisting hook, hook slips;	Clutch is polluted by oil; Air pressure is not enough; Clearance of clutch friction disc is too big; Clutch friction disc wears seriously;	Clean out oil pollution; Adjust air pressure; Adjust clearance of clutch friction disc; Change clutch friction disc;
3	Drum brake	Brake power is not enough;	Air pressure is too low; Clearance of brake rim is too big; Brake band wears seriously; Brake rim is polluted by oil; Left and right brake bands are not balanced; Cooling temperature of main drum is overtop;	Adjust air pressure up; Check and repair; Check and change; Check and clean; Check and adjust; Adjust temperature of cooling water;
		Brake band wears quickly;	Lowering speed of hook is too quick; Main drum doesn't engage hydrobrake; Brake rim is not enough cooled; Clearance of brake rim is undersize;	Control hook speed; Engage hydrobrake in time; Adjust flow and temperature of cooling water; Check and adjust;
4	Hydro-brake	Radiation	Rotate speed is overspeed;	Adjust temperature of cooling water;
5	Chain gearbox	Part radiation	Shortage of oil lubricant; Lubricant is polluted; Bearing wears;	Add lubricant; Change lubricant; Repair and change bearing;
		Rotate with abnormal sound;	Bearing wears; Chain wears; Chain plate extends;	Repair and change bearing; Repair and change chain; Repair and change chain;
6	Right angle gearbox	Part radiation	Shortage of oil lubricant; Lubricant is polluted; Bearing wears;	Add lubricant; Change lubricant; Repair and change bearing;

		Rotate with abnormal sound;	Bearing wears; Bevel gear wears; Big cone gear wheel loosen ;	Repair and change bearing; Repair and change bevel gear; Check and repair, fasten;
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. Service, debug and check of main consumable accessories

The section introduces service, debug and check on location of main consumable accessories. Service, debug and check of hard dismantling, complex process and high-requirement service need repairing in special workshop.

Note:

- Before repairing, make sure equipment is steady thoroughly and in safe condition, or hazard incidents will happen and hurt equipment and working personal;
- Maintainer shall be specially trained, have operation certificate;
- Before repairing, read operating manual.

1. Change brake band and brake block of main drum

Periodically check wearing of main drum brake blocks during running equipment, prevent brake blocks from excessively wearing and dropping braking performance to hurt equipment and personal.

When brake band and brake blocks of main drum wear, fixed bolt head closes to brake rim, i.e. wearing thickness of brake blocks near 15mm, change brake bands.

1) Repairing work

- a. Shutdown engine, place gearbox at neutral position, close DC power switch of chassis;
- b. Place traveling block on the substructure, loosen wireline, wingding floor of drum wireline doesn't exceed second floor.
- c. Above drawworks frame without mast.

2) Dismount brake band

- a. Mark on left and right brake band;
- b. Dismount support of saver valve, loosen two ends of support and connecting bolt of top shield, dismount support and saver valve, air circuit piping line, place them near drawworks;
- c. Dismount two (2) hitch yokes of left and right top shield; loosen nut, take of gasket and spring;
- d. Loosen four (4) adjusting bolts of left and right top shield; loosen closed nut, loosen bolt, distance between bolt head and brake band is over 10mm;
- e. Dismount left and right shields, take of cotter pin of two ends high of shields, draw out connecting pin;
- f. Loosen roller assy, place it on the left and right brake bands in drawworks frame; loosen closed nut and bolt, distance between roller and brake band

is over 10mm;

- g. Dismount reset extension spring parts; loosen closed nut, take of extension spring;
- h. Dismount four (4) connecting pins on the two ends' lug of left and right brake band; take of cotter pin, draw out connecting pin;
- i. Dismounting left and right brake bands, adjust brake bands, opening downwards, have brake bands away from brake rim to drum. On the middle of drum, hoist brake bands away from drawwoks.

Note:

During dismounting brake bands, carefully operate to prevent brake bands from deformation.

3) Change brake blocks

- a. Dismount used brake blocks, fix locking nut, dismount brass screw; orderly dismount all used brake blocks;
- b. Check and align brake steel belt, clean out burrs and foreign matter on the surface of steel belt, check lug pin hole of steel belt, repair hurting;
- c. Check locking nut and brass screw, repair hurting;
- d. Install brake block, at the dead end of brake band install cast brake; screw locking nut of brake block, locking torque of nut is 16.7 ~ 22.3Nm;

Note:

Brake blocks of left and right brake bands shall be from identical industry.

- e. Check installation quality of brake band; brass screw is under brake block surface, tilting and loosening is not allowed;
- f. Install left and right brake belts; opening downwards, on the middle of drum, draw brake bands into main drum, have brake belt into left brake rim; orderly install right brake belts;

Note:

During assembling and dismounting brake belts, distinguish left and right installation position.

During assembling and dismounting brake belts, carefully operate.

- g. Install four (4) connecting pins of left and right brake band lugs;
- h. Install left and right top shields;
- i. Install support of saver valve.

4) Adjust brake bands

- a. Adjust left and right brake bands, press brake crank, loosen closed nut of 4 adjusting bolts on the left and right top shields, adjust bolt. Loosen brake handle, then clearance between brake belt and brake rim is about 4.5 ~ 5mm;
- b. Adjust left and right brake belt roller assy, roller assy is installed on the left brake belt in the drawworks frame, 4; brake handle is in open condition, loosen locking nut, adjust bolt. Lock nut, clearance is about 4.5 ~ 5mm.
- c. Adjust two (2) hitch yokes of left and right top shield; adjust nut, press spring, hoist brake band to proper height, keep clearance between brake belt and brake rim within 4.5 ~ 5mm, after adjusting lock screw and fix nut;

- d. Adjust two (2) reset extension spring parts of left and right brake bands, install reset extension spring of bake bands, adjust length of screw, have spring undraw brake band away from brake rim, relieve braking, keep clearance of brake bands and brake rim within 4.5 ~ 5mm, after adjusting lock bolt and fix nut;
- e. Check ambient clearance of two brake bands with plug gauge within 4.5 ~5mm, if not reach to the clearance, repeat above steps.

Adjust working position of connecting arm and balance beam, reference to “Adjustment of drum brake system”.

5) Grinding

After changing with new brake blocks, friction contact area of brake block is small, which influences braking performance of drawworks. Therefore, before running equipment, perform runin.

- 1) Running-in with load, perform running-in at 50% of rated load, i.e. max. hook load shall not exceed 500kN.
- 2) During runining, at least perform 4 hours runin.
- 3) Rotate at 60% of rated rotate speed, i.e. max. falling speed of traveling block shall not exceed 3m/s; rotate speed of grinding is too big, which leads part overburnt of friction material and deterioration of material, influences braking performance after normal running.

Attached Table 1 Consumable Parts

S/N	Drawing No.	Description	Qty.	Remarks
1	E4005000053	Knit brake block	20	Set quality
2	E301.2.3.38	ScrewM10×32	120	Set quality
3	E301.2.3.39	Locking nut	120	Set quality

2. Change brake band and brake block of sand drum

Periodically check wearing of sand drum brake blocks during running equipment, prevent brake blocks from excessively wearing and dropping braking performance to hurt equipment and personal.

When brake band and brake blocks of sand drum wear, fixed bolt head closes to brake rim, i.e. wearing thickness of brake blocks near 15mm, change brake bands.

Change procedure of brake band and brake block of sand drum is the same as above procedure of main drum, excluding dismounting and installation of saver valve support.

3. Change brake rim of main drum

Periodically check wearing of brake rim during running equipment, prevent brake blocks from excessively wearing, lower mechanical performance of accessories and dropping braking performance to hurt equipment and personal.

When exicircle wearing of main drum brake rim is up to required allowable

wearing capacity, change brake rim in time.

Nominal diameter of main drum brake rim: $\Phi 970\text{mm}$

Min. diameter of allowable wearing of main drum brake rim: $\Phi 945\text{mm}$

1) Inspection of exicircle wearing of brake rim

- A. Measuring tools, pit gauge, steel tape, ruler, caliper, fine line and other auxiliary tools.
- B. Prepare for measure.
 - a. Shutdown engine, place gearbox at neutral position, close DC power switch of chassis;
 - b. Place traveling block on the substructure, loosen wireline, wingding floor of drum wireline doesn't exceed second floor.
 - c. Above drawworks frame without mast.
 - d. Dismount top shield above main drum brake rim, move brake band for easy measuring.
- C. Measure method of pit gauge: close sliding gauge to unworn surface of brake rim, close dial to wearing surface, dial reading is the unilateral wearing value of brake rim; measuring point is not less than 6. If one value of the unilateral wearing values is up to 12.5mm, change brake rim.
- D. Measuring method of steel tape: close ruler to unworn surface of brake rim, close steel tape vertically to wearing surface, mark at crossing point of ruler and steel tape, steel tape reading is the unilateral wearing value of brake rim; measuring point is not less than 6. If one value of the unilateral wearing values is up to 12.5mm, change brake rim.
- E. Measuring method of caliper: measure wearing diameter of brake rim with caliper, then measure distance of two legs of caliper with steel tape, steel tape reading is the wearing value of brake rim diameter; measuring point is not less than 3. If one value of the unilateral wearing values is up to 1045mm, change brake rim.
- F. Measuring method of fine line: wind wearing surface of brake rim with fine line, mark at interjunction of fine line, draw out fine line, measure distance between two labels, length of circle wearing value of brake rim divided by 3.14, the remainder is wearing diameter; measuring time is not less than 3. If diameter average of the wearing value is up to 1045mm, change brake rim.

2) Dismounting of brake rim

- a. Dismount wireline, drum reversely rotates, draw out wireline winded on the drum, draw out wireline head from flume in the sidewall of drum.
- b. Dismount air joint of air swivel joint at the shaft end of main drum, air pipe.
- c. Dismount dual duct water cooling swivel joint at hydrobrake end, dismount cooling water pipe joint of main drum and that of hydrobrake.
- d. Dismount shield of main drum clutch.
- e. Dismount chain of main drum.
- f. Dismount shield of power input end.

- g. Dismount shield of hydrobrake.
- h. Dismount top shield. (reference to above)
- i. Dismount brake band. (reference to above)
- j. Dismount lubricant piping joint at two ends drum shaft of drawworks frame.
- k. Dismount disc clutch of two ends.
 - Loosen locking screw, dismount the fixed sleeve.
 - Dismount air hose joint on the drum shaft.
 - Dismount shield and retainer of clutch, dismount connecting bolt.
 - Dismount connecting bolt between clutch and sprocket.
 - Dismount clutch, mark on the shaft and clutch, dismount disc clutch with clutch puller.

Note:

During dismounting clutch, mark for installation to keep drum dynamic balanced.

- l. Dismount two (2) flat keys.
- m. Dismount spacer.
- n. Dismount sprocket package with puller.
- o. Dismount hydrobrake.

Note:

During dismounting clutch, mark for installation to keep drum dynamic balanced.

- p. Dismount two (2) flat keys.
- q. Dismount bearing box, loosen connecting bolt, dismount shield connecting disc.
- r. Dismount two (2) closure plates of drawworks frame.
- s. Dismount main drum.
 - Repair a support to bear main drum, loading is more than 3.5t, height 350 ~ 400, length 850, width 500.
 - Repair slings and hoisting equipment, loading is more than 3.5t.
 - Hoist main drum away from drawworks frame with hoisting equipment, place it on the support.
- t. Dismount upper spacer and right bearing box on the drum shaft; left bearing box and spacer sleeve at the other end of drum shaft.
- u. Dismount water pipe joint at the two ends of brake rim.
- v. Dismount connecting screw between two end brake rim and drum body.
- w. Dismount two end brake rim, hoist main drum.

3) Change brake rim and assembly

- a. Repairing work
 - Wash oil pollution of the main drum, clean out burrs on the contact surface of brake rim, that of connecting pin and key groove.
 - Wash bearing box, check bearing, oil seal, oil seal sleeve, repair and change hurt parts.

- Wash sprocket bearing box, check bearing, oil seal, oil seal sleeve, repair and change hurt parts.
 - Fill lubricant into bearing box, grease on the surface of oil seal and oil seal sleeve.
 - Check main drum shaft, clean out burr, lubricate on the shaft surface.
 - Clean and check drawworks frame, clean out oil pollution and sundries in the drawworks frame, check if brake mechanism is complete, repair and change hurt parts.
- b. Check and clean brake rim, wash preservative oil of brake rim, check surface quality of brake rim, check exhaust plug.

Note:

Brake rim shall be from identical industry to ensure drum brake performance.

- c. Install brake rim at two ends, connect connecting screw between brake rim at two ends and drum body.
- d. Connect brake rim at two ends, coat junction with sealant or wind with seal membrane to avoid leakage of joint.
- e. Install upper spacer of two ends brake rim, right bearing box; at the other end of roller shaft install left bearing box, spacer.
- f. Install main drum, hoist main drum away from support with hoisting equipment, place it on the main drum seat of drawworks.
- g. Install left and right closure plates of drawworks.
- h. Install shield connecting disc at two ends of drum shaft, notice joint position of lubricating pipe, align bolt through hole of shield connecting disc, that of right bearing box and drawworks frame.
- i. Install hydrobrake.
- j. Install fixed sleeve, and screw up locking screw.
- k. Install disc clutch.
 - Install sprocket package and spacer, flat key at two ends of drum shaft, lubricate spacer, flat key and shaft head.
 - Install retainer, align bolt through of retainer and bolt on the clutch.
 - Install disc clutch, align install marks.
- l. Connect clutch and sprocket, align bolt through hole position.
- m. Install shield, align bolt through hole of shield and bolt of clutch.
- n. Install hose joint of air swivel joint on the drum shaft, coat junction with sealant or wind with seal membrane to avoid leakage of joint.
- o. Install fixed sleeve, and screw up locking screw.
- p. Connect lubrication piping joint of drum bearing box at two ends of drawworks frame.
- q. Install brake band.
- r. Install top shield.
- s. Install shield of power input end.
- t. Install chain of main drum.
- u. Install shield of main drum clutch.
- v. Install hose joint of air swivel joint on the main drum, coat junction with

- sealant or wind with seal membrane to avoid leakage of joint.
- w. Install shield of hydrobrake.
 - x. Install dual duct water cooling swivel joint and piping line, install dual duct air swivel joint and piping line.
 - y. Stringing.

Note:

Torque of each bolt and nut, reference to attached table 3.

4. Change brake rim of sand drum

Periodically check wearing of brake rim during running equipment, prevent brake blocks from excessively wearing, lower mechanical performance of accessories and dropping braking performance to hurt equipment and personal.

When excircle wearing of sand drum brake rim is up to required allowable wearing capacity, change brake rim in time.

Excircle diameter of sand drum brake rim: $\Phi 970\text{mm}$

Min. diameter of allowable wearing of sand drum brake rim excircle: $\Phi 945\text{mm}$

Change procedure of brake rim of sand drum is the same as above procedure of main drum, excluding dismounting and installation of saver valve support.

5. Inspection and repair of air disc clutch

Periodically check wearing of air disc clutch and friction disc during running equipment, prevent brake blocks from excessively wearing, lower mechanical performance of accessories and dropping driving performance to hurt equipment and personal.

When friction disc wears, adjust clearance of friction disc; when wearing of friction disc is up to required allowable wearing capacity, change friction disc in time.

Clearance of friction disc: 1.5 ~ 2mm.

Max. allowable wearing capacity of friction disc: 3mm.

1) Measure wearing

A. Measuring tools, plug gauge, steel tape, caliper.

B. Prepare for measure.

- a. Dismount air swivel joint.
- b. Dismount outer shield and inner shield of clutch.

C. Measuring clearance:

- a. Measure clearance of each friction disc between clamp plate and connecting disc.
- b. If clearance is undersize, dismount hangwire and fixed screw, all adjusting gaskets, measure after assembling.
- c. If clearance is too big, reduce adjusting gaskets.
- d. When clearance of friction disc is not identical, check stiffness of spring, check weaken spring.
- e. When dismount all adjusting gaskets, clearance is still too big, testify

- wearing of friction disc is excessive, change friction disc in time.
- D. Measuring friction disc
- a. Dismount clutch.
 - b. Measure thickness of friction disc, thickness is less than 19mm, wearing is excessive, change it.
 - c. Check friction disc, serious cracks, nicks on the surface, change it.
- 2) Dismount air bag and friction disc
- A. Repairing work
 - a. Avoid placing drill tool below well during dismounting clutch.
 - b. Get a set of new air bag, friction disc, pressboard, spring and adjusting gasket.
 - c. Shutdown engine, place gearbox at neutral position, close DC power switch of chassis;
 - d. Assemble platform, support, steel pipe ($\Phi 80\sim 90\text{mm}$, length 500~800mm).
 - B. Dismount clutch from drum shaft
 - a. Loosen locking screw, and dismount the fixed sleeve.
 - b. Dismount air hose joint on drum shaft.
 - c. Dismount shield and retainer of clutch, dismount connecting bolt and shield.
 - d. Dismount connecting bolt between clutch and sprocket.
 - e. Dismount clutch, mark on shaft head, dismount disc clutch with clutch puller.

Note:

Mark during dismounting clutch to keep drum dynamic balanced.

- C. Dismount clutch
 - a. Place horizontally clutch on assembly platform, back of connecting plate is downwards, connecting bolt upwards.
 - b. Mark on the connecting plate, middle fluted disc, pressboard and fixed plate to prevent to misplace seriously during re-assembling.
 - c. Dismount hangwire.
 - d. Dismount fixed screw, loosen screw, when loosen 30mm, dismount 3 interphase screws, change 3 long screws (longer 30mm than changed screws), press fixed plate; dismount left screws, than loosen long screws, release spring force till take of long screws.
 - e. Dismount fixed plate, air bag, pressboard, spring, friction disc and middle fluted disc package from connecting plate.

Attached Table 2 Consumable Parts

S/N	Drawing No.	Description	Qty.	Remarks
1	G301.51.2	Spring	18	Set qty.
2	G301.51.4	Friction disc	ATD-224-H 4	Set qty.

3	G301.51.5	Air bag	1	Set qty.
4	G301.51.7	Pressboard	1	Set qty.
5	G301.51.8	Adjusting gasket	7	Set qty.

3) Change air bag, friction disc and assemble clutch

A. Preparation

- Clean the oil fith of the clutch, clean out burrs on the working surface of connecting plate gullet.
- Wash and check pressboard and spring, repair and change hurt parts.
- Clean out package preservative oil, make sure surface of air bag and friction disc is clean.
- Lubricate connecting plate gullet slightly, oil trace on the other part is not allowed.
- Classify the springs, 6 pcs per group with free height error of 0.5mm.

B. Assemble and adjust clutch

- Measure thickness of each friction disc, middle fluted disc and pressboard, adjust thickness of gasket, primarily determine quality of adjusting gasket.
- Connecting plate gullet upwards, horizontally place it.
- Place 6 springs on spring seat of connecting plate; install friction disc.
- Install pressboard, align installation marks on connecting plate.
- Install estimated quality of adjusting gaskets.
- Install air bag on fixed plate, align air joint of air bag and hole of fixed plate. Then place fixed plate on connecting plate, align installation marks of connecting plate.
- Penetrate 3 lengthen screws into hole of fixed plate, screw up long screws, keep fixed plate flatten.

C. Adjust clearance

- Stand up clutch, penetrate steel pipe into center hole, place clutch on the support.
- Measure clearance of friction disc between pressboard and connecting plate.
- If clearance is undersize, dismount hangwire and fixed screw, all adjusting gaskets, measure after assembling.
- If clearance is too big, reduce adjusting gaskets.
- When clearance of friction disc is not identical, check stiffness of spring.

D. Install clutch

a. Install disc clutch

- Install sprocket package and spacer, flat key at two ends of drum shaft, lubricate spacer, flat key and shaft head.
- Install retainer, align bolt through of retainer and bolt on the clutch.

b. Install push disc clutch and align adjusting marks.

- c. Connect clutch and sprocket, align bolt through hole position.
- d. Install the guard shield, align bolt through hole of shield and bolt of clutch.
- e. Install hose joint of air swivel joint on the drum shaft, coat junction with sealant or wind with seal membrane to avoid leakage of joint.
- f. Install fixed sleeve, and screw up locking screw.
- g. Install shield of main drum clutch.
- h. Install hose joint of air swivel joint on the main drum, coat junction with sealant or wind with seal membrane to avoid leakage of joint.

E. Running-in

After changing with new air bag and friction disc, friction contact area of clutch is small, which influences driving performance of drawworks. Therefore, before running equipment, perform running-in.

- Running-in with load, perform running-in at 50% of rated load, i.e. max. hook load shall not exceed 500kN.
- During running-in, at least perform 4 hours running-in.
- Rotate at 60% of the rated rotate speed, i.e. max. falling speed of the traveling block not exceeding 4m/s. If the rotate speed of grinding is too high, it will lead part over-burnt of friction material and material deterioration and greatly influence the driving performance after normal running.

F. Description

The section introduces the maintenance procedure of ATD-224-H air push disc clutch. ATD-124-H air push-disc clutch has the similar structure. Only the quantity of the friction pairs is different.

The air push-disc clutches of variable sizes are similar in structure, such as ATD-118-H, ATD-230-H. The maintenance and repair can be performed as per the procedure described in the above.

Attached table:

**Table 3 The Moment of Force
of the Locking Thread Connection Screw and Nut**

(kN.m)

Dia. of thread M mm	10.15.Q23 Hb110	25.35.Q235 Hb145~216	35.45		4.Cr.15MnrB
	Strength grade of thread				
	4.6	5.6	6.5	8.8	10.9
6	3.5	4.6	5.2	7	116
8	8.4	11.2	12.6	15	281
10	16.7	22.3	25.0	30	56
12	29	39	44	50	97
14	46	62	70	75	150
16	72	96	109	130	240
18	100	133	149	180	330
20	140	188	212	240	470
22	190	256	290	330	640
24	240	325	366	400	810
27	360	480	540	580	1190
30	480	650	730	800	1620
36	850	1130	1270	1360	2820
42	1350	1810	2030	2150	4520
48	2030	2710	3050	3200	6770