Jiangsu Sanyi Petroleum Equipment Co., Ltd.

Drilling Choke Control Console System

Operation and Maintenance Manual
Edition I
2017-6

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INTRODUCTION

This manual provides operating and service personnel written instruction for the proper operation and care of the SANYI Drilling Choke Control Console System. Since application of this equipment is site - specific, operation, service and repair procedures are given in general terms.

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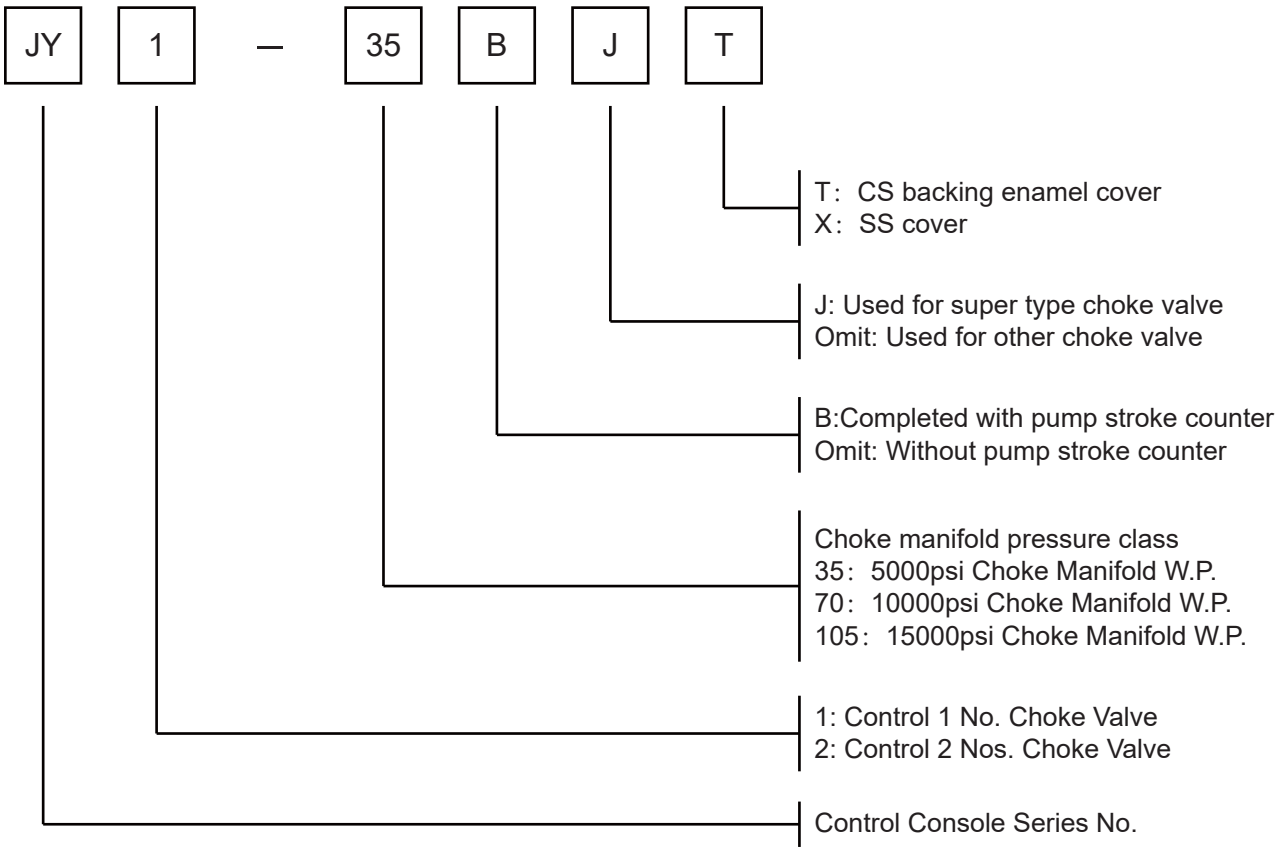
1. General

The control console is control device of choke manifold, and can close and open hydraulic valve in remote. It can display standpipe pressure, casing pressure, and choke valve position, also show three mud pumps stroke and frequency in simultaneity respectively. Therefore, the console can be used to hold well pressure, and it is key indispensability equipment in well control service.

The long time service productions which are discarded with useless or remanufactured are not included in scope of the book, by this is not meant that control console service life isn't limited. The user or operator should make proper judgment, if required.

2. Model Illustration

The symbols of the models of the control console are shown as below:



3. Main technical parameters

Nominal Working pressure: 435 psi

System maximum working pressure: 480 psi

Accumulator nitrogen charging pressure: 145±14.5psi

Super choke valve control panel: 870 psi

Super choke valve control panel: 1160 psi

Super Choke valve control panel for accumulators nitrogen charging pressure: 290±29psi

Air supply pressure: 93 ~ 115psi

Ambient Temp.: -20℃ ~ +60℃

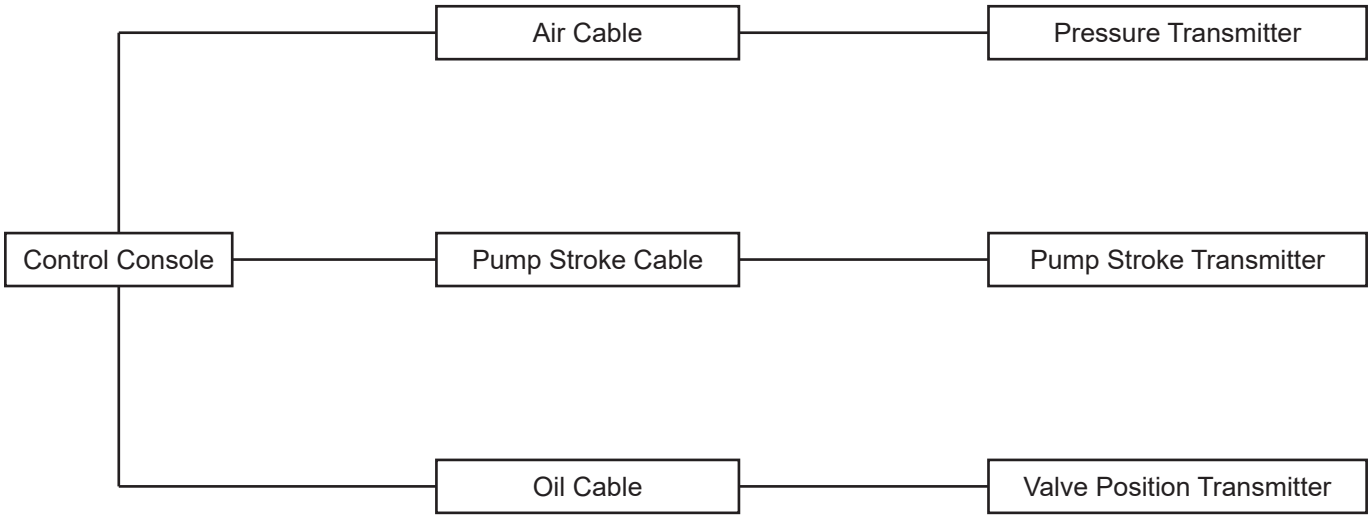
Note: Special order is needed when beyond the above technical parameters.

4. Features and Structure

The JY serial control console basically consists of the following components:

1) Control box
2) Pump stroke counter
3) Air pipeline
4) Oil pipeline
5) Air-operated shock resistant pressure transmitter
6) Air-operated valve position transmitter or angle valve driver

Layout and connection of the control console are as shown below:



CAUTION: Composition of the control console is subject to the range of customers order.

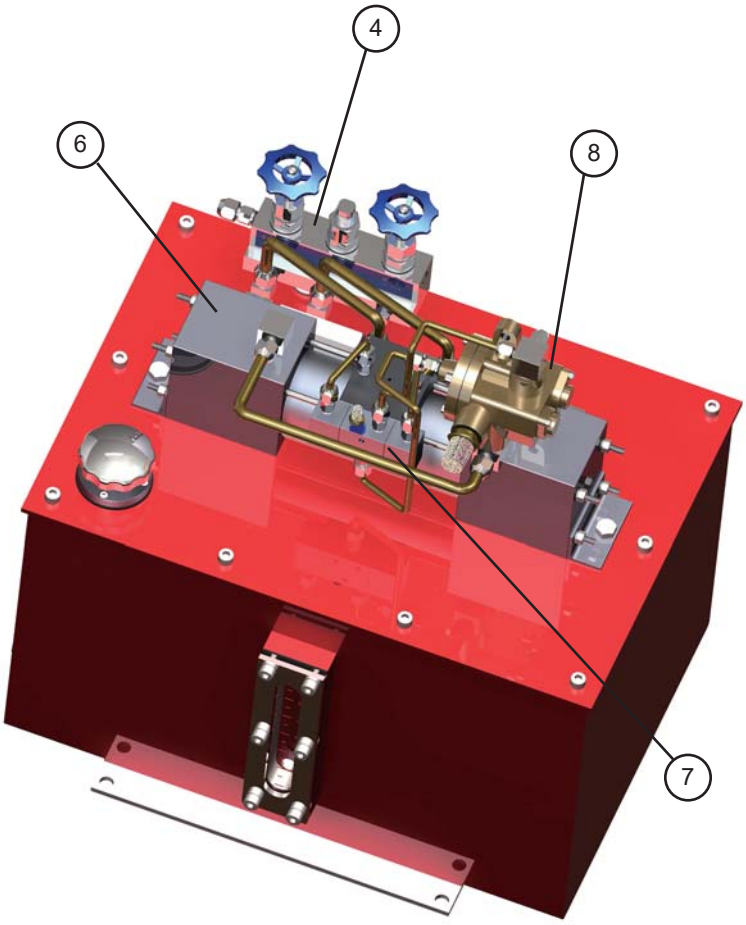
4.1 Drilling Choke Control Console System

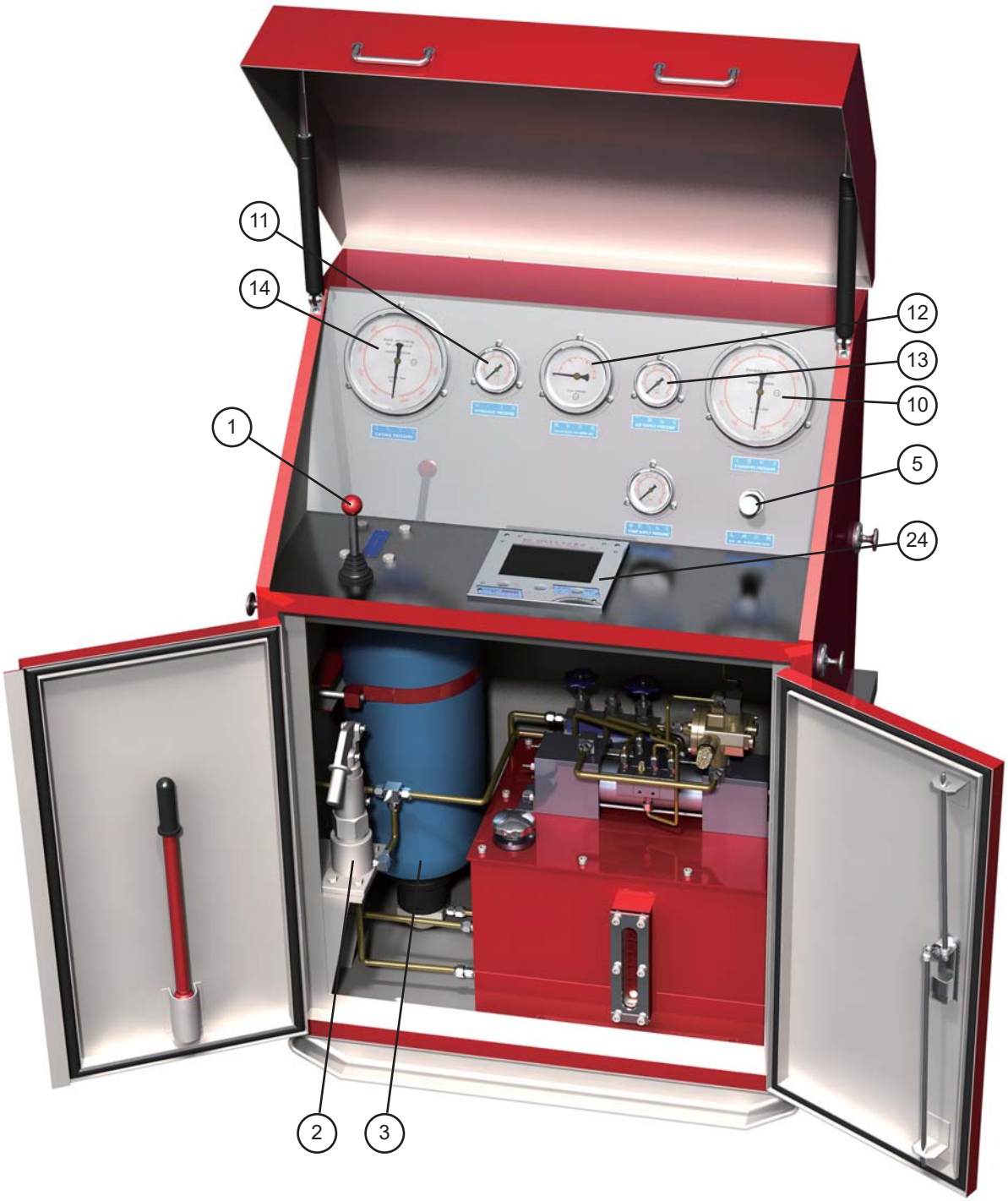
The control box consists of box cover, oil tank, pneumatic hydraulic pump, hand-operated pump, accumulators, gauges, and various valves fittings, etc. The control box is mainly used to control generating of high-pressure fluid by the pump and the storage of the high-pressure oil in the accumulator. When there is a need to open or close hydraulic valve of the choke manifold, high-pressure fluid will go from the accumulator via the manual position changing valve of the choke panel to open /close hydraulic valve in remote.

Control box is featured in:

- It is equipped with tow different pump systems: air-operated hydraulic pump and hand-operated pump. Therefore, in case of power failure, you may keep the system in normal operation.
- The accumulator has high-pressure liquid reserved enough to meat the control requirement of closing/opening all hydraulic valves of the choke manifold.
- The air-operated pump are both equipped with the pressure switch to start and /or stop the pumps automatically. Even when the automatic control device goes wrong in normal operation, the overflow valve may quickly open to avoid overload.
- The control panel can display standpipe pressure, casing pressure, the choke valve position opening of choke manifold, and mud pump’s strokes and frequency.

Diagrammatic Sketch of Drilling Choke Control Console:

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Part Details Sheet

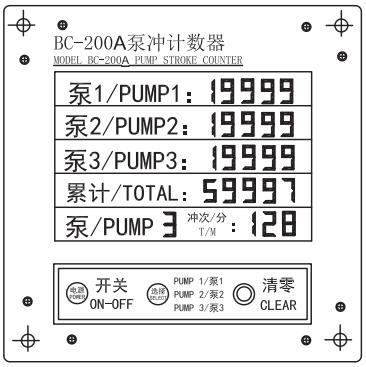
Item	Description	Qty	Part Number	Remark
1	Manual Diversion Valve	1	JY-01.4.2	JY2 Series Completed with 2 PCS
2	Hand-operated Pump	1	JYKQ-4	
3	Accumulators	1	NSQA-10/10-L-A	
4	Combination Valve	1	JYK3-50	
5	Regulator Valve	1	JYK-TF-15	
6	Air-operated Hydraulic Pump	1	JYKQ-63	JYKQ-80 used to super choke valve
7	Pilot	1	JYKX-5	
8	Air Controlled Diversion Valve	1	JYK-QK25	
9	Air-operated F.R.L Combination	1	JYKQ3-1	
10	Standpipe Pressure Indicator	1	JYK150-35	10K manifold: JYK150-70 15K manifold: JYK150-105
11	Oil Pressure Gauge	1	JYK60-10	
12	Valve Position Indicator	1	JYK100-35.47	
13	Air Supply Gauge	1	JYK60-1.6	
14	Casing Pressure Indicator	1	JYK150-35	10K manifold: JYK150-70 15K manifold: JYK150-105
15	Air Supply Quick Coupler	2	JYK-CJ-6	
16	Air Line Quick Coupler	18	JYK-CJ-6	JY2 series completed with 23 sets
17	Oil Line Quick Coupler	5	JYK-CJ-8	JY2 series completed with 10 sets
18	Air Supply Hose	1	JYK-TQ-6	
19	Air Line Hose	6	JYK-TQ-6	JY2 series completed with 8 PCS
20	Oil Line Hose	2	JYK-TQ-8	JY2 series completed with 4 PCS
21	Air-Operated Valve Position transmitter	1	QFW-47A	JY2 series completed with 2 Sets
	Super Choke Valve Driver		CJ6	
22	Standpipe Pressure Transmitter	1	YPQ-40A	10K manifold: YPQ-70A 15K manifold: YPQ-105A
23	Casing Pressure Transmitter	1	YPQ-40A	
24	Pump Stroke Counter	1	BC-200	

4.2 Pump stroke counter

The pump stroke counter consists of 6” LCD screen, main cable, branch cable, and pump stroke sensor and so on. The main function: store and display three pumps stroke counter and frequency respectively, and also show three pumps total stroke number simultaneous.

Pump stroke counter features:

- There are function buttons like power supply, selection, clear.
- It can show the three pumps frequency respectively by using “selection” button.
- The counter is completed with self-feeding power (6V low voltage DC buttery), with 2-3 years service life.
- After complete installing and debugging, and power is off, as the counter is of save function, the counter could open for relevant datum about mud pump at any time.



4.3 Air Hose

The air hose is connection between console and air-operated shock proof pressure transmitter, and air-operated valve position transmitter. The line is nominal 6” rubber hose with steel wire interlayer, 15 m long in normal.

Feature: the pipe is of pressure and break resistance, connection end is nominal 6” self-seal SS quick coupler, for easy installing and disassembly.

4.4 Oil Hose

The oil hose is connection between console and hydraulic choke valve on choke manifold. The line is nominal 8” rubber hose with steel wire interlayer, 15 m long in normal.

Feature: the hose is of pressure and break resistance, connection end is nominal 8” self sealing SS quick coupler, for easy installing and disassembly.

CAUTION：The specification and length of air/oil hose are subject to the customers’ order.

4.5 Air-operated anit-shock pressure transmitter.

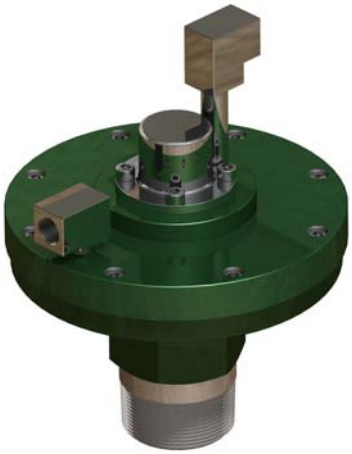
The pressure transmitter could change high pressure flow of choke manifold, drilling pipes or other into lower pressure, which is transmitted remotely to control console for pressure display

Feature: corrosion proof, anit-shock, and be of good impact performance.

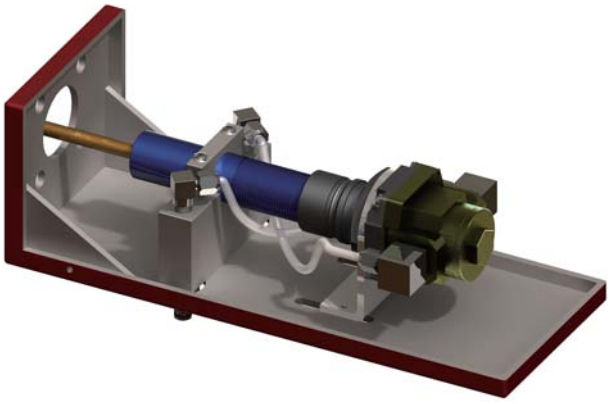
4.6 Air-operated valve position transmitter

The air-operated valve position transmitter could indicate hydraulic choke valve open and close position.

Feature: corrosion proof, anit-shock.



Air-operated anit-shock pressure transmitter

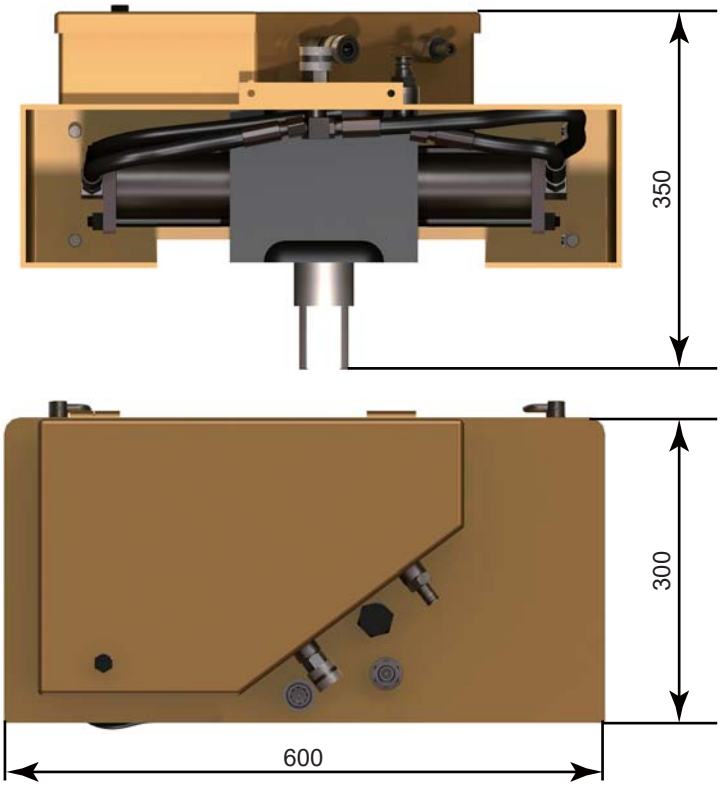


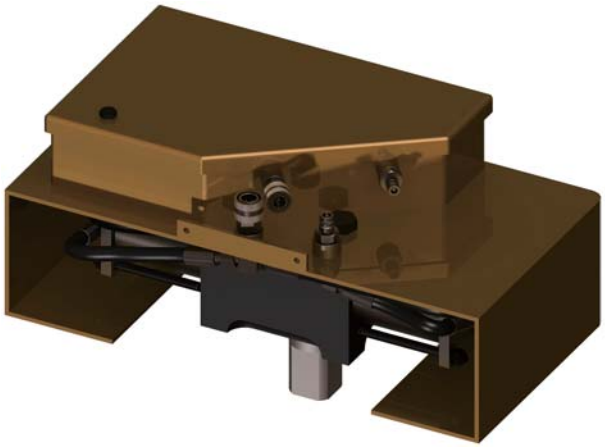
Air-operated valve position transmitter

4.7 Super choke valve driver

Super choke valve driver is for controlling control consol angle valve to open and close, which could be showed on panel.

Feature: corrosion resistance, anit-shock, and good impact performance.





4.8 Bladder Accumulator

4.8.1 Purpose: The bladder accumulator in the hydraulic system is used for cumulating energy, stabilizing pressure and reducing the power dissipation, compensating leak, and absorbing pressure impulse and relaxing the impact forceand so on.

4.8.2 Futures: construction type----- large diameter, maintain from the top of accumulator.

Fixed type:	dead ring
Installation type:	vertical
Work medium:	nitrogen – Petro base hydraulic oil
Work temperature:	- 10℃ ~ + 70℃
Work pressure:	435psi ~ 870psi

4.8.3 Specification :

nominal volume：10L.

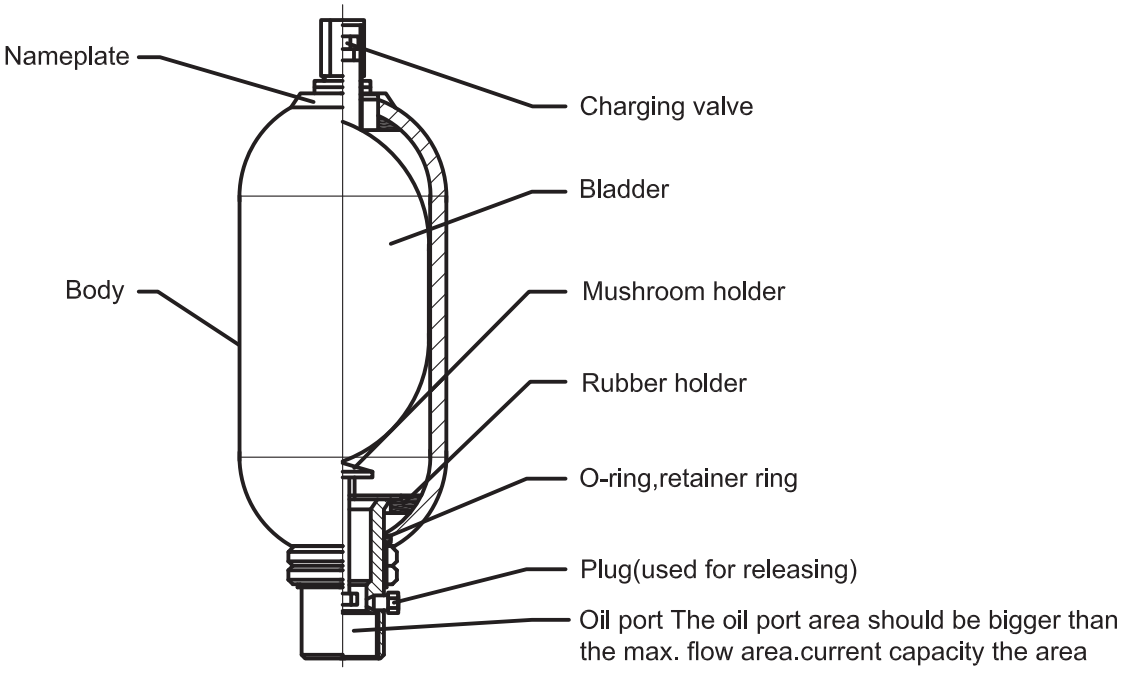
Nominal pressure：1450psi

4.8.4 Dimension: Φ219 × 670 mm

4.8.5 Charge pressure: Use the charging tools to charge, discharge, measure and correct the charging pressure and so on. The accumulator can't be charged with oxygen, compressed air or other inflammable gas. The charging pressure of the accumulator is thirty percent of working pressure of the control console for the choke manifold.

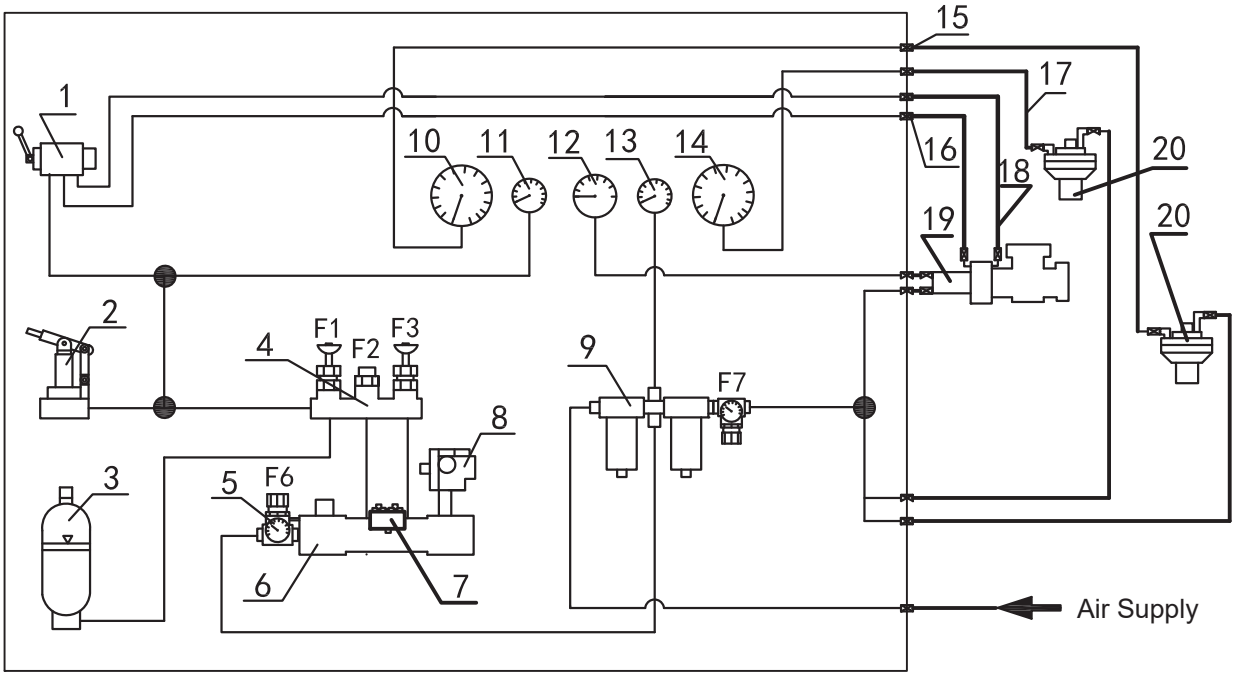
4.8.6 Inspect and Repair: When control console has ceased to be used for a long time, the stop valve for the accumulator should be closed to keep the oil pressure in the accumulator over the charging pressure. In case of the accumulator doesn't work, please check if the air valve is leakage and charge when necessary. If there is no nitrogen in the bladder and bleed from the air valve, please check if the bladder is damaged. If the bladder is leakage, please tighten the connection part. If the leakage is going on, all the relative parts should be replaced.

Model NXQ accumulator structural Figure.

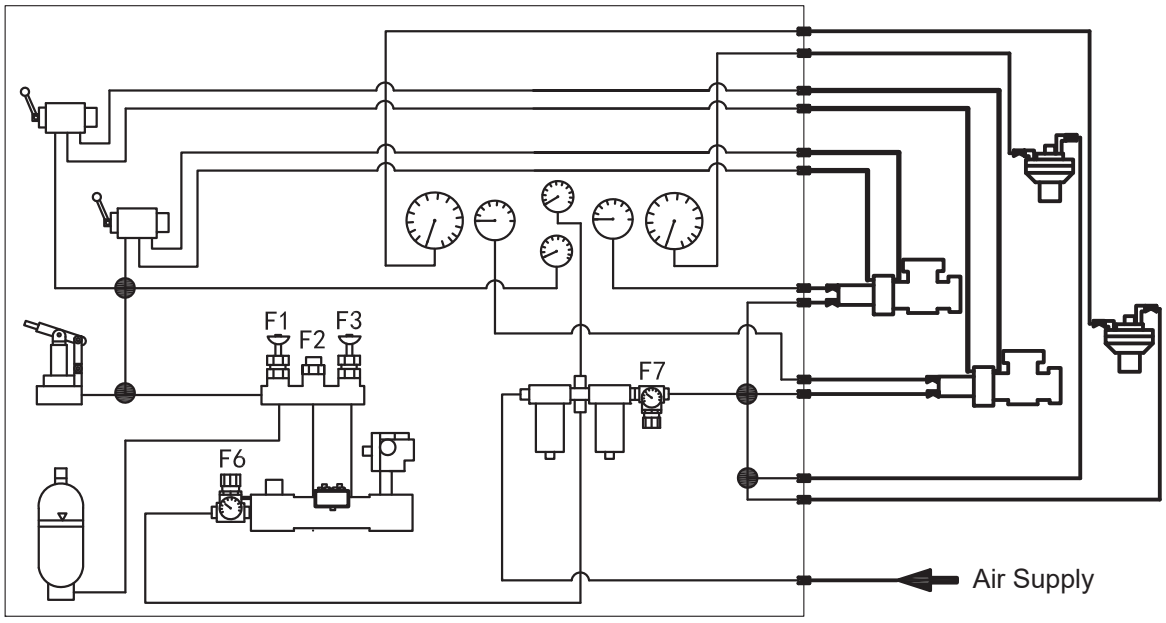


5 Working principles and operation instruction

The control console could convert outer air supply pressure into high pressure liquid reserved in accumulators, which is controlled to open& close choke manifold hydraulic choke valve, according to sensed pressure of standpipe &case and requirements of drilling. Therefore, the control console could stabilize well pressure for choke and kill.



JY1 Parts Connection Drawing
(Detail see page 5)



JY2 Parts Connection Drawing

5.1 The control of Air-operated hydraulic pump

Connect with air supply, open Air-operated hydraulic pump regulator. Hydraulic pump is driven by compressed air through regulator, and discharge pressurized oil into control system. When the system pressure is less than nominal pressure 3MPa(435 psi), the Air-operated hydraulic pump could start to work under the compressed air.

CAUTION:	when using the air-operated hydraulic pump ,normal operation of overflow valve of hydraulic system should be confirmed. Prior test should be done if required to ensure it fully open and overflow at the max. working pressure of 4Mpa(480psi).

5.2 Hand-operated pump

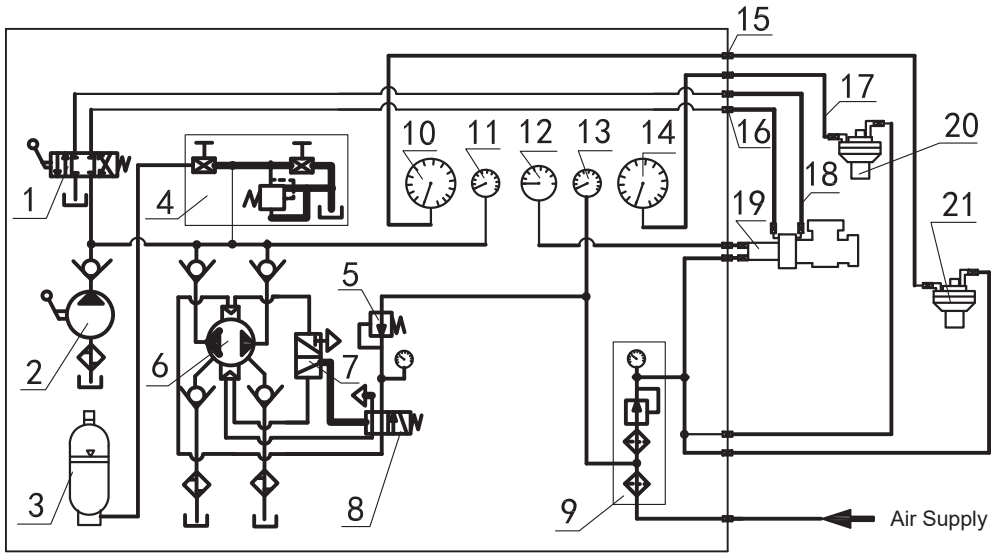
The hand-operated pump is spare pump for choke manifold control console backup pump. It is used to hold system pressure up to 3MPa（435psi）for control console working in normal statio.

5.3 Control principles of hydraulic system

The hydraulic system working principle is that reserved pressurized oil go by accumulator stop valve into hydraulic system, operate manual diversion valve to effect choke manifold hydraulic choke valve' opening and closing.

Manual directional control valve is spring self-returning, 3-positon 4-way valve. Operating handle effects choke manifold's open and close.

The control principles of console control are shown below:



JY1 Working Principles

1. Manual Directional Control Valve
2. Hand-operated Pump
3. Accumulator
4. Combination Valve
5. Regulator Valve
6. Air-operated Hydraulic Pump
7. Pilot Valve
8. Air-operated Directional Control Valve
9. Air-operated F.L.R Combination
10. Standpipe Pressure Indicator
11. Oil Pressure Gauge
12. Valve Position Transmitter
13. Air Supply Pressure Gauge
14. Casing Pressure Indicator
15. Air Course Quick Coupler
16. Oil Course Quick Coupler
17. Air Coures Hose
18. Oil Coures Hose
19. Air-operated Valve Position Transmitter
20. Standpipe Pressure Transmitter
21. Casing Pressure Transmitter

6 Installing and debugging

6.1 Installation

Open mainframe and spare parts case, fit mainframe on corresponding place of rig floor. Take out two Air-operated shock proof pressure transmitters from the spare case, one installed on standpipe of rig floor, the other installed on choke manifold. Then install Air-operated valve position transmitter on hydraulic choke valve of choke manifold. Connect well air and oil line according to connection.

Caution: Pipeline must be connected accurately, or else cause equipments damage and system failure.

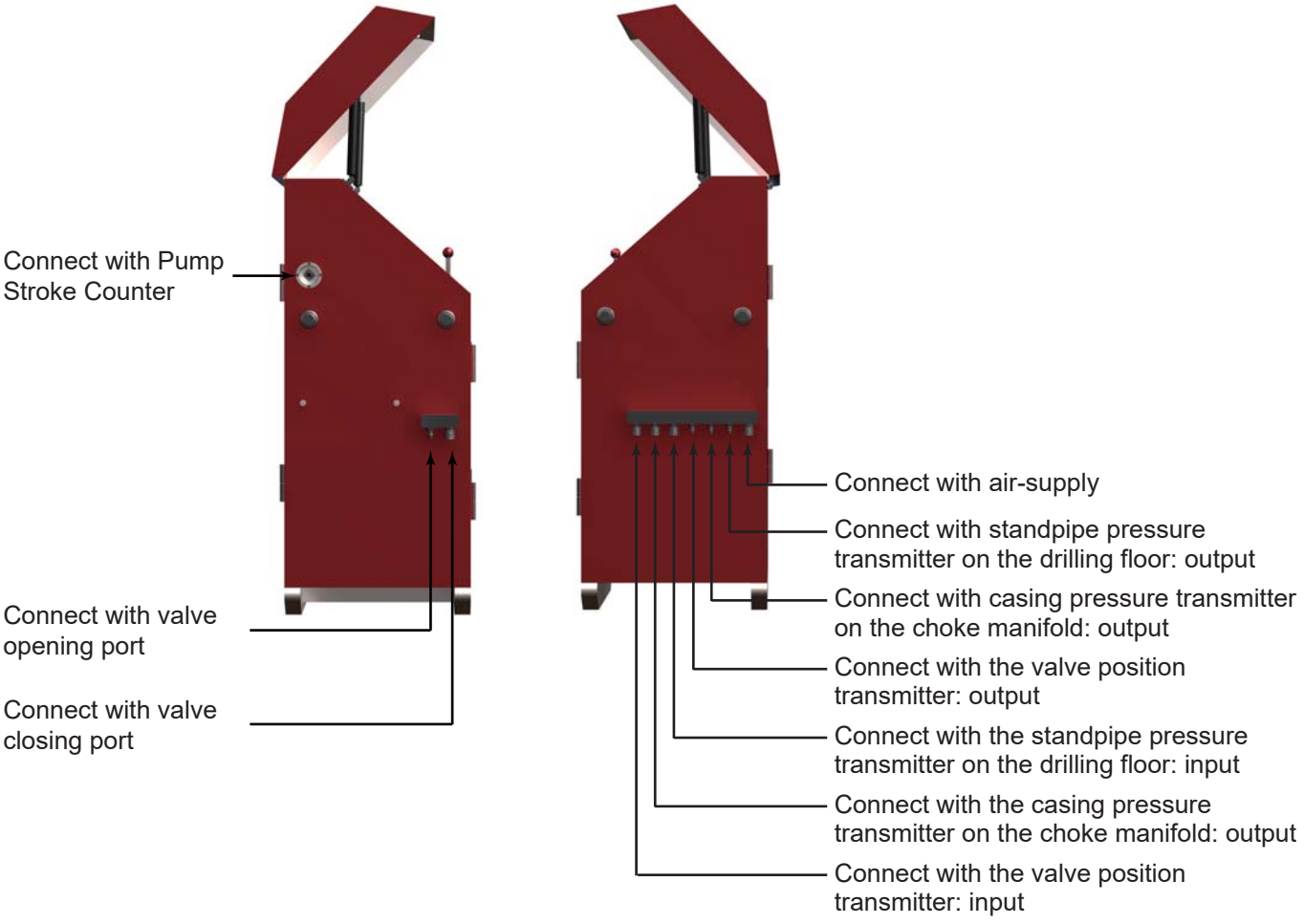
Model JY1 choke manifold control console

Right side air line connection plate:

Air-supply signal for the valve position transmitter	-	Connect with Air-operated valve position transmitter: input
Air-supply signal for the casing pressure	-	Connected with the air-operated anti-shock pressure transmitter for choke manifold: input
Air-supply signal for the standpipe pressure	-	Connected with the air-operated anti-shock standpipe pressure transmitter on the drilling floor: input
Return signal for the valve position transmitter	-	Connect with air-operated valve position transmitter of hydraulic choke valve: output
Return signal for the casing pressure	-	Connect with the air-operated anti-shock pressure transmitter for the choke manifold : output.
Return signal for the standpipe pressure	-	Connect with the air-operated anti-shock pressure transmitter for the drilling floor: output
Air –supply	-	Connect with the external air-supply of the drilling floor: 116 Psi

Left of oil line connection plate:

Valve Opening	-	Connect with hydraulic choke valve of the choke manifold: valve opening port.
Valve closing	-	Connect with hydraulic choke valve of the choke manifold: valve closing port.



Quick coupler connected with hose shall not be blocked, or else the system will be unreliable.

After complete oil and air pipeline connecting, keep them in sequence as per well equipments installation requirements.

If choke manifold complete with pump stroke counter, install the pump stroke sensor on the corresponding place of mud pump according to the “pump stroke counter” instruction. Separate main cable and branch cable in right direction, and signal plug on main cable shall connect with the port of pump stroke counter on the left of control console.

If completed with angle valve driver, the driver shall be installed on choke manifold angle valve according to its instruction.

After control console completely installing, if any fault is found in oil or air line connection, and adjustment is needed. Fist of all, close the external air supply and unload the system oil pressure to zero, and then move the open/close button of the manual change valve on the control panel for two times or three times. Adjust the oil /air hose connection after unloading the oil pressure in the oil hose.

6.2 Debugging

The following procedures shall be performed before choke manifold control console to be operated.

a) Check to know accumulators’ nitrogen pressure, and the pressure is 145 ± 14.5psi, nitrogen must be charged when in shortage.

b) Oil reservoir oil charge: oil charge amount should be controlled at 4/5 nonius.

When ambience temperature is above 0℃, use L-HM32 normal hydraulic oil or substitute.

When ambience temperature is below 0℃, use L-HM32 hydraulic oil for low temp. or substitute.

c) Open accumulators’ stop valve and discharging valve.

d) Adjust pressure of F.R.L combination regulator to 0.35MPa, and then lock down the handle.

e) Adjust hydraulic pump regulator pressure to 0.1MPa. Then run the pump 2~3 minutes without load.

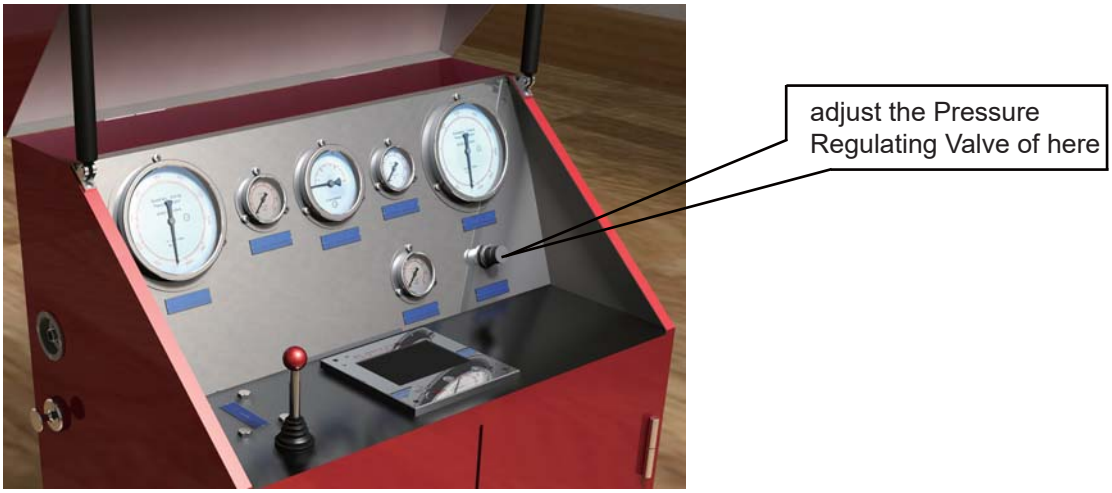
Debugging procedure

6.2.1 Air-operated hydraulic pump start and stop running test

Close hydraulic system unloading valve, adjust regulator to run Air-operated hydraulic pump, stop adjustment of the unloading valve when the system pressure is up to 435psi. When the pump reaches the balance between gas and liquid, it shall stop working. Turn on hydraulic system unloading valve gradually, when system pressure drop to around 362 psi, hydraulic pump automatically run.

In the above process of checking, adjust regulator on air operated pump to assure that the regulator pressure could make air operated hydraulic pump work properly. While the hydraulic system pressure goes up, check and see if there is any leak, and take measure timely if necessary.

Refer to the figure air-operated hydraulic pump to debug.



6.2.2 Manual pump debugging

Turn off accumulator stop valve and unload valve, pump pressure manually, check whether the system pressure (oil pressure gauge) rise up, or else pump pressure again until the system pressure rise up to 580psi.

Refer to figure manual pump and combination valve to debug.

Manual Pump

Combination Valve

6.2.3 Overflow valve debugging

Reference to figure manual pump and combination valve to debug.

Open accumulator stop valve, close unloading valve, adjust air-operated hydraulic pump regulator, observe the system pressure (oil pressure gauge)

Choke valve control console's overflow valve: when the system pressure rise up to around 5MPa, turn on overflow valve. Then open unloading valve slowly, the system pressure drop to 652psi, overflow valve shall in closing position.

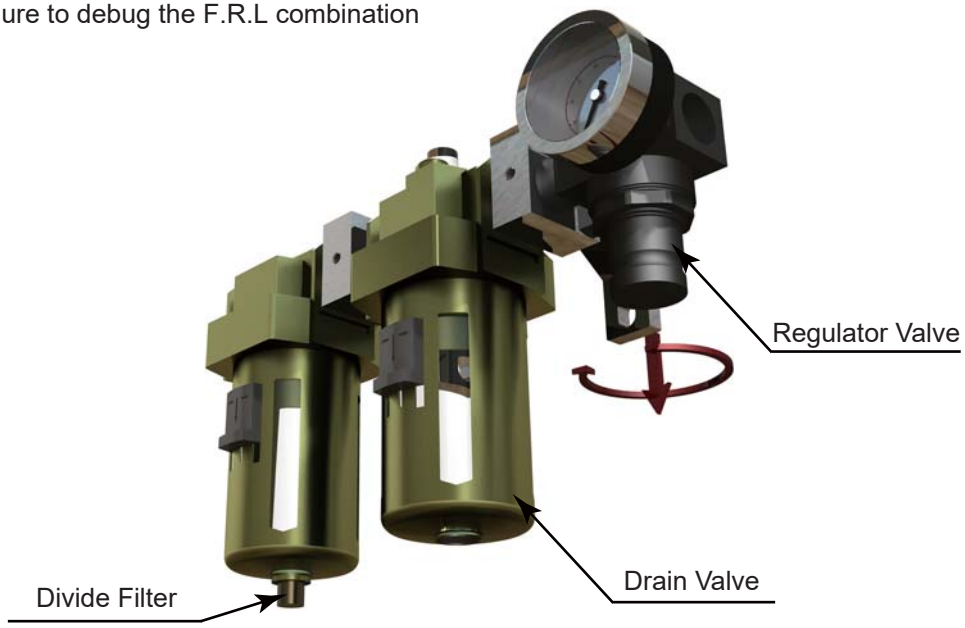
Angle valve control console's overflow valve: when the system pressure rise up to around 9MPa, turn on overflow valve. Then open unloading valve slowly, the system pressure drop to 1232psi, overflow valve shall in closing position.

The overflow pressure of the overflow valve should be adjusted when necessary.

6.2.4 Air-operated F.R.L combination debugging

Connected with external air supply, adjust regulator on the F.R.L combination to the pressure of 50psi, press the handle to lock (The pressure is furnished to air-operated anti-shock pressure transmitter exterior of the control console and the air supply input signal of air-operated valve position transmitter)

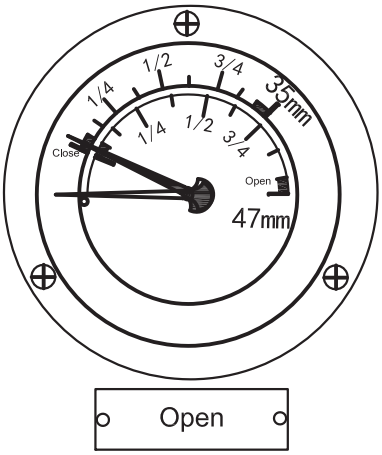
Refer to the figure to debug the F.R.L combination

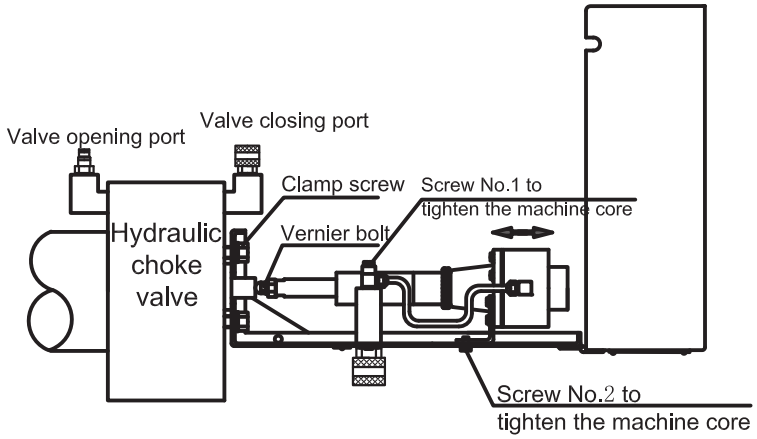


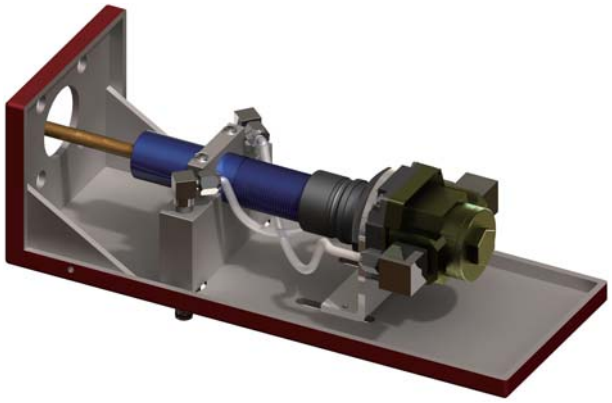
6.2.5 Air-operated valve position transmitter debugging

Open upper cover, loosen set screw 1 and 2, remove air operated valve position transmitter machine core, check and see whether the needle of valve position indicator on control console panel rise up to “close” scale. Then tighten the two set screws(1,2), adjust micro-switch to assure the needle reach the intermediate “close” scale. Handle manual directional control valve on the panel, if the stem travel of hydraulic choke valve on choke manifold equals 47mm, the needle indicate valve position opening at inner track 47mm of “open” position, and while the stem travel of hydraulic choke valve on choke manifold equals 35, the needle indicate valve position opening at outer track 35mm of “open” position

Please refer to figure air-operated valve position transmitter to debug







6.2.6 Complete control console debugging

Open unloading valve on combination valve, accumulator globe valve and regulator on the Air-operated hydraulic pump, then close the unloading valve after control console’s running 1~2minitues without load, check to know whether the oil pressure indicated on the panel rise up, or else perform the above operation again to make sure the oil pressure rise up. Secondly, adjust regulator of Air-operated hydraulic pump to pump pressure up to specified pressure value(pressure set value for choke manifold control console is 435psi, and 870psi for angle valve control console). Then lock down handle of regulator, adjust regulator of Air-operated F.R.L combination to reach output pressure of 50psi, lock down the handle. Operate directional control valve on the panel, valve position indicator shall take less than 60 seconds to indicating position form open to close, or from close to open. The pressure difference between practical pressure of casing & standpipe and indicator pressure shall not exceed 2.5% of full-scale. Otherwise, check whether all inside and outside pipeline is connected well. and have defective parts rectified, repaired or replaced.

7 Usage and maintenance

Choke manifold control console is critical for well control. Thus, the operating personnel must be specially qualified to well know configure& principle, and how to install, operate and maintain the control console.

The operator shall grasp the following standards and relative documentations.

SY/T5225-2005	<oil and gas drilling, exploiting, storage and transports safety regulation>
SY/T5742-1995	<oil and gas drilling, well control technic assessing& management code >
SY/T5964-2003	<combined well control equipments installation, debugging and maintenance>
SY/T6203-1996	<wrecking method for oil and gas well blowout and fires>
SY/T6283-1997	<Health, safety and environment management system guideline for oil and gas drilling>
SY/T6426-2005	<Well drilling& control technic regulation>

7.1 Operating notice

7.1.1 In general, the handle of manual directional control valve shall locate in central section. And the hydraulic choke valve is in fully closed position.

7.1.2 The control console outside connection pipeline must not be passed vehicles in event of being pressed broken.

7.1.3 Choke manifold control console must be checked every tour in drilling. Tested item include:

- If oil reservoir liquid level is correct
- If accumulator pressure is correct
- If air-operated, hydraulic components work safely and reliably
- If there is any leak in oil& gas circuits
- If automatic start and stop of hydraulic pump work properly.
- If indicating valve of pressure gauges are in demand.
- According to relation safety regulation, perform hydraulic valve opening and closing test.

7.1.4 User should make a record for usage, failure, testing and repairmen. All documents and record must be run in random.

7.2 Maintenance

7.2.1 Keep all filter and screens of reservoir oil inlet clean. Take the screens out and have them washed carefully in order to protect them from dirt stuff .

7.2.2 To the water-trap in the air treatment unit: open the water discharge valve at its lower end and drain dirty water out of the cup daily, remove and wash the filter cup and the water cup once every two weeks, wash them with gasoline or other mineral oils, dry them with compressed air. Do not use acetone or toluene to wash them avoiding damage.

7.2.3 Check the pressure of the pre-charged nitrogen in the accumulator periodically. During the beginning period, check nitrogen pressure weekly, and thereafter, during normal operation, check it monthly,(charge nitrogen pressure of choke valve control console is 145 ± 14.5psi and chare pressure of angle vale control console is 290 ± 29psi.), recharge nitrogen when the pressure is low. Check nitrogen pressure only after the accumulators releases pressure thoroughly.

7.2.4 Check air-operated hydraulic pump and manual pump seals, and replace damaged one timely.

7.2.5 Clean console panel, be careful of broking any identification plate.

7.2.6 After one well drilling completed, check all pressure gauge.

8 Failure and elimination

8.1 Air-operated hydraulic pump doesn't work.

Reason: Air-operated directional control valve with excessive displacement.

Measure: Demount muffler and clean it up, then restart after installing

Reason: Pilot valve with excessive displacement.

Measure: Demount muffler and clean it up, then restart after installing

Reason: There is leakage of air line

Measure: Examine air line connector whether exist break, replace the broken connector timely if required.

Reason: Check whether directional control, pilot valve, and regulator is damaged or failure.

Measure: Do replacement and adjustment.

8.2 Aair operated hydraulic pump start system pressure doesn't rise or rise up slowly

Reason: The oil reservoir oil level is too low, and pump sucks air

Measure: Refill oil

Reason: The valve for the oil suction orifice is closed or the oil filter is blocked.

Measure: Open unload valve, run it without load, discharge air in the pipeline; wash oil filter

Reason: Hydraulic system unloading valve is not closed

Measure: Close the unload valve

Reason: There is no pressure in accumulators

Measure: Check the accumulators' capsule, replace it timely if required

8.3 Air operated hydraulic pump could not stop automatically after start

Reason: Oil sucking one way valve couldn't be seal completely (oil may be dirty, or to much feculence)

Measure: Replacing oil

Reason: There is leak in hydraulic components, connector or oil circuit.

Measure: Check hydraulic components, connector and oil circuit

Reason: Overflow valve open pressure is lower

Measure: Adjust overflow valve open pressure

8.4 The hydraulic choke valve can't be opened /closed from the choke manifold or the relative action is out phase.

Reason: The connection of hydraulic pipeline is not accuracy or pipeline is broken or quick coupler is blocked.

Measure: Replace the broken pipeline and blocked quick coupler after checked.

If the opening / closing is out of phase, exchange the hydraulic pipeline.

8.5 Valve position opening index is not accurate

Reason： The air supply pressure of regulator valve for air operated F.R.L combination is not accurate.

Measure： Adjust originator pressure to 0.35MPa

Reason： Valve position transmitter become loose

Measure： Rerun-test the valve position transmitter according to above debugging procedures.

9 How to order

Console standard configuration

a) Controlled object: 1 PC hydraulic choke valve

b) Console panel: standpipe pressure, casing pressure, hydraulic choke valve position.

c) Hydraulic system completed with double pump: Air-operated hydraulic pump and manual pump

d) Oil reservoir capacity：40L

e) Accumulator capacity：10L

f) Air line control line: nominal size 6mm, length 15m, rubber hose

g) Oil line control line: nominal size 8mm, length 15m, rubber hose

h) Air-operated shock resistance pressure transmitter: 2 ea

i) Air-operated valve position transmitter: 1 ea.

Information required in order:

Control console for choke manifold is rather complicated and a large variety of structure and models available, in order to help customers make right choice and a proper order, and make its configuration comply with national standard and API specification, customers are kindly requested to provide technical data and operation requirements as detailed as possible. These date and requirements include:

a) Choke manifold model or pressure scale

b) The quantity of hydraulic valve in control console.

c) Choke manifold hydraulic valve type: (plug choke valve ,orifice plate choke valve, or other types)

d) If completed with “ pump stroke counter”

e) Shell material choice: CS painting cover and SS polished cover.

If there are any special requirements, please express clearly in order. Without special expression, the console shall be manufactured according to standard configuration.

The choke manifold control console manufactured by our company is in accordance with national standard and ministerial standard, and could satisfy general service. The special requirements proposed by buyer are according to the technical agreement.

Appendix A. general metric and inch units conversion

1) Mass

1 KG = 2.2 LBS

1 LBS = 0.45 KG

2) Capacity

1 L = 2.64 US GAL = 61 CU.IN

1 US GAL = 3.785 L = 231 CU.IN

3) Pressure

1 MPA = 145 PSI

1 PSI = 0.069 MPA

4) Length

1 M = 3.28 FT = 39.37 IN

1 FT = 0.305 M

5) Temperature

$$1℃ = \frac{℉ - 32}{1.8}$$

$$1℉ = ℃ \times 1.8 + 32$$

Appendix B: hydraulic system recommended oil

GB:	L-HM32（ambience temp. above 0 ℃）
	L-HL32 (ambience temp. below 0 ℃)
ISO:	HM32（lower zincs or non-zincs hydraulic oil for plunger pump.）
Mobil:	D.T.E24（lower zincs or non-zincs hydraulic oil for plunger pump.）
Shell:	Tellus32（lower zincs or non-zincs hydraulic oil for plunger pump.）

Note: hydraulic oil viscosity is 17 ~ 33mm(2)/s in motion when temperature is 50 ℃.

Appendix C: Control console configuration parameters table.

Model	W.P of CM	Controlled Object	Shell Material	Pump Stroke Counter	Valve Position Transmitter	Pressure Transmitter	Angle Valve Driven	Working Pressure
JY1-35T	5000 psi	1	CS	None	1	2	None	435 psi
JY1-35BT	5000 psi	1	CS	1	1	2	None	435 psi
JY1-35JT	5000 psi	1	CS	None	None	2	1	870 psi
JY1-35BJT	5000 psi	1	CS	1	None	2	1	870 psi
JY2-35T	5000 psi	2	CS	None	2	2	None	435 psi
JY2-35BT	5000 psi	2	CS	1	2	2	None	435 psi
JY2-35JT	5000 psi	2	CS	None	None	2	2	870 psi
JY2-35BJT	5000 psi	2	CS	1	None	2	2	870 psi
JY1-70T	10000 psi	1	CS	None	1	2	None	435 psi
JY1-70BT	10000 psi	1	CS	1	1	2	None	435 psi
JY1-70JT	10000 psi	1	CS	None	None	2	1	870 psi
JY1-70BJT	10000 psi	1	CS	1	None	2	1	870 psi
JY2-70T	10000 psi	2	CS	None	2	2	None	435 psi
JY2-70BT	10000 psi	2	CS	1	2	2	None	435 psi
JY2-70JT	10000 psi	2	CS	None	None	2	2	870 psi
JY2-70BJT	10000 psi	2	CS	1	None	2	2	870 psi
JY1-105T	15000 psi	1	CS	None	1	2	None	435 psi
JY1-105BT	15000 psi	1	CS	1	1	2	None	435 psi
JY1-105JT	15000 psi	1	CS	None	None	2	1	870 psi
JY1-105BJT	15000 psi	1	CS	1	None	2	1	870 psi
JY2-105T	15000 psi	2	CS	None	2	2	None	435 psi
JY2-105BT	15000 psi	2	CS	1	2	2	None	435 psi
JY2-105JT	15000 psi	2	CS	None	None	2	2	870 psi
JY2-105BJT	15000 psi	2	CS	1	None	2	2	870 psi
JY1-35BJX	5000 psi	1	SS	1	None	2	1	870 psi
JY2-35BJX	5000 psi	2	SS	1	None	2	2	870 psi
JY1-70BJX	10000 psi	1	SS	1	None	2	1	870 psi
JY2-70BJX	10000 psi	2	SS	1	None	2	2	870 psi
JY1-105BJX	15000 psi	1	SS	1	None	2	1	870 psi
JY2-105BJX	15000 psi	2	SS	1	None	2	2	870 psi