

XR series

Helical swing hydraulic actuator

HELICAL HYDRAULIC ROTARY ACTUATORS



High torque density · Integrated support · Two-way hydraulic drive

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01 Product Overview

The XR series spiral swing hydraulic actuator uses a sliding spiral pair transmission to convert the linear motion of the hydraulic piston into the rotation of the output shaft. The actuator integrates rotary drive, installation support and load retention. It has a compact structure and large output torque. It is suitable for valve opening and closing, industrial indexing, flipping, clamping and rotary positioning.

Features

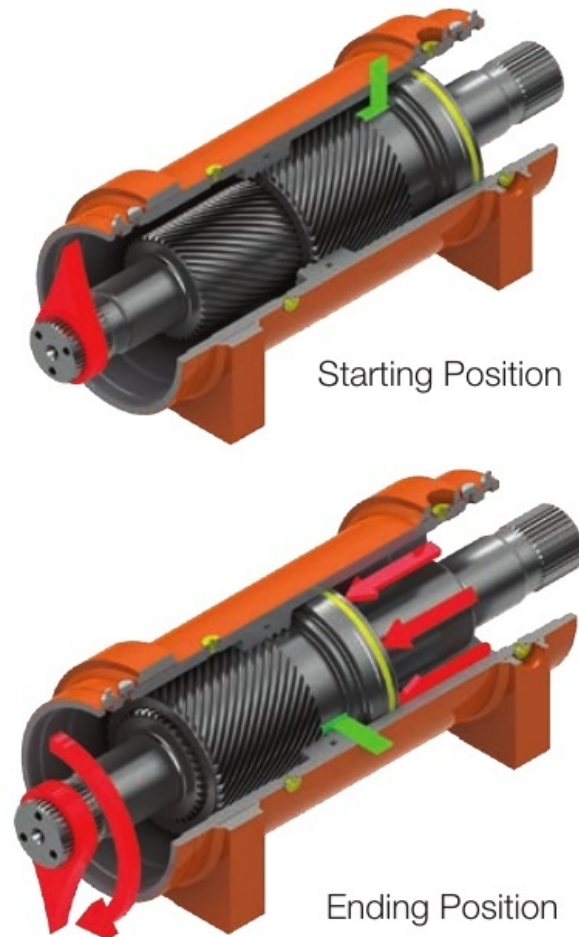
- Double helix pair superimposed transmission achieves large swing angle and high output torque within a short axial dimension.
- The output shaft is integrated with the load-bearing bearing and can simultaneously bear torque, radial force, axial force and overturning moment.
- The closed sports pair is suitable for dust, moisture and outdoor industrial environments.
- Two-way hydraulic drive, smooth action; the ability to maintain the intermediate position depends on internal leakage, valve group and load conditions.
- The flange, foot seat, output interface, swing angle, valve block and valve position feedback can be configured in combination.

Series structure

series	Installation form	Standard swing angle	Torque range	Main purpose
XRF	Front and rear flanges	180° / 360°	0.19-2.83 kN·m	Valves, indexing, small rotary mechanisms
XRT	Foot support	180°	0.51-4.41 kN·m	Turning, clamping, heavy-duty support
XRH	Flange or foot	180° / 360°	1.92-42.94 kN·m	Heavy-duty rotary, large valves and mining and metallurgical equipment

02 Working principle

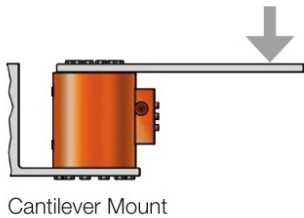
The pressure oil pushes the annular piston to move axially. The outer spiral of the piston meshes with the inner spiral of the casing, and the inner spiral of the piston engages with the outer spiral of the output shaft. The two-stage spiral motion in opposite directions jointly drives the output shaft to rotate. When oil is supplied to the other oil port, the piston moves in the opposite direction and the output shaft rotates in the opposite direction.



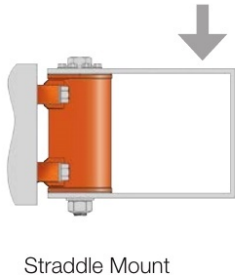
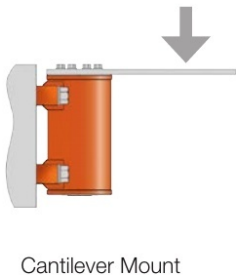
Schematic diagram of the working principle of double helix transmission (structural reference)

03 Installation form instructions

L10 Series

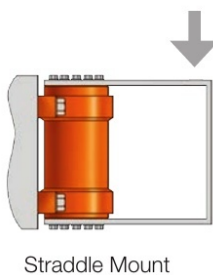
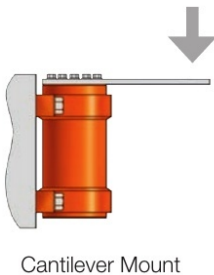


L20 Series



The upper portion of the bracket is bolted to the shaft flange. The lower portion is secured either by a tie rod passed through the shaft bore or is bolted to the endcap flange.

L30 Series



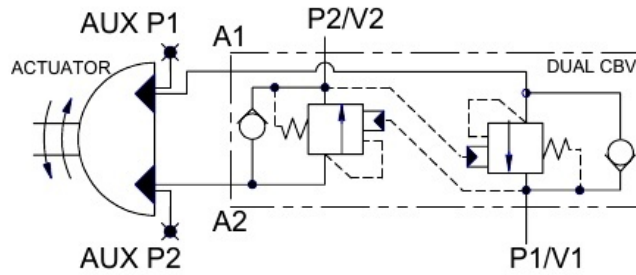
The upper portion of the bracket is bolted to the shaft flange, the lower portion is bolted to the endcap flange.

Cantilever, jumper, foot and flange installation forms (structural reference)

Installation form

form	Force mode	Structural description
Cantilever installation	Load connection output flange, single-ended support	Compact structure; external overturning moment meter optional
Jumper installation	The load is supported at both ends of the output shaft	Suitable for larger radial loads and overturning moments
Foot installation	The housing feet are fixed, and the output shaft is connected to the load.	Easy installation and maintenance of equipment base
Flange installation	Housing flange directly fixed	Suitable for valve and compact device interfaces

04 Hydraulic control configuration



Hydraulic Schematic of Optional Counterbalance Valve

Schematic diagram of the hydraulic principle of a two-way balancing valve (circuit reference)

Hydraulic control configuration

- Basic type: A and B oil ports are connected to the reversing valve to achieve bidirectional rotation.
- Hydraulic lock type: maintains actuator position under specified internal leakage, load and oil temperature conditions.
- Balance valve type: Controls overload and prevents loss of pressure in the pipeline causing load loss of control.
- Throttle speed regulating type: The opening and closing speed is adjusted through the throttling element of the valve block.
- Valve position feedback type: mechanical pointer, proximity switch or limit switch outputs valve position signal.

05 XRF light flange series specifications

The driving torque reference pressure difference $\Delta p=20.7$ MPa; the standard swing angle is 180°, and XRF03-XRF28 provides 360° specifications.

model	driving torque kN·m	Maintain torque kN·m	Overturning moment kN·m	Radial load kN	Axial load kN
XRF02	0.192	0.633	0.565	8.9	8.9
XRF03	0.339	1.243	1.017	13.3	13.3
XRF06	0.622	1.921	2.26	17.8	17.8
XRF11	1.074	3.842	5.65	35.6	35.6
XRF17	1.695	5.65	9.04	48.9	48.9
XRF28	2.825	9.379	11.3	66.7	66.7

Displacement, weight and appearance

model	180°displace ment L	360°displace ment L	180° weight kg	360° weight kg	Shell diameter mm	180° length mm	360° length mm
XRF02	0.064	-	6.4	-	100	140	-
XRF03	0.121	0.243	10.0	12.7	119	143	189
XRF06	0.192	0.384	14.1	19.1	135	156	212
XRF11	0.365	0.733	25.9	34.9	170	184	258
XRF17	0.552	1.105	43.1	54.4	198	224	311
XRF28	0.914	1.829	56.7	83.0	226	241	346

06 XRT foot series specifications

Driving torque reference pressure difference $\Delta p=20.7$ MPa; standard swing angle 180°; foot installation.

model	driving torque kN·m	Maintain torque kN·m	bridging moment kN·m	Cantilever moment kN·m	Radial load kN	Axial load kN
XRT05	0.509	1.333	2.543	1.356	13.6	4.9
XRT09	0.927	2.373	4.52	2.486	20.9	6.7
XRT17	1.695	4.375	10.17	5.424	41.1	9.8
XRT28	2.825	7.108	22.597	11.3	54.7	13.8
XRT44	4.407	10.532	31.64	15.82	93.4	17.3

Displacement, weight and appearance

model	180°displacem ent L	weight kg	Flange diameter D1 mm	total length mm	Installation width mm	total width mm
XRT05	0.132	12.2	104	188	145	178
XRT09	0.234	16.8	117	216	152	191
XRT17	0.436	29.9	142	248	197	248
XRT28	0.726	51.3	170	298	222	279
XRT44	1.077	76.7	196	337	267	330

07 XRH Heavy Duty Series Specifications

The performance listed in the table is based on a pressure difference of 20.7 MPa; flange installation and foot installation are provided. XRH19-XRH243 are listed in 180° and 360° specifications, while XRH429 is only listed in 180° specifications.

model	driving torque kN·m	Maintain torque kN·m	Cantilever moment kN·m	Crossover moment 180° kN·m	Crossover moment 360° kN·m	Radial load kN	Axial load kN
XRH19	1.921	4.927	5.187	13.447	19.21	17.8	13.3
XRH28	2.825	6.825	7.063	16.95	24.634	22.2	17.8
XRH47	4.746	11.639	11.865	30.849	45.426	35.6	26.7
XRH73	7.345	18.306	18.363	47.799	71.19	48.9	35.6
XRH107	10.735	26.216	29.521	75.145	111.531	66.7	44.5
XRH141	14.125	34.578	38.844	98.875	146.335	80.1	57.8
XRH186	18.645	45.652	55.935	130.515	197.75	97.9	66.7
XRH243	24.295	58.76	72.885	170.065	256.51	115.7	80.1
XRH429	42.94	105.768	64.41	170.065	-	115.7	80.1

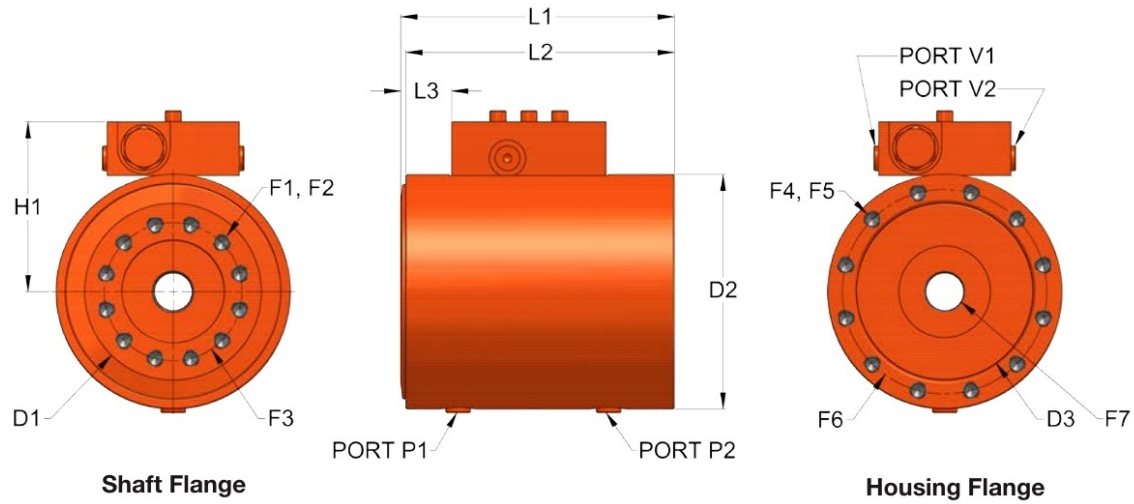
08 XRH heavy-duty series displacement and appearance

model	180°displace ment L	360°displace ment L	180° weight kg	360° weight kg	Shell diameter mm	180° length mm	360° length mm
XRH19	0.488	0.983	34.5	45.4	140	298	427
XRH28	0.697	1.393	49.9	63.5	152	323	470
XRH47	1.183	2.36	72.6	99.8	178	365	538
XRH73	1.868	3.736	108.9	140.6	203	413	615
XRH107	2.688	5.359	163.3	204.1	229	475	705
XRH141	3.54	7.079	222.3	285.8	254	524	776
XRH186	4.654	9.324	276.7	367.4	279	551	836
XRH243	5.998	11.995	358.3	453.6	305	600	906
XRH429	10.193	-	499.0	-	305	906	-

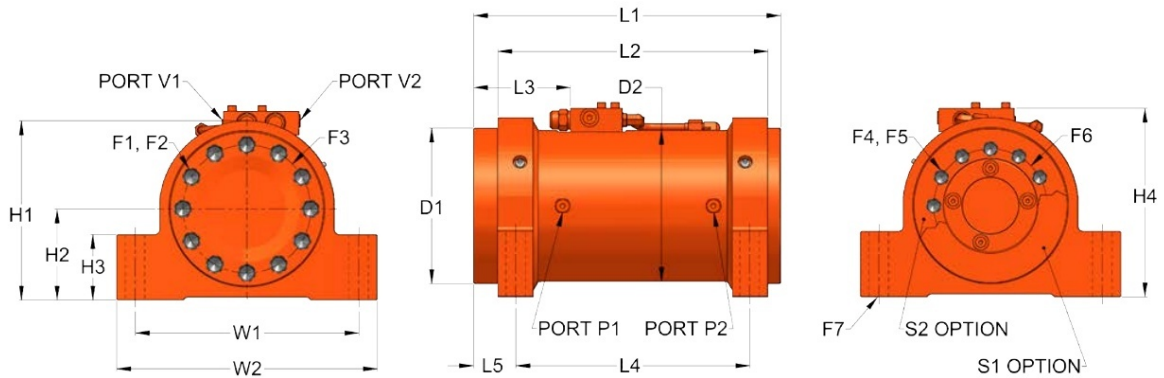
Model code

Example	XRH73-FF-180-C-LS
series	XRF light flange / XRT foot / XRH heavy duty
Install	FF front flange / RF rear flange / T foot; select according to the installation form allowed by the series
swing angle	180 / 360; select according to the corresponding specification table, special swing angles use the order extension code
control valve	0 No valve / L hydraulic lock / C balance valve; the balance valve solution is used for overload loads
feedback	0Mechanical indication/LS limit switch/PS position sensor

09 Dimension symbols



XRf series outline dimension symbols (structural reference)



XRh series outline dimension symbols (structural reference)

The size letters are used for model selection and interface communication. The specific values are based on the corresponding model confirmation diagram.

10 XRF series dimensions

model	D1 Mounting surface diameter	D2 Shell diameter	D3 Stop diameter	F1 Output flange thread	F2 Quantity	F3 Output flange hole circle	F4 Housing flange thread	F5 Quantity	F6 Housing flange hole circle	F7 Through hole diameter
XRF02	77.2	100	76.7	M8×1.2 5×11.9	8	54	M8×1.2 5×11.9	8	86	14.3
XRF03	89	119	93	M8×1.2 5×12	8	73	M8×1.2 5×12	8	103	17
XRF06	102	135	105	M10×1.5 5×15.2	12	80	M10×1.5 5×18	12	117	21.4
XRF11	127	170	134	M12×1.75 5×19.1	12	102	M12×1.75 5×19.1	12	151	35.7
XRF17	148	198	157	M12×1.75 5×19.1	12	127	M12×1.75 5×19.1	12	175	45.7
XRF28	185	226	186	M16×2 ×25.4	12	140	M12×1.75 5×19.1	12	203	66.7

Overall size (mm)

model	H1 center to valve top	L1 180° total length	L1 360° total length	L2 180° non-rotating length	L2 360° non-rotating long	L3 180° valve position	L3 360° valve position
XRF02	80	140	-	138	-	25.4	-
XRF03	89.7	143	189	142	188	26.9	22.6
XRF06	97.8	156	212	154	211	27.7	24.6
XRF11	115	184	258	182	256	27.9	42.7
XRF17	129	224	311	221	308	38.6	60.2
XRF28	143	241	346	239	344	43.9	70.4

11 XRT series dimensions

model	D1 Flange diameter	D2 Shell diameter	F1 Output flange thread	F2 Quantity	F3 Output flange hole circle	F5 Foot bolts	H1 Body height	H2 center height	H3 Feet high	H4 Including valve height
XRT05	104	101	M10×1.5×12.7	6	53.9	M16	119	66	34.3	146
XRT09	117	114	M10×1.5×15.2	8	65	M20	135	76.2	38.1	163
XRT17	142	139	M12×1.75×19.1	8	85	M24	158	85.9	44.5	185
XRT28	170	165	M20×2.5×30	8	102	M24	193	108	63.5	220
XRT44	196	191	M20×2.5×28	10	121	M30	218	121	70	245

Length and width (mm)

model	L1 total length	L2 non- rotating length	L3 valve position	L4 Installation length	L5 Flange to mounting hole	W1 Installation width	W2 total width
XRT05	188	173	32	111	37.9	145	178
XRT09	216	197	34.5	140	37.6	152	191
XRT17	248	229	44.7	152	47	197	248
XRT28	298	276	48.8	184	57.2	222	279
XRT44	337	314	49	216	60.5	267	330

12 XRH series dimensions

model	D1 Flange outer diameter	D2 Stop diameter	D3 End flange diameter	D4 Shell diameter	F1 Output flange thread	F3 Output flange hole circle	F4 Housing flange bolts	F6 Housing flange hole circle
XRH19	200	150	139	140	M12×1.75 ×18	115	M10	175
XRH28	235	175	155	152	M16×2×2 3.9	125	M12	205
XRH47	280	205	183	178	M20×2.5× 30	150	M16	245
XRH73	315	230	209	203	M22×2.5× 33	170	M20	275
XRH107	355	260	234	229	M24×3×3 6.1	195	M22	310
XRH141	396	290	263	254	M27×3×4 0.6	215	M24	345
XRH186	442	315	288	279	M27×3×4 0.6	240	M27	380
XRH243	475	340	310	305	M30×3.5× 44.9	255	M30	410
XRH429	475	340	310	305	M30×3.5× 44.9	255	M30	410

Length and installation dimensions (mm)

model	H1 center to valve top	L1 180° total length	L1 360° total length	L2 180° non-rotating length	L2 360° non-rotating long	L4 Flange thickness	L5 Flange end distance
XRH19	99.1	298	427	261	390	25.2	26.9
XRH28	106	323	470	283	430	25.9	32
XRH47	118	365	538	323	496	30.9	35.1
XRH73	131	413	615	363	565	33	41.9
XRH107	144	475	705	431	661	40.1	40.1
XRH141	156	524	776	462	715	41.9	53.1
XRH186	169	551	836	493	775	45.9	54.1
XRH243	182	600	906	534	839	52	55.9
XRH429	182	906	-	840	-	52	55.9

13 Selection method

step	input parameters	Selection content
1	Running torque, starting torque, peak torque	Determine drive torque specifications
2	Swing angle, action time, cycle frequency	Determine displacement and system flow
3	Radial force, axial force, overturning moment	Determine the installation series and load-bearing specifications
4	Working pressure, oil temperature, medium and cleanliness	Determine seals, ports and valve banks
5	Mounting flange, output connections and space dimensions	Determine shape and connection code

Torque and flow

- The driving torque changes approximately in proportion to the actual pressure difference between the two oil ports of the actuator. The reference conditions for the torque listed in the table are the effective pressure difference between ports A and B $\Delta p = 20.7 \text{ MPa}$; the maximum continuous pressure, peak pressure and withstand pressure values follow the product nameplate, confirmation diagram and technical agreement.
- Driving torque, radial force, axial force and overturning moment are selected according to the combined load conditions. It is prohibited to superimpose the maximum values listed in the table at the same time.
- The ideal uniform speed action time is calculated according to $t=V/Q$. When V is in cm^3 and the actual average flow rate Q at the actuator inlet is in L/min, $t(\text{s})=0.06V/Q$; the actual cycle includes forward and reverse strokes, dwell and acceleration and deceleration times.
- The system overflow pressure, valve block set pressure and pipeline peak pressure shall not exceed the allowable values on the product nameplate or technical agreement; the pressure increase generated by exceeding the load must be controlled through the balance valve circuit.

Inquiry data

project	content
load	Running/starting/peak torque, load direction, external forces and moments
action	Swing angle, action time, frequency, positioning and holding requirements
Hydraulic	Working pressure, peak pressure, flow rate, oil temperature, media and filtration accuracy
interface	Mounting Method, Flange Diagram, Output Shaft/Stem Diagram and Space Limitations
environment	Temperature, corrosion, dust, outdoor, explosion protection and protection levels

14 Receiving, storage and installation

Receiving and storage

- Check the packing list and product nameplate, and check whether there are any bumps on the actuator, connecting sleeve, keyway, spline, stop and sealing surface.
- During transportation, prevent impacts, drops and rainwater intrusion, and keep the oil port blocked.
- Store the product in a dry, cool place indoors; regularly check the rust prevention and oil port sealing status during long-term storage.

Valve installation sequence

1. Install the transition plate on the valve flange, keeping the pin hole in the same direction as the oil port; tighten the connecting bolts and install the positioning pin.
2. Install the key or spline connecting sleeve to the valve stem, making sure that the mating surface is clean and free of burrs.
3. With the actuator and the valve in the same open/closed position, lower the actuator vertically onto the transition plate.
4. Check that the tabs, positioning pins and all mounting holes are fully seated, install the gasket and tighten the bolts in diagonal order.
5. When the direction needs to be adjusted, first disengage the output shaft from the connecting sleeve, and then rotate the actuator housing; it is prohibited to pull the actuator forcibly with the connection.

Pipe connection

- Flush pipes thoroughly to remove welding slag, chips, sealing tape and other particles before connecting.
- Connect oil ports A and B according to the product diagram; look at the output flange end, and the direction of rotation is based on the arrow on the nameplate and the project confirmation diagram.
- Hoses and pipes must not exert additional pulling force or bending moment on the actuator ports.
- Carry out low-pressure leakage inspection after tightening the oil port, valve block and pressure measuring joint.

15 Hydraulic oil, exhaust and debugging

Hydraulic system requirements

project	Require
Filtering requirements	The filter accuracy, position and β value are determined according to the selected valve group and system requirements; it is prohibited to use ambiguous expressions such as "not less than 10 μm "
Oil cleanliness	Use the ISO 4406 three-section code and determine it according to the highest requirements in the system; the goal should be stated as "not dirty less than" the specified level
Hydraulic oil varieties	Indoor fixed equipment usually uses HL/HM; open air or cold areas can choose HV/HS, and the final confirmation is based on sealing and temperature.
Working viscosity	The operating viscosity window is used as the control condition; the ISO VG grade is selected according to the lowest starting temperature and the highest working oil temperature.
working temperature	Operate within fluid, seal, and valve train allowable limits
pollution control	New oil must be added after filtering; oil changes, filter elements and sampling cycles are performed according to the system maintenance plan

First exhaust

1. Confirm that the actuator, valves and pipelines are installed and the system oil level is normal.
2. Use the dedicated exhaust port according to the confirmation diagram; if there is no dedicated exhaust port, only loosen the highest point pipe joint to exhaust under safe conditions.
3. Low pressure and low flow reciprocate slowly, and do not run at high speed or hit the end position when the air is not exhausted.
4. Continue to exhaust until there are no continuous air bubbles at the oil return or exhaust point and the movement is smooth, and then gradually increase the pressure.
5. Close the exhaust point, clean up the leaked oil, and recheck the joints, oil level, rotation direction and full stroke movement.

run check

- Confirm that the rotation direction, swing angle and end position are consistent with the valve opening and closing status.
- Gradually increase the pressure and flow, and check for crawling, impact, abnormal noise, temperature rise and external leakage.
- The end position speed is adjusted through system throttling or valve block, and internal end positions are not used to absorb high-speed impacts.
- After debugging is completed, lock the adjusting parts and recheck the mounting bolts, pipe joints and valve position feedback signals.

16 Maintenance and troubleshooting

Routine maintenance

Check items	processing request
Unusual noise and vibration	Stop the machine to check for load jamming, loose installation, cavitation and internal wear.
external leakage	Check joints, end caps, output shaft seals and housing mating surfaces
Action speed and hysteresis	Check flow, air, internal leakage, spiral pair clearance and load changes
Oil status	Check cleanliness, moisture, temperature and viscosity, filter or replace according to system cycle
Shell heat dissipation	Regularly remove dust and oil to maintain surface heat dissipation
fastener	Regularly recheck mounting bolts, valve blocks and pipe supports

Troubleshooting

Phenomenon	Check order
No action	Oil supply pressure → reversing valve → hydraulic lock → load jam → internal fault
Slow or crawling movements	Flow→System air→Filter→Back pressure→Sealing and kinematic pair
end impact	Flow is too large → Throttle setting → External limit → Load inertia
Can't hold position	External pipeline leakage → valve block → internal leakage of actuator
Temperature too high	Continuous operating frequency → overflow loss → oil viscosity → internal friction

security requirements

- During operation, personnel are strictly prohibited from entering the output rotation envelope and pinch point areas, and starting is prohibited when the protective device is removed.
- Suspension and overrunning loads must be equipped with balance valves and pressure loss protection; mechanical supports should be used to fix the loads before maintenance.
- Before maintenance, depressurize the system and confirm that the accumulator, valve block and closed oil chamber are completely depressurized.
- Stop immediately and isolate the hydraulic source in case of hose rupture, abnormal impact, severe vibration, excessive temperature or leakage.
- The oil and shell temperatures after continuous operation are relatively high. Disassemble after cooling and wear protective equipment.
- Collect hydraulic oil during disassembly and assembly to prevent it from entering the ground and drainage system.

17 Ordering and Contact

Optional configuration

- Front flange, rear flange, foot base and special mounting bracket.
- 180°, 360° and special swing angles defined on order.
- Internal hexagonal, key, spline, output flange and special coupling.
- Hydraulic lock, two-way balancing valve, throttle valve and pressure measuring interface.
- Mechanical valve position indicators, limit switches and position sensors.
- Low temperature, high temperature, corrosion resistant sealing and surface protection.

Ordering information

Submit project	content
model	Series, size, installation, swing angle, valve group and feedback code
Working parameters	Pressure, flow, torque, external load, action time and frequency
Interface information	Valve/equipment installation drawings, output interfaces and spatial envelopes
environmental conditions	Temperature, media, corrosion, explosion protection and protection levels

Contact Xinhai Fluid

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