



HZD 系列核电厂 1E 级
多回转阀门电动装置

SERIES HZD

**CLASS 1E MULTI-TURN ELECTRIC
VALVE ACTUATORS**

使用说明书

OPERATION INSTRUCTION

中华人民共和国常州电站辅机总厂有限公司

CHANGZHOU POWER STATION AUXILIARY EQUIPMENT WORKS Ltd

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一 概 述 GENERAL DESCRIPTION

HZD 系列 1E 级阀门电动装置(以下简称 1E 级电装)是为满足核电站使用要求专门设计的双位阀门电驱动装置,适用于阀瓣做直线运动的阀门,如截止阀、闸阀、节流阀、隔膜阀等。产品遵循并符合以下标准:

- 1) IEEE382-1996 《IEEE Standard for Qualification of Actuators for Power Operated Valve Assemblies with Safety-Related Functions for Nuclear Power Plants》, 等效于 EJ/T531-2001 《核电厂安全级阀门驱动装置的鉴定》。
- 2) EJ/T1022.11-1996 《压水堆核电厂阀门电动装置》。
- 3) NB/T20010.11-2010 《压水堆核电厂阀门第 11 部分: 电动装置》。
- 4) JB/T8528-1997 《普通型阀门电动装置技术条件》。

本装置根据核电厂工作环境, 分成三种类型:

- H1 型: 用于安全壳内, 有事故、有辐照、抗地震的环境。(也能满足 EJ/T1022.11-96、NB/T20010.11-2010 标准中 K1 类环境)
- H2 型: (a). 用于安全壳内, 有辐照、抗地震, 无事故的环境; (b). 用于安全壳外, 受事故影响, 有辐照、抗地震的环境。(也能满足 EJ/T1022.11-96、NB/T20010.11-2010 标准中 K2 类环境)
- H3 型: 用于安全壳外, 无事故影响、无辐照, 抗地震的环境。(也能满足 EJ/T1022.11-96、NB/T20010.11-2010 中 K3 类环境)

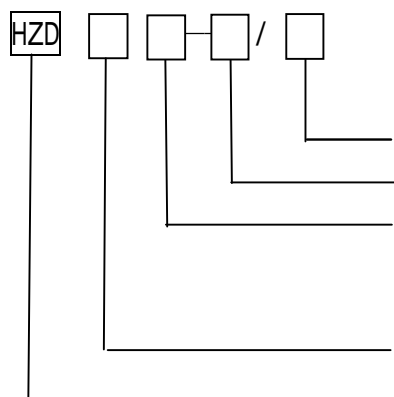
Series HZD electric valve actuators of Class 1E (abbrev. as Class 1E Actuators) are designed to meet the demand of nuclear power stations and are suitable for the two-position operation of globe valves, gate valves, throttle valves and diaphragm valves etc. These actuators are conformed to the following standards:

- 1) IEEE382-1996 IEEE Standard for Qualification of Actuators for Power Operated Valve Assemblies with Safety-Related Functions for Nuclear Power Plants. (idt EJ/T531-2001 Qualification of Actuators for Power Operated Valve Assemblies with Safety-Related Functions for Nuclear Power Plants.)
- 2) EJ/T1022.11-1996 Electric Valve Actuators Used in Pressurized-Water Reactors
- 3) NB/T20010.11-2010 Electric Valve Used in Pressurized-Water Reactors eleven : Electric Actuators
- 4) JB/T8528-1997 Specifications of Normal Type Electric Valve Actuators

These actuators are divided into three types according to plant service environment:

- Type H1: used inside containment, subject to event, radiation and seismic environments (satisfied to Category K1 environmental conditions in EJ/T1022.11-96、NB/T20010.11-2010)
- Type H2: (a) used inside containment, subject to radiation and seismic environments but without event environment; (b) used outside containment, subject to effect of event, radiation and seismic environments (satisfied to Category K2 environmental conditions in EJ/T1022.11-96、NB/T20010.11-2010)
- Type H3: used outside containment, without effect of event, radiation and seismic environments (satisfied to Category K3 environmental conditions in EJ/T1022.11-96、NB/T20010.11-2010)

二 型号表示方法 REPRESENTATION OF TYPE



输出轴最大转圈数。Max.turns of output shaft

输出转速: r/min。Output speed: r/min

连接型式: T 为推力型 (ISO5210), 无字母为转矩型 (JB2920)。Connecting mode: Letter T means thrust mode (ISO5210), Torque mode (JB2920) without any letter.

输出额定转矩 $\times 10N \cdot m$ Rated output torque $\times 10N \cdot m$

型号: 分 H1、H2、H3 三种类型, Z 表示多回转, D 为开发序列 Type of product: divided into three types of H1, H2 and H3. Z means multi-turn, and D is the serial number of development sequence.

三 工作环境和主要技术数据 SERVICE ENVIRONMENTS AND MAIN TECHNICAL DATA

1. 电源: Power supply

动力线: 三相 380V^{+5%}_{-10%}, 50Hz^{+5%}_{-5%} Power lines: three-phase 380V^{+5%}_{-10%} 50Hz^{+5%}_{-5%}
 控制线: 单相 220V^{+15%}_{-15%}, 50Hz^{+5%}_{-5%} Control lines: single-phase 220V^{+15%}_{-15%} 50Hz^{+5%}_{-5%}

其它电压和频率需特殊订货。Other ratings of voltage and frequency need special order.

2. 工作定额: 短时 15 分钟, 寿命: 40 年; 电机绝缘等级: H1、H2: H; H3: F。

Rating: short time duty, 15 min Life time: 40 years Motor insulation: H1、H2: H; H3: F.

3. 正常使用条件: Normal Service Conditions:

表 1 Table 1

环境条件	service environment	H1	H2	H3
温度	Temperature (C°)	-20~70	-20~70	-20~60
压力	Pressure (MPa)	0~0.6	0~0.6	0~0.6
相对湿度	Relative Humidity (%)	≤100	≤100	≤95
辐照累积剂量	Accumulated Radiation Dose (Gy)	1.9×10 ⁶	1.9×10 ⁶	0
地震加速度, 在 X,Y,Z 三个方向	Seismic acceleration, in three direction of X,Y,Z (g)	6	6	6
地震频率范围	Seismic spectrum (Hz)	2~35	2~35	2~35

4. 事故使用条件: Event Conditions:

表 2 Table 2

事故 Event Conditions	失水事故 LOCA
温度 Temperature (C°)	185
压力 Pressure (MPa)	0.56
相对湿度 Relative Humidity (%)	100

失水事故 LOCA 工况时, 安全壳内喷淋, 重量百分比为 1.5%的硼酸与氢氧化钠溶液, 室温下 PH 值为 10.5。

For LOCA condition, chemical spray solutions inside containment consist of 1.5% by weight of boric acid and sodium hydroxide to PH 10.5 at room temperature.

5. 防护等级: IP68。Protection: IP68

6. 规格和主要技术数据表 3~表 5 (重量以铭牌为准) For specifications and main technical data, see Table 3 ~ Table 5. (Weight of product is based on the nameplate)

表 3

Table 3

型号 Type	转矩范围 Torque N·m	转速范围 Output Speed r/min	公称 推力 Thrust kN	最大 阀杆直径 Max. dia of stem mm	最大 转圈数 Max rev	手动 速比 Hand ratio i	参考 重量 WT kg	
							转矩型 Torque Type	推力型 Thrust Type
HZD ₄ ^{2.5}	25~40	18~24	20	20	160	1	40	44
HZD ₁₅ ⁵	50~150	12~192	40	30	320	1	55~62	60~78
HZD ₄₀ ²⁰	200~400	12~192	100	40	320	1	65~75	75~95
HZD ₆₀ ⁴⁵	450~600	12~192	150	50	320	2.829	112~135	130~165
HZD ₁₂₀ ⁹⁰	900~1200	12~192	200	60	320	4.3	150~180	185~245
HZD ₂₅₀ ¹⁸⁰	1800~2500	6~72	325	70	200	11.48	225~263	285~350
HZD ₅₀₀ ³⁵⁰	3500~5000	6~48	700	100	130	17.2	355~370	465~490
HZD ₁₀₀₀ ⁸⁰⁰	8000~10000	6~18	1100	120	65	34.4	515~535	740~760

表 4

Table 4

型号 Type	电 机 Motor				输 出 转 速 Output Speed (r/min)								
	型 号 Type	功 率 Power (kW)	电 流 Current (A)	堵转电流 Locked rotor Current ≤(A)	12	18	24	36	48	72	96	144	192
					公 称 转 矩 Rated Torque (N·m)								
HZD ^{2.5} ₄	YDF ₃ 56M ₂ -4FZ	0.05	0.45	3.15		²⁵ ₄₀	25						
HZD ⁵ ₁₅	YDF ₃ 800-6 I FZ	0.18	1.1	7.7	¹⁰⁰ ₁₅₀								
	YDF ₃ 631-4 I FZ	0.09	0.63	4.41		50							
	YDF ₃ 632-4 I FZ	0.12	0.74	5.18		80	50	50					
	YDF ₃ 633-4 I FZ	0.18	1.0	7		100	80	80	50				
	YDF ₃ 800-4 I FZ	0.25	1.4	9.8		150	100	100	80				
	YDF ₃ 801-4 I FZ	0.37	1.8	12.6			150	150	100				
	YDF ₃ 802-4 I FZ	0.55	2.4	16.8					150				
	YDF ₃ 800-2 I FZ	0.37	1.38	9.66						80	50		
HZD ²⁰ ₄₀	YDF ₃ 801-2 I FZ	0.55	1.86	13.02						120	100	80	50
	YDF ₃ 801-6 II FZ	0.25	1.42	9.94	250								
	YDF ₃ 802-6 II FZ	0.37	1.96	13.72	350								
	YDF ₃ 801-4 II FZ	0.37	1.8	12.6		300	250						
	YDF ₃ 802-4 II FZ	0.55	2.4	16.8		400	350	300	250				
	YDF ₃ 901-4 II FZ	0.75	2.8	19.6			400	400	300				
	YDF ₃ 802-2 II FZ	0.75	2.4	16.8						150	120	100	80
HZD ⁴⁵ ₆₀	YDF ₃ 901-2 II FZ	1.1	3.3	23.1						250	200	150	120
	YDF ₃ 100M-6III FZ	0.75	3.11	21.77	600								
	YDF ₃ 100M1-4III FZ	0.75	2.8	19.6		450							
	YDF ₃ 100M2-4III FZ	1.1	4	28		600	450	450					
	YDF ₃ 100L1-4III FZ	1.5	5	35			600	600	450				
	YDF ₃ 100L2-4III FZ	2.2	7	49					600				
	YDF ₃ 100L-2III FZ	2.2	6.3	44.1						450	300	300	
	YDF ₃ 112M1-2III FZ	3	7.8	54.6						600	450	450	300
	YDF ₃ 112M2-2III FZ	4	9.7	67.9							600	600	450
HZD ⁹⁰ ₁₂₀	YDF ₃ 112L-2III FZ	5.5	13.3	93.1									600
	YDF ₃ 100L1-6III FZ	1.1	4.2	29.4	900								
	YDF ₃ 100L2-6III FZ	1.5	5.7	39.9	1200								
	YDF ₃ 100L1-4III FZ	1.5	5	35		900							
	YDF ₃ 100L2-4III FZ	2.2	7	49		1200	900	900					
	YDF ₃ 112L1-4III FZ	3	9	63			1200	1200	900				
	YDF ₃ 112L2-4III FZ	4	11.9	83.3					1200				
	YDF ₃ 112M2-2III FZ	4	9.7	67.9						900			
	YDF ₃ 112L-2III FZ	5.5	13.3	93.1						1200	900	900	
	YDF ₃ 132L1-2III FZ	7.5	17.1	119.7							1200	1200	900
YDF ₃ 132L2-2III FZ	10	22.8	159.6									1200	

表 5

Table 5

型 号 Type	电 机 Motor				输 出 转 速 Output Speed (r/min)							
	型 号 Type	功 率 Power (kW)	电 流 Current (A)	堵转电流 Locked rotor Current ≤(A)	6	9	12 (14)	18	24 (27)	36	48 (54)	72
					公 称 转 矩 Rated Torque (N·m)							
HZD ₂₅₀ ¹⁸⁰	YDF ₃ 100L1-4III FZ	1.5	5	35	1800 2500	1800						
	YDF ₃ 100L2-4III FZ	2.2	7	49		2500	1800 2500	1800				
	YDF ₃ 112L1-4III FZ	3	9	63				2500				
	YDF ₃ 112M1-2III FZ	3	7.8	54.6					1800			
	YDF ₃ 112M2-2III FZ	4	9.7	67.9					2500	1800		
	YDF ₃ 112L-2III FZ	5.5	13.3	93.1						2500	180	
	YDF ₃ 132L1-2III FZ	7.5	17.1	119.7							250	1800
YDF ₃ 132L2-2III FZ	10	22.8	159.6								2500	
HZD ₅₀₀ ³⁵⁰	YDF ₃ 100L2-4III FZ	2.2	7	49	3500	3500						
	YDF ₃ 112L1-4III FZ	3	9	63	5000	5000	3500					
	YDF ₃ 112L2-4III FZ	4	11.9	83.3			5000					
	YDF ₃ 112M2-2III FZ	4	9.7	67.9				3500				
	YDF ₃ 112L-2III FZ	5.5	13.3	93.1				5000	3500	3500		
	YDF ₃ 132L1-2III FZ	7.5	17.1	119.7					5000	5000	350	
	YDF ₃ 132L2-2III FZ	10	22.8	159.6							500	
HZD ₁₀₀₀ ⁸⁰⁰	YDF ₃ 112L2-4III FZ	4	11.7	83.3	8000 10000							
	YDF ₃ 112L-2III FZ	5.5	13.3	93.1		8000 10000						
	YDF ₃ 132L1-2III FZ	7.5	17.1	119.7			8000 10000	8000 10000				
	YDF ₃ 132L2-2III FZ	10	22.8	159.6					8000 10000			

说明：输出速度栏中括号内数据专用于 HZD₂₅₀¹⁸⁰

Note: Data in parentheses in speed column are for HZD₂₅₀¹⁸⁰ only.

四 结 构 STRUCTURE

1. 输出转矩 $25\text{N}\cdot\text{m}\sim 1200\text{N}\cdot\text{m}$, 为单级 1E 级电装, 见图 1 The specifications with output torque of $25\text{N}\cdot\text{m}\sim 1200\text{N}\cdot\text{m}$ are individual actuators of Class 1E (refer to Fig. 1).
2. 输出转矩 $1800\text{N}\cdot\text{m}\sim 10000\text{N}\cdot\text{m}$, 为单级 1E 级电装和附加减速器叠加而成。The specifications with output torque of $1800\text{N}\cdot\text{m}\sim 10000\text{N}\cdot\text{m}$ are combined with a individual actuator and an additional reducer.

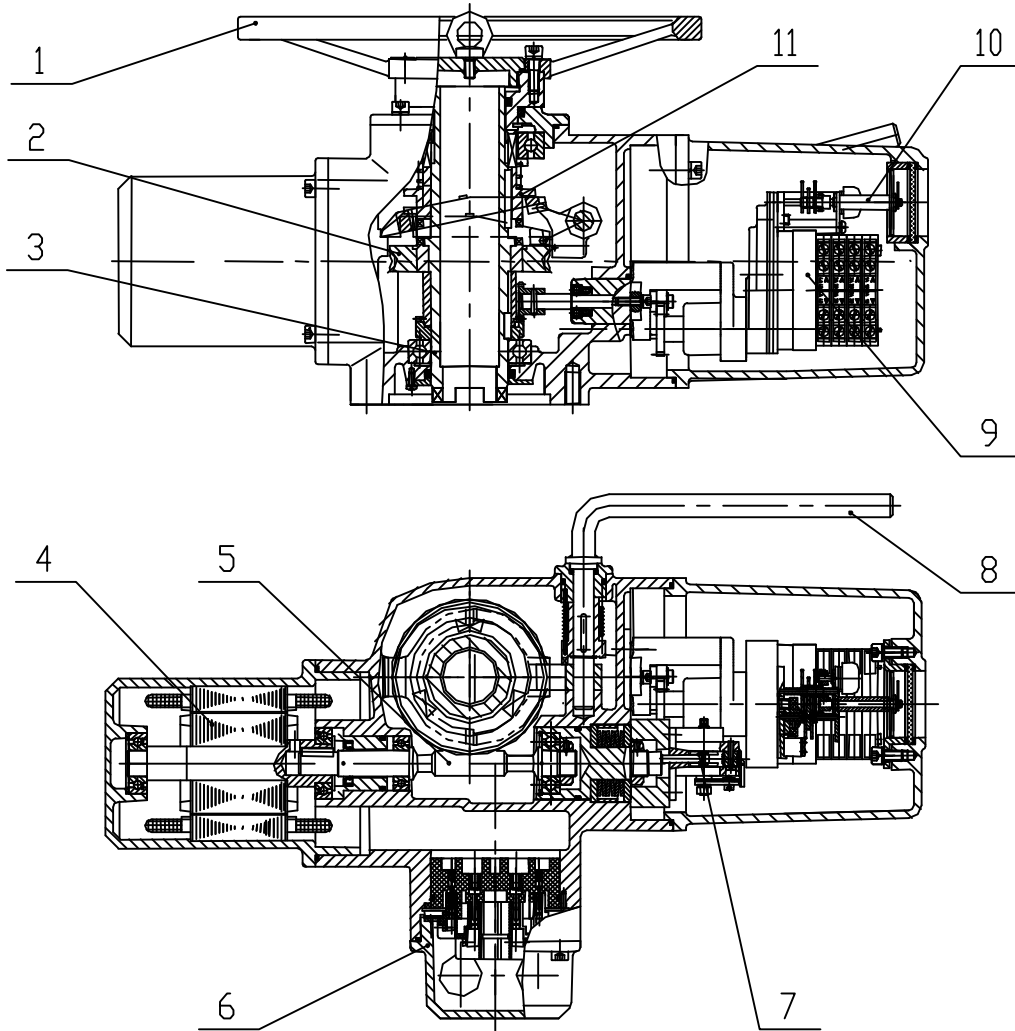


图 1 HZD2.5~HZD120 结构图 Fig. 1 Structure of HZD2.5~HZD120

- | | | | |
|-------------------------------|--------------------------|-----------------------------------|--------------------------|
| 1. 手轮 Handwheel | 2. 蜗轮 Wormgear | 3. 输出轴 Output shaft | |
| 4. 专用电机 Special motor | 5. 蜗杆轴 Worm shaft | 6. 接线盒 Terminal box | 7. 力矩机构 Torque mechanism |
| 8. 切换手柄 Auto/hand shift lever | 9. 行程机构 Travel mechanism | 10. 开度机构 Valve position indicator | 11. 离合器 Clutch |

3. 工作原理: Operating principle

电动时, 传动路线如下: 专用电机---蜗杆轴---蜗轮---离合器---输出轴; 需要手动时, 压下切换手柄, 使离合器上移脱开蜗轮而与手轮接上(这时松开手柄, 手柄将恢复到初始位置)即可手动操作, 传动路线如下: 手轮---离合器---输出轴。HZD45~HZD1000 带有增力机构, 速比分别见主要技术数据表 3。

When operating electrically, the driving course is as below:

Special motor—Worm shaft—Wormgear—Clutch—Output shaft

When manual operating, press down auto/hand shift lever, the clutch will shift up and declutch the wormgear to engage the handwheel (then let the lever go and it will return its original position).

Thus manual operation can be performed. The driving course is as below:

Handwheel—Clutch—Output shaft

Specifications of HZD45~HZD10000 are with hand force extension. Their speed ratio refers to Data Table 3 respectively.

4. 推力型 1E 级电装 Class 1E actuators of thrust mode

对于推力型 1E 级电装，是在转矩型的基础上附加图 2 所示的普通推力盘。与阀门组装前配套单位或用户需根据阀杆的参数加工阀杆螺母。阀杆螺母拆装方法：拧下螺钉，卸下接盘即可取出阀杆螺母，重装时要注意不能漏装和损伤 O 形密封圈。

推力型 1E 级电装所能承受的最大推力和允许通过的最大阀杆直径均不能超过表 3 中的规定，否则可能造成零件损坏。

Class 1E actuators are formed by an actuator of torque mode and a thrust attachment. Before Class 1E actuators of thrust mode is matched with valve, stem nut needs machining according to parameters of user's valve stem. Disassembling and reassembling of the stem nut are as below: back off the screws and remove the attachment, then the stem nut may be taken out. When reassembling, any part should not be missed and o-rings should not be damaged.

Maximum thrust force of Class 1E actuator of thrust mode and allowed maximum diameter of valve stem shall not exceed the specifications in Table 3 or it will result in parts damage.

对于输出速度较高的推力型 1E 级电装，一般采用缓冲推力盘，增加碟形弹簧以吸收冲击能量，如图 3、图 4。缓冲型推力盘分中速与高速二种，中速缓冲推力盘适用于输出速度为 72r/min 和 96r/min 的 1E 级电装，高速缓冲推力盘适用于输出速度为 144r/min 和 192r/min 的 1E 级电装。

springs are generally adopted as shown in Fig. 3、Fig. 4 to absorb impacting energy. Buffering attachment is divided into tow kinds: intermediate speed and high speed. Intermediate speed buffering attachment is suitable to Class 1E actuators with output speed of 72r/min or 96r/min. High speed buffering attachment is suitable to Class 1E actuators with output speed of 144r/min or 192r/min.

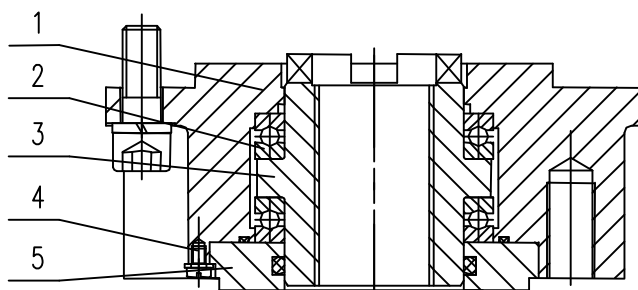


图 2 普通推力盘 Fig. 2 Common thrust attachmen

- | | | | |
|---------|-------------|---------|----------------|
| 1. 推力盘座 | thrust base | 2. 推力轴承 | thrust bearing |
| 3. 阀杆螺母 | stem nut | 4. 螺钉 | screws |
| 5. 接盘 | attachment | | |

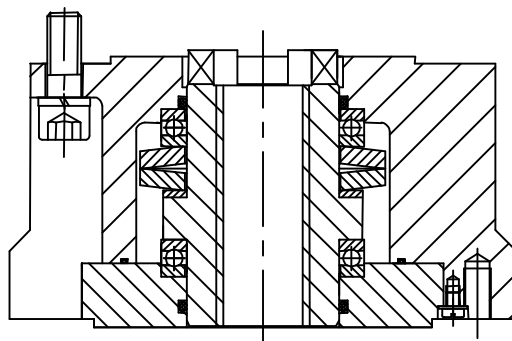


图 3 中速缓冲推力盘 Fig. 3 Medium speed buffering thrust attachment

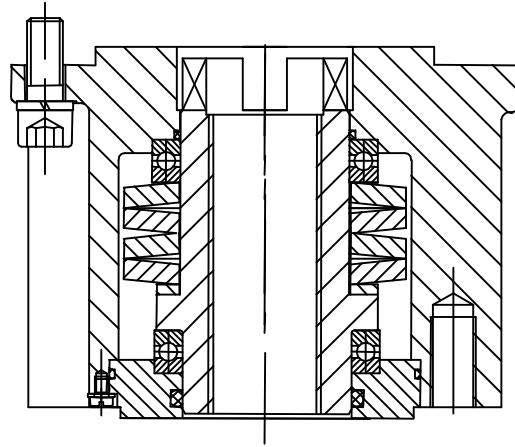


图 4 高速缓冲推力盘 Fig. 4 High speed buffering thrust attachment

五外形和连接尺寸 OVERALL SIZE AND CONNECTING DIMENSIONS

1. HZD2.5~HZD250 外形尺寸 Overall size of HZD2.5~HZD250

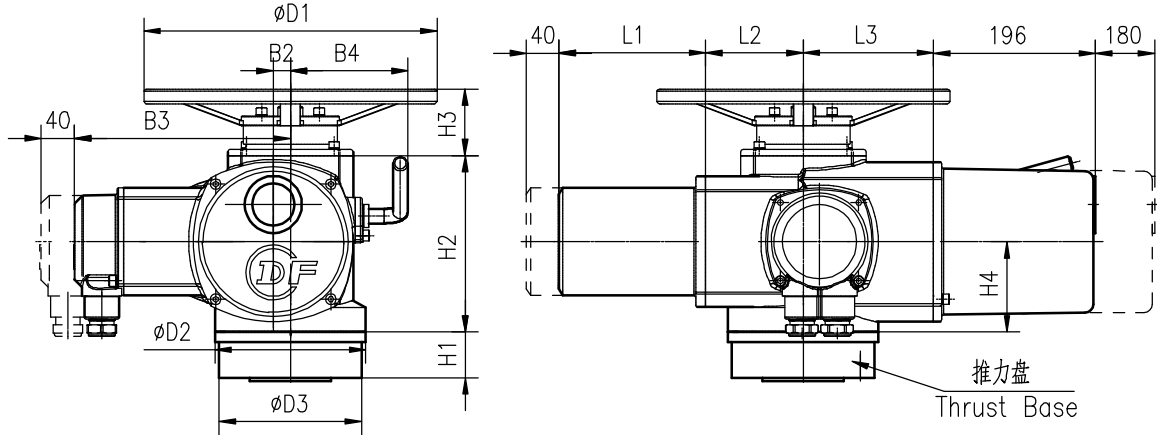


图 5 HZD2.5~HZD60 外形尺寸图 Fig. 5 Overall size of HZD2.5~HZD60

HZD2.5~HZD60 外形尺寸表: Overall size of HZD2.5~HZD60

表 6 Table 6

型号 Type	L1	L2	L3	H1	H2	H3	H4	B2	B3	B4	D1	D2	D3
HZD ₄ ^{2.5}	88	85	147	38	182	66	102	0	213	144	200	115	90
HZD ₁₅ ⁵	145, 180	110	145	46(69, 89)	214	70	108	21	242	144	260	140	126
HZD ₄₀ ²⁰	180, 190	120	160	54(89, 118)	217	83	111	21	266	144	360	185	175
HZD ₆₀ ⁴⁵	200~285	148	208	80(117, 152)	245	97	118	55	277	142	420	225	210

说明: 1.表中 H1 括号内尺寸前后分别为中速、高速缓冲推力盘尺寸。2.图中 H1 为推力盘的高度尺寸,用于推力型连接(连接尺寸符合 ISO5210 即 GB12222)。3.如果需要保护阀杆用的护罩,其长度尺寸由用户决定。

Note:

- Sizes of H1 in parentheses are respectively for intermediate speed buffering attachment and high speed buffering attachment.
- Size H1 in the figure is the height of the attachment for thrust connecting (connecting dimension is in accordance with GB 12222 idt. ISO 5210).
- If protection cover of valve stem is needed, its length size will be decided by users.

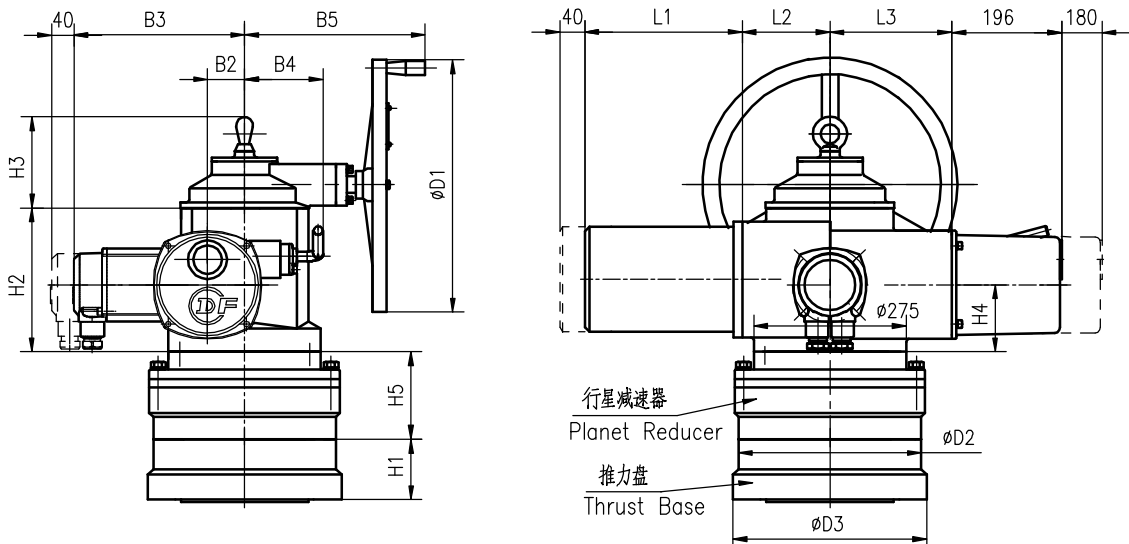


图 6 HZD90~HZD250 外形尺寸图

Fig.6 Overall size of HZD90~HZD250

HZD90~HZD250 外形尺寸表: Overall size of HZD90~HZD250

表 7 Table 7

型号 Type	L1	L2	L3	H1	H2	H3	H4	H5	B2	B3	B4	B5	D1	D2	D3
HZD ⁹⁰ ₁₂₀	255~302	158	220	110(151,190)	260	165	121	67	67	310	142	326	460	275	300
HZD ¹⁸⁰ ₂₅₀	255~302	158	220	125(191)	260	165	121	158	67	310	142	326	460	330	350

说明: 1. HZD⁹⁰无行星减速器。2. 图中 H1 为推力盘的高度尺寸,用于推力型连接(连接尺寸符合 ISO5210 即 GB12222)。3. 如果需要保护阀杆用的护罩,其长度尺寸由用户决定。4. 表中 H1 括号内尺寸前后分别为中速、高速缓冲推力盘尺寸。

Note:

- 1) Types HZD⁹⁰ are without planet reducer.
- 2) Size H1 in the figure is the height of the attachment for thrust connecting (connecting dimension is in accordance with GB 12222 idt. ISO 5210).
- 3) If protection cover of valve stem is needed, its length size will be decided by users.
- 4) Sizes H1 in parentheses in the table are respectively for intermediate speed buffering attachment and high speed buffering attachment.

2. HZD350~HZD1000 外形尺寸 Overall size of HZD350~HZD1000

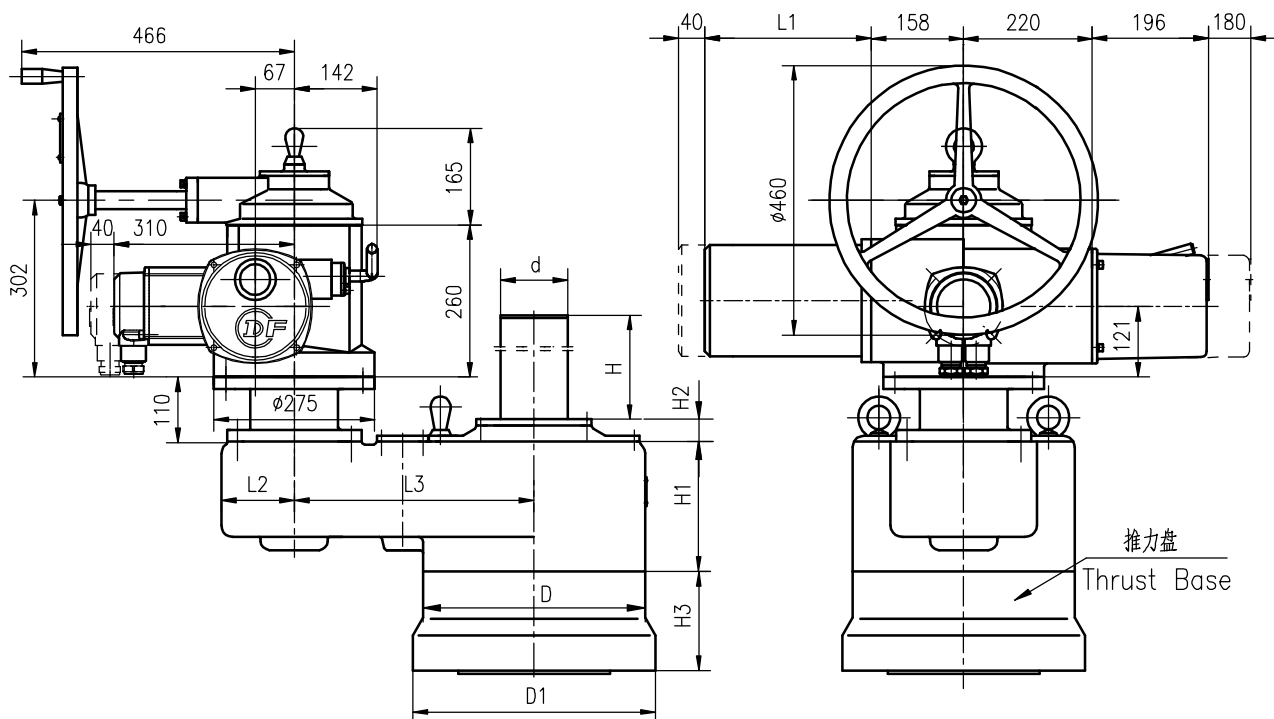


图 7 HZD350~HZD1000 外形尺寸图 Fig. 7 Overall size of HZD350~HZD1000

HZD350~HZD1000 外形尺寸表 Overall size of HZD350~HZD1000

表 8 Table 8

型号 Type	L1	L2	L3	H1	H2	H3	ϕd	ϕD	$\phi D1$
HZD ³⁵⁰ ₅₀₀	255~302	125	410	222	38	169	115	380	415
HZD ⁸⁰⁰ ₁₀₀₀	285、302	130	450.5	238	51	195	138	510	510

说明:

1. 尺寸 H 为高阀盖高度,由阀门决定。尺寸 H3 为推力盘高度,对于转矩型不需加推力盘。
2. 尺寸 L1 为电机长度,由电机功率决定。(有 255、285、302 三种长度尺寸)。

Note:

- 1) Size H is the height of stem protection cover, and is determined by the valve. Size H3 is the height of thrust attachment. For the actuator of torque mode, thrust attachment is not

needed.

- 2) Size L1 is the length of motor, and is determined by power of motor. (There are three sizes of the length: 255, 285, and 302)

3. 连接尺寸 Connecting size

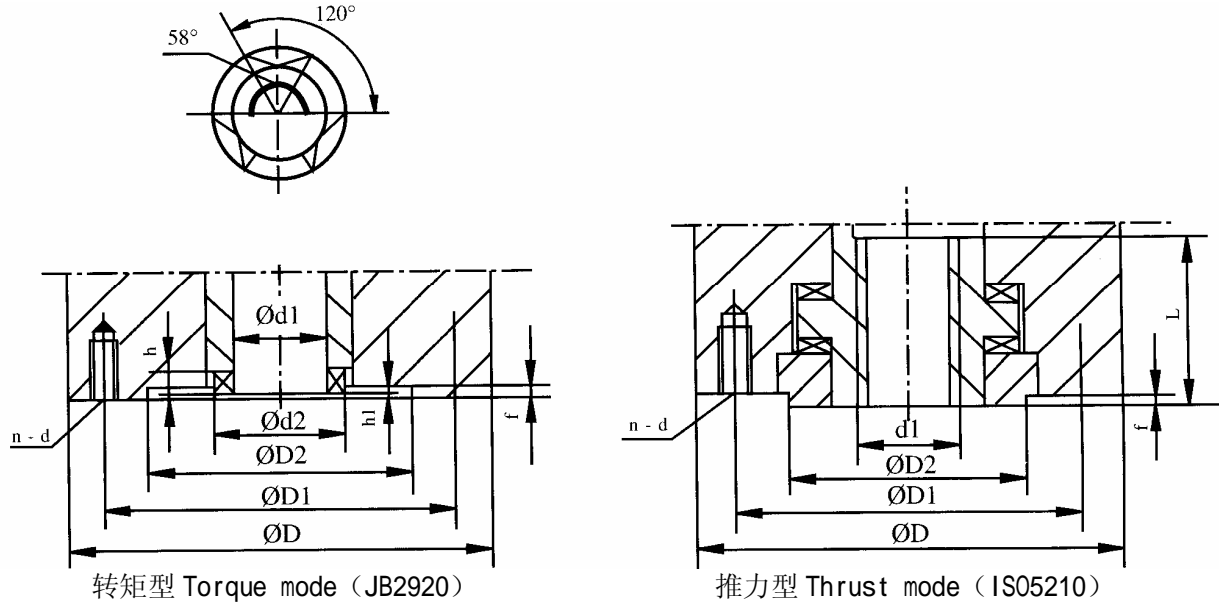


图 8 连接尺寸图 Fig. 8 Connecting size

连接尺寸表 Connecting size

表 9 Table 9

型号 Type	转矩型 Torque mode (JB2920-81)										推力型 Thrust mode (IS05210 i.e. GB12222)							
	机座号 Frame size	d1	d2	D2 (H9)	n-d	D1	D	h1	h	f	法兰号 Flange size	D	D1	D2 (f8)	d1 max	n-d	L	f
HZD ₄ ^{2.5}	1	20	28	75	4-M8	95	115	2	6	5	F07	90	70	55	T20	4-M10	36	3
HZD ₁₅ ⁵	2	30	45	90	4-M10	120	145	2	8	4	F10	125	102	70	T28	4-M10	40	3
HZD ₄₀ ²⁰	3	42	58	125	4-M12	160	185	2	10	4	F14	175	140	100	T40	4-M16	50	4
HZD ₆₀ ⁴⁵	4	52	72	150	4-M16	195	225	2	12	5	F16	210	165	130	T50	4-M20	80	5
HZD ₁₂₀ ⁹⁰	5	62	82	180	4-M20	235	275	2	14	5	F25	300	254	200	T60	8-M16	114	5
HZD ₂₅₀ ¹⁸⁰	7	73	98	220	4-M24	285	330	3	16	6	F30	350	298	230	T70	8-M20	130	5
HZD ₅₀₀ ³⁵⁰	8	80	118	280	8-M20	340	380	3	20	6	F35	415	356	260	T100	8-M30	170	5
HZD ₁₀₀₀ ⁸⁰⁰	9	85	128	300	8-M24	380	510	3	25	8	F40	510	406	300	T120	8-M36	230	8
	10	105	158	360	8-M30	450	510	3	30	8								

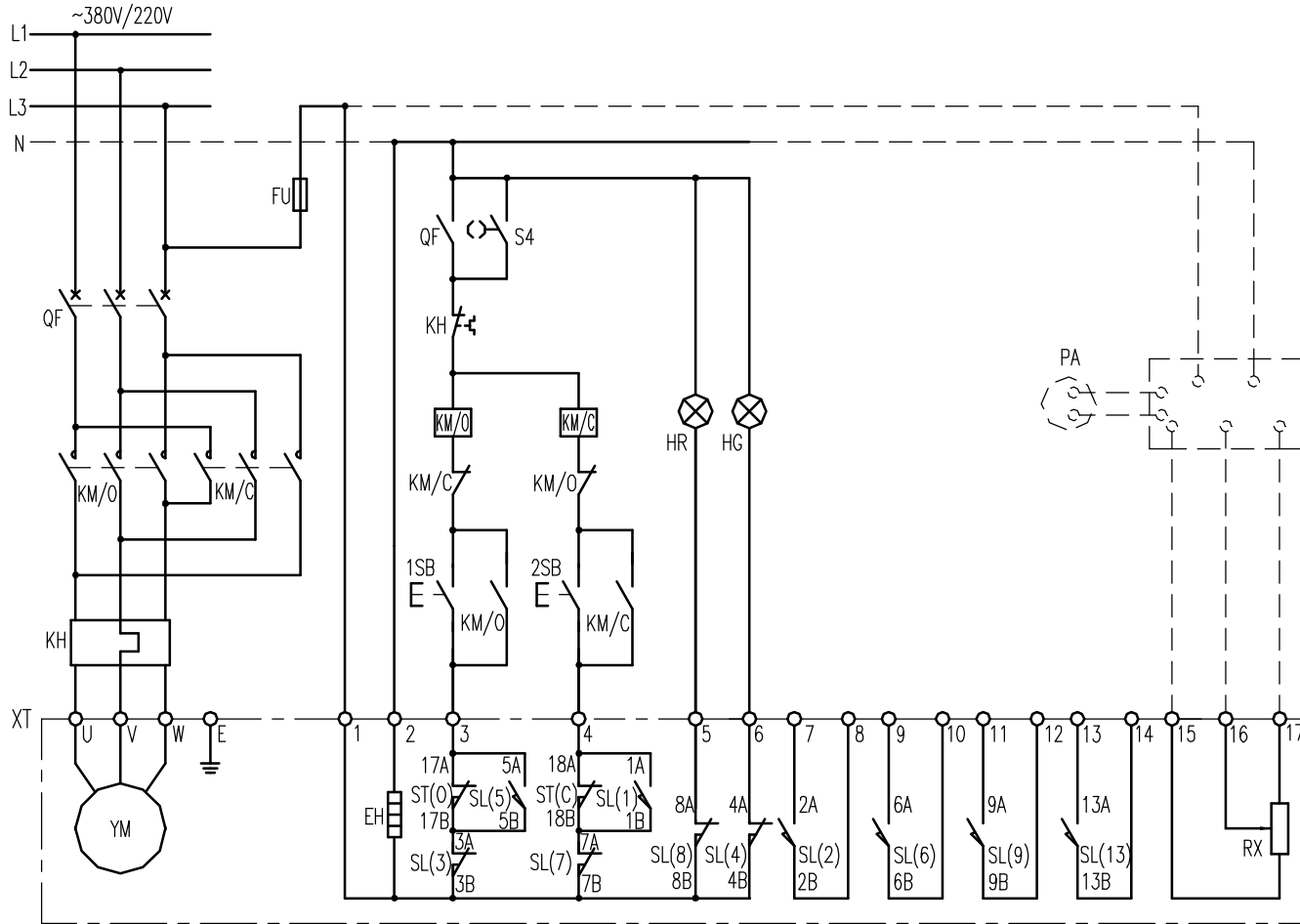
说明:

1. 安装螺纹孔的位置与电机轴线成错开对称分布;
2. 安装螺纹孔的有效深度 ≥ 螺纹公称直径的 1.8 倍。

Note:

- 1) Positions of screwed holes for mounting are distributed staggered and symmetrical around motor shaft axis
- 2) Effective depth of screwed holes for mounting is equal or more then 1.8 times of nominal diameter of screw.

六 电气原理及接线 SCHEMATIC CIRCUIT DIAGRAM AND WIRING DIAGRAM



电气元件表 electric elements

代号 code	名称 name	代号 code	名称 name
YM	电动机 motor	PA	电表 galvanometer
KH	热继电器 thermal relay	RX	电位器 potentiometer
KM/O KM/C	交流接触器 A.C.contactor	EH(5.1k20w)	空间加热器 electric heater
FU	熔断器 fuse	ST(O)	开闭力矩开关 torque switch (open)
QF	断路器 circuit breaker	ST(C)	关闭力矩开关 torque switch (close)
1SB 2SB	按钮 switch button	SL(1)-(4), (9)-(12)	开闭行程开关 limit switch (open)
HR HG	指示灯 indicating lamp	SL(5)-(8), (13)-(16)	关闭行程开关 limit switch (close)
S4	延时开关 delay switch		

说明: 点划线框内的元件均在电动装置上。

Note: Components in dash dotted Line are built in.

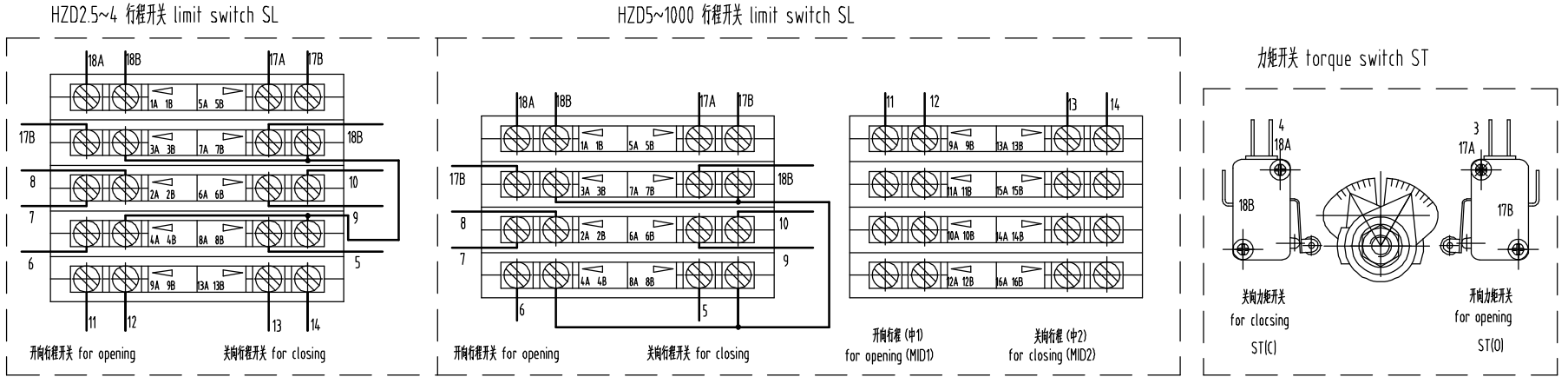
图9 电气原理图
Fig.9 schematic diagram

HZD2.5~4 行程开关接点表 limit switch development						
开关 switch	符号 symbol	触点 cont. No.	阀门开度 proportion of travel			接点号 terminal
			全关 close	中 middle	全开 open	
行程 开关 limit switch	SL	(1)				1A-1B
		(2)				2A-2B
		(3)				3A-3B
		(4)				4A-4B
		(9)				9A-9B
		(5)				5A-5B
		(6)				6A-6B
		(7)				7A-7B
		(8)				8A-8B
		(13)				13A-13B
		(17)				17A-17B
		(18)				18A-18B
		力矩 开关 torque switch	ST	(O)		
		(C)				18A-18B

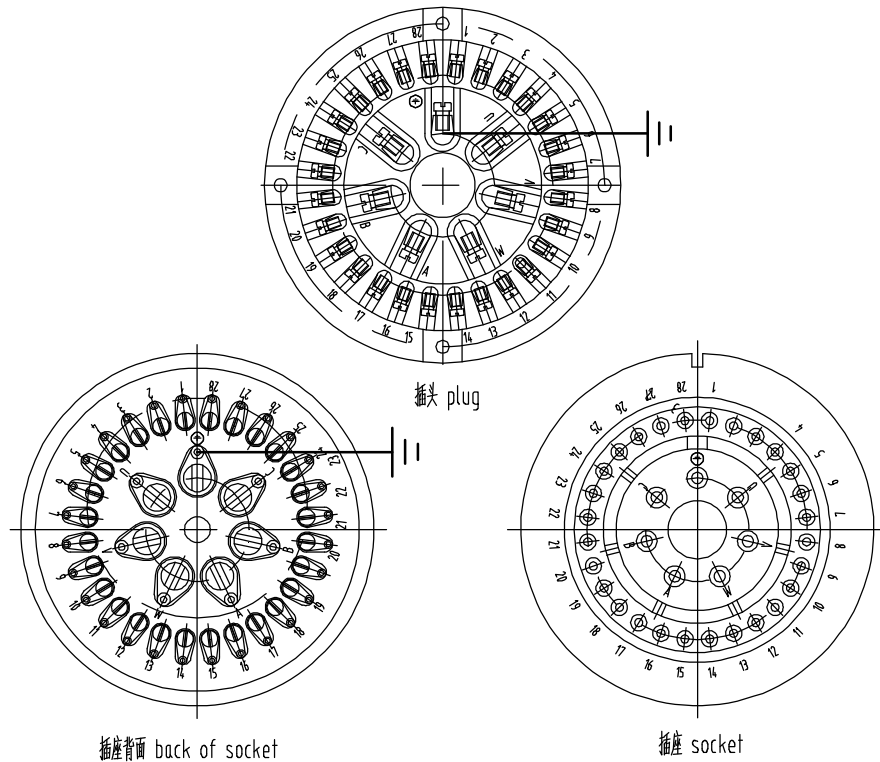
接点 闭合 contact closed

行程开关接点表 (不含HZD2.5~4) limit switch development (except HZD2.5~4)						
开关 switch	符号 symbol	触点 cont. No.	阀门开度 proportion of travel			接点号 terminal
			全关 close	中 middle	全开 open	
行程 开关 limit switch	SL	(1)				1A-1B
		(2)				2A-2B
		(3)				3A-3B
		(4)				4A-4B
		(9)				9A-9B
		(10)				10A-10B
		(11)				11A-11B
		(12)				12A-12B
		(5)				5A-5B
		(6)				6A-6B
		(7)				7A-7B
		(8)				8A-8B
		(13)				13A-13B
		(14)				14A-14B
		(15)				15A-15B
		(16)				16A-16B
力矩 开关 torque switch	ST	(O)				17A-17B
		(C)				18A-18B

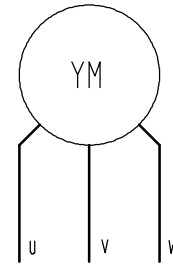
接点 闭合 contact closed



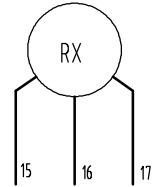
接线端子盘 terminal plate XT



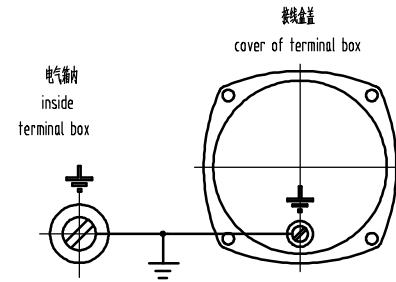
电机 motor



电位器 potentiometer



接地 earthing



空间加热器 electric heater

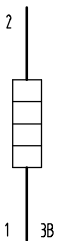


图 10 电气接线图
Fig.10 wiring diagram

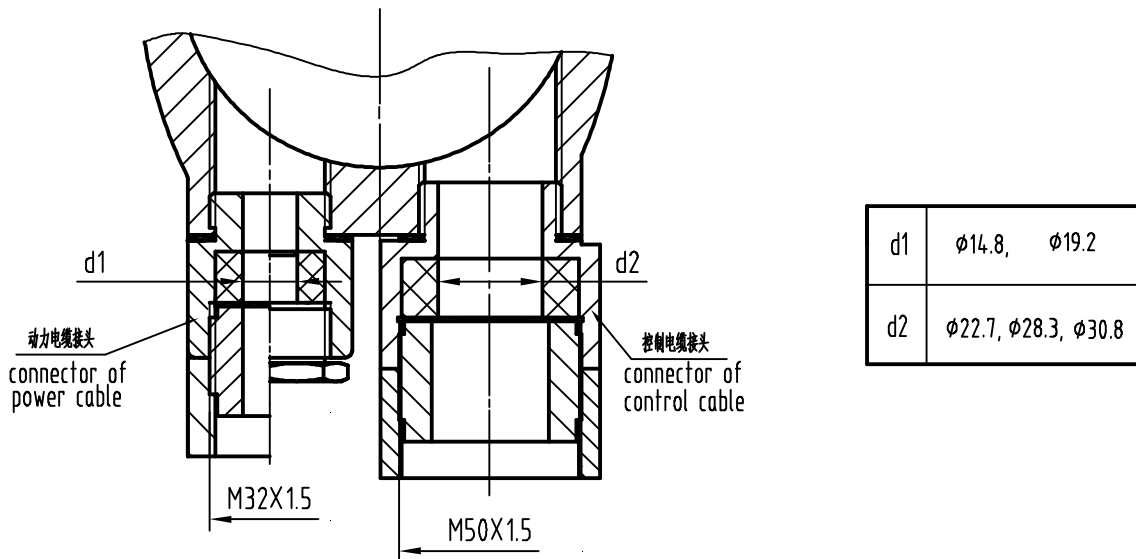


图 12 电缆引入装置尺寸 Fig. 12 Size of cable entrance

允许通过电缆直径见图 12。当电动机输出功率小于 1.5kW 时，控制线和动力线可用一根电缆，接头采用控制电缆接头。

The permitted lead-in diameter of cable refers .When the output power is less than 1.5 kW, control cable and power cable can use a cable, connector use a connector of control cable .

七 调 整 ADJUSTMENT

核级电装与阀门组装后，应对力矩控制器、行程控制器、开度机构进行调整，方可使用。调整前务必使阀门处于中间位置。

After the assembling of valve and electric actuators for nuclear service and before it is put into operation, adjustment shall be carried out for torque controller, travel controller, position indicating mechanism. When adjusting, the valve must be at middle position.

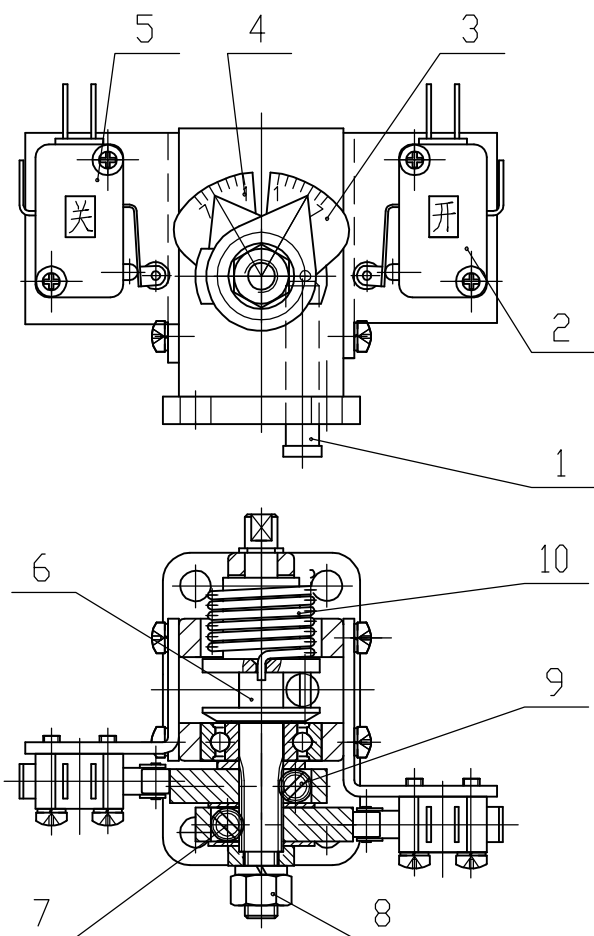
(一) 力矩控制器的调整 Adjustment of torque controller

力矩控制器的结构见图 13 Structure of torque controller built is as shown in Fig. 13.

力矩控制器在出厂前已根据订货要求整定好并填在产品证明书上(如用户未指定，通常开向整定在公称值上，关向为公称值的 0.7)，一般不允许再调整，若一定要调的话，必须十分谨慎，可参考产品证明书上的力矩曲线，查找对应刻度值，进行调整。方法如下：松开该方向的螺钉，将调整臂调到对应的刻度值，再紧固螺钉即可。决不能盲目调大，否则关严后可能打不开，如果超出力矩机构的控制范围将烧毁电机。

Before delivery the torque controller has been set according to ordering requirement, and the set value is filled in product quality certificate (If customers do not put forward any specification, the torque level in opening direction is set to nominal value, and the torque level in closing direction is set to 0.7 time of nominal value). It is not allowed to reset in general. If it is needed to reset, the resetting must be carried out carefully. Refer to the torque curve in the quality certificate and find out corresponding scale value for resetting. Resetting method is as below:

Loosen the screw in the operating direction. Set the adjusting arm to corresponding scale and then fix the set screw. Not to increase the value blindly at any time or the valve may not be able to open after it is seated. If the torque level is set beyond control limit, the motor will be burnt.



- 1 推杆 Push bar
- 2 开向微动开关 Microswitch for opening
- 3 开向凸轮 Opening cam
- 4 关向凸轮 Closing cam
- 5 关向微动开关 Microswitch for closing
- 6 转轴 Rotating axis
- 7 开向调整轴 Setting axis in opening direction
- 8 螺母 Nut
- 9 关向调整轴 Setting axis in closing direction
- 10 扭簧 Torsion spring

顺时针转动关向调整轴 9 (若转不动或很费劲, 需略拧松螺母 8, 待调后再拧紧), 这时关向凸轮 4 相应顺时针转过一角度, 使得关向凸轮与关向微动开关 5 的压动滚轮之间的距离增大, 力矩也随之增大, 但决不能盲目调大, 否则关严后可能打不开。如果超出力矩机构的控制范围将烧毁电机。对于开方向, 因为已经整定在公称值上, 所以不允许调大只允许调小。

Rotate clockwise the setting axis 9 in closing direction (If it is hard to rotate the setting axis with a screwdriver, it is necessary to loose the Nut 8 slightly and tighten it again when adjustment is finished).

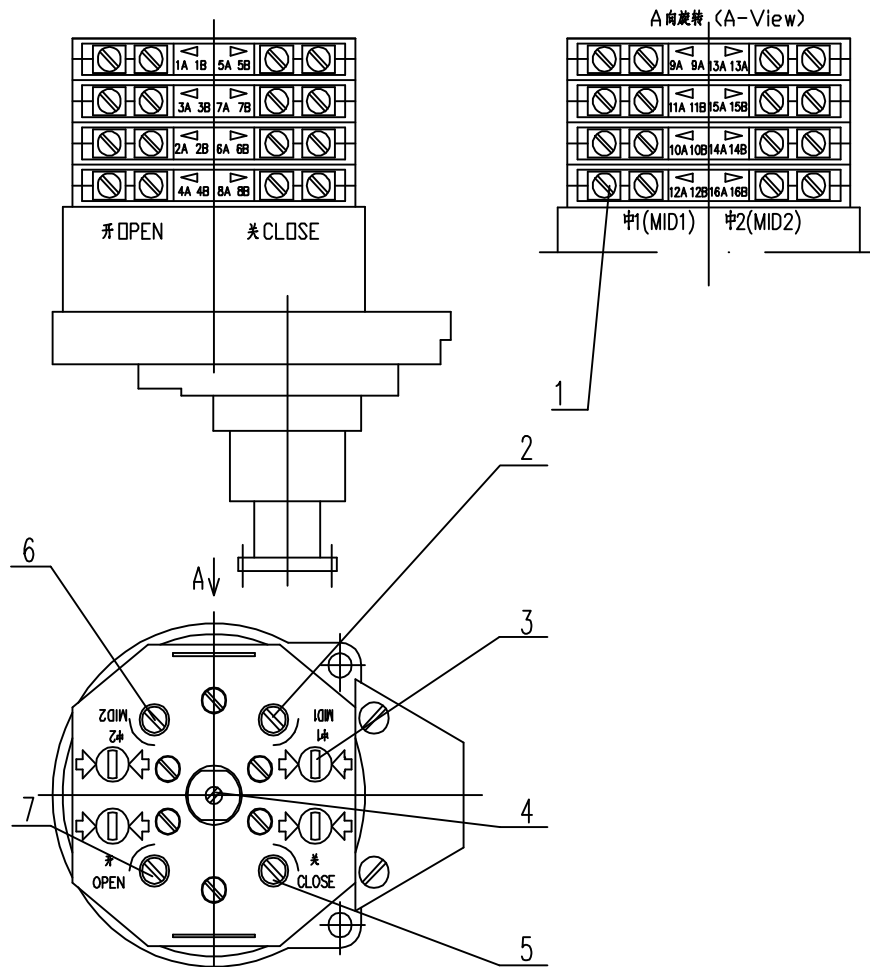
图 13 力矩控制器
Fig. 13 Torque controller

Then the closing cam 4 in shall rotate a angle to make the gap increase between the cam and the pressing roller for microswitch 5 in closing direction and the torque level will also increase. But the torque level shall not increase blindly or the valve will not be able to open when it is seated. If the torque level goes beyond control limit, it will result in motor damaging. For the torque level in opening direction, it has already been set to nominal value and is not allowed to reset for increasing, but for decreasing only.

(二) 行程控制器的调整 行程控制器的结构见图 14 Adjustment of travel controller
Structure of travel controller is as shown in Fig.14.

(1) 阀门“全关”位置的调整 Adjustment of valve “Seating”

- ① 将手电动切换手柄向下压, 用手动将阀门“全关”, 再从这个位置稍退回一点。
- ② 用螺丝刀压下顶轴, 并转 90° 可卡住为止。
- ③ 按关向箭头旋转“关向”调整轴, 直到转动柱上的小凸台方向与两旁箭头方向基本一致为止。
- ④ 旋回顶轴, 使之复位。
- ① Push the auto/hand shift lever down . Operate the valve to seating and then retreat a little from this point.
- ② Press the top axis down and rotate 90° with screwdriver till it is clamped.
- ③ Rotate the setting axis in closing direction according the arrow in closing direction till the dummy club of the roller is consistent with the arrows on both sides.
- ④ Turn the top axis back to original position.



1 接线柱 Terminals 2 中1调整轴 Mid 1 setting axis 3 传动柱 Drive roller
 4 顶轴 Top axis 5 关向调整轴 Setting axis in closing direction
 6 中2调整轴 Mid 2 setting axis 7 开向调整轴 Setting axis in opening direction

图 14 行程控制器 Fig. 14 Travel controller

(2) 阀门“全开”位置的调整 Adjustment of valve “Full open”

- ① 在阀门“全关”位置调好的基础上，手动或电动将阀门开到“全开”位置之前停下（建议开到全行程的95%左右）。
- ② 用螺丝刀压下顶轴，并转90°可卡住为止。
- ③ 按开向箭头旋转“开向”调整轴，直到转动柱上的小凸台方向与两旁箭头方向基本一致为止。
- ④ 旋回顶轴，使之复位。

① When the adjustment of valve “Seating” is finished, operate the valve by hand or electrically to open and stop it before “Full open” (about 95% of whole travel is recommended).

② Press the top axis down and rotate 90° with screwdriver till it is clamped.

③ Rotate the setting axis in opening direction according the arrow in opening direction till the dummy club of the roller is consistent with the arrows on both sides.

④ Turn the top axis back to original position.

(3) 中间位置的调整 Adjustment of middle position

中1和中2两个中间位置，用户可以根据需要用于开向或关向的中间位置，或用于增加开、关向的触点数。这时调整轴的旋转方向视中1、中2是用于开向还是关向而定，若用于开向则与开向调整轴的旋向一致，若用于关向则与关向调整轴的旋向一致。

行程控制器全部调好后，需电动试运转，控制器控制的整个行程应符合要求，否则需要重新进一步调整。

在行程控制器的调整过程中，如果出现调过头或者还没有开始调转动柱已经处于动作状态（即转动柱上小凸台方向与两旁箭头基本一致），这时需反方向旋转调整轴，直到恢复动作前状态，再按箭头方向重新调。

Users may use Mid 1 and Mid 2 as middle position limit in opening course or in closing course, or use them to increase number of switch contacts according to user's requirement. Then rotation direction of setting axis during adjustment is based on in which operating direction Mid 1 and Mid 2 are applied. If they were used in opening course, rotation of setting axis should be consistent with the setting axis in opening direction or be consistent with the setting axis in closing direction if were used in closing course.

When the adjustment of travel controller is finished, electrical trial operation shall be performed.

The controller shall be conformed to the requirement in whole travel or further resetting is necessary.

During the adjustment of travel controller, if over setting or action before the roller rotating (i.e. the dummy club of the roller is almost consistent with the arrows on both sides.) occurs, reverse adjustment of setting axis is needed till the original state is recovered. Then reset it according to the arrow direction.

(三) 开度机构的调整 开度机构结构见图 15 Adjustment of position indicator Structure of position indicator is as shown in Fig.15.

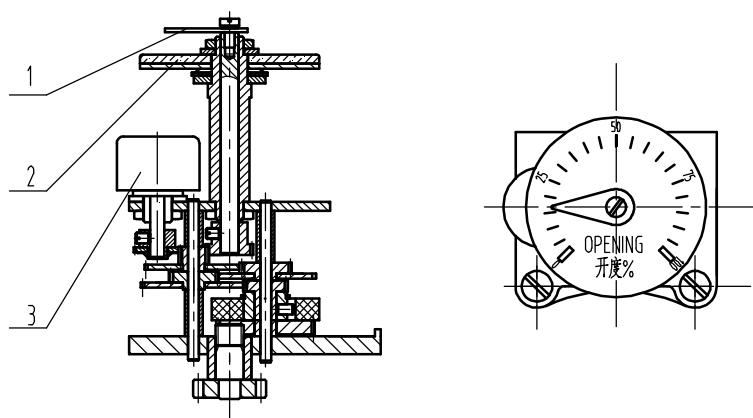


图 15 开度机构 Fig.15 Position indicating mechanism

1. 指针 Pointer 2. 开度指示盘 Position indicator dial 3. 电位器 Potentiometer

(1) 电动或手动操作，将阀门关至“全关”位置后，切断电源。

Operate the valve electrically or by hand wheel to “seated” position, then cut off power supply.

(2) 松开开度指示盘上的指针螺钉，使指针与刻度盘上的“关”对齐，再将螺钉拧紧。

Loosen screw of pointer on indicating dial, set pointer pointing to “CLOSE”, then fix screw .

(3) 用钳子夹住电位器转轴，面对指示盘，按指针关方向转动电位器转轴至接近终端位置。

Clip the turning shaft of potentiometer by pliers, facing the dial, turn the shaft of potentiometer in the direction the closing dial points to approach end position.

(4) 电动或手动将阀门“全开”，保持“关”指示盘不动，转动“开”指示盘至指针所在的位置。

Operate the valve electrically or by handwheel to “complete opening” position, keeping the “closing dial” at original position, turn the “opening dial” to align with the pointer.

八 故障及其排除方法 FAULTS AND TROUBLESHOOTING

序 No	故 障 Fault	原 因 Cause	排除方法 Troubleshooting
1	电动机不能启动 Motor does not start	1. 电源不通 2. 操作回路不通 3. 行程或力矩控制器开关动作 1.Power supply is disconnected. 2.Operating loop is disordered. 3.Travel or torque limit acts.	1. 接通电源 2. 排除回路故障 3. 解除动作开关 1.Connect power supply. 2.Eliminate loop fault. 3.Eliminate switch action.
2	输出轴旋向与规定要求相反 Rotation of output shaft is counter to specification.	电机电源相序不对 Phase sequence of power is not in order.	三相线中任意对调二相 Exchange any two line of three-phase.
3	电机过热 Motor is overheated	1. 连续试车时间过长 2. 电装与阀门选配不当 3. 电机二相运转 1.Too long a trial run. 2.Actuator does not fit valve. 3.Motor runs under 2-phase.	1. 停止试车，待电机冷却 2. 复核配套情况 3. 检查供电回路 1.Stop trial running to cool motor. 2.Check the fitting. 3.Check power loop.
4	运行中电机停转 Motor stops during running.	1. 负载过大，力矩控制器动作 2. 阀门故障 1. Torque limit acts owing to overload. 2. Valve goes out of order	1. 提高力矩控制器的设定值 2. 检查阀门 1. Increase setting value of torque level. 2. Check valve.
5	阀门到位电机不停转，阀位指示灯不亮 Motor does not stop or position indicating lamp does not light when valve reached required position.	1. 行程或力矩控制器失灵 2. 行程控制器调整不当 1.Malfunction of travel controller or torque controller. 2.Improper adjustment of travel controller.	1. 检查行程及力矩控制器 2. 重新调整行程控制器 1.Check travel controller or torque controller. 2. Reset travel controller.
6	远方开度发信失控 Signal transmitting of remote position indication is out of control.	远方开度电位器故障 Fault of remote position indicating potentiometer.	清洗或更新电位器 Clean or replace the potentiometer.

九 注意事项 CAUTIONS

- 1、安装前应将电动装置存放在清洁干燥的室内。
 - 2、安装时应把电气箱盖和导线进出口密封好，以防潮气进入电气箱内，造成电气元件及零件锈蚀。
 - 3、不得在阴雨天于户外打开电气箱盖、电机等密封部位，打开电气箱盖时，必须先切断电源。拆开重装时，密封部位需盖严紧固。
 - 4、手动操作前应将手电动切换手柄向下压，若压不下去时需边推边转手轮。切换后即可手动操作（可适当用加力杆）。手轮旋向通常与输出轴一致，顺时针为关，逆时针为开。电动时手动自动脱开。
 - 5、首次电动操作时，先手动操作使阀门处于中间位置，然后电动检查输出轴的旋向与阀门开关是否一致，若相反应立即停机切断电源，将电动机的三相电源任意两相对调。
 - 6、由于专用电机为短时工作制，调试时，连续试车时间不可太长。
 - 7、箱体内部采用专用抗辐照润滑脂，使用期为4年，故到期要更换。
 - 8、拆卸重装时，应注意检查密封件，发现损伤应及时更换（密封件为抗辐照专用橡胶），密封部位必须盖严紧固。
 - 9、对于不经常使用的阀门，应定期检查保养运行操作，建议每月运行一次，时间不超过10分钟。
 - 10、起吊时，不得吊装手轮。
 - 11、与阀门连接时应采用强度8.8级的螺钉。推荐拧紧力矩当M8为23N·m，M10为45N·m，M12为78N·m，M16为200N·m，M20为380N·m，M24为650N·m，M30为1270N·m。
1. Before installation, the actuator shall be kept in clean and dry room.
 2. When installing, the cover of the electric compartment and the conduit of the cable shall be well sealed to prevent the entrance of the moisture which may result in electric elements and parts rusty and corroded.
 3. Do not open sealed positions such as cover of electric compartment or electric motor etc. outdoors when it is overcast or rainy. Before open cover of electric compartment, do cut off power supply. And when reassembling, sealed positions must be tightened and sealed.
 4. Before hand operating, push the auto/hand shift lever down. If it can not be pushed down up, please pull or push while turning the handwheel (the hand extending lever may be adopted). The rotation of the handwheel is generally in accordance with the rotation of the output shaft. Clockwise rotation makes valve closing and counterclockwise rotation makes valve opening. When electric operating, the auto/hand shift lever will return its original position. Do not pull the lever back.
 5. when the actuator is electrically operating for the first time, operate the valve to middle position by hand operation at first, and then operate electrically to check if rotation of output shaft is consistent with rotation of valve. If it is reverse, stop running at once and cut off power supply and then exchange any two lines of the three-phase.
 6. Owing to the short time duty of the special electric motor, the continuous trial running can not be too long a time.
 7. The housing is filled with radiation-proof grease for special purpose. The useful-life of the grease is 4 years and it is necessary to replace when it is expired.
 8. When the actuator is reassembled, do check the sealing parts. If there is any damage, it shall be replaced (sealing parts are made of radiation-proof rubber) in time. The sealing locations shall be tightened and sealed.
 9. For the valves not often running, maintenance and maintaining operation shall be carried out periodically. Once a month and one time no more than 10 minutes is recommended.
 10. When lifting, do not lift the actuator with its handwheel.
 11. When the actuator is connecting with the valve, use screws of strength level 8.8. Tight torque of 23N·m for M8; 45N·m for M10; 78N·m for M12; 200N·m for M16; 380N·m for M20; 650N·m for M24; and 1270N·m for M30 is recommended.

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