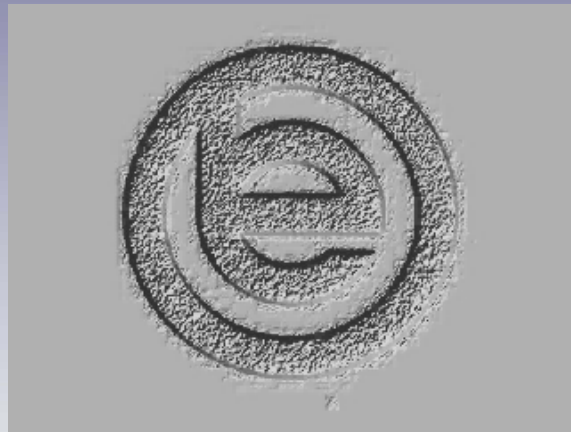




# ***BLACKHALL ENGINEERING LTD***



## ***FIXED CONE VALVE INSTALLATION OPERATION AND MAINTENANCE MANUAL***

## FIXED CONE VALVE

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## SECTION 1

### 1) FIXED CONE VALVE

- The valve is a terminal discharge type design, comprising of an external control sleeve which is positioned by two side mounted spindles, synchronized by a high precision dual bevel gearbox. The control sleeve movement results in a variable annular area for the flow passage and thus results in regulation.
- The entire valve operating mechanism is external, allowing for ease access for routine maintenance.
- The valve is fitted with a resilient seat to ensure tight shut off.
- Economical and versatile method of controlling free discharge at terminal point of pipe or culvert in the base of a dam.



## **SECTION 2**

### 2) PRINCIPLE OF OPERATION

The Blackhall Fixed Cone Free Discharge Valve was developed, after exhaustive testing, to enable efficient and reliable operation over the full range of its stroke without inducing vibration.

The outlet cone ensures that discharge is in the form of a hollow conical expanding jet, which is ideal for energy dissipation as the water is spread over an increasing surface area. This permits effective atmospheric “cushioning”.

The Fixed Cone Valve is of a relatively simple construction comprising of two concentric cylinders, an inner body piece and an external control sleeve which is positioned by two side mounted spindles synchronized by a high precision dual bevel gearbox/actuator.

Radial ribs extend within the body in an outlet cone. The axial length of the opening is adjustable by a movable sleeve allowing flow control to be achieved between the closed and open limit of valve travel.

For sleeve movement the operating mechanism overcomes the friction between the body/sleeve guides and seal, or in angled installations, a component of the weight of the sleeve, the sleeve being virtually balanced radially and the other hydraulic forces being negligible.



### **SECTION 3**

#### 3) INSTALLATION

Without dismantling, the valve should be thoroughly cleaned and examined to ensure that there is no foreign matter in the waterway. It should then be positioned in the pipeline with care being taken to see that it is installed in the correct way to suit the direction of flow.

When the valve has been correctly positioned a permanent support should be built up to the supporting feet on the valve.



## **SECTION 4**

### 4) MAINTENANCE

#### 4.1) Routine Maintenance

Lubrication points (Grease-gun points) are shown on Drg.21564A.

Routine maintenance is confined to an annual inspection/maintenance of the exterior of the valve for leakage.

The valve should also be operated from fully shut to fully open and reversed at least once every six months to remove any silt deposits.

#### 4.2) DISMANTLING PROCEDURE

To dismantle the valve, we recommend it be moved from the pipeline. (Lifting points are available).

- a) Close the upstream isolating valve.
- b) Disconnect the actuator from the electrical supply.

#### 4.3) DISMANTLE AS FOLLOWS (Ref. Drg. No. 21563A)

- a) Stand the valve in the vertical position (i.e. stood on its inlet flange.)
- b) Remove nuts (Ref. 22) together with caphead screws (Ref. 21), on both sides of valve. The cover tubes (Ref. 7) can now be removed.
- c) By removing button head screws (Ref. 17) the bellows (Ref. 5) will be disconnected.
- d) Access to seal (Ref. 10) is achieved by removing nuts (Ref. 12) which will enable seal retainer (Ref. 11) to be removed.
- e) Rotating the actuator handwheel in clockwise direction, the sleeve (Ref. 9) will traverse towards the shut position. After travelling approx. 420mm, the sleeve will disconnect from stems (Ref. 15).
- f) Fix slings to sleeves (Ref. 9) and lift vertically until the sleeve (Ref. 9) is clear of the body (Ref. 1).
- g) Access to guide strips (Ref. 24) and seal (Ref. 14) is now available.
- h) By removing socket setscrew (Ref. 20), locknut (Ref. 6) can be unscrewed from stem nut (Ref. 18). This will enable stem nut (Ref. 18) to be removed from the sleeve (Ref. 9).
- i) Re-position valve into horizontal position  
By removing nut (Ref. 2), stem (Ref. 15) can be removed from assembly.

4.4) DISMANTLING PROCEDURE CONTINUED (Ref. Drg. No. 21564A)

- a) To enable disconnection of gearbox (Ref. B) from master gearbox (Ref. A). Remove spring pin (Ref. C) and slide connector (Ref. D) down extension rod (Ref. E).
- b) Remove nuts (Ref. G) and lower gearbox (Ref. B) can be lifted clear of assembly.
- c) Removal of nuts (Ref. F) allows the actuator to be removed.

Finally check the valve for erosion of control surfaces and for wear of bearing surfaces.

Replace if found necessary.

Re-assemble valve in reverse order to that described above for dismantling, taking care to thoroughly clean all parts before assembly.

It is recommended that joints, packing and seals are not re-used but that correct replacements are always fitted.



## **SECTION 5**

### 5) TOOLS

No special tools are required for maintenance purposes.

Normal engineers tools plus spanners to suit the following sizes will be adequate:

- Metric spanners up to and including M36.



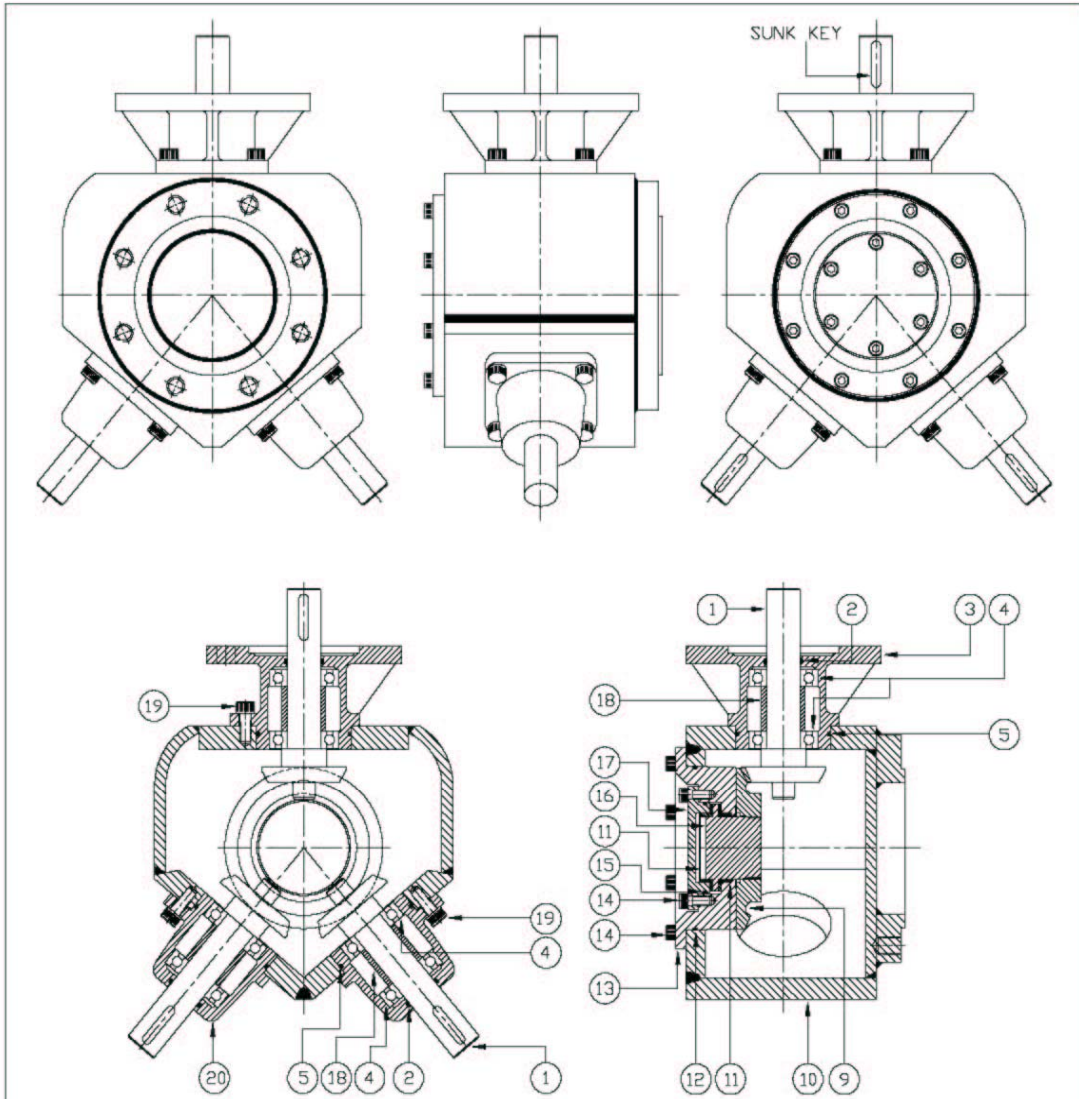
## **SECTION 6**

### 9) SPARES

The following spares are recommended:

- 'T' Seal (Ref. 10).
- Body Seal (Ref. 14).





REF	COMPONENT	MATERIAL	PART No
1	INPUT SHAFT	STAINLESS STEEL	ROTORC REF:-IB4C271
2	O-RING	SYNTHETIC RUBBER	ROTORC REF:-FL16
3	INPUT FLANGE	CAST IRON	ROTORC REF:-FL16
4	BEARING	STEEL	ROTORC REF:-IB4C271
5	O-RING	SYNTHETIC RUBBER	ROTORC REF:-FL16
9	BEVEL WHEEL	STEEL	ROTORC REF:-IB4D11
10	GEARBOX CASE	STAINLESS STEEL	20526A
11	BUSH	H.T.BRASS	20528A

REF	COMPONENT	MATERIAL	PART No
12	O-RING	SYNTHETIC RUBBER	DRG1395
13	BEVEL WHEEL SUPPORT	STAINLESS STEEL	20527A
14	CAP HEAD SCREW	STAINLESS STEEL	SCS0014
15	O-RING	SYNTHETIC RUBBER	DRG1394
16	DRIVE SLEEVE	STEEL	ROTORC REF:-IB4C29
17	GEARBOX END COVER	STAINLESS STEEL	20531A
18	DISTANCE PIECE	STEEL	ROTORC REF:-IB4C08
19	CAP HEAD SCREW	STAINLESS STEEL	SCS0026
20	INPUT HOUSING	CAST IRON	ROTORC REF:-IB4C08

LUBRICATION:- CENTURY OILS LACERTA CL2X GREASE

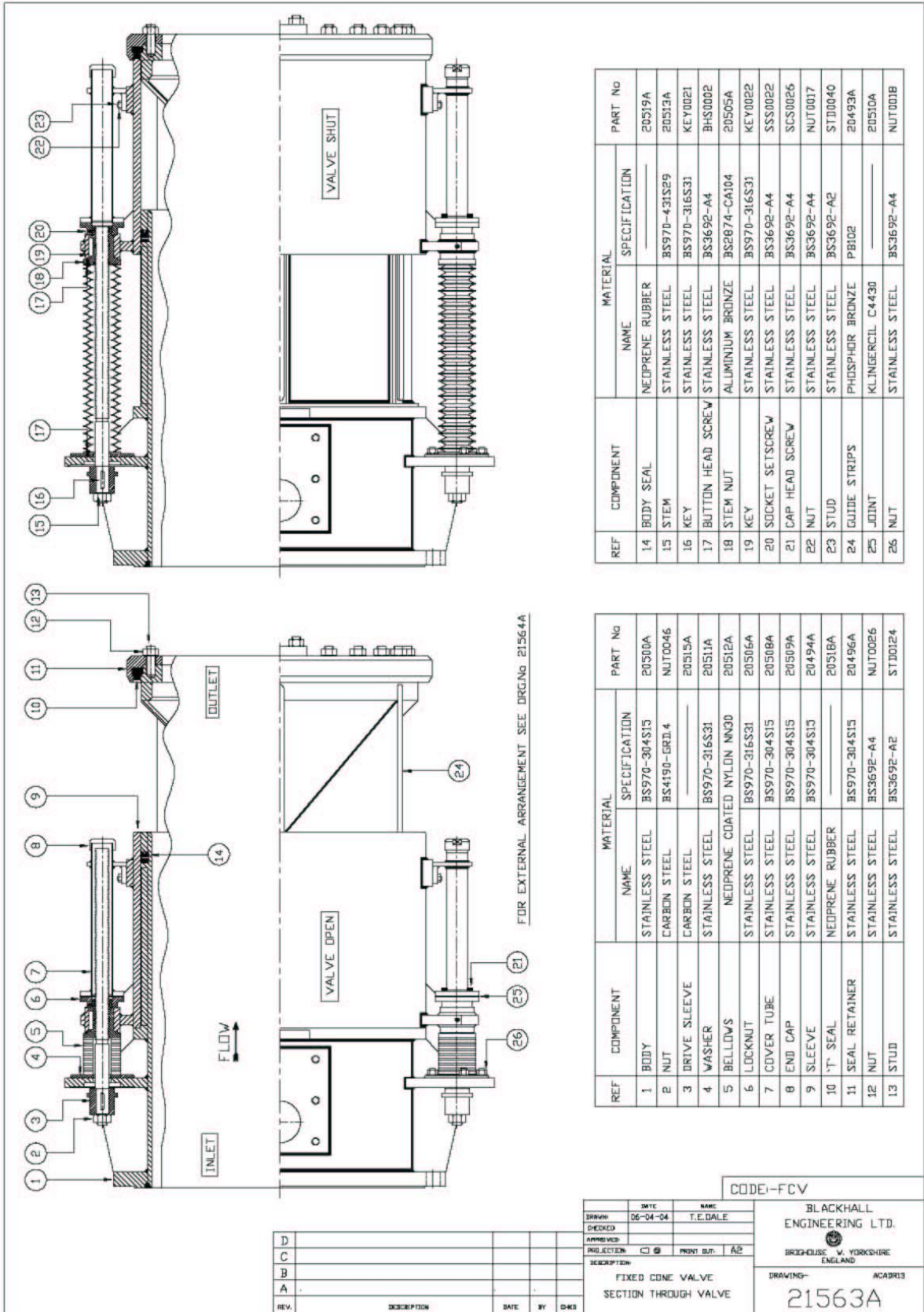
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F				
E				
D				
C				
B				
A				

	DATE	NAME
DRAWN	30-06-04	T.E.DALE
CHECKED	30-06-04	J.M.LEWTHWAITE
APPROVED	30-06-04	A.J.H.BLACKHALL
PROJECTION	1	PRINT OUT: A4
DESCRIPTION		
SLEEVE REGULATOR		
MASTER GEARBOX		

BLACKHALL  
ENGINEERING LTD.  
BRIGHOUSE W. YORKSHIRE  
ENGLAND

DRAWING- ACAD

21565A



REV.	DESCRIPTION	DATE	BY	CHKD
D				
C				
B				
A				

DATE	NAME
06-04-04	T.E.DALE
CHECKED	
APPROVED	
PROJECTION	PROJ. SUT. A2

CODE-FCV

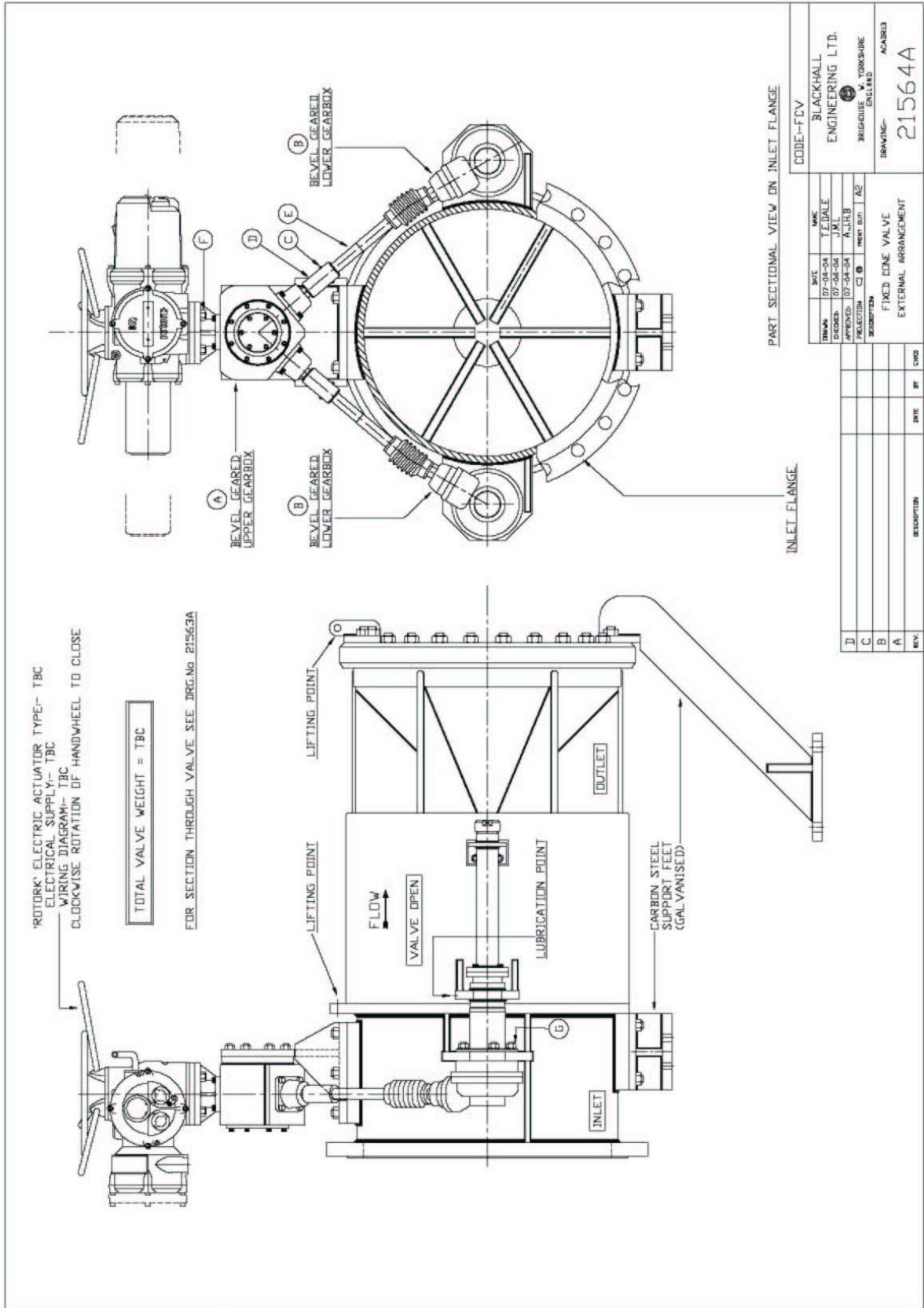
BLACKHALL  
ENGINEERING LTD.

BREG-KLUSE, V. YORKSHIRE  
ENGLAND

DRAWING- ACABR13  
**21563A**

REF	COMPONENT	MATERIAL		PART No
		NAME	SPECIFICATION	
14	BODY SEAL	NEOPRENE RUBBER		20519A
15	STEM	STAINLESS STEEL	BS970-43IS29	20513A
16	KEY	STAINLESS STEEL	BS970-316S31	KEY0021
17	BUTTON HEAD SCREW	STAINLESS STEEL	BS3692-A4	BHS0002
18	STEM NUT	ALUMINIUM BRONZE	BS2874-CA104	20505A
19	KEY	STAINLESS STEEL	BS970-316S31	KEY0022
20	SOCKET SETSCREW	STAINLESS STEEL	BS3692-A4	SSS0022
21	CAP HEAD SCREW	STAINLESS STEEL	BS3692-A4	SCS0026
22	NUT	STAINLESS STEEL	BS3692-A4	NUT0017
23	STUD	STAINLESS STEEL	BS3692-A2	STD0040
24	GUIDE STRIPS	PHOSPHOR BRONZE	PB102	20493A
25	JOINT	KLINGERCTL C4430		20510A
26	NUT	STAINLESS STEEL	BS3692-A4	NUT0018

REF	COMPONENT	MATERIAL		PART No
		NAME	SPECIFICATION	
1	BODY	STAINLESS STEEL	BS970-304S15	20500A
2	NUT	CARBON STEEL	BS4190-GRD.4	NUT0046
3	DRIVE SLEEVE	CARBON STEEL		20515A
4	WASHER	STAINLESS STEEL	BS970-316S31	20511A
5	BELLOWS	NEOPRENE COATED NYLON NN30		20512A
6	LOCKNUT	STAINLESS STEEL	BS970-316S31	20506A
7	COVER TUBE	STAINLESS STEEL	BS970-304S15	20508A
8	END CAP	STAINLESS STEEL	BS970-304S15	20509A
9	SLEEVE	STAINLESS STEEL	BS970-304S15	20494A
10	T SEAL	NEOPRENE RUBBER		20518A
11	SEAL RETAINER	STAINLESS STEEL	BS970-304S15	20496A
12	NUT	STAINLESS STEEL	BS3692-A4	NUT0026
13	STUD	STAINLESS STEEL	BS3692-A2	STD0124



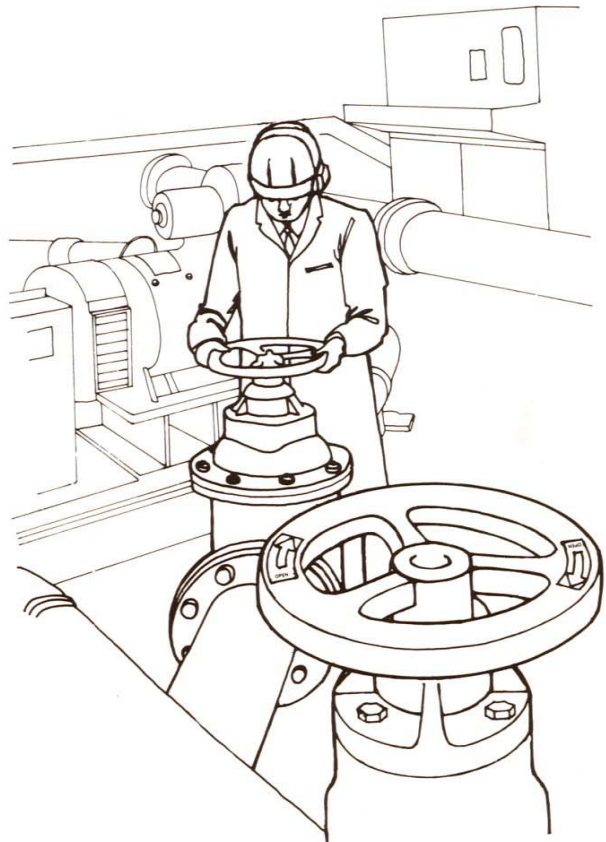
# Safety with valves

## The do's and don'ts of installation operation and maintenance

### Installation

**DO** remove all external and internal packaging together with any temporary protective material.

- carefully inspect the valve to ensure that no damage has occurred in transit or during subsequent handling.
- ensure that the valve is the correct type and size and that the identification markings show that the material and pressure/temperature rating is suitable for the service conditions.
- read the installation instructions carefully and work to them.
- ensure that the valve is installed so that it can be safely operated and maintained. Make sure that a firm footing is provided for the operator with adequate space around the valve to meet operating and maintenance requirements. Where fitted, indicators should be clearly visible from the normal operating position.
- ensure that adjoining pipework and connections are square, true and adequately supported to prevent the valve being subjected to stresses which could affect its performance.
- take care that, where direction of flow is indicated, valves are installed the correct way round in the pipeline.



### Operation

**DO** read the operating instructions and ensure that these are fully understood and carried out.

- check the handwheel or lever markings which show the direction of rotation to close the valve. If no such indication can be seen, positively establish that the valve closes in the conventional clockwise direction.

### DON'T

- Don't use wheel keys or wrenches to gain extra leverage when operating the valve.
- Don't delay in repairing a valve once it becomes obvious that something is wrong.

## Maintenance

### **DO** read the maintenance instructions.

- ensure that the working area or platform around the valve is stable, free from any obstruction and meets all requirements as a safe working area.
- know the valve duty. If the valve has been in service with hazardous material, take the necessary precautions during maintenance operations.
- check the external appearance of the valve, including paintwork or lagging, for signs of fault conditions. Special precautions may be needed - if in doubt, seek guidance from a supervisor.
- check that the valve is at ambient pressure and temperature before carrying out any adjustments or dismantling. Pressure gauges must read zero before commencement.  
Any drain valve or vent valve in the adjacent piping must be open and not discharging. The vent or drain must not discharge for at least:
  - 5 minutes for valves up to and including 150 mm (6") bore
  - 10 minutes for valves above 6" up to and including 300 mm (12") bore
  - 30 minutes for valves larger than 300 mm (12") boreThe valve should be operated through at least half its travel to ensure that there is no sound or other indication of anything in the valve.
- use correctly fitting tools. When special maintenance equipment is required to carry out a particular operation, make sure that this is used.
- isolate any local and remote operating device (other than direct mounted handwheel or operating lever) before starting maintenance work.  
Valve designs which incorporate stored energy devices (e.g. springs, weights and pressure accumulators must be treated with special care).
- purge or drain any pipes carrying gas or liquids which operate valves, such as relay operated control valves, before commencing work on the valve.
- ensure that the pipework on either side of the valve is fully and independently supported if it becomes necessary to remove the valve from its installed position. If a valve is removed, it may be necessary to blank off the pipe ends - find out. ensure that the valve is adequately and correctly slung during all handling operations.
- observe the appropriate safety procedures if asbestos lagging is to be removed from the valve. Asbestos gland packing should be damped down with water, to prevent release of dust, both before and during removal and should be handled and disposed of in accordance with the appropriate safety instructions.

- examine all parts for wear, tear, erosion, corrosion and cracking when dismantling the valve and replace as appropriate.
- use replacement parts which comply fully with the manufacturers recommendations and ensure that they are fitted in accordance with manufacturers instructions.
- If heat is applied to any component to aid removal, it must be replaced with a new part. This applies particularly to bolting.
- make sure that an inspection with the valve under pressure, before or during re-commissioning is carried out if maintenance work has involved the stripping down of pressure containing parts.
- check and follow-up packed glands periodically to prevent leakage.

### **DON'T**

- Don't overtighten glands - valve operation may be affected.
- Don't tighten glands unevenly - scoring of the valve spindle may result.
- Don't repack valve glands under pressure unless the operating/maintenance instructions specially cover this feature.

