# Guidance Notes on the
# Safe Operation of Valves

As the components of valves are subject to high water pressure of the pipeline, care should be taken in the operation of valves to prevent undue stress or damage to them.

Valves are mainly classified into two types: horizontal valves which are usually of size 600 mm and above and vertical valves which are usually of size equal and below 300 mm. For valves of size 400 mm and 450 mm, both the horizontal and vertical types are common. Vertical valves are of more concern from a safety point of view as their spindle may be blown out if the valve is improperly operated to an extent of breaking or loosening the holding down bolts and nuts, detaching the spindle from the wedge nut and damaging/lifting the seal housing of the valve.

A valve being open is less susceptible to blow-out incidents because when the gate is being raised, the risk of the valve spindle from being dislocated from the wedge nut is slim due to the non-rising spindle design. However, particular care is warranted in closing a valve equipped with a non-rising spindle.

*Designation of No-entry Zone during valve operations*

1. To safeguard against injury by a water jet or loosened parts of a damaged valve flying out suddenly from the valve chamber, a no entry zone of a minimum size covering the area within 0.6 m measured from the edges of the opening of the valve chamber shall be delineated by barriers/cones, as far as the site conditions permit. No one, except those performing the valve operation or carrying out essential official duties shall be allowed to enter the zone. Staff should be reminded to avoid having his body or head directly over the spindle of any defective vertical valve under pressure when carrying out work at or near the valve.

*Inspection before work*

2. Before any work is carrying out at a valve, a visual inspection to the valve

chamber and the valve should be conducted. If the seal housing of the valve is found broken or loosen, no further operation on the valve should be proceeded. The gang leader should arrange immediate putting back the valve chamber cover. If the valve is of **vertical type**, the gang leader should arrange closing the neighbouring valves of the pipeline (immediately or when the term contractor start repairing works) for de-pressuring the defective valve for carrying out immediate emergency repair of the valve **even though** no water is seen oozing out from the valve chamber. If further inspection is necessary, the neighbouring valves of the pipeline should be closed to de-pressurize the defective valve. The gang leader should report the incident to the inspectorate officer for planned repair/replacement of the defective valve.

*Warnings for defective valves*

3. A warning device should be placed inside the valve chamber in a conspicuous manner to warn others not to operate or touch the defective valve. The valve chamber cover shall be marked with a "blue cross" and the frame of the cover shall also be painted in blue to give warning to all staff involved. (Upon replacement of the valve, the blue colour is to be removed.)

*Avoiding damage to valves during valve closure*

4. In closing a valve, a steady amount of torque should be applied throughout the process. Upon lowering the gate completely onto the seating ring, the valve spindle shall be turned in the opposite (reversed) direction for one to two turns, unless so doing will cause the valves letting by. This will help avoid the seal housing from being subjected to excessive stress thereby damaging various parts of the valve.

*Avoiding excessive torque in valve operations*

5. It is of paramount importance that no excessive torque is applied in operating the valve in order to avoid excessive stress exerted to the valve gate, seal housing, gears, spindle and other components of the valve. If the valve operation requires the addition of extension bar, it must be fully inserted into the turning rod on each end and its length should not be longer than 1m. Besides, no excessive operators are allowed to operate the valve at any one time to avoid the applied torque to exceed the capacity of the valve i.e. the minimum strength test torque (MSTT) causing damage to the valve component. The estimated operating torque at the valve spindle in N-m could be demonstrated by the following example for a DN400 valve designed to BS5163-1986 with a MSTT at 2,400 N-m and WSD

specification with reducing gearing of 3:1:

| Nos. of Operator<br><br>M | Operating Radius of Bar (m)<br>L | Gearing Ratio<br><br>G | Input effort per person (kgf)<br>F | Operating Torque (N-m)<br><br>MxLxGxFx9.8 |
|---|---|---|---|---|
| 2 | 1 | 3 | 40* | 2x1x3x40x9.8 = 2,352 N-m |

*[*Note: The achievable manual pushing/pulling force for a person is within the range of **35~40kgf** depending on the body weight of the operator while the safe manual effort exerted by a person is **25kgf**]*

6. When operating a very stiff valve, the conditions of the packed grand, gearing and also the shafting in particular the bearings should be checked. It is necessary to free or lubricate any stuck gland, rusted bearing/bush/joint in gearing and shafting with penetrating oil (e.g. WD40) and then to repeat opening/closing several times until the stem action is smooth.

7. Valve key with shear pin coupling should be used for closing valve of size ranging from 350mm to 550mm to protect the valve from being damaged by excessive torque.

8. The approximate number of turns required for fully opening/closing an ungeared gate valve can be assessed by using the empirical formula stated in the "Guidelines for Operation of Gate Valves In Planned Operations" issued by Development (1) Division in 2004 (Appendix A). The Guidelines stipulate good practice for operation of gate valves in planned operations, which should also be followed, whenever practicable, under emergency conditions.

*What to do when a valve is possibly damaged during operation*

9. In the event that the resistance of the turning rod is suddenly drastically reduced during valve closure, the valve spindle has probably somehow been detached from the wedge nut. The valve key should then be turned in the opposite (reversed) direction for a few turns to re-screw the valve spindle back into the gate nut. If successful, the gang leader should stop operating the valve and report the incident for planned repair/replacement of the defective valve as necessary. If unsuccessful and the valve is of **vertical type**, the gang leader should arrange for closing the neighbouring valves of the pipeline to

de-pressurise the defective valve for carrying out immediate emergency repair of the valve. The valve cover should be marked with a blue cross, which should subsequently be washed upon valve replacement.

*Precautions for replacing defective valves*

10. In case of doubt about the condition of the valve to be replaced, the gang leader should always arrange for closing the neighbouring valves of the pipeline for de-pressurising the defective valve before breaking the concrete encasing the valve. When the upper part of the valve is exposed and found to be intact, the closed neighbouring valves should be opened to resume water supply temporarily to the customers and the concrete breaking works may then continue. Otherwise, the valve must first be replaced and water supply suspension resulting from it has to continue until the completion of the valve replacement work.

*Routine valve exercising*

11. As a precautionary measure, the person responsible for valve exercising shall make reference to the previous valve exercising report before carrying out any valve exercising operation. No valve exercising should be carried out unless it is confirmed that the valve defect as recorded in the previous valve exercising has been rectified. Moreover, when carrying out planned valve operation, opportunity should be taken to inspect the conditions of the valve. Any defects identified shall be reported to the inspectorate officer for prompt repair.

*Labels for odd valves*

12. The majority of valves are closed in clockwise direction. However, there are exceptions in particular those installed a long time ago. For these odd valves, the direction of closing/opening the valves should be clearly indicated at a conspicuous position at the valves.

**Appendix A**

# Guidelines for Operation of Gate Valves

# In Planned Operations

The following guidelines are good practices for the operation of gate valves in planned operations. They should also be followed, whenever practicable, under emergency condition.

**(1) Operation of Ungeared Gate Valves**

In general, the approximate number of revolutions required for fully opening or fully closing an ungeared gate valve can be assessed by the following formula:

No of revolution = 1 + 2 x (valve size in inches)]

| Size of Valve (mm) | Size of Valve (Inch) | No. of Revolutions required |
|---|---|---|
| DN150 | 6 | 13 |
| DN200 | 8 | 17 |
| DN250 | 10 | 21 |
| DN300 | 12 | 25 |
| DN400 | 16 | 33 |
| DN450 | 18 | 37 |
| DN600 | 24 | 49 |
| DN800 | 32 | 65 |
| DN1000 | 40 | 81 |
| DN1200 | 48 | 97 |

**(2) Operation of Geared Gate Valves**

The number of revolutions required for fully opening or fully closing a geared gate valve depends on its gear ratio. For example, the number of revolutions required for fully opening or closing a DN800 mm geared gate valve can be as high as 1100 due to gearing effect. In view of this, the regional staff should record the number of

revolutions required for fully opening or fully closing the geared gate valves for future reference.

**(3) Use of Valve Actuator for Valve Operation**

If a valve actuator is used for valve operation, set the torque value ⩽the maximum torque and follow the guidelines on the use of generator and valve actuator.

**(4) Closing a Gate Valve**

To close a gate valve (assuming that the valve is not fully opened),

(i) use a listening stick if practicable or use the fire hydrant if there is one nearby to confirm that water is flowing through the valve to be closed;

(ii) exert a steady torque for 5 or more revolutions in the closing direction;

(iii) reverse the turning direction until the valve is fully opened;

(iv) apply the torque in the closing direction until the gate is about half way down i.e. up to half the no. of revolutions specified in paragraph (1) above for ungeared gate valves, paragraph (2) above for geared gate valves or the number of revolutions recorded by the Regional staff as appropriate;

(v) when closing the remaining half of the valve, reverse the turning direction for 2 to 4 revolutions after closing every 5 or 10 revolutions; the purpose is to flush away the sediment at the invert of the valve;

(vi) be cautious when the valve is about to be fully closed;

(vii) further closing of the valve should be done manually; the operator should feel the resisting torque in order to apply the final gentle touch to fully close the valve; and

(viii) use a listening stick if practicable to confirm that the valve is fully closed.

**(5) Opening a Gate Valve**

To open a gate valve,

(i) use a listening stick if practicable to confirm the valve status;

(ii) exert a steady torque for 5 or 10 revolutions in the opening direction;

(iii) reverse the turning direction for 2 to 3 revolutions;

(iv) repeat steps (ii) and (iii) above until the valve is fully opened;

(v) be cautious when the valve is about to be fully opened, especially when a valve actuator is used for valve operation.

(vi) further opening of the valve should be done manually; the operator should feel the resisting torque in order to apply the final gentle touch to fully open the valve;

(vii) it is a good practice to give one or two turns in the closing direction from the fully opened position at the end of the valve operation; and

(viii) use a listening stick if practicable to confirm that the valve is opened.