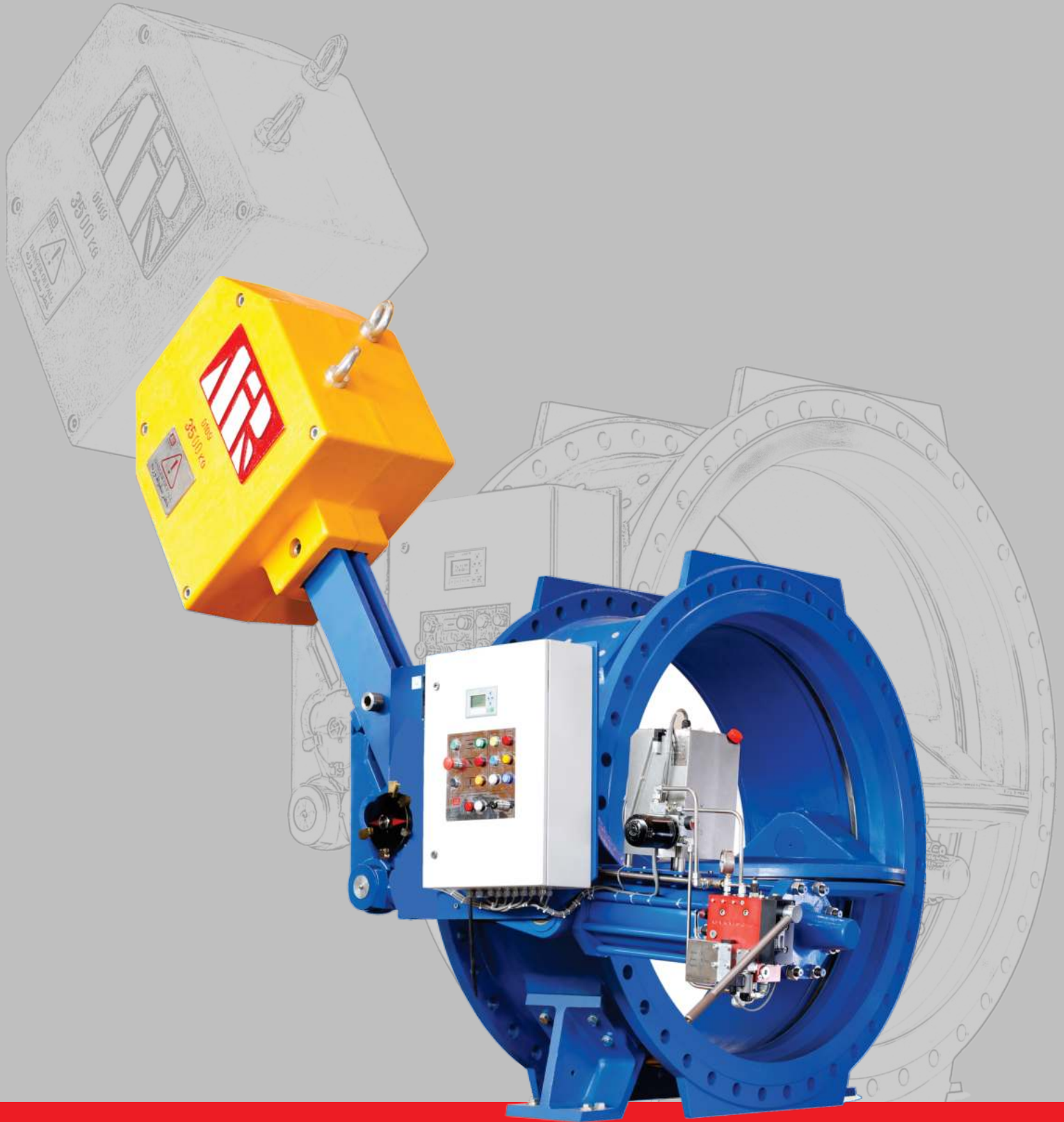




®

**NIRAB CO.**

Manufacturer of Industrial Valves  
and Relevant Equipment



**Emergency Butterfly Valve with Weight Loaded Hydraulic Actuator**

**BEF**



Normally open (fail to close)  
 emergency Excess shut-off  
 valve DN1800, PN25  
 Water supply project in Algeria,  
 Contractor: Efacec  
 (Portuguese corporation)



Normally open (fail to close)  
 emergency Excess shut-off  
 valve DN350, PN16  
 Water supply project in ZAHAK  
 (Water & WasteWater of Systan  
 & Balouchestan, IRAN),



Normally open (fail to close)  
 emergency Excess shut-off  
 valve & pump control valve  
 DN1800, PN25  
 DOUSTI Dam, IRAN,  
 KHORASAN



Normally close (fail to open)  
 emergency Quick Discharge  
 valve DN1800, PN10  
 DAMAVAND power plant, IRAN



Normally open (fail to close)  
 emergency Excess shut off  
 valve DN1800, PN25  
 IDOGHMOUSH Dam, IRAN.

### Valve Specification:

Mirab Weight-loaded Hydraulic Actuators are used wherever valves are installed at critical points of pipe networks which are supposed to close or open securely and reliably even in case of failure of external operating energy.

They have to meet the most stringent requirements in terms of functional safety.

Weight-loaded actuators can be used in emergency valves for closing or opening the valve in emergency conditions independent of electrical power.

The weight-loaded actuator provides the energy required for a single closing or opening operation of the valve.

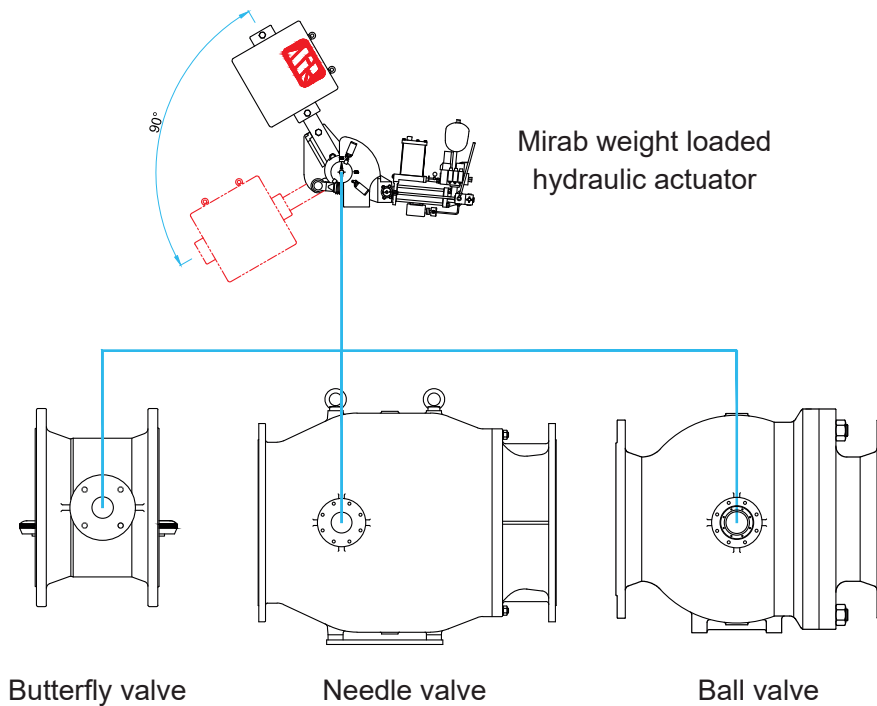
Mirab co. Manufactures different types of weight-loaded hydraulic actuators customized for desired applications.

This actuator is designed to be mounted on part-turn valves such as Butterfly, Needle, Ball, or Plug valves with a variable range of size and pressure rating which enables the valve for either throttling or on/off purposes.

Since this valve is an emergency type, should be ready to operate at any time and all components must be made of high quality. So a smart control system checks all parts and provides the report of failed mechanisms or components.

If needed this report can be shown in the control room (DCS) or monitored by in-charge people.

This valve can be operated by signals from the control room..



### Description of Valve Operation

The shaft of the valve is connected to the hydraulic actuator. By hand pump or electro-pump, pressure is produced on the piston side of the cylinder which raises the weight-loaded lever to open or close the main valve. The weight and length of the lever are calculated to be able to operate the valve.

Falling weight can be done in the following circumstances:

- By energizing or de-energizing the solenoid valve in a hydraulic circuit (from remote or local signal)
- By hydraulic or electrical command signal from a fluid velocity sensor (or other sensors).
- Using manual hydraulic valve on control block.

To prevent creating a water Hammer and impacting to Hydraulic system, the weight falling at the beginning is rapid and at the near end of its travel will be slow. Each falling step time of weight movement is adjustable.

## Applications

### **Applications of Mirab weight Hydraulic actuated valves can be classified as follows:**

Please note that the below-mentioned are the most popular applications and this valve can be used for other applications according to the designer's opinion..

#### **1- Isolating, Control pump & Non-return valve**

Combined function in one valve starting pumps in a controlled manner and non-return function the actuator helps towards a smooth start of the pump. Closing slams of the disc are prevented using 2 phase closing characteristics. Also, the valve can be used as an emergency shut-off valve for prevention of water return to the pump station when a pipe burst has occurred.

#### **2- Over flow control valve**

In this case of application, this valve can be installed at the inlet of the reservoir and can close the inlet water pipe to control the water level, also it can prevent water from returning in case of an inlet pipe burst.

#### **3- Turbine inlet safety valve**

Safety valve directly installed at the turbine inlet. It is used as a safety valve for quick closing in case of sudden load rejection, avoiding inadmissibly high speed (runaway speed) of the turbine and water hammer phenomena that might be created there. In a lot of plants, weight-loaded hydraulic actuators are also used in the bypass-acting quick-opening device to open synchronously to the closing of the inlet valve in a neutral manner as far as the flow rate is concerned.

#### **4- Burst shut-off valve**

In water piping systems, pipe bursts can happen due to natural disasters or other reasons like fire, explosion, etc. An emergency hydraulic valve can be used in the system to close water flow and to protect buildings, traffic routes, pumping stations, etc.

#### **5- Emergency drain valve (Quick opening valve)**

Sometimes water drainage is necessary for the protection of systems for instance in a power plant for any reason, the cooling tower should be drained (to avoid freezing in winter time) in this situation emergency valve will open and allow the drain of the water.

For applications items 1, 2, 3 & 4 the valve is normally open (when the Weight is up valve is in the open situation). In application item 5 (emergency opening) the valve is normally closed (when the Weight is up, the valve is closed)

**For more data, contact the technical office of Mirab Co.**



**Technical specification**

**Hydraulic system:**

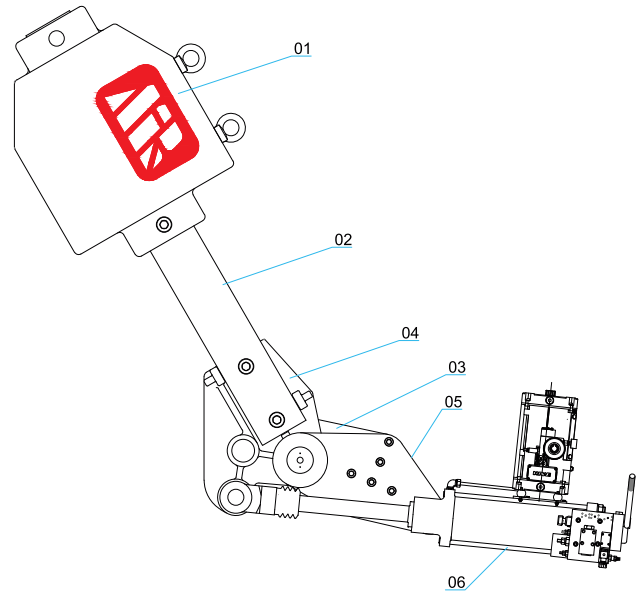
The hydraulic system in the Mirab weight-loaded hydraulic actuated valve is considered to raise the weight and also to control the falling speed of weight and prevent water hammer. The hydraulic system consists of :

- Hydraulic actuator
- Power pack (consists of motor, pump, oil tank, and protection elements)
- Hydraulic Control block
- Pipe and fittings

Hydraulic standard parts are manufactured by well-known European companies. All hydraulic systems also will be tested after installation on valves.

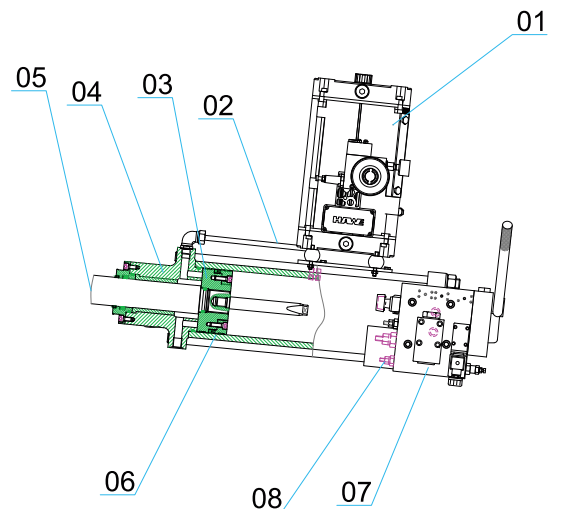
**Part list of Weight loaded hydraulic actuator**

Part No.	Part Name
01	weight
02	Weight arm
03	Main plate
04	Joint plate
05	External plate
06	actuator



**Hydraulic system**

Part No.	Part Name
01	Power pack & Oil tank
02	Pipe
03	Piston
04	Joint
05	Shaft
06	Cylinder
07	Block
08	3-way hand valve
09	Hand pump



### Control System

The control system of weight-loaded hydraulic valves is supposed to receive, analyze, and send control signals to run the main valve. These systems allow the operator to control the valve as following options:

- Sending the control signal locally (from the control panel, installed near the valve).
- Sending the control signal remotely (from the control room).
- Generating the control signal by electrical sensors such as velocity & flow sensors, water level detecting devices & earthquake detecting sensors.
- Generating the hydraulic and electric control signal by paddle-type tripping Device.

Note:

Some of these control devices can be produced by Mirab Co.

The electrical control system for valves equipped by weight loaded-hydraulic actuator consists of:

- Local control panel including PLC, contactors, timers & connection terminals.
- Limit switches & pressure switches.
- Electrical motors for hydraulic pump.
- Connection cables.

The generating signal system to fall the weight (opening or closing the valve) for the emergency position is available in this table:

Electrical situation	Description	Command signal source
Electrical power is available (Near to the valve)	The valve can be operated by the electrical control system.	- Cut off the main electrical power. - Speed or flow meter or earthquake sensor - Flow switch fig.1 page 9
Electrical power is not available (Near to the valve)	The valve cannot be operated by the electrical control system. weight will fall when the hydraulic system gets a signal from the mechanical flow speed sensor.	- Mechanical paddle fig.2 page 9
	The valve cannot be operated by the electrical control system. weight will fall when the hydraulic system gets a signal from the pressure differential sensor (venture).	- Venture pipe fig.3 page 10

### Technical Specification

Default Technical data for weight-loaded with hydraulic actuated valves are listed below:

Standards	Butterfly Valve	DIN EN 593 (DIN 3354)
	Face to face	DIN EN 558-1 series 14 / ISO 5752-14 (DIN 3202-F4)
	Flanges	DIN EN 1092-2 (DIN 2501)
Material	Body , Disc , Clamping ring	EN-GJS-400-15 DIN EN 1563 = GGG 40 (DIN 1693)
	Solid-body seat	1.4301
	Profile sealing ring	NBR or EPDM
	Shaft , driven & free end	1.4021
	O-ring	NBR with Certificate KTW
	Bearing bushes	Al- Bz DIN 1714
	Screws	A2 DIN 931
Disc Configuration	Eccentric or double eccentric	
Coating	The body and disc are coated with blue electrostatic powder epoxy coating	
Flange Drilling	DIN EN 1092-2 (DIN 2501)	

**Weight loaded - Hydraulic actuator**

<b>Material</b>	Actuator bracket	Steel
	Weight lever	Steel
	Weight	Cast iron
	Piston rod	Steel with hard-chrome plating
	Hydraulic cylinder	Steel with inner roller burnishing
	Cylinder Front & end	Ductile cast iron
	Sealing	High-quality NBR packing.
	Pipe fittings	Zinc-coated steel
	Bearing	AL-BZ
<b>Operation</b>	Valve opening	Using electric pump & manual pump
	Valve closing	Using :Solenoid valve , Remote command from flow sensor or central control room, or by manual hand valve
	Valve blocking	Using a Solenoid valve or Hand valve
	Weight raising time	Min. opening time is about 60 Sec. and would be increased using the flow control.
	2-step adjustable weight falling	1st step (%70) is adjustable with flow control on the main block.
		2nd step(%30) is adjustable with flow control on the main block.
Total closing time	~20 Sec. and more	
<b>Electrical system</b>	Solenoid valve	Zero leakage (Seated cone type) ED %100
	Voltage of Solenoid	24 VDC (other on request).
	Limit switches	3 high corrosion resistant limit switches for open, close & %90 open (signal for compensation of unexpected internal oil leakage). or proximity switch.
	Control panel	The Control Panel is installed on the valve or wall and all electric devices connected to it operate using the PLC.
<b>Protection Class IEC 529</b>	Control Panel	IP 54
	Junction Box	IP 54 ( if necessary )
	Limit switches	IP 67
	power pack	IP 54
	Solenoid valve	IP 65
<b>Power pack unit</b>	Type:	Compact power pack unit
	Electrical motor	400 VAC–3 phases 50 Hz or 230V-1 phase 50Hz
	Hydraulic pump	Gear type
<b>Safety guards</b>	Effective protective guards have to be installed around moving parts, by the customer.	
<b>Coating</b>	The body and disc are coated with blue electrostatic powder epoxy coating (250μ).	



Schematic sketch for installation of Emergency valve :

Fig1) installation with flow speed switch

This equipment applicable for water speed  $0.3 \frac{m}{s} \leq V < 1 \frac{m}{s}$

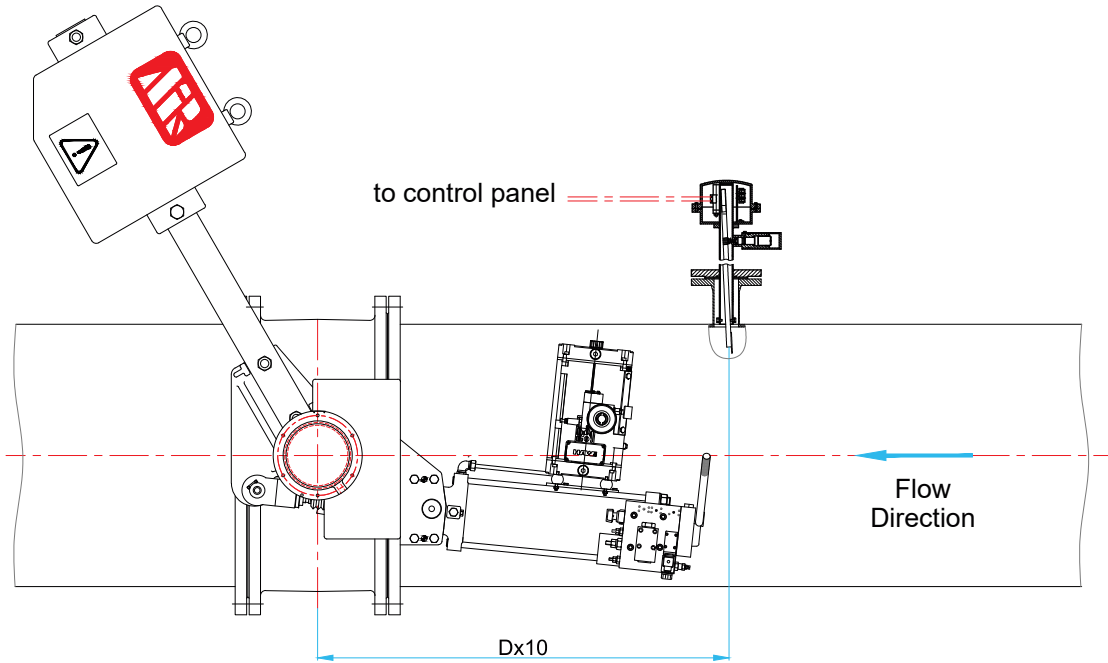
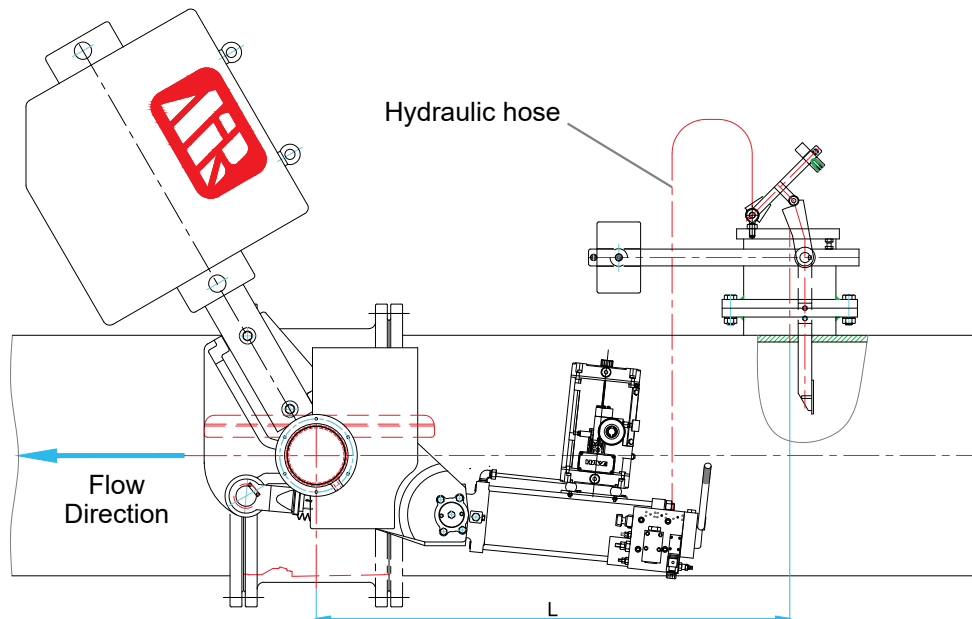


Fig2) installation with mechanical speed sensor (paddle-type tripping Device)

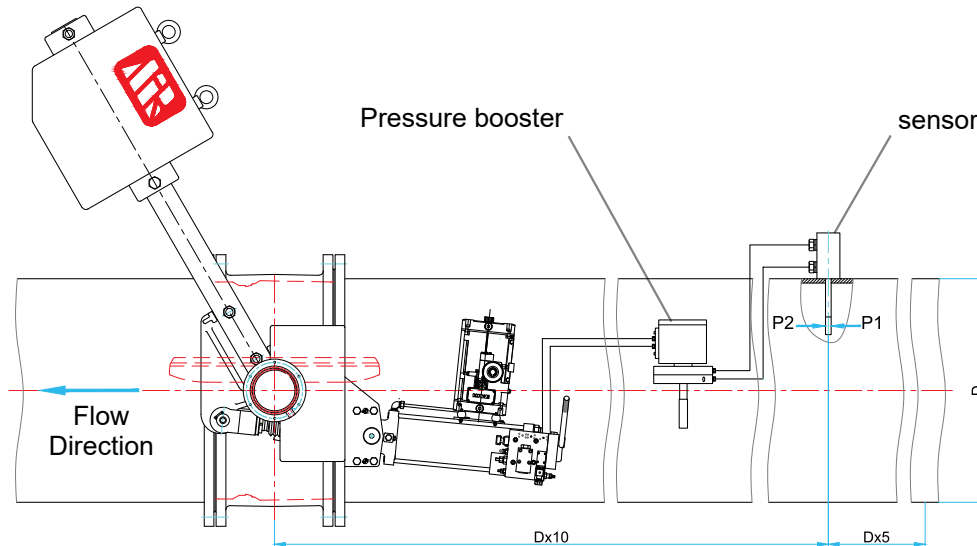
This equipment is applicable for water speed more than  $1 \frac{m}{s}$  (electricity power not required)



DN	L
300	1300
400	1300
500	1350
600	1400
700	1450
800	1450
900	1500
1000	1550
1200	1550
1400	1600
1600	1700
1800	1800
2000	2000
2200	2200

**Fig3) with Differential pressure sensor**

This equipment is applicable for high-speed water without depending on electricity power.



**Important notes on valve operation:**

- 1- Butterfly valves are designed for on/ off application (fully open or fully closed), so they should not be used for flow rate regulation, it will cause cavitation, and the valve will be damaged.
- 2- For better sealing ability and easy maintenance and adjustment works, it is recommended to select and install the valve in the pipeline in a way that the pressurized side of the flow, is located at the disc shaft side in the closed position.
- 3- Opening the valve under unbalanced pressure conditions –when both sides of the valve don't have the same pressure will impose extra stress on the shafts and other parts, so it is strongly recommended to balance pressure on both sides of the disc before opening the valve.
- 4- If the valve is kept in the warehouse for a long time before installation, it is recommended to open the disk 5 degrees to prevent any possible seal damage. The valve should be covered properly to prevent direct sunlight or dust.
- 5- Avoid any impact to the valve especially the hydraulic system and electrical control panel and take care while transportation and installation process.
- 6- It is necessary to clean the pipeline carefully before installation and operation of the valve, any external particles like metals, welding electrodes, wooden parts, eta, can damage the sealing parts.
- 7- Be sure of the compatibility of fluid physical and chemical properties and valve parts especially sealing rubber.
- 8- The valve installation site should be designed in such a way that the valve installation and maintenance process can be performed easily.
- 9- Service and maintenance of the valve and hydraulic system should be carried out regularly based on related instructions. Installation, operation, and maintenance instruction manual will be sent to the customer upon valve delivery.

## Accessories:

### 1- Fault reporting system:

In some cases, there is no control room near the emergency valve, so operator staff are not able to be aware of possible faults.

This system enables to sending of SMS (via Global System for Mobile (GSM)) containing the below items to the person in charge person:

- Valve failure and type of error
- Valve opening or closing due to emergency, etc.
- The valve is ready to be operated, after fixing the fault.
- The valve is ready to be operated, in the desired period (e.g., weekly)
- Operator staff can send open/ close commands from their cellphone after giving the password, and immediately receive a confirmation message. Meanwhile, it is recommended to use reliable systems for safety considerations.

### 1-Bypass electrical valve:

For balancing fluid pressure on both sides of the butterfly valve disc, before the opening process it is recommended to use a bypass line with an electrical valve that is connected to the main emergency valve control system. The signal for opening the valve will be released after the pressure balance of both sides.

The control panel of this valve, when receives the opening signal, by default sends a command signal for opening the bypass valve and waits for the balancing pressure signal.

### 2-Differential pressure switch

To ensure equal pressure on both sides of the butterfly valve before opening it, the installation of a differential pressure switch is recommended. After opening the bypass valve, it will send an equal pressure confirmation signal to the control system of the main valve. If differential pressure reaches 0-1 bar, opening the valve will be safe.



### 3-Econo plug for hydraulic solenoids

In case of using fail-safe control systems, the coil of hydraulic solenoid valve will be energized for a long time; it is an electrical component and its lifetime will be over finally, when the solenoid coil fails, it may cause a fault in the system and sometimes it is a serious trouble for systems.

Mirab Co. find a solution to reduce the probability of this fail and postpone this trouble as late as possible. Econo plugs are used in hydraulic solenoid electrical system.



#### Plug Function:

When the solenoid valve starts to open, high force is required to overcome the spring force and move the moving parts but lower force is needed to maintain this position. In the beginning, as soon as electricity power connected, the supplied voltage is transferred to the solenoid coil by this plug very quickly.

#### Advantages:

- Reducing continual voltage and consuming electrical power of the coil.
- Reducing produced heat in the solenoid coil.
- Increase life time of the coil.

#### Plug Types:

Different models of sockets specifically designed to extend the service life of hydraulic solenoids, along with their technical specifications and environmental operating conditions, are presented in the table below:

Row	Voltage	Voltage Range	Technical Code	ATM. Temp.
1	DC	15 to 55 Volt	15-55VDC - T75	-25 to +75
2	DC	100 to 250 Volt	100-250VDC - T75	-25 to +75
3	AC	98 to 130 Volt	98-130VAC - T40	0 to +40
4	AC	200 to 250 Volt	200-250VAC - T40	0 to +40

**Required information for ordering a socket:** type and voltage of the solenoid valve coil and working environment temperature

#### 4-Accumulator

In weight weight-loaded hydraulic actuated system due to unavoidable little oil leakage over time, weight will move down a little after starting the operation and it will cause shaft and disk rotation 5-10 degrees (it is beneficial for preventing shaft locking if preventive maintenance had not been performed on the valve) In some cases when electrical power is not available or little disk and weight movement is not allowable according to valve function, a hydraulic accumulator can be installed on the actuator for decrease the effect of hydraulic leakage over time.



#### 5-Accumulator testing and charging

For testing and charging of accumulators during operation and maintenance activities, a charging kit is available.

Accumulators are used in hydraulic systems to provide pressure in required situation, so these devices should be pre-charged by Nitrogen gas.

Mirab co. Provides the kit of accumulator test & charge. The customers can test, regulate & charge the accumulator gas by these devices. The pressure of charged gas is mentioned in operation and maintenance procedure of weight loaded-hydraulic actuated valve.



#### Needed information for ordering charging kit:

Manufacturer name and code of accumulator - accumulator volume – port size of accumulator and gas tank.

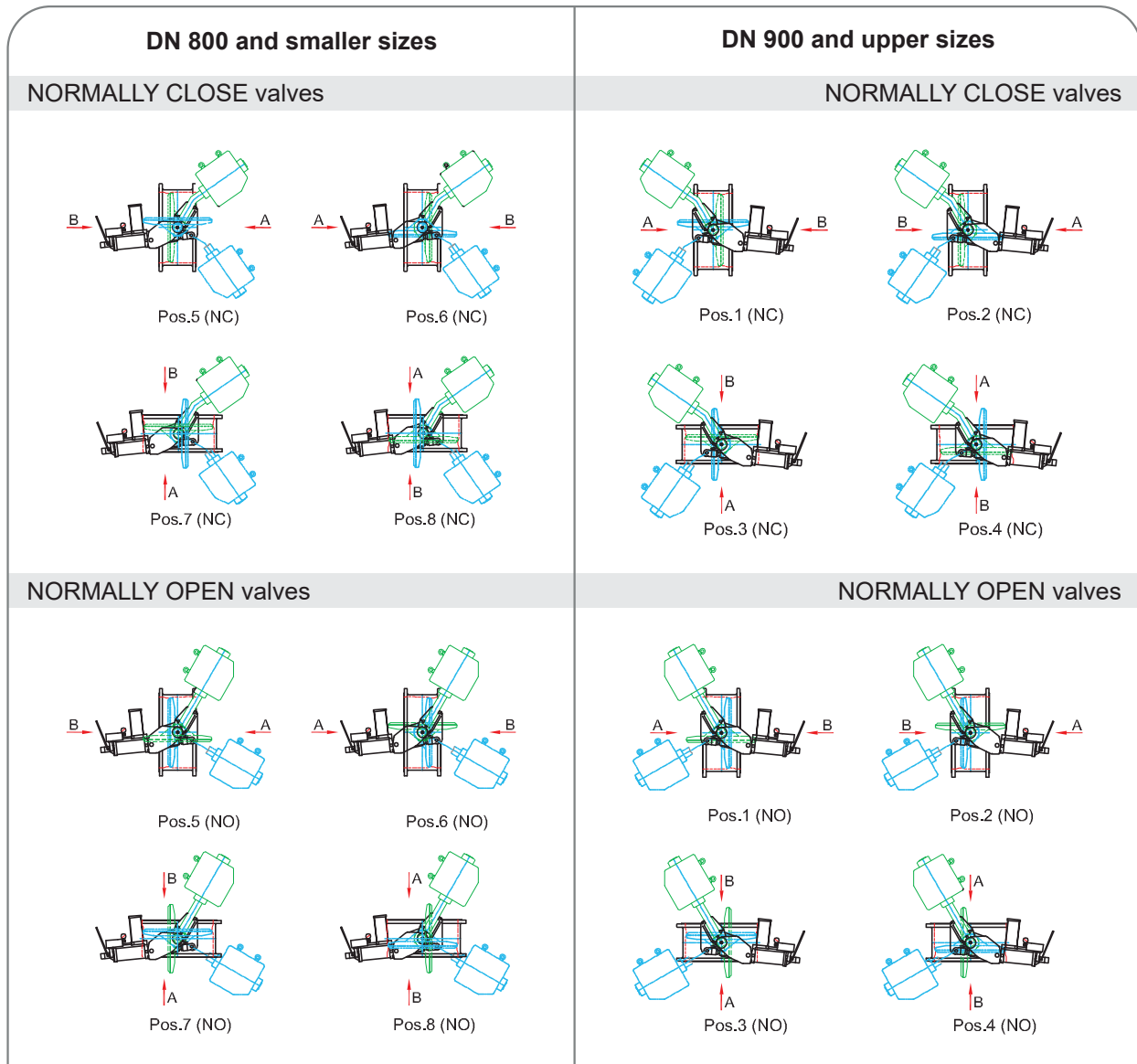


Hydraulic actuator installation positions

For the selection of an actuator installation position consider the following notes:

- Valve size (for DN 800 and smaller use the left column and for DN900 and upper sizes use the right column)
- Normal valve working situation during operation (it is normal to close or normal open type)
- The angle of installation (horizontal or vertical situation)
- Weight direction according to pipeline and valve high-pressure side (A)

**Important note:** Butterfly valve can be installed independent of pressure side or flow direction, but **Mirab Co. Valves** strongly recommends that the valve high-pressure side (A) and disk shaft side be the same, It ensures better sealing and allows adjusting profile ring during operation time.



■ Normal operation

□ Emergency conditions

**A** : high-pressure side( Recommended direction for better sealing, especially for sizes DN1000 and above and pressures above 16bar)



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