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WALL MOUNTING PENSTOCKS

TRADITIONAL WALL MOUNTING PENSTOCKS SMALL, MEDIUM, LARGE DESIGN

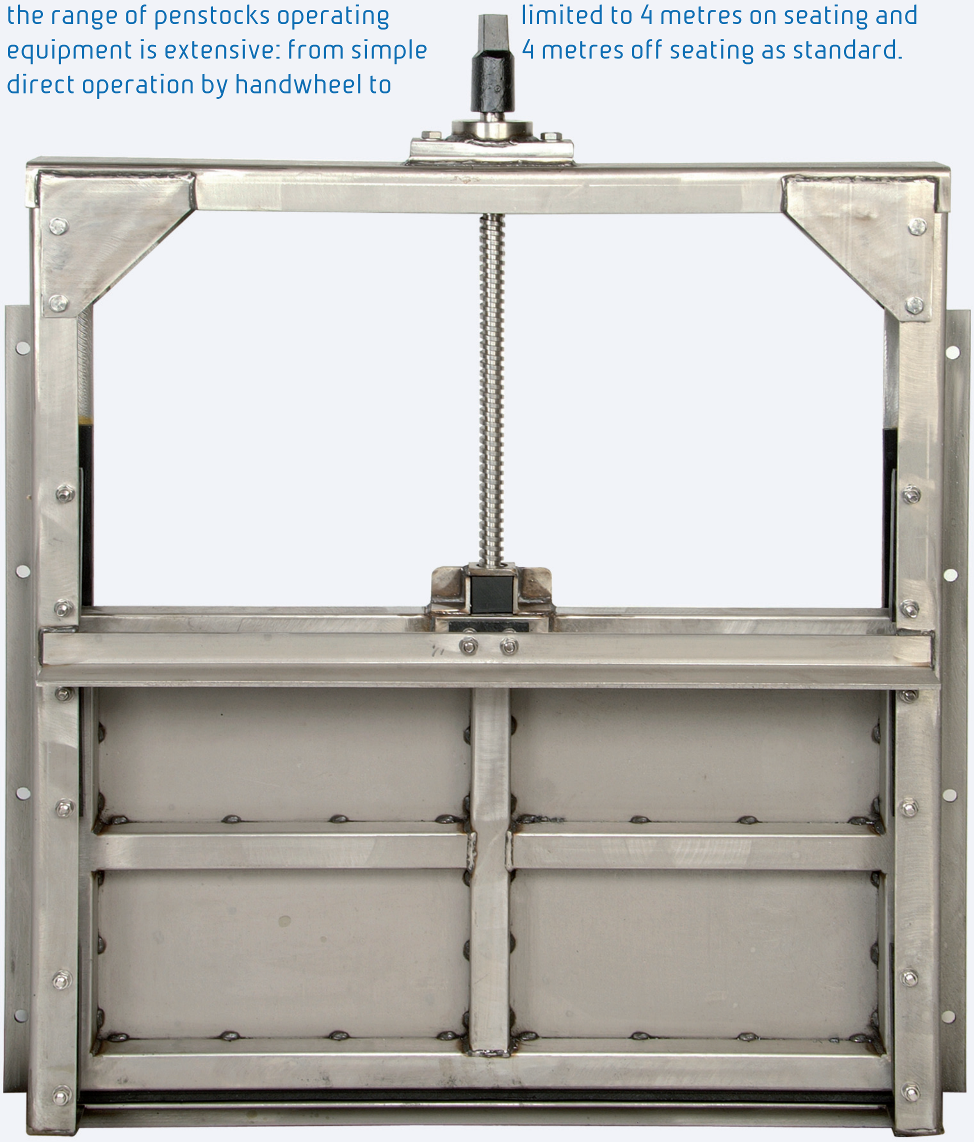
The primary application of Penstocks is the flow control and isolation of fluids associated with water, waste water, sewage treatment plant, power generation, irrigation schemes and process plant.

The modern penstock is designed to cater for a wide variety of duties from low seating to high off-seating heads in sizes from 150mm up to 2000mm square.

Selection of the correct penstock to suit the duty is important to satisfy the design criteria and provide the most cost effective solution. Operation of the penstock is governed generally by factors outside the control of the penstock manufacturer. However, the range of penstocks operating equipment is extensive: from simple direct operation by handwheel to complex control systems for electrical, pneumatic or hydraulic actuation. The range of penstocks with associated operating equipment will cater for the most demanding specification and application.

Wall mounting Penstocks are fixed to vertical end walls of channels, chambers or similar structures by means of foundation bolts utilising a sand/cement non shrink grout to effect a seal between the wall and penstock frame.

The frame can be manufactured from either galvanized mild steel, painted mild steel or grade 304/316 stainless steel, complete with an optional gate in the same material. The head is limited to 4 metres on seating and 4 metres off seating as standard.



Wall Mounting Penstocks
Small, Medium and Large Range

Operating Duty

Application:	Flow control and isolation
Type of Mounting:	Wall with rebate invert
Type of Media:	Water and Sewage
Operating Head:	4 Metres on seating 4 Metres off seating

Options

Mounting:	Side and invert wall mounted
Stem Types:	Rising and non-rising
Size Range:	Any size from 150mm to 2000mm in square or rectangular format

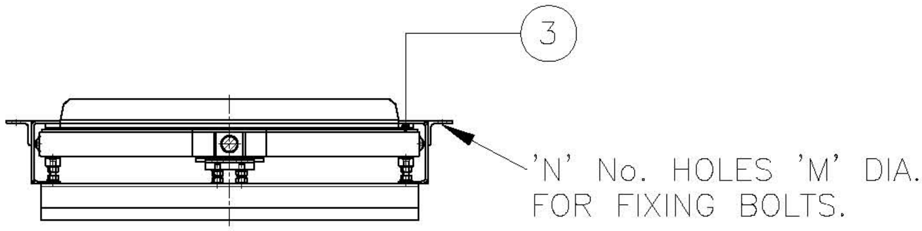
Applicable Standards

BS 7775: 1995, Specification for general purpose penstocks

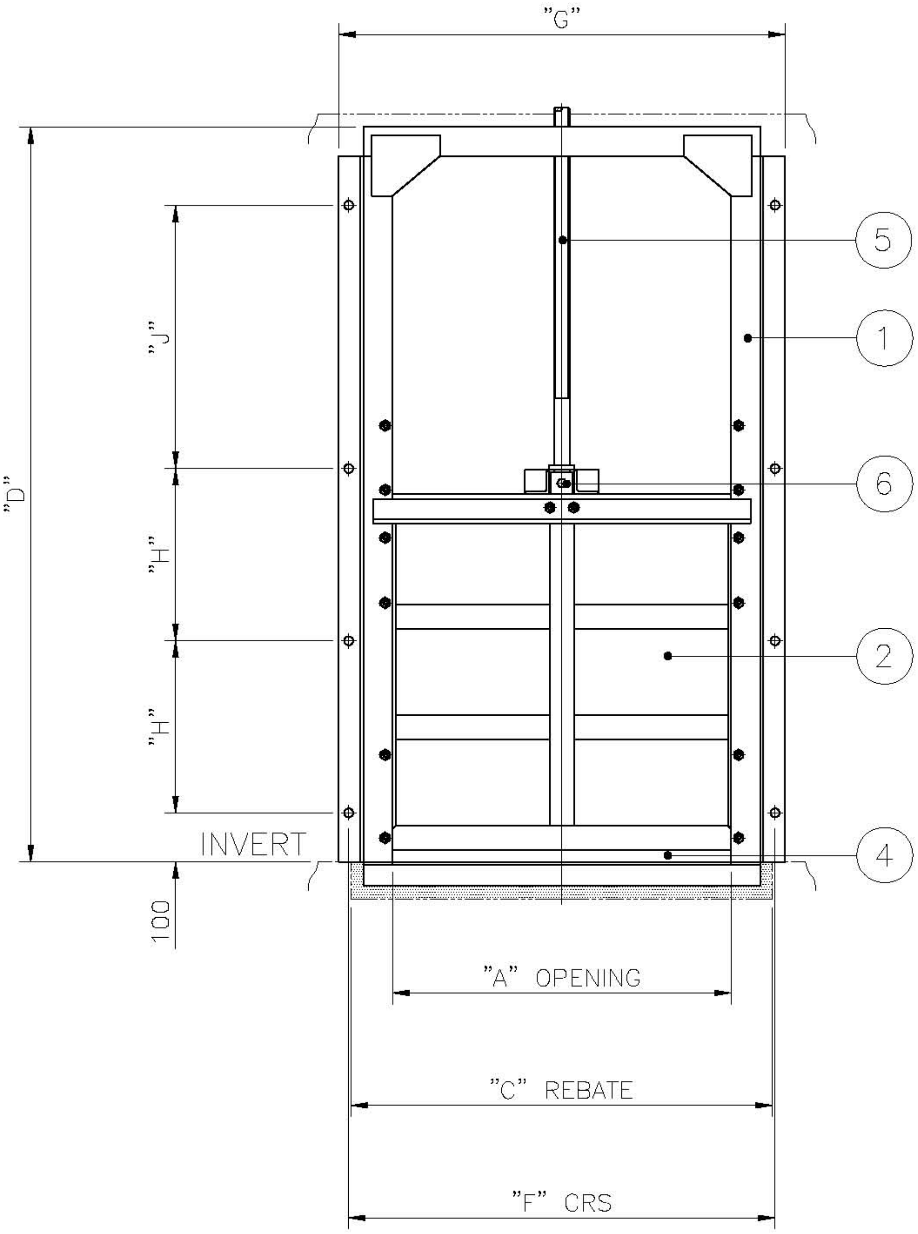
Construction Materials

ITEM	DESCRIPTION	MATERIAL
1	Frame	Mild Steel, BS 4360 Gr 43A Stainless Steel, BS 970 Gr 304 Stainless Steel, BS 970 Gr 316
2	Door	Mild Steel, BS 4360 Gr 43A Stainless Steel, BS 970 Gr 304 Stainless Steel, BS 970 Gr 316
3	Side Seals	Low Friction Polyolefin
4	Invert Seal	Neoprene
5	Stem	Stainless Steel, BS 970 Gr 303 Stainless Steel, BS 970 Gr 304 Stainless Steel, BS 970 Gr 316
6	Fasteners	Stainless Steel, BS 6105, Gr A4

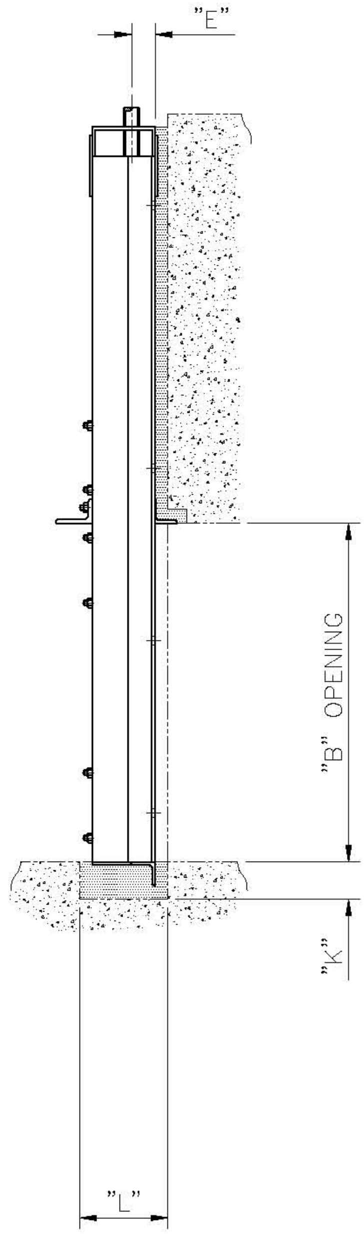
Traditional Wall Mounting Penstock Small, Medium and Large Range



PLAN VIEW



FRONT ELEVATION



SIDE ELEVATION

Wall Mounting Penstocks
Small, Medium and Large Range

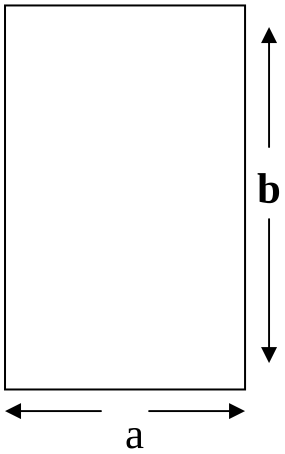
	RANGE		
	SMALL	MEDIUM	LARGE
A	OPENING WIDTH	OPENING WIDTH	OPENING WIDTH
B	OPENING DEPTH	OPENING DEPTH	OPENING DEPTH
C	A + 120	A + 120	A + 152
D	2B + 130	2B + 150	2B + 190
E	2B + 60	2B + 75	2B + 100
F	A + 120	A + 120	A + 152
G	A + 80	A + 80	A + 102
H	B/2	B/3	B/4
J	B - 100	B - 110	B - 120
K	29	32	49
L	8	10	12
M	18	22	27

Penstocks / Sluice Gates

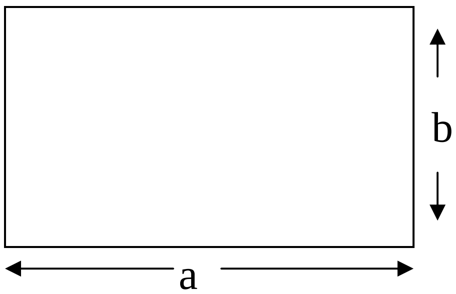
Although throughout this publication rectangular penstocks / sluice gates are generally indicated as having a square orifice, in practice many of the units supplied are either wider than they are deep or vice-versa.

Therefore, below are the preferred proportions for units of this type:-

For rectangular opening penstocks BS7775 recommended ratio of width to depth should be as follows:



a : b = 2 : 3



a : b = 4 : 3

The aperture size and configuration of a penstock is frequently determined by the dimensional proportions of the waterway it is required to control. A penstock is however, a constituent part of the waterway and its hydraulic characteristics cannot always be ignored when calculations are undertaken to determine a system head loss. The wide ranging size of gates and the number of constructional variations enable only approximations to be made using empirical formulae.

TECHNICAL DETAILS AND SPECIFICATIONS

Where gates are fully submerged they generally behave in a manner predicted by the discharge theory for an orifice with typical overall velocity and contraction coefficients of 0.70.

The discharge capacity of the frame aperture at varying stages of opening can therefore be closely approximated from:-

$$q = 0.7A\sqrt{2gH}$$

where q = Discharge rate – m3/sec

A = Aperture area – m2

H = head over the aperture centreline-m

G = 9.81 m/s2

When undertaking hydraulic calculations, standard formulae frequently express relationships in terms of diameter. In order to extend the use of these formulae to penstocks with square or rectangular openings, it is necessary to derive an equivalent hydraulic diameter.
This can be established by relating the wetted perimeter of the aperture with the cross sectional area.
For a fully submerged aperture the equivalent hydraulic diameter can be defined from:-

$$dH = \frac{2wh}{w + h}$$

A penstock running part filled will have an equivalent diameter in hydraulic terms of :-

$$dH = \frac{4wh}{2h + w}$$

where dH = the equivalent hydraulic diameter

w = aperture width

h = depth of flow passing through the aperture.

When it is required to relate a penstock to an equivalent length of pipework for integration into an overall hydraulic calculation this can be found from:-
Le = F.dH

Where Le = the equivalent length of pipework

dH = the hydraulic diameter

F =the factor

Door Setting	Open	¾ open	½ open	¼ open
F. factor	6	40	200	800

Penstocks / Sluice Gates

Size and Flow Characteristics

Weir Penstocks behave generally in their discharge capability as a rectangular weir with partial end contractions, the extent of contraction being influenced by the civil engineering design of the up-stream port being controlled. A close approximation can be found from:-

$Q = 1.73\ WH^{1.5}$
Where Q = Discharge rate – m ^{3}/sec
W= Width of opening – m
H= head over weir – m

A free fall over the weir in the order of 75mm from its lowest setting to the downstream top water level and an approach upstream on each side of the weir not less than four times the maximum depth of flow expected to pass over the weir is recommended.

Leakage

Treble R Fabrications penstocks / sluice gates will be virtually drop-tight at their working pressure if installation has been carried out carefully.
Units subjected to seating pressure are expected to seal tighter than those used for off-seating duties; a common question voiced by engineers is “What amount of leakage should we expect or should we specify as a maximum for penstocks / sluice gates?”
Such a question is difficult to answer directly, in that the responsibility lies primarily with the installing contractor and not the manufacturer. Present day designs and manufacturing procedures produce units which are virtually drop-tight, However distortion of the door frame at the time of installation is the determining factor.
An average criterion for leakage would be –

Conventional Penstocks
On-seatingduty
1.25 litres/minute/seal perimeter (metres)
Off-seating duty
Up to 6M head-2.5litres/minute/seal perimeter (metres)
Up to 9M head-3.0 litres/minute/seal perimeter (metres)
Up to 12M head-3.75 litres/minute/seal perimeter (metres)
Up to 15M head-4.50 litres/minute/seal perimeter (metres)
Leakage rates for off-seating duty over 15M will be advised on request.

TECHNICAL DETAILS AND SPECIFICATIONS

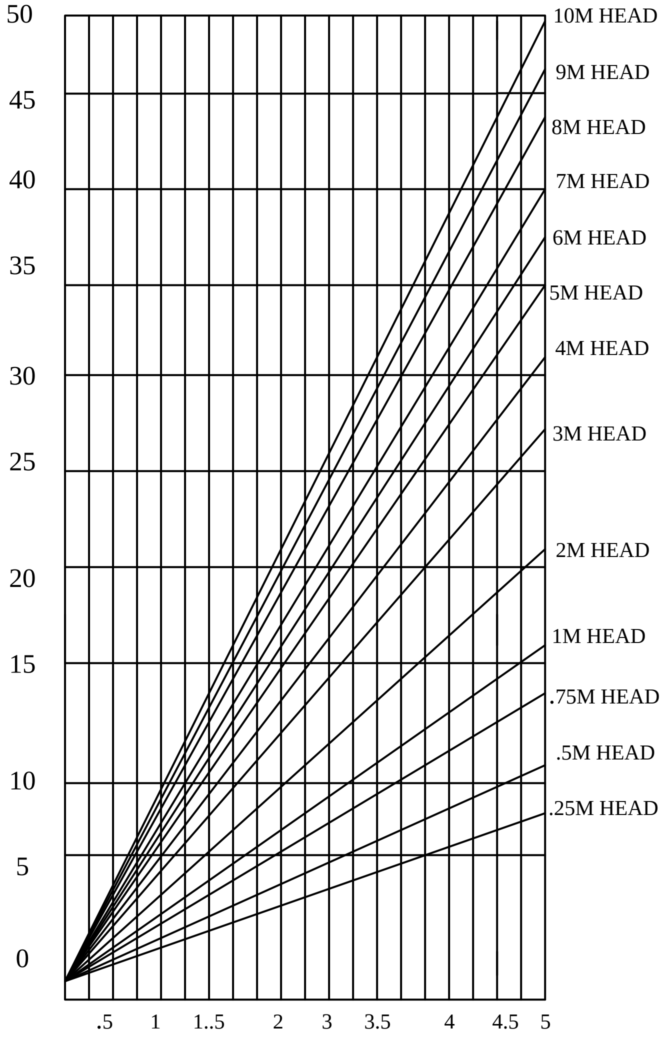
The above figures are based on the rates indicated in the BS7775 Standard.

Treble R Fabrication penstocks give a tighter seal than conventional metal seated penstocks if installation has been carried out carefully.

An average criterion would be 0.33 litres/minute/seal perimeter (metres).

Discharge

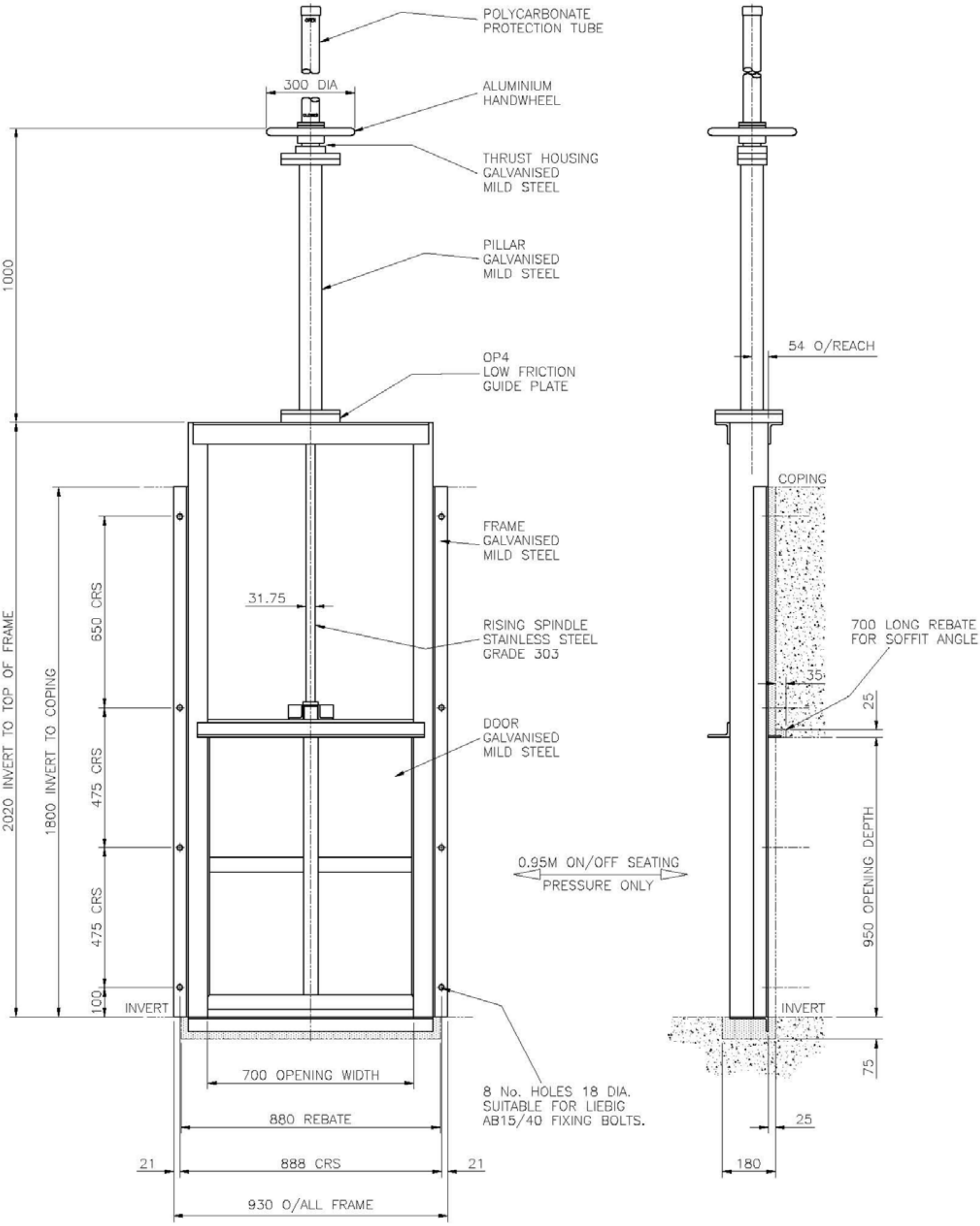
Discharge through Penstock in m3/sec



AREA OF PENSTOCK OPENING IN SQ.M

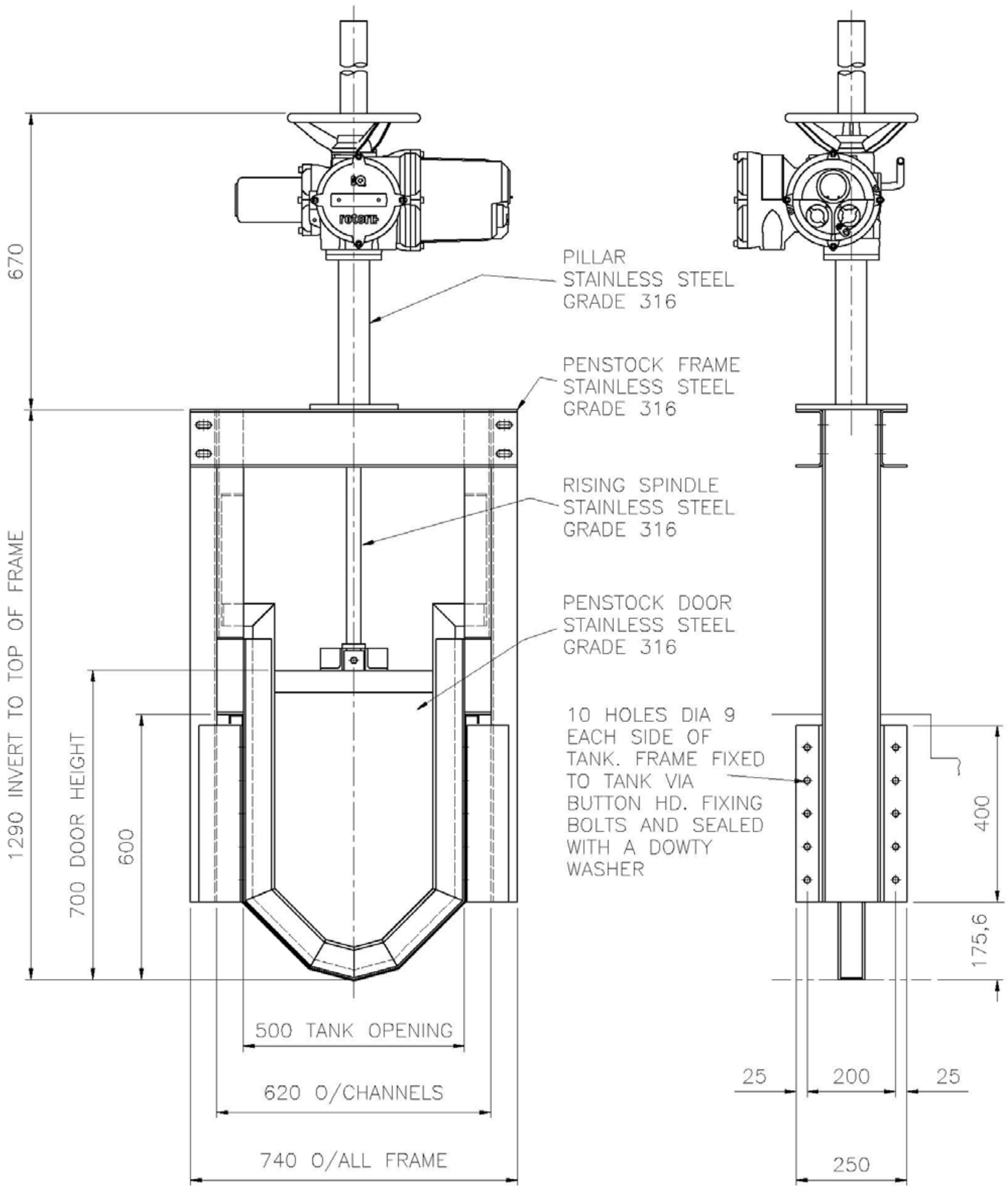
PENSTOCK DISCHARGE= 0.7 X AREA $\sqrt{2 \times g \times \text{HEAD}}$

Wall Mounting Penstocks
Standard Duty Range



Typical Drawing of a 700mm wide x 950mm deep Wall mounting Penstock.

Special Wall Mounting Penstocks
Standard Duty Range



Typical Drawing of a 600mm wide x 700mm deep
Side Wall mounting Penstock.