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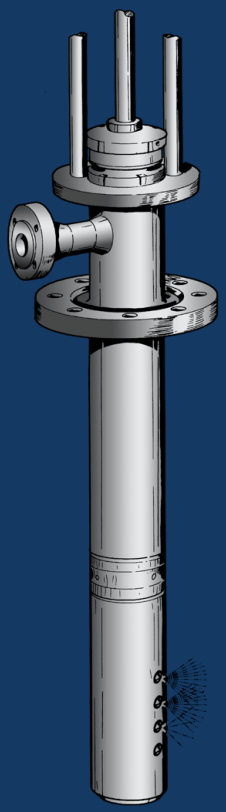
Series DK

Type DKV

Desuperheaters to control the Temperature of Superheated Steam (or Gas)

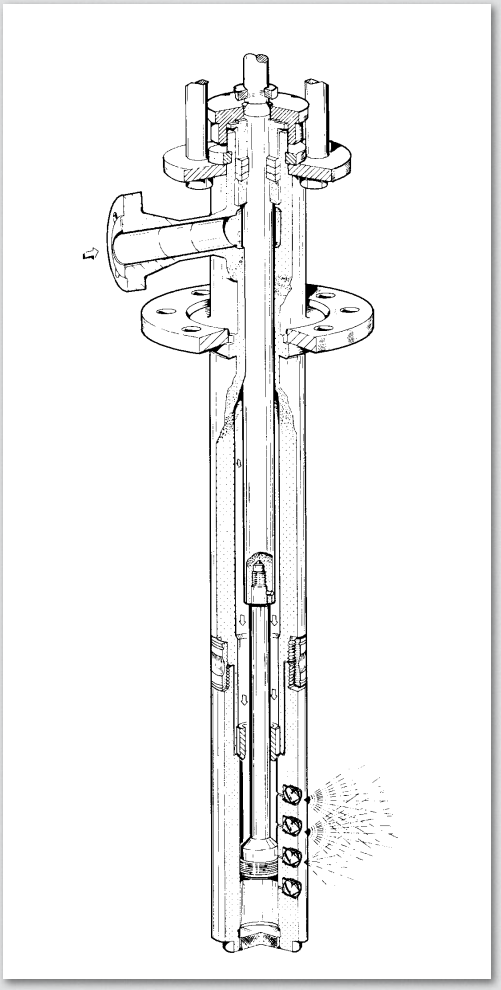


Introduction

Desuperheating (cooling) the steam can simply be achieved by inject water into the steam flow. When injected, the water is evaporated by means of the desuperheater nozzles. Thereby the water absorbs heat and consequently the temperature of steam is reduced.

The desuperheater type DKV is designed so, theat even at low injection water quantities an efficient spray of very fine droplets (mist) is obtained. When increasing the stroke, the waterinjection will increase with a modified parabolic flow characteristic. (See fig. 3)

Fig.1:

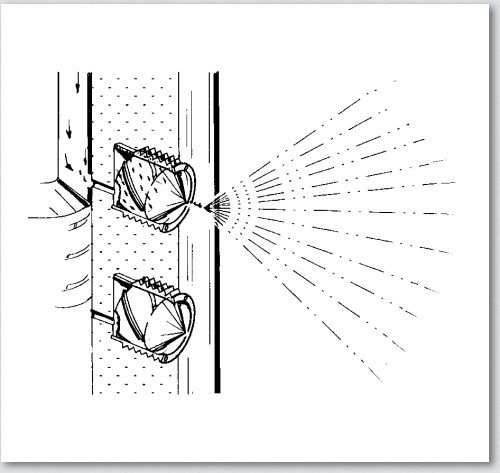


The nozzles in the sprayhead are designed to give the injection water a high velocity and a radial rotating movement under all conditions. The result is a fine atomisation and very quick evaporation. (See fig. 2)

Features of the DKV Desuperheater:

- 3 types of control characteristics, for accurate temperature control
- Large delta p water/ steam pressure difference of 100 bar (1450 psi) can be applied without an external control valve
- Excellent atomising characteristics at a delta p water/ steam of min. 10 bar (145 psi) and at min. steam velocity of 10 m/s.
- Tight shut-off. No leakage in closed position
- No additional control valve required
- High reliability due to simple party, minimal wear
- Excellent control accuracy for the whole control range

Fig.2:



Principal of Operation

The temperature sensor (Fig 5) transmits a signal through the control system to the actuator (positioner) and postitions the control piston according to the valve characteristic (Fig. 3).

The cooling fluid is now admitted to the injection nozzle, and is accelareated by the nozzle insert.

The cooling fluid is injected as a very fine water spray cone; the small droplets are quickly evaported and absorbed by the independent steam (hot gas). Our high quality atomisation of the cooling liquid is the basis of a good mixing from cooling fluid and steam at all load conditions.

The position of the valve seat, just before the spray head, provides a tight shut-off in the closed position, so that dripping is prevented (the piston is lapped into the seat!).
The small number of moving parts results in a reliable operation of the valve.

Materials

Standard housing materials
15 Mo 3 (DIN 1.5415) eq. to ASTM A 182 F1
13 CrMo44 (DIN 1.7335)eq. to ASTM A 182 F12

The body material is selected according to temperature and pressure conditions of steam and water.

Internal parts are various stainless steel
(min 13 % chrome).

DKV Details

The desuperheater is available in a standard body size with a max. pressure rating of PN 160 (lbs). Higher pressure ratings upon request.

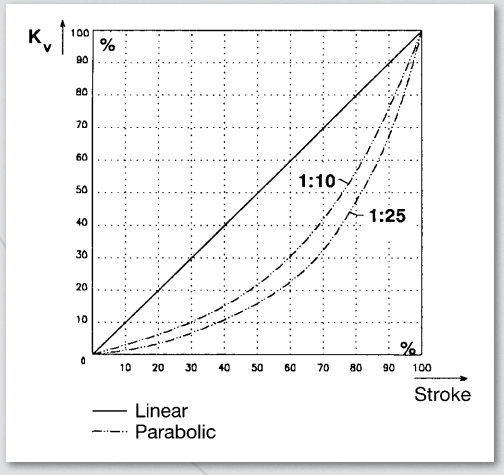
Connections

Inlet flanges
DN 25 (1"), DN 40 (1,5") or DN 50 (2");
up to PN 160 (900 lbs)

Mounting flanges:
DN 80 (3") or DN 100 (4"); up to PN 160 (900 lbs)

Flanges acc. DIN and ANSI. The min. required internal pipe-diameter of the mounting flange is
76 mm.

Fig.3:



Capacities

K_V (C_V) - values of the standard sprayheads:

Table 1: Rangeability			
1:25*	1:10*	Linear min - max	Stroke mm
0,8 (0,92)	1,0 (1,16)	0,25 (0,29) - 1,5 (1,75)	32
1,5 (1,75)	2,5 (2,9)	0,80 (0,92) - 4,5 (5,20)	32
4,0 (1,75)	2,5 (5,8)	0,90 (1,00) - 7,0 (8,10)	55
6,5 (7,5)	7,0 (8,1)	1,00 (1,16) - 10,0 (11,6)	80

*Max. K_V (C_V)-valve

Capacities

The desuperheater can be installed on a stub (min 150 mm or 6" height) on the steam pipe (see fig. 10). Water is injected in the same direction as the steam flow. The desuperheater can be installed in any position. The spray nozzle orientation, in regard to the waterflange position, can be selected according fig. 4.

At a stroke of 32 mm the minimum pipe size is DN 150 (6"). At a stroke of 55 or 80 mm, minimum pipe size is DN 200 (8"). The minimum distance – Ls – (see fig. 5) required between the desuperheater and the sensing element depends on service conditions (see fig. 6).

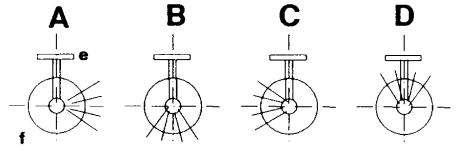
Instrumentation

A temperature sensing element, fitted on the steam piping (downstream of the desuperheater) transmits changes of the steam temperature to a temperature controller.
This controller sends a signal (electric or pneumatic) to the actuator, which results in an upward or downward repositioning of the desuperheater stem and control piston. Thus the injection water quantity and subsequently the steam temperature are controlled.

Actuator

The desuperheater can be fitted with all electric, pneumatic or electric/hydraulic actuators. For manual operations the valve can be fitted with a handwheel.

Fig.4: Water Connection Flange Options



e = Water Flange; f = Mounting Flange

Fig.5:

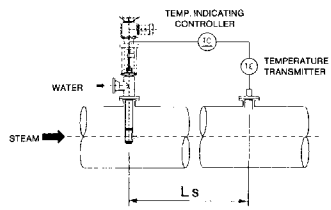
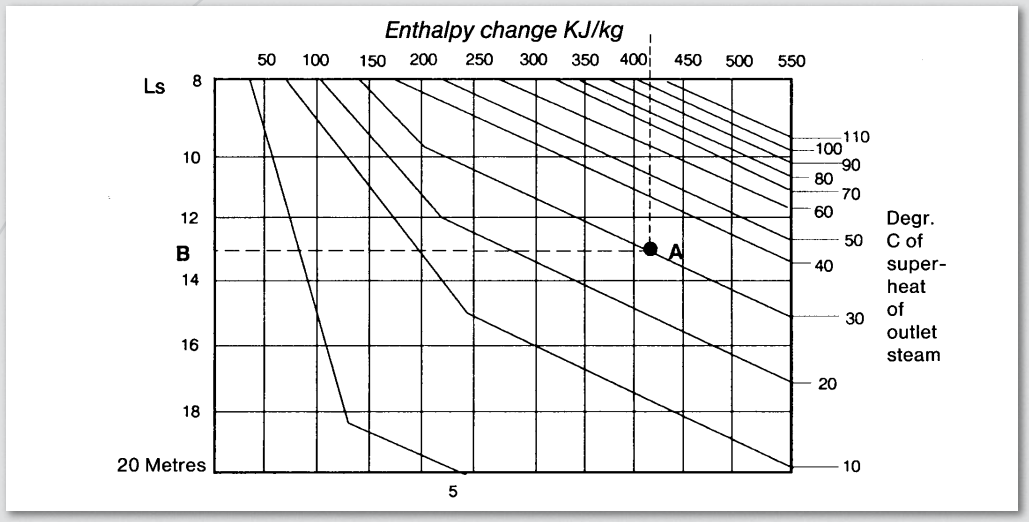


Fig. 6: Distance between Desuperheater and Temerature Sensor



*Above values are for DN 300 pipe sizes for other pipe sizes multiplydistance by 0,06 $\sqrt{D}$ (D = pipe dia.)

Example:

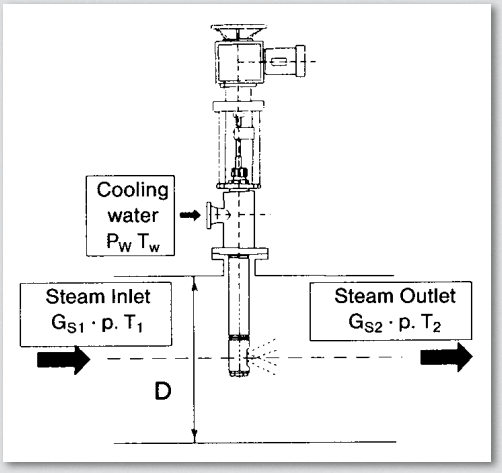
Enthalpy change between inlet- and outletsteam = 420 kJ/kg. Temperature of outlet steam is 30° above saturation temperature. Draw a vertical line from 430 kJ/kg until it intersects with the 30°C superheat line graph (point A). Draw a horizontal line from point A and read required distance of 13 m at B. (Ls = 13 m)

Sizing and Selection

Data´s required for sizing and selection:

G_S = steam flow (kg/hr or lbs/hr)
P = steam pressure (bar/psi)
T_1 = temperature inlet steam (°C/°F)
T_2 = temperature outlet steam (°C/°F)
p_W = cooling water pressure (bar/psi)
T_W = cooling water temperature (°C/°F)
D_S = diameter of steam piping

Fig. 7:



Calculation

Calculation of the injection water quantity

$$G_W = G^S \times \frac{h_1 - h_2}{h_2 - h_W} \text{ (k/hr)}$$

$$Q_W = \frac{G_W}{S.G. \times 1000}$$

Calculation of the K_V (C_V)

$$K_V = Q_W \sqrt{\frac{S.G.}{\triangle p}}$$

$$C_V = 1{,}16 \times K_V$$

- Select K_V (C_V) and corresponding stroke from table 1
- Check of the min. required steampipe diameter for selected stroke in table 3

Nomenclature

K_V (C_V) = valve flow cowfficient
S.G. = specific gravity injection water (kg/dm³)
Q_W = injection water quantity (m³/hr or gpm)
G_W = injection water quantity (kg/hr or lbs/hr)
h_1 = enthalpy inlet steam (kJ/kg)
h_2 = enthalpy outlet steam (kJ/kg)
h_W = enthalpy injection water (kJ/kg)
$\triangle p$ = p_W - p

Example

G_S = 100.000 kg/hr p = 50 bar (a)
T_1 = 430°C T_W = 190°C
T_2 = 330°C p_W = 140 bar (a)
S.G. = 0,885

From steamtable find enthalpy at inlet (h_1) and outlet (h_2) conditions.

$$G_W = 100.000 \times \frac{3270.4 - 3016.1}{3016.1 - 813.6} = 11546 \text{ kg/hr}$$

$$Q_W = \frac{11546}{0.885 \times 1000} = 13 \text{ m}^3\text{/hr}$$

$\triangle p = 140 - 50 = 90$ bar

$$K_V = 13 \sqrt{\frac{0.885}{90}} = 1.29;\ K_V \text{ (selected)} = 1.5$$

Selected K_V and corresponding stroke of the valve from table 1. Check max. stroke versus steam pipe diameter in table 3.

Table 2: Valve Code		
Actuator code	**Water connection/ Size Code**	**Connection Code**
P = Pneumatic	DN 25 (1") = 05	F = DIN Flanges
R = Electric	DN 40 (1.5") = 07	U = ANSI Flanges
O = Hydraulic	DN 50 (2") = 08	
M = Manual Drive		

Pressure rating	**Characteristic Code**
PN 25/150 lbs = 3	Parabolic 1:10 = PL
PN 40/- = 4	Parabolic 1:25 = PH
PN 64/300 lbs = 5	Linear = LH
PN 100/600 lbs = 6	
PN 160/900 lbs = 7	

Mounting Flange Size	**Material Code**
DN 80 (3") = 10	DIN 1.5415 (A 182F1) = 1
DN 100 (4") = 11	DIN 1.7335 (A 182F12) = 2

Example:

DKVP057/107U-PL-1 = Valve Type DKV; suitable for pneumatic actuator; water connection 1"/900 lbs; mounting flange 3"/900 lbs; flanges ANSI; parabolic 1:10 characteristic; body material acc. DIN 1.5415.

Fig.8

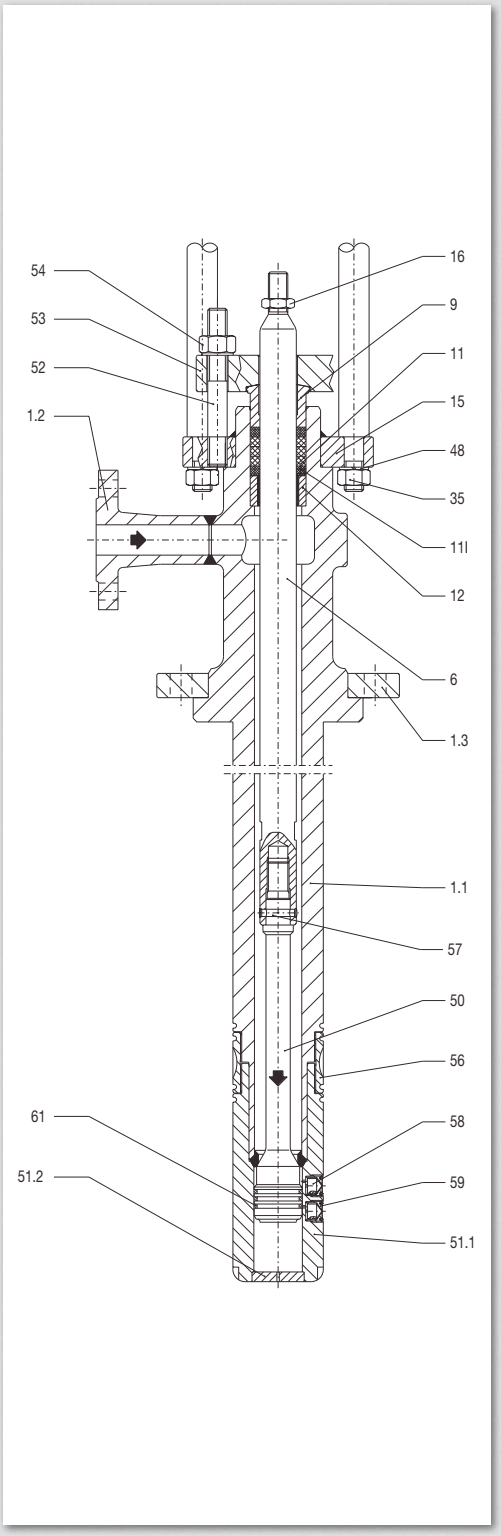


Fig.9: Gearbox for electric Actuator

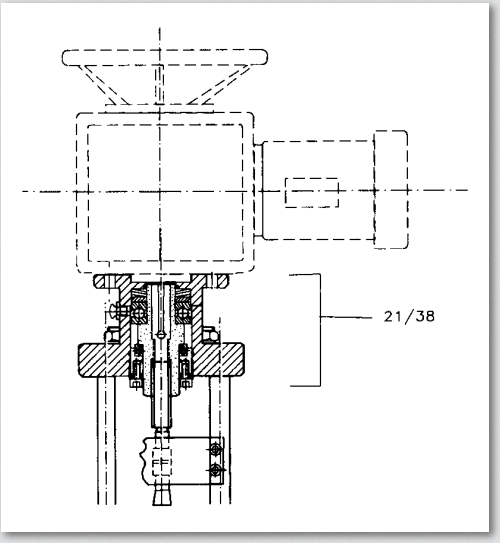
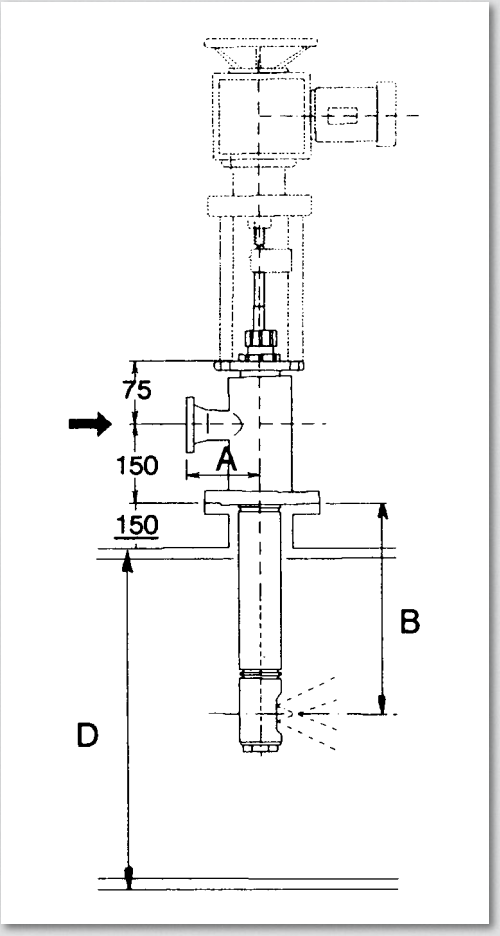


Fig.10



Parts and Materials (Fig.8)					
Pos.	Description	Qty.	Material DIN Code	Mat. Nr.	ASTM/ANSI
1	Housing (assy.)	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
1.1	Body	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
1.2	Flange	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
1.3	Flange	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
6	Stem	1	X20CrNi72	1.4057	A473-431
9	Packing Follower	1	X35CrMo17	1.4122	A422
11	Packing Ring	3	Graphite		Graphite
11 I	Packing Ring	2	Graphite		Graphite
12	Bottom Ring	1	X6CrNINb1810	1.4550	A182F347
15	Flange	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
16	Hexagon Nut	1	Steel		
21	Gearbox	1	Steel		
50	Control Piston	1	X35CrMo17	1.4122	A422
51.1	Spray Head	1	X10Cr13	1.4006	A182F429
51.2	Bottom Plate	1	X10Cr13	1.4006	A182F429
52	Stud Bolt	2	21CrMoV57	1.7709	A193GrB16
53	Packing Gland	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
54	Hexagon Nut	2	24CrMo5	1.7258	A194GrB7
56	Tighten Ring Nut	1	X10Cr13	1.4006	A182F429
57	Pin	1	X5CrNi189	1.4301	A182F304
58	Nozzle Insert	*	X5CrNi189	1.4301	A182F304
59	Nozzle	*	X5CrNi134	1.4313	A182F6NM
61	Piston Ring	3	X22CrMoV121	1.4923	

* Number of nozzles varies with required K_v (C_v) value and injection characteristic

** Depending on service conditions (pressures, temperatures)

Additional Parts and Materials (Fig. 9)			
Pos.	Description	Qty.	Material
21/38	Gearbox (assy.)	1	various

Demensions A

Dimension A:

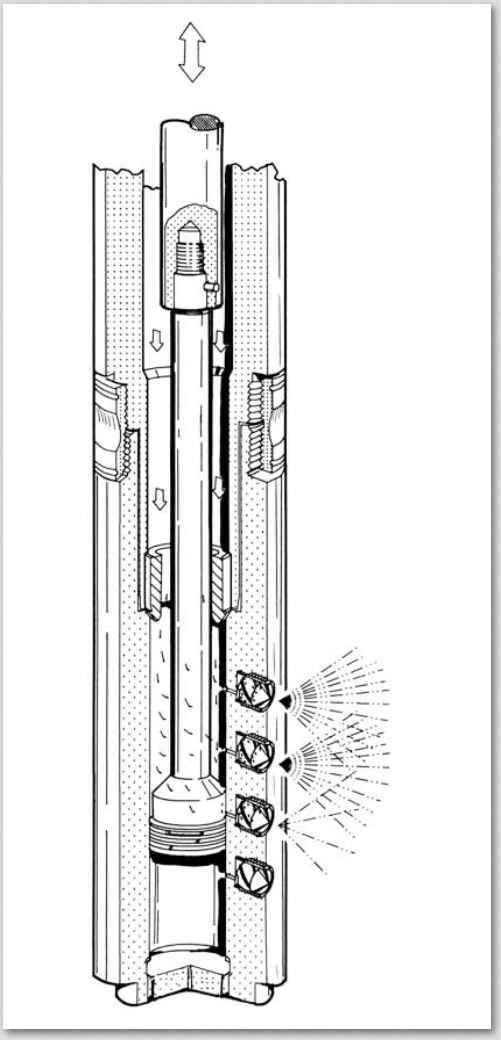
For pressure ratings ≤ PN 100 (600 lbs)
Dimension A = 150 (mm)

For pressure rating PN 160 (900 lbs)
Dimension A = 175 (mm)

Demensions B

Table 3		Stroke		
Ds (mm)	B (mm)	32	55	80
21/38	225	•		
	250	•	•	•
	275	•	•	•
	300	•	•	•

For larger steampipe size (max. 700 mm):
B (mm) = 0,5 × D + 150

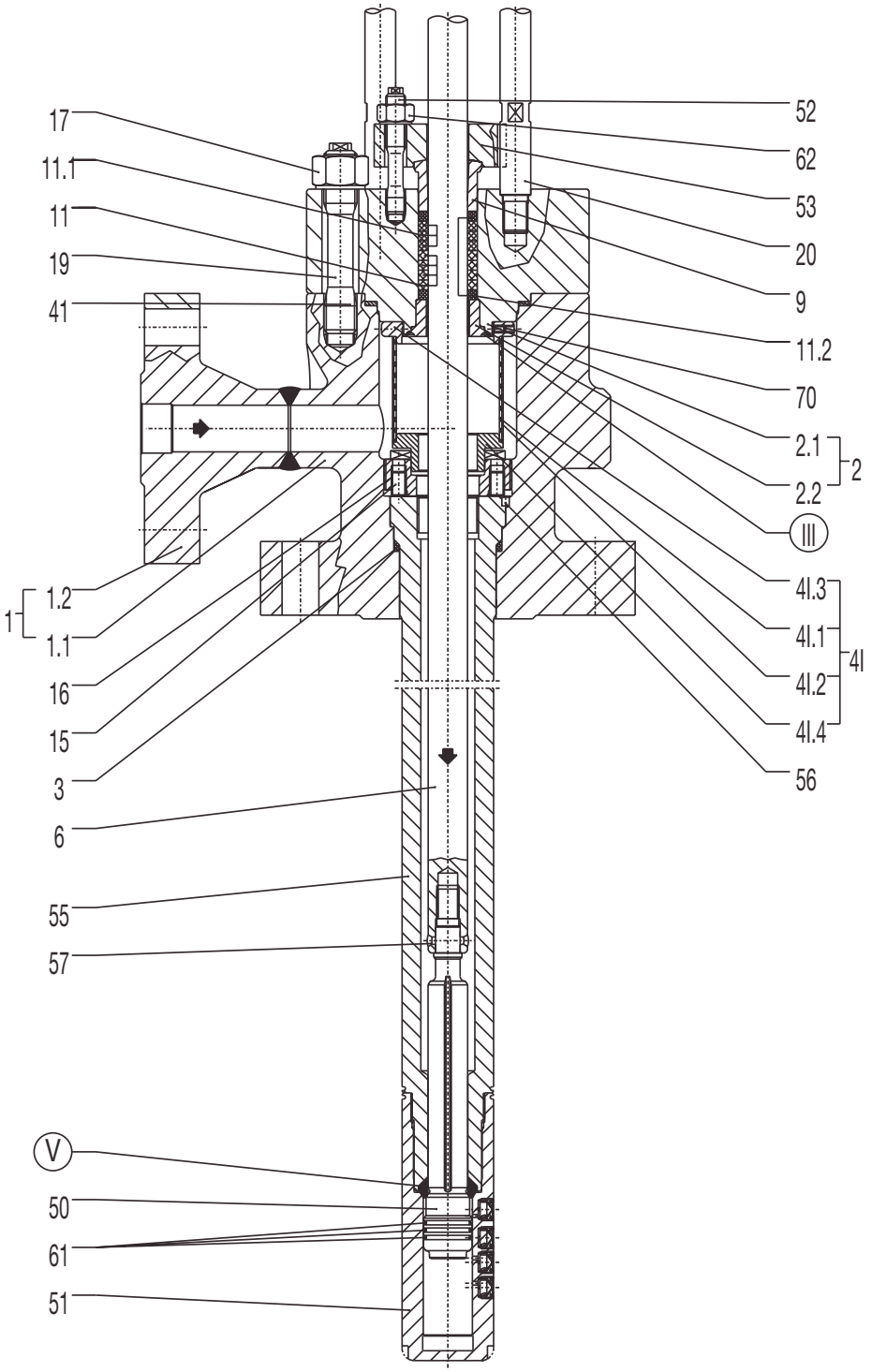


The following Data´s are required to prepare a Quotation:

- Valve operating- and design data (as per page 5)
- Type of actuator and required accessories:
  e.g. pneumatic actuator, make...; failsafe open;
  incl. electro/pneumatic positioner + air filter/reducer station + limitswitches.
  e.g. electric actuator make...
- Installation Position:
  standard: valve stem vertical upward
  option: valve stem horizontal
- Which inspections/ certificates/ non-standard tests are required

Standard test are:

- Dimensional Check
- Visual Inspection
- Hydraulic Pressure Test
- Seat Leakage Test
- K_V/C_V-Valve Test
- Functional Test (mechanical)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III
4I
4I.3
4I.1
4I.2
4I.4
56

Parts and Materials (Fig.8)					
Pos.	Description	Qty.	Material DIN Code	Mat. Nr.	ASTM/ANSI
1	Housing (assy.)	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
1.1	Body	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
1.2	Flange	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
2	Bonnet (assy.)	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
3	Bonnet seal	1	Graphite		Graphite
4	Sieve (assy.)	1	X6CrNINb1810	1.4122	A182F347
6	Stem	1	X20CrNi172	1.4057	A579
9	Packing Follower	1	X35CrMo17	1.4122	A422
11	Packing Ring	4	Graphite		Graphite
11.1	Packing Ring	2	Graphite		Graphite
15	Bolt	4	A2-70		
16	Ring slotted	1	X35CrMo17	1.41.22	A422
17	Hexagon Nut	8	24CrMo5	1.7258	A194Gr. B7
19	Bolt	8	21CrMoV57	1.7709	A193Gr. B16
41	Spiral Gasket	1	X10CrNiTI189/Graphite	1.4541	A167-321
50	Control Piston	1	X35CrMo17	1.4122	A422
51	Spray Head (assy.)	1			
51.1	Spray Head	1	X10Cr13	1.4006	A182F6A
51.2	Bottom Plate	1	X10Cr13	1.4006	A182F6A
52	Stud Bolt	4	21CrMoV57	1.7709	A193Gr. B16
53	Packing Gland	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
55	Insert	1	15Mo3/13CrMo44**	1.5415/1.7335**	A182F1/A182F12**
56	Pin	1	X5CrNi189	1.4301	A182F304
57	Pin	1	X5CrNi189	1.4301	A182F304
58	Nozzle Insert	*	X5CrNi189	1.4301	A182F304
59	Nozzle	*	X5CrNi189	1.4313	A182F6NM
61	Piston Ring	3	X22CrMoV121	1.4923	
62	Hexagon Nut	4	24CrMo5	1.7258	A194Gr. B7

* Number of nozzles varies with required K_V (C_V) value and injection characteristic

** Depending on service conditions (pressures, temperatures)

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