



Figure 1 TM Unox variable area meter

## Application

The TM Unox variable area meters are used to measure the volume of transparent liquids and gases passing through closed piping. The variable area meters can also be used for flow monitoring if they are equipped with one or more switching contacts. Standard scales are available for liquids with a density of 1 kg/l (62.43 lbs/cu.ft). The scales must be recalculated for all other media depending on the physical characteristics.

The measuring accuracy corresponds to class 1.6 according to VDE/VDI 3513, page 2.

## Design and Operation

The main components of the TM Unox variable area meters are the glass variable-area flow tube with float and the connection parts. The flow is displayed directly on the scale present on the flow tube (e.g. in l/h). The flow tube is optionally available with a percentage or 2 mm (0.079 inch) scale.

The flow is read at the position of the float's widest diameter.

## Special Features

- Product scales for liquids and gases
- Fast installation/removal of the flow tube possible without removal of the fitting
- Increased protection of users from glass breakages by additional cover with single-pane safety glass.

## Note of Application

The operator of these measuring instruments is responsible for suitability, proper use and corrosion resistance of the used materials with regard to the measuring material. It must be ensured that the materials selected for the flow meter parts in contact with the medium are suitable for the used process media. The flow meter may only be used within the pressure and voltage limits specified in the operating instructions. Before replacing the measuring tubes, check that the unit is free of hazardous media and pressures. Provide a touch guard for surface temperatures of >70 °C. This touch guard must be designed in a way that the max. allowable ambient temperature on the unit is not exceeded. The flow meter meets the requirements of the PED 97/23/EG as stated in the table on page 2.

## Connection and Mode of Operation

The variable area meter must be fitted vertically and without tension. Control elements or reductions/extensions in the pipe diameter upstream or downstream of the variable area meter have no influence on the accuracy when measuring liquids. However, when measuring gases, the variable area meter should be installed upstream of valves to prevent pulsations resulting from compression. Since variable area meters respond extremely sensitively to changes in flow, control elements should always be adjusted slowly.

The calibration has been carried out for defined media conditions. Deviations in the density, pressure or temperature of gases, or in the density or viscosity of liquids, result in measurement errors. It is essential to observe the calibration conditions. When ordering, it is therefore essential to provide data on the medium, density and viscosity at the operating temperature and pressure. With gases, it is additionally necessary to specify the exact reference point for the pressure (pressure above atmospheric or absolute pressure).

Retrofitting of switching contacts is only possible if variable area meters with magnets are used. When using for the first time, move the float completely past the contact to permit polarization.

The float guide rod prevents the float from making contact with the glass flow tube.

The option is recommended to increase the operational safety and to protect against glass breakages in the case of operating conditions such as solenoid valve control. The option is not possible in conjunction with floats with magnets and weighted PVC/ PVDF floats.

### Liquids

Standard: flow tubes E 4000 to H 25000

Option: flow tube C 125 and upwards

### Gases

Standard: flow tubes D 2500 to H 25000

Option: flow tube C 125 and upwards

### Technical Data TM Unox

Measuring principle	Variable area flowmeter
Input	
• Flow	Vertically upwards
Rated operating conditions	
Temperature limits	
• With float made of stainless steel mat. No. 1.4305 / 303 or 1.4571 / 316Ti or aluminum	max. 150 °C / 302 °F
• With float made of PVDF	max. 100 °C / 212 °F
• With float made of PVC	max. 50 °C / 122 °F
	etched scale required with temp. of medium >90 °C / 194 °F
Medium conditions	
• Accuracy	Class 1.6 (according to VDE/VDI 3513, sheet 2)
• Measuring range	dependent on flow tube, see tables on page 3 and 4
- for liquids	0.1 l/h to 25 m³/h / 0.00044 to 110 USgpm
- for gases	1.6 l/h to 400 m³/h / 0.007 to 1,761 USgpm
A special scale must be provided for liquids with a density other than 1 kg/l / 62.43 lbs/cu.ft and all gases	
• Dimensions for measured variable	l/h (up to flow tube D2500) m³/h (flow tube D3000 and above)
Permissible operating pressure	
• Flow tubes A 1 to D 3.000	max. 10 bar / 145 psi
• Flow tubes E 4.000 to F 10.000	max. 8 bar / 116 psi
• Flow tubes G 12.500 to H 25.000	max. 5 bar / 73 psi
Design	
Connections	Flanges DIN 15 to DN 80 (DIN 2501) / ½ to 3 inch, optional ANSI 16.5 B, screwed gland G ¼ to G2
Material	
• Flow tube	Borosilicate glass (length 300 mm (11.81 inch))
• Connection	EN-GJL-250 (GG25), optional: stainl. steel mat. No. 1.4571 / 316Ti or GG25, liner with hard rubber or PTFE
• Float	Stainl. steel mat. No. 1.4305 / 303, mat.No.1.4571 / 316Ti, PVC, PVDF, aluminum
• Float guide rod	Stainl. steel mat. No. 1.4571 / 316 Ti as standard for: <ul style="list-style-type: none"> <li>• Flow tubes D 2.500 to H 25.000 for gases</li> <li>• Flow tubes E 4.000 to H 25.000 for liquids</li> </ul> As option for flow tube C 125 and above (not together with contacts)
• Gasket	Perbunan up to 90 °C / 194 °F, Viton up to 150 °C / 302 °F, PTFE up to 150 °C / 302 °F, EPDM up to 150 °C / 302 °F

- Limit Springs made of stainl. steel up to flow tube D3.000, otherwise limit buffer from gasket material

Weight	
• DN 15 (G½)	6 kg (13.23 lb)
• DN 25 (G1)	10 kg (22.05 lb)
• DN 40 (G1½)	14 kg (30.86 lb)
• DN 50 (G2)	14 kg (30.86 lb)
• DN 65	26 kg (57.32 lb)
• DN 80	27 kg (59.52 lb)

### Classification According to PED 97/23/EC

	Order No. 7ME5815-	Permissible media	Category
DN 15 to DN 80 G¼ to G2	xxaxx-xxxx; a ≠ K, R	Gases of fluid group2 and liquids of fluid group1	Article 3.3
≤DN 25 (G¼ to G 1)	xxaxx-xxxx; a = K, R	Gases of fluid group2 and liquids of fluid group1	Article 3.3
>DN 25 (G1¼ to G2)	xxaxx-xxxx; a = K, R	Gases of fluid group1 and liquids of fluid group1	I

### Technical Data Contacts

Switching principle	Magnet spring contact
Designation	
• Flow tube size C 125 to H 25000	K 17
• Flow tube size D 650 to H 25000	K 23
Housing/plug	PP/PA 6
Contact material	Rhodium
Degree of protection	IP65
Ambient temperature	-20 to +80 °C / -4 to +176 °F
Max. switching frequency	5/min
Max. rating	
• K 17	AC 250 V / 0.5 A / 10 VA DC 250 V / 0.5 A / 5 W
• K 23	AC 250 V / 1 A / 150 VA DC 250 V / 1 A / 100 W
	Rating data apply to resistive loads; a suppressor circuit is required for inductive loads

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### Selection of Float

There are three versions of floats:

- Non-guided float
- Guided float
- Viscosity-compensated float.

Use of the viscosity-compensated float is necessary above the following viscosities:

Flow tube	mPa·s
C 125 to C 500	≥3
D 650 to D 3000	≥5
E 4000 to F 10000	≥8
G 12500 to H 25000	≥10

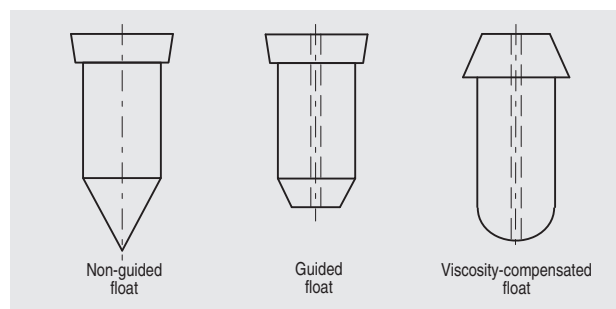


Figure 2 Float versions

### Measuring Ranges for Air

Connection		Flow Tube	Pressure Loss	Max. measuring range for the selected floats									
Female Thread G, NPT	Flange DN (ANSI)		mbar (psi)	Aluminum, W.-Nr. 3.1645		Aluminum, W.-Nr. 3.1645		PVC		PVDF		PVC with magnet	
				(l/h)	(USgpm)	(l/h)	(USgpm)	(l/h)	(USgpm)	(l/h)	(USgpm)	(l/h)	(USgpm)
(G¼) (G¾) G½	15 (½")	A 1	4 (0.058)	16	(0.07)	-	-	10	(0.044)	10	(0.044)	-	-
		A 3		50	(0.22)	-	-	25	(0.11)	25	(0.11)	-	-
		A 5		80	(0.35)	-	-	50	(0.22)	50	(0.22)	-	-
		A 10		160	(0.70)	-	-	80	(0.35)	80	(0.35)	-	-
		A 25		400	(1.76)	-	-	250	(1.10)	250	(1.10)	-	-
		B 30		500	(2.20)	-	-	320	(1.40)	360	(1.59)	-	-
		B 40		650	(2.86)	-	-	450	(1.98)	500	(2.20)	-	-
		B 50		800	(3.52)	-	-	550	(2.42)	650	(2.86)	-	-
		B 65		1100	(4.84)	-	-	750	(3.30)	800	(3.52)	-	-
		B 80		1400	(6.2)	-	-	900	(3.96)	1000	(4.4)	-	-
		B 100	1600	(7.0)	-	-	1100	(4.84)	1250	(5.5)	-	-	
		C 125	6.5 (0.094)	2000	(8.8)	2500	(11.0)	1400	(6.2)	1500	(6.6)	2200	(9.7)
		C 160		3000	(13.0)	3200	(14.0)	1800	(7.9)	2000	(8.8)	3000	(13)
		C 200		3600	(16.0)	4000	(17.6)	2200	(9.7)	2500	(11)	3600	(16)
		C 250		4000	(17.6)	5000	(22.0)	2800	(12.3)	3000	(13)	4500	(19.8)
		C 315		15 (0.218)	5000	(22)	6400	(28.0)	3400	(15.0)	3600	(16)	6000
C 400	6400	(28)			8000	(35.0)	4000	(17.6)	5000	(22)	7000	(31)	
C 500	8000*	(35)*	-		-	5000*	(22.0)*	5500*	(24)*	-	-		
D 650	7 (0.102)	10000	(44)		12000	(53)	7000	(31.0)	8000	(35)	10000	(44)	
D 800		13000	(57)	15000	(66)	9000	(39.6)	9000	(40)	12000	(53)		
D 1000		16000	(70)	20000	(88)	11000	(48)	12000	(53)	16000	(70)		
(G½) (G¾) G1		25 (1")	D 1250	9 (0.131)	20000	(88)	24000	(106)	14000	(62)	15000	(66)	20000
D 1600	28000		(123)		32000	(141)	18000	(79)	20000	(88)	25000	(110)	
D 2000	36000		(159)		40000	(176)	22000	(97)	25000	(110)	32000	(141)	
D 2500	12 (0.174)		40000*	(176)*	-	-	28000*	(123)*	30000	(132)*	-	-	
D 3000			50000*	(220)*	-	-	32000*	(141)*	36000	(159)*	-	-	
(G1¼) G1½	40 (1½")	E 4000	10 (0.145)	64000*	(282)*	75000*	(330)*	45000	(198)	50000	(220)	60000	(264)
E 5000		80000*		(352)*	100000*	(440)*	55000	(242)	65000	(282)	80000	(352)	
E 6500		100000*		(440)*	125000*	(550)*	75000	(330)	80000	(352)	100000	(440)	
(G1½) G2	50 (2")	F 8000	13 (0.189)	140000*	(616)*	150000*	(660)*	90000	(396)	100000	(440)	125000	(550)
F 10000		160000*		(704)*	180000*	(793)*	120000	(528)	125000	(550)	160000	(704)	
only with flange connection	65 (2½")	G 12500	13 (0.189)	200000*	(881)*	220000*	(969)*	130000*	(572)*	150000*	(660)*	175000*	(771)*
		G 16000		280000*	(1233)*	300000*	(1321)*	180000*	(793)*	200000*	(881)*	240000*	(1057)*
	80 (3")	H 20000	14 (0.203)	320000*	(1409)*	36000*	(1585)*	220000*	(969)*	250000*	(1100)*	300000*	(1320)*
		H 25000		400000*	(1761)*	450000*	(1981)*	280000*	(1233)*	300000*	(1320)*	360000*	(1585)*

Standard measuring range for air (p<sub>abs</sub> = 1.023 bar (14.69 psi) at T = 0 °C (32°F)) (dynamic range 1:10) \*Guided float  
 Non-standard sizes for the connections are listed in square brackets

### Measuring Ranges for Liquids

Connection		Flow tube	Pressure loss	Max measuring range for the selected floats									
Female thread G	Flange DN (ANSI)		mbar (psi)	Up to flow tube B100 mat. No.		Viscosity compensated mat. No.		With magnet mat. No.		PVC / PVDF weighted		PVC / PVDF with magnet	
				1.4305, 1.4571	303/316Ti	1.4571	316Ti	1.4571	316Ti	l/h (Usgpm)	l/h (Usgpm)	l/h (Usgpm)	l/h (Usgpm)
(G¼), (G¾), G½)	15 (½")	A 1	10 (0.145)	1	(0.0044)	-	-	-	-	-	-	-	-
		A 3		3	(0.013)	-	-	-	-	-	-	-	-
		A 5		5	(0.022)	-	-	-	-	-	-	-	-
		A 10		10	(0.044)	-	-	-	-	-	-	-	-
		A 25		25	(0.110)	-	-	-	-	-	-	-	-
		B 30		30	(0.132)	-	-	-	-	11	(0.048)	-	-
		B 40		40	(0.176)	-	-	-	-	15	(0.066)	-	-
		B 50		50	(0.22)	-	-	-	-	20	(0.088)	-	-
		B 65		65	(0.29)	-	-	-	-	25	(0.110)	-	-
		B 80		80	(0.35)	-	-	-	-	32	(0.140)	-	-
	B 100	100	(0.44)	-	-	-	-	40	(0.176)	-	-		
	20 (0.290)	C 125	125	(0.55)	100*	(0.44)*	120	(0.53)	65	(0.29)	65	(0.29)	
		C 160	160	(0.70)	125*	(0.55)*	150	(0.66)	90	(0.40)	90	(0.40)	
		C 200	200	(0.88)	160*	(0.70)*	180	(0.79)	110	(0.48)	110	(0.48)	
		C 250	250	(1.10)	200*	(0.88)*	240	(1.06)	140	(0.62)	140	(0.62)	
		40 (0.58)	C 315	315	(1.39)	240*	(1.06)*	300	(1.32)	175	(0.77)	175	(0.77)
			C 400	400	(1.76)	300*	(1.32)*	360	(1.59)	220	(0.97)	220	(0.97)
			C 500	500	(2.20)	360*	(1.59)*	480	(2.11)	250	(1.10)	250	(1.10)
			19 (0.28)	D 650	650	(2.86)	400*	(1.76)*	600	(2.64)	500	(2.20)	450
		D 800		800	(3.52)	500*	(2.20)*	750	(3.30)	600	(2.64)	550	(2.4)
D 1000		1000		(4.4)	600*	(2.64)*	950	(4.18)	750	(3.30)	700	(3.1)	
	D 1250	1250		(5.5)	750*	(3.30)*	1200	(5.3)	1000	(4.40)	900	(4.0)	
(G½), (G¾), G1)	25 (1")	D 1600	24 (0.35)	1600	(7.0)	1000*	(4.40)*	1500	(6.6)	1250	(5.50)	1100	(4.8)
		D 2000		2000	(8.8)	1200*	(5.30)*	1800	(7.9)	1600	(7.0)	1400	(6.2)
	33 (0.48)	D 2500	2500	(11.0)	1400*	(6.20)*	2400	(10.6)	2000	(8.8)	1750	(7.7)	
		D 3000	3000	(13.0)	1800*	(7.9)*	2800	(12.3)	2400	(10.6)	2000	(8.8)	
		D 4000	4000	(17.6)*	2500*	(11.0)*	3800*	(16.7)*	3200	(14.0)	3200	(14.0)	
(G1¼), (G1½), (G2), (G2½))	40 (1½")	E 5000	25 (0.36)	5000*	(22.0)*	3000*	(13.0)*	4800*	(21.1)*	3800	(16.7)	3800	(16.7)
		E 6500		6500*	(28.6)*	4000*	(17.6)*	6400*	(28.0)*	5000	(22.0)	5000	(22.0)
(G2), (G2½))	50 (2")	F 8000	25 (0.36)	8000*	(35.0)*	4500*	(19.8)*	7500*	(33.0)*	6400	(28.0)	6400	(28.0)
		F 10000		10000*	(44.0)*	5500*	(24.0)*	9500*	(42.0)*	7500	(33.0)	7500	(33.0)
only with flange connection	65 (2½")	G 12500	34 (0.49)	12500*	(55.0)*	7000*	(31.0)*	12000*	(53.0)*	10000	(44.0)	9000	(40.0)
		G 16000		16000*	(70.0)*	9000*	(40.0)*	16000*	(70.0)*	15000	(66.0)	12500	(55.0)
	80 (3")	H 20000	38 (0.55)	20000*	(88.0)*	11000*	(48.0)*	18000*	(79.0)*	18000	(79.0)	15000	(66.0)
		H 25000		25000*	(110.0)*	14000*	(62.0)*	24000*	(106.0)*	22000	(97.0)	18000	(79.0)

Standard measuring range for liquid ( $\rho = 1 \text{ kg/l}$  (62.43) lbs/cu.ft, viscosity 1 mPa·s (1cp)) (dynamic range 1:10) \*Guided float  
 Non-standard sizes for the connections are listed in square brackets

## Versions

Ten standard versions are defined in the price list using different combinations of fittings, connection materials and floats (the type numbers correspond to the 4th digit in the 2nd block of the Order No.

Version	Type 1 (J)	Type 2 (K)	Type 3 (L)	Type 4 (M)	Type 5 (N)	Type 6 (P)	
Measured Medium	Liquids						
Connection Material	Steel	Mat. No. 1.4571/316 Ti	GG25	Mat. No. 1.4571/316Ti	GG25	GG25	
Liner of fittings					Mat. No. 1.4571/316Ti above DN65	Hard rubber	PTFE
Connection type	Thread	Thread	Flange	Flange	Flange	Flange	
Float	Standard	W.-Nr. 1.4571/1.4305316Ti/303	W.-Nr. 1.4571/316Ti	W.-Nr. 1.4571/1.4305316Ti/303	W.-Nr. 1.4571/316Ti	W.-Nr. 1.4571/316Ti	PVDF beschwert 2)
	Options	SV, Mat.No. 1.4571/316Ti <sup>1)</sup>	SV, Mat.No. 1.4571/316Ti <sup>1)</sup>	SV, Mat.No. 1.4571/316Ti <sup>1)</sup>	SV, Mat.No. 1.4571/316Ti <sup>1)</sup>	PVC, PVDF weighted <sup>2)</sup> and SV in Mat.No. 1.4571/316Ti <sup>1)</sup>	-
Contact	As option with flow tube C 125 and above only with magnetic float						
Flow tube, size	A to F	X	X	X	X	X	X
	G and H	-	-	X	X	X	X

Standard designs of the variable area meters (for liquids)

Version	Type 7 (Q)	Type 8 (R)	Type 9 (S)	Type 10 (T)	
Measured Medium	Gases				
Connection Material	Steel	W.-Nr. 1.4571/316 Ti	GG25	GG25	
Liner of fittings	PTFE				
Connection type	Thread	Thread	Flange	Flange	
Float	Standard	Aluminum	Aluminum	Aluminum	-
	Options	PVC or PVDF <sup>3)</sup>	PVC or PVDF <sup>3)</sup>	PVC or PVDF <sup>3)</sup>	PVDF <sup>3)</sup>
Contact	As option with flow tube C 125 and above only with magnetic float			-	
Flow tube, size	A to F	X	X	X	X
	G and H	-	-	X	X

<sup>1)</sup>Float SV only viscosity-compensated with flow tube C and above  
<sup>2)</sup>Float PVC and PVDF only weighted with flow tube B and above  
<sup>3)</sup>Float PVDF only delivered without contact.

Standard designs of the variable area meters (for gases)

### Contact Assembly

The bistable contact assembly K17 consists of a contact spring set sealed in a glass tube filled with protective gas.

Three contacts can be selected:

- K 17 A: contact closes when the limit is fallen below
- K 17 B: contact closes when the limit is exceeded
- K 23: changeover contact.

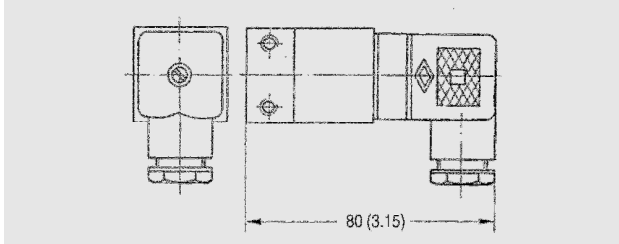


Figure 3 Contact K17, dimensions in mm (inches)

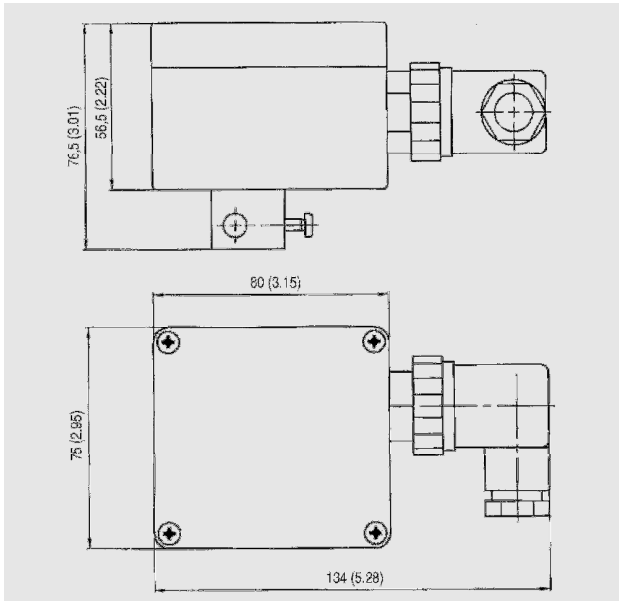


Figure 4 Changeover contact K23, dimensions in mm (inch)

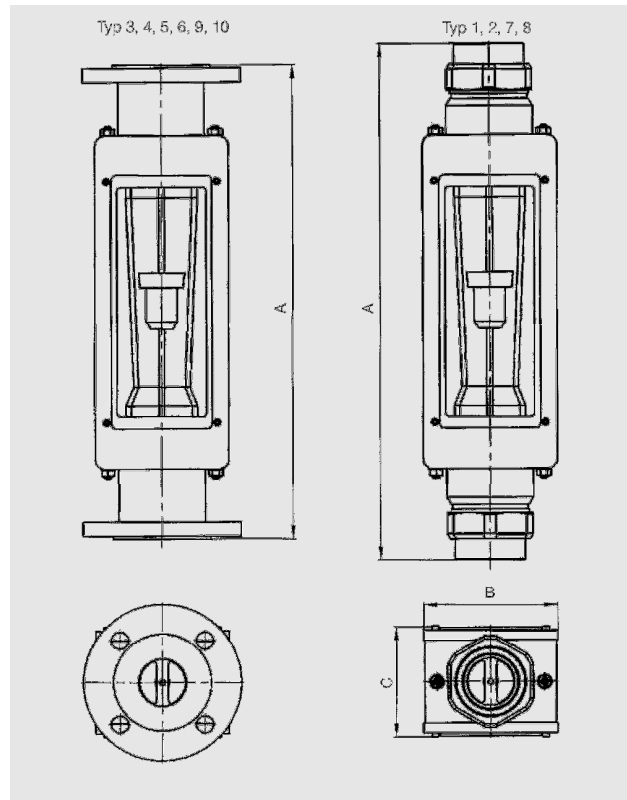


Fig. 5 TM Unox, dimensions in mm (inches)

Dimensions: flange according to DIN is always drilled to PN 10

Connection		Flow tube	Dimensions in mm (inch)			
Thread	Flange		A ±4 (0,16)		C	
G	DN (ANSI)		Type 1, 2, 7, 8	Type 3,4,5, 6,9,10		
1/2 (3/8, 1/4)	15 (1/2 in)	A 1 to C 500	490 (19.29)	500 (19.68)	84 (3.31)	65 (2.56)
		D 650 to D 1000			100 (3.94)	80 (3.15)
1 (3/4, 1/2)	25 (1 in)	D 1250 to D 3000	500 (19.68)		118 (4.65)	100 (3.94)
1 1/2 (1 1/4)	40 (1 1/2 in)	E 4000 to E 6500	535 (21.06)		138 (5.43)	115 (4.53)
2 (1 1/2, 1 1/4)	50 (2 in)	F 8000 to F 10000	540 (21.26)		142 (5.59)	120 (4.72)
	65 (2 1/2 in)	G 12500 to G 16000			168 (6.61)	150 (5.91)
	80 (3 in)	H 20000 to H 25000			185 (7.28)	170 (6.69)