

Size 492 to 5326 cc/rev up to 250 bar 20,100Nm/189Kw	Dual Displacement Hydraulic Motor Staffa, Series C	Data Sheet M-1002/10.02 GB
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Features

- ◇ High torque at low speed.
- ◇ High efficiency.
- ◇ Smooth running.
- ◇ Wide range of displacements to suit specific applications.
- ◇ Displacements change with ease when the motor is running.
- ◇ Electro-hydraulic or hydro-mechanical control methods available.
- ◇ Various mounting options available.



Description

Kawasaki “Staffa” high torque, low speed radial piston motor use hydrostatic balancing techniques to achieve high efficiency, combined with good breakout torque and smooth running capability.

The HMC series dual displacement models have two pre-set displacements which can be chosen from a wide range to suit specific application requirements. The displacements are hydraulically selected by a directional control valve which can be remote from, or mounted directly on the motor. Displacements change with ease when the motor is running.

The range of HMC motors extends from the HMC030 of 492 cc/rev to the HMC325 of 5326 cc/rev displacement.

These motors are also available in a continuously variable version using either hydro-mechanical or electro-hydraulic control methods.

Other mounting options are available on request to match many of the competitor interfaces.

There are 7 frame sizes in this product range for performances details see table below;

Motor Type	Max Torque (Nm)	Continuous output/power (kW)
C030	1654	60
C045	2930	99
C080	6050	138
C125	8222	135
C200	12800	174
C270	19000	189
C325	22000	189

The Kawasaki “Staffa” range also includes fixed displacement motors, refer to literature M-1001.

Model Staffa C	Page 1.68	Data Sheet M-1002/10.02
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Ordering Code – Staffa Motor Series C

F11	HM	C125	Q2	125	70	FM3	CS	TX	30	PL**
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Fluid Type

Blank: Mineral oil.

F3: Phosphate ester (HFD fluid).

F11: Water-based fluids (HFA, HFB & HFC)

For alternative fluids contact Kawasaki Precision Machinery UK Ltd.

Nominate fluid type and make on order.

Model Type

HM: Standard (HMC)

Motor frame size

C030	C200
C045	C270
C080	C325
C125	

Shaft Type

See shaft type option list on Page 3

High Displacement Code

See displacement code details on Page 7-12

Low Displacement Code

See displacement code details on Page 7-12.

Main Port Connections

See Port Connection details on Page 3-4.

Displacement Control Ports (and Shuttle Valve) (page 5)

Threaded ports/bi-directional shaft rotation:

X: X and Y ports G¹/₄" (BSPF to ISO 228/1)

ISO 4401 size 03 mounting face/bi-directional shaft rotation:

C: No shuttle

CS: With shuttle valve (see options by product type)

ISO 4401 size 03 mounting face/uni-directional shaft rotation (viewed on shaft end):

C1: Control pressure from main port 1 (shaft rotation clockwise with flow into port 1)

C2: Control pressure from main port 2 (shaft rotation counter-clockwise with flow into port 2)

C2 non preferred option consult Kawasaki before placing orders.

Special Features

PL**: Non-catalogued features, (**)= number assigned as required.

eg:

High pressure shaft seals.

Alternative port connections.

Stainless steel shaft sleeves.

Alternative encoder and tach drives.

Motor valve housing orientation.

Special paint.

Design Number.**Tacho/Encoder Drive**

T: Staffa original tach drive.

TX: Customer specific encoder drive

Note: Omit if not required.

Shaft Options

MOTOR TYPE

SHAFT DESCRIPTION

HMC030/045/080/125/200	P*	=	Parallel keyed shaft
HMC030/045	S*	=	Cylindrical shaft with 17 splines to BS3550
HMC030/045/080	Z*	=	Cylindrical shaft to DIN5480 (W55 x 3 x 7h)
HMC045	Q*	=	Female, 21 splines to BS3550
HMC080	S*	=	Cylindrical, 14 splines to BS3550
HMC080	Q*	=	Female, 24 splines to BS3550
HMC080	T*	=	Long tapered shaft
HMC080	X*	=	Short tapered shaft
HMC125/200/270/325	S*	=	Cylindrical, 20 splines to BS3550
HMC125	Q2*	=	Female, 34 splines to BS3550.
HMC125	T*	=	Long tapered keyed shaft
HMC125/200	Z*	=	Cylindrical shaft to DIN 5480 (W85 x 3 x 7h)
HMC200	Q*	=	Female, 34 splines to BS3550
HMC200	T*	=	Long tapered keyed shaft
HMC270/325	P1*	=	Cylindrical shaft with single parallel key
HMC270/325	Q*	=	Cylindrical ,internal splines to DIN5480 (W75 x 3 x 24 x 9H).
HMC270/325	Z*	=	Cylindrical shaft to DIN 5480 (W90 x 4 x 21 x 7H)
HMHDC200	T*	=	Long tapered keyed shaft
HMHDC270	T*	=	Long tapered keyed shaft

Notes:

* - For installations where shaft is vertically upwards specify "V" after shaft type letter to ensure that additional high level drain port is provided.

For all shaft dimensions see the motor installation drawings

Main Port Connections

Product Type

HMC030

F3	=	1 ¹ / ₄ " SAE 4-bolt flange (UNC)
FM3	=	1 ¹ / ₄ " SAE 4-bolt flange (Metric)
SO3	=	Staffa 3" 6-bolt flange
FM2	=	1" SAE 4-bolt flange (Metric)
F2	=	1" SAE 4-bolt flange (UNC)

HMC045

F3	=	1 ¹ / ₄ " SAE code 61 4-bolt flange
FM3	=	1 ¹ / ₄ " SAE code 61 4-bolt flange
SO3	=	Staffa 3" 6-bolt flange
FM2	=	1" SAE code 61 4-bolt flange
F2	=	1" SAE code 61 4-bolt flange



Main Port Connections (continued)

Product Type (continued)

HMC080

F3	=	11/4" SAE 4-bolt flange
FM3	=	11/4" SAE 4-bolt flange
SO3	=	Staffa 3" 6-bolt flange
FM2	=	1" SAE code 61 4-bolt flange
F2	=	1" SAE code 61 4-bolt flange

HMC125

F3	=	11/4" 3000 series SAE 4-bolt flange
FM3	=	11/4" 3000 series SAE 4-bolt flange
SO3	=	Staffa 3" 6-bolt flange
FM2	=	1" SAE code 61 4-bolt flange
F2	=	1" SAE code 61 4-bolt flange

HMC200

F2	=	SAE 1" 4-bolt UNC flange
FM2	=	SAE 1" 4-bolt UNC flange
F3	=	11/4" SAE code 61 4-bolt flange
FM3	=	11/4" SAE code 61 4-bolt flange
SO3	=	Staffa 3" 6-bolt flange
SO4	=	6-bolt UNF flange Staffa original valve housing
F4	=	SAE 1 1/2" 4-bolt UNC flanges
FM4	=	SAE 1 1/2" 4-bolt metric flanges

HMC270

F4	=	11/2" SAE code 62 4-bolt flange
FM4	=	11/2" SAE code 62 4-bolt flange
SO4	=	Staffa 4" 6-bolt flange

HMC325

F4	=	11/2" SAE code 62 4-bolt flange
FM4	=	11/2" SAE code 62 4-bolt flange
SO4	=	Staffa 4" 6-bolt flange

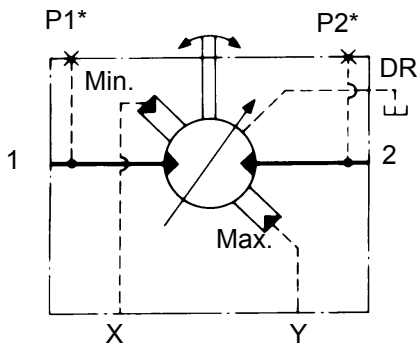


Functional Symbols

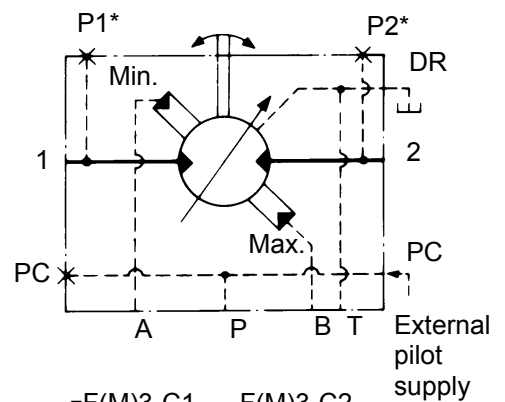
Note: All model types with variants in ordering code Main Port Connections and Displacement Control Ports (See Ordering Code Page 3/4).

- HMC030/HMC045 Valve housings which are normally mounted to motors are shown on pages 3/4.
 - HMC080
 - HMC125 Any five cylinder motor valve housing can mount to any five cylinder none monoblock.
 - HMC200
 - HMC270 Limitations are normally flow i.e. F(M)2 valve housings are limited to 200 litres/min.
 - HMC325
- HMC270 and 325 only mount 4" valves which are peculiar to the seven cylinder motors.

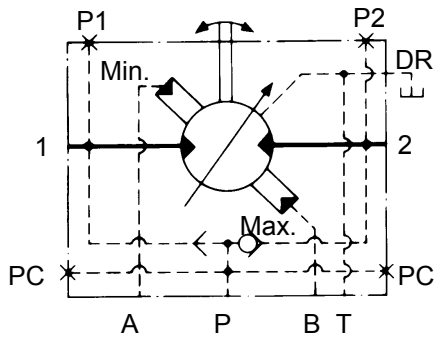
- F(M)3-X- -F(M)4-X-
- SO3-X- -SO4-X-
- F(M)2-X-



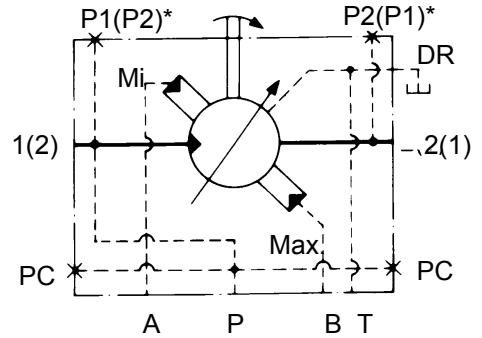
- F(M)3-C- -F(M)4-C-
- SO3-C- -SO4-C-
- F(M)2-C-



- F(M)3-CS-
- F(M)4-CS-



- F(M)3-C1- -F(M)3-C2-
- S03-C1- -S03-C2-
- F(M)4-C1- -F(M)4-C2-
- S04-C1- -S04-C2-



***-F(M)3 models only**
***-F(M)4 models only**

C2 is a non preferred option and complicated to achieve. The result can be achieved by using C1 and reversing the valve spool 180 degrees. Consult Kawasaki before ordering.

The pressure ports are only offered as standard where they are shown on the installation drawings. There is a single port in the 'C' spacer. Pressure ports in F(m) 3 and 4 valve housings can be called up in special features when required.



Performance Data

Performance data is valid for Staffa HMC Motors fully run in and operating with mineral oil. Leakage values are at fluid viscosity at 50cSt (232 SUS).

Motor Selection: Use table on pages 7 to 12 to select appropriate displacement for each application. Refer to table on this page for pressures and speed limits when using fire-resistant fluids.

Limits for fire resistant fluids

Fluid Type	Continuous Pressure (bar)	Intermittent Pressure (bar)	Max Speed r/min	Model type
HFA 5/95% oil-in emulsion	130	138	50% of limits for petroleum oil	All models
HFB 60/40 water in oil emulsion	138	172	As for petroleum oil	All models
HFC water glycol	103	138	50% of limits for petroleum oil	All models
HFD phosphate ester	207	241	As for petroleum oil	C030
	250	275	As for petroleum oil	All other models

Specify make and type of fluid on your order if other than petroleum oil.

Rating definitions**Continuous rating**

For continuous duty the motor must be operating within each of the maximum values for speed, pressure and power.

Intermittent rating

Operation within the intermittent power rating (up to the maximum continuous speed) is permitted on a 15% duty basis, for periods up to 5 minutes maximum.

Intermittent max pressure

C030 = 241 bar

All other models to 275 bar.

These pressures are allowable on the following basis:

- (a) Up to 50 r/min: 15% duty for periods up to 5 minutes maximum.
- (b) Over 50 r/min: 2% duty for periods up to 30 seconds maximum.

Static pressure to DNV rules 380 Bars.



Performance Data Tables

HMCO30 Motor

Displacement Code		30	27	24	21	18	15	12	09	06	03/00
Displacement volume/r	cm ³	492	442	393	344	295	246	197	147	98	49/00
Average actual running torque	Nm/bar	6.86	6.08	5.3	4.59	3.88	3.2	2.51	1.83	1.15	0.44/0
Max continuous speed	r/min	450	500	525	550	575	600	600	600	600	1000
Max continuous output	kW	60	60	55	49	42	35	27	20	10	0
Max intermittent output	kW	66	66	61	55	48	41	32	24	13	0
Max continuous pressure	bar	207	207	207	207	207	207	207	207	207	17*
Max intermittent pressure	bar	241	241	241	241	241	241	241	241	241	17*

HMCO45 Motor

Displacement Code		45	40	35	30	25	20	15	10	05/00
Displacement volume/r	cm ³	737	655	573	491	410	327	246	163	81/00
Average actual running torque	Nm/bar	10.65	9.4	8.04	6.88	5.68	4.4	3.2	1.55	0
Max continuous speed	r/min	450	550	600	600	600	600	600	600	1000
Max continuous output	kW	99	89	79	67	54	42	30	15	0
Max intermittent output	kW	119	107	95	80	65	50	36	18	0
Max continuous pressure	bar	250	250	250	250	250	250	250	250	17*
Max intermittent pressure	bar	275	275	275	275	275	275	275	275	17*

Note: Intermediate displacements can be made available to special order

*See "Small displacements" Page 27, for information about higher pressure applications, in 05/00 displacements.



Performance Data Tables (continued)**HMC080 Motor**

Displacement Code		90	85	80	75	70	65	60	55	50	45
Displacement volume/r	cm ³	1475	1393	1310	1230	1147	1065	983	900	820	737
Average actual running torque	Nm/bar	20.02	20.8	19.66	18.48	17.11	15.9	14.55	13.2	12.0	10.6
Max continuous speed	r/min	300	315	335	360	385	415	450	490	540	600
Max continuous output	kW	138	134	129	127	123	118	115	110	105	99
Max intermittent output	kW	170	165	159	156	151	145	142	135	129	122
Max continuous pressure	bar	250	250	250	250	250	250	250	250	250	250
Max intermittent pressure	bar	275	275	275	275	275	275	275	275	275	275

HMC080 Motor (continued)

Displacement Code		40	35	30	25	20	15	10	05/00
Displacement volume/r	cm ³	655	574	492	410	328	246	164	82/00
Average actual running torque	Nm/bar	9.24	7.87	6.48	5.31	3.93	2.56	1.57	0
Max continuous speed	r/min	600	600	600	600	600	600	600	1000
Max continuous output	kW	92	79	64	52	38	26	12	0
Max intermittent output	KW	113	97	79	64	47	32	15	0
Max continuous pressure	bar	250	250	250	250	250	250	250	17*
Max intermittent pressure	bar	275	275	275	275	275	275	275	17*

Note: Intermediate displacements can be made available to special order

* See "Small displacements" Page 27, for information about higher pressure applications, in 05/00 displacements.



Performance Data Tables (continued)

HMC125 Motor

Displacement Code		125	120	110	100	90	80	70	60	50	40
Displacement volume/r	cm ³	2048	1966	1802	1639	1475	1311	1147	983	819	655
Average actual running torque	Nm/bar	29.9	28.7	26.3	23.6	21.0	18.3	15.7	12.8	10.6	8.1
Max continuous speed	r/min	190	195	210	235	260	295	340	390	440	540
Max continuous output	KW	135	131	122	114	105	98	88	81	72	62
Max intermittent output	Kw	152	147	137	128	118	110	99	91	81	70
Max continuous pressure	bar	250	250	250	250	250	250	250	250	250	250
Max intermittent pressure	bar	275	275	275	275	275	275	275	275	275	275

HMC125 Motor (continued)

Displacement Code		30	20	10	05/00
Displacement volume/r	cm ³	492	328	164	82/00
Average actual running torque	Nm/bar	5.9	3.8	0.6	0
Max continuous speed	r/min	600	600	600	1000
Max continuous output	kW	48	24	4	0
Max intermittent output	kW	54	33	6	0
Max continuous pressure	bar	250	250	250	17*
Max intermittent pressure	bar	275	275	275	17*

Note: Intermediate displacements can be made available to special order

* See "Small displacements" Page 27, for information about higher pressure applications, in 05/00 displacements.



Performance Data Tables (continued)**HMC200 Motor**

Displacement Code		188	180	170	160	150	140	130	120	110	100
Displacement volume/r	cm ³	3080	2950	2790	2620	2460	2290	2130	1970	1800	1640
Average actual running torque	Nm/bar	46.6	44.0	41.7	39.1	36.6	34.0	31.3	28.7	26.3	23.6
Max continuous speed	3" valve r/min	155	160	165	170	175	180	185	195	210	235
	4" valve r/min	200	205	210	215	220	230	250	270	295	320
Max continuous output	KW	174	174	174	165	156	148	139	131	122	114
Max intermittent output	KW	195	195	195	185	175	166	156	147	137	128
Max continuous pressure	bar	250	250	250	250	250	250	250	250	250	250
Max intermittent pressure	bar	275	275	275	275	275	275	275	275	275	275

HMC200 Motor (continued)

Displacement Code		90	80	70	60	50	40	30	20	10	05/00
Displacement volume/r	cm ³	1470	1310	1150	980	820	670	490	330	160	82/00
Average actual running torque	Nm/bar	21.0	18.3	15.7	12.8	10.6	8.1	5.9	3.8	0.6	0
Max continuous speed	3" valve r/min	260	295	340	390	440	540	600	600	600	1000
	4" valve r/min	350	350	350	350	350	350	350	350	350	1000
Max continuous output	KW	105	98	88	81	72	62	48	25	5	0
Max intermittent output	KW	118	110	99	91	81	70	54	33	6	0
Max continuous pressure	bar	250	250	250	250	250	250	250	250	250	17*
Max intermittent pressure	bar	275	275	275	275	275	275	275	275	275	17*

Note: Intermediate displacements can be made available to special order.

* See "Small displacements" Page 27, for information about higher pressure applications, in 05/00 displacements.



Performance Data Tables (continued)

HMC270 Motor

Displacement Code		280	250	220	200	180	160	140	120	100	80
Displacement volume/r	cm ³	4588	4097	3605	3277	2950	2622	2294	1966	1640	1310
Average actual running torque	Nm/bar	69.4	61.9	53.9	49.0	43.6	38.3	33.2	27.9	22.4	17.1
Max continuous speed	r/min	120	135	150	165	185	200	240	270	325	350
Max continuous output	kW	189	176	161	150	139	128	116	104	89	73
Max intermittent output	kW	213	198	181	169	156	144	132	120	101	95
Max continuous pressure	bar	250	250	250	250	250	250	250	250	250	250
Max intermittent pressure	bar	275	275	275	275	275	275	275	275	275	275

HMC270 Motor (continued)

Displacement Code		60	40	30	20	10/00
Displacement volume/r	cm ³	980	655	492	328	160/00
Average actual running torque	Nm/bar	12.2	7.9	5.15	2.4	0
Max continuous speed	r/min	350	350	350	350	1000
Max continuous output	KW	57	38	26	14	0
Max intermittent output	KW	80	55	38	20	0
Max continuous pressure	bar	250	250	250	250	17*
Max intermittent pressure	bar	275	275	275	275	17*

Note: Intermediate displacements can be made available to special order

*See "Small displacements" Page 27, for information about higher pressure applications, in 05/00 displacements.



Performance Data Tables (continued)**HMC325 Motor**

Displacement Code		325	310	300	220	200	180	160	140	120	100
Displacement volume/r	cm ³	5326	5080	4916	3605	3277	2950	2622	2294	1966	1639
Average actual running torque	Nm/bar	80.4	76.9	74.3	53.9	49.0	43.6	38.3	33.2	27.9	22.4
Max continuous speed	r/min	100	105	110	150	165	185	200	240	270	325
Max continuous output	KW	189	189	189	161	150	139	128	116	104	89
Max intermittent output	KW	213	213	213	181	169	156	144	132	120	107
Max continuous pressure	bar	250	250	250	250	250	250	250	250	250	250
Max intermittent pressure	bar	275	275	275	275	275	275	275	275	275	275

HMC325 Motor (continued)

Displacement Code		95	80	60	40	30
Displacement volume/r	cm ³	1557	1311	980	655	492
Average actual running torque	Nm/bar	20.9	17.1	12.2	7.9	5.15
Max continuous speed	r/min	350	350	350	350	350
Max continuous output	KW	85	73	57	38	14
Max intermittent output	KW	104	95	80	55	20
Max continuous pressure	bar	250	250	250	250	250
Max intermittent pressure	bar	275	275	275	275	275

★ **Note:** Intermediate displacements can be made available to special order, but not below 30 cubic inch displacement.

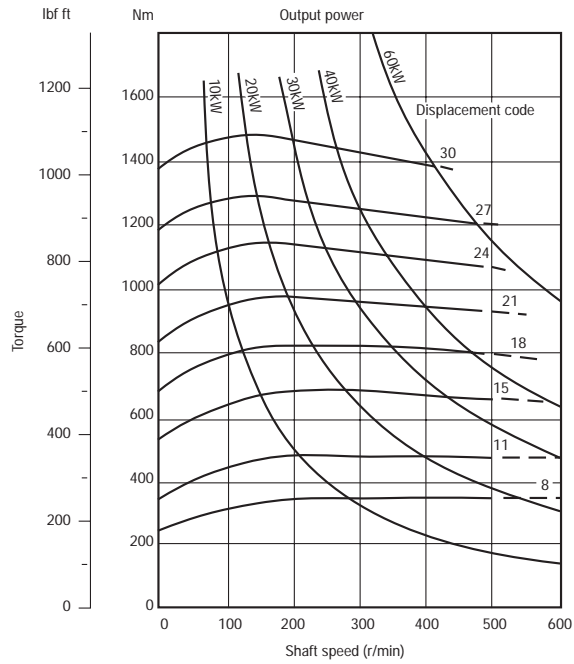


Output Torque

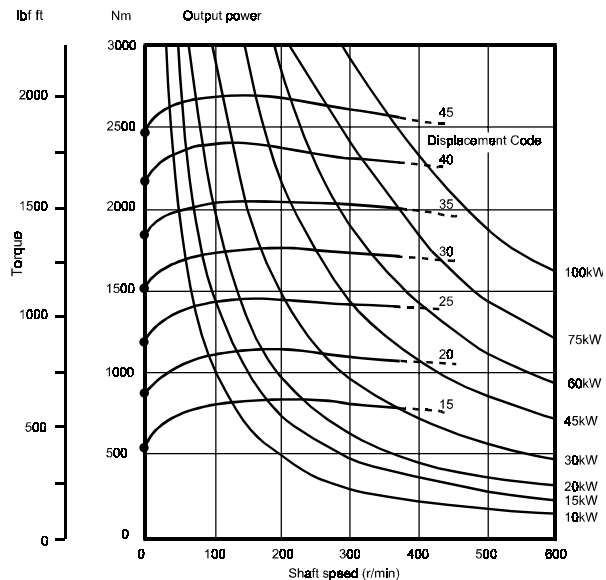
The torque curves indicated, for each displacement, the maximum output torque of the motor with an inlet pressure of (HMC030 only 207 bar) all other models 250 bar and zero output pressure. High return line pressures will reduce the torque for any given pressure differential.

The solid line portion of each curve indicate the level of maximum torque and speed that are permitted on a "continuous" basis. The dotted portion of each curve indicates the level of torque and speed at which the motor can operate at an "intermittent" rating. The starting torque shown on the graph are average and will vary with crankcase angle.

C030

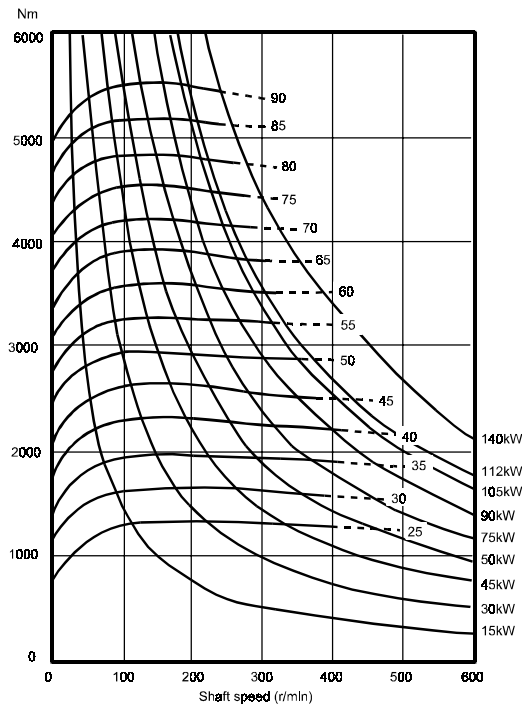


C045

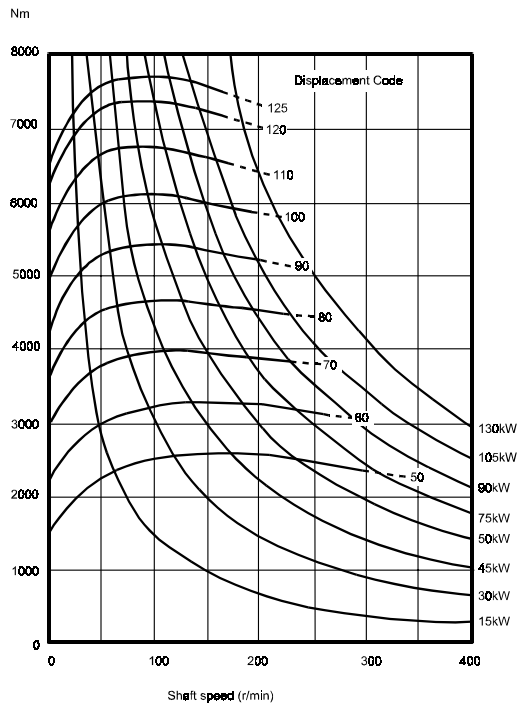


Output Torque (continued)

C080

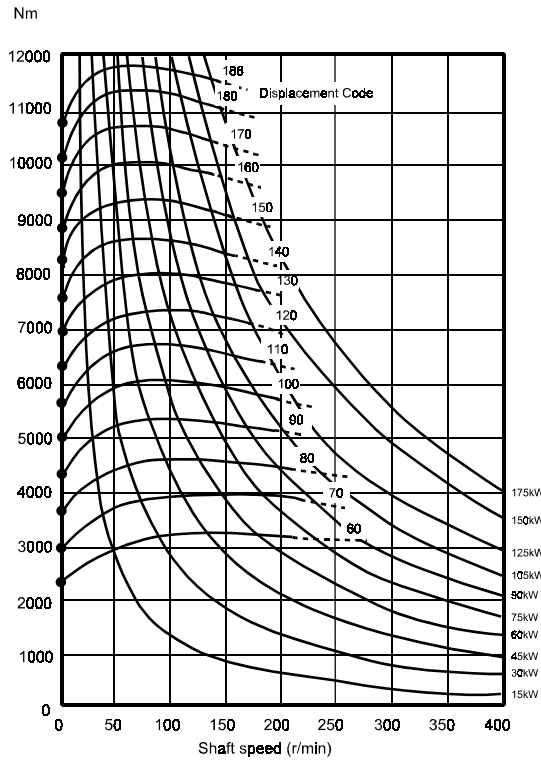


C125

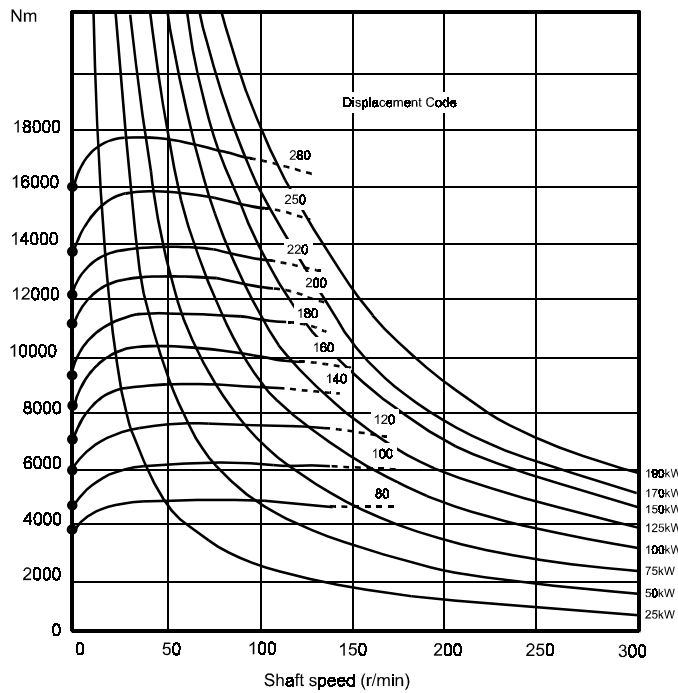


Output Torque (continued)

C200

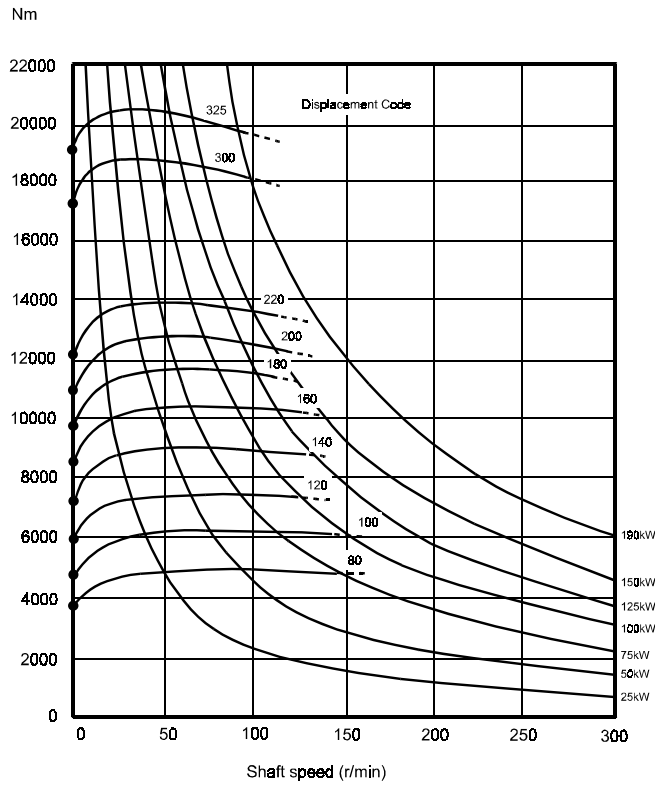


C270



Output Torque (continued)

C325



Bearing Life

Notes: The nomograph allows mean (median)[^] bearing life to be determined for conditions of;

- (a) No side load and no axial thrust.
- (b) Side load and no axial thrust.

To determine L10 life predictions per ISO281-1-1997 multiply the median figure by 0.2. For more precise bearing life predictions, or where axial thrust are incurred, contact Kawasaki Precision Machinery (UK) Ltd.

Stress Shaft Limits

The shaft stress limit in the nomograph is based on the fatigue rating of shaft types "S" and "P"; For shaft type "Z" the shaft stress limit is approx. 20% higher.

Note: Example is given against HMC125/200

Example 1 (HMC125) (follow chain dotted line)

- Side load (W) a) 0
- System pressure (P) b) 138 bar
- Speed (N) c) 175 r/min
- Median bearing life d) 22 000 hrs
- L10 bearing rating = median x 0.2 4400 hrs

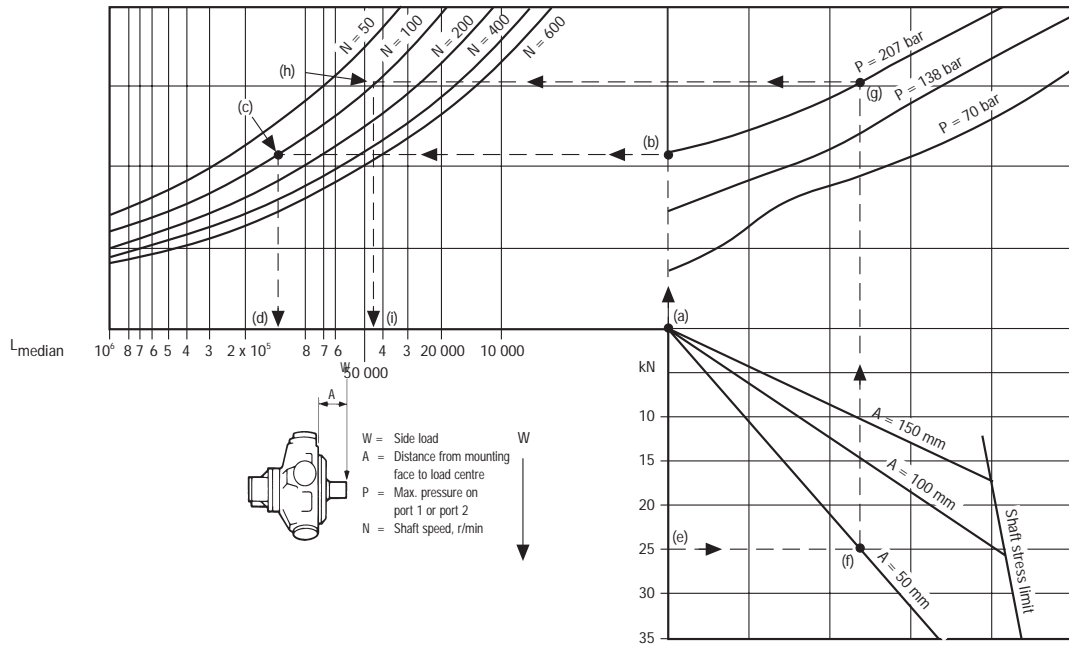
Example 2 (HMC200) (follow chain dotted line):

- Side load (W) e) 50 kN
- Load offset (A) from motor mounting face f) 100 mm
- System pressure (P) g) 138 bar
- Speed (N) h) 50 r/min
- Median bearing life i) 12 000 hrs
- L10 bearing rating = median x 0.2 2400 hrs

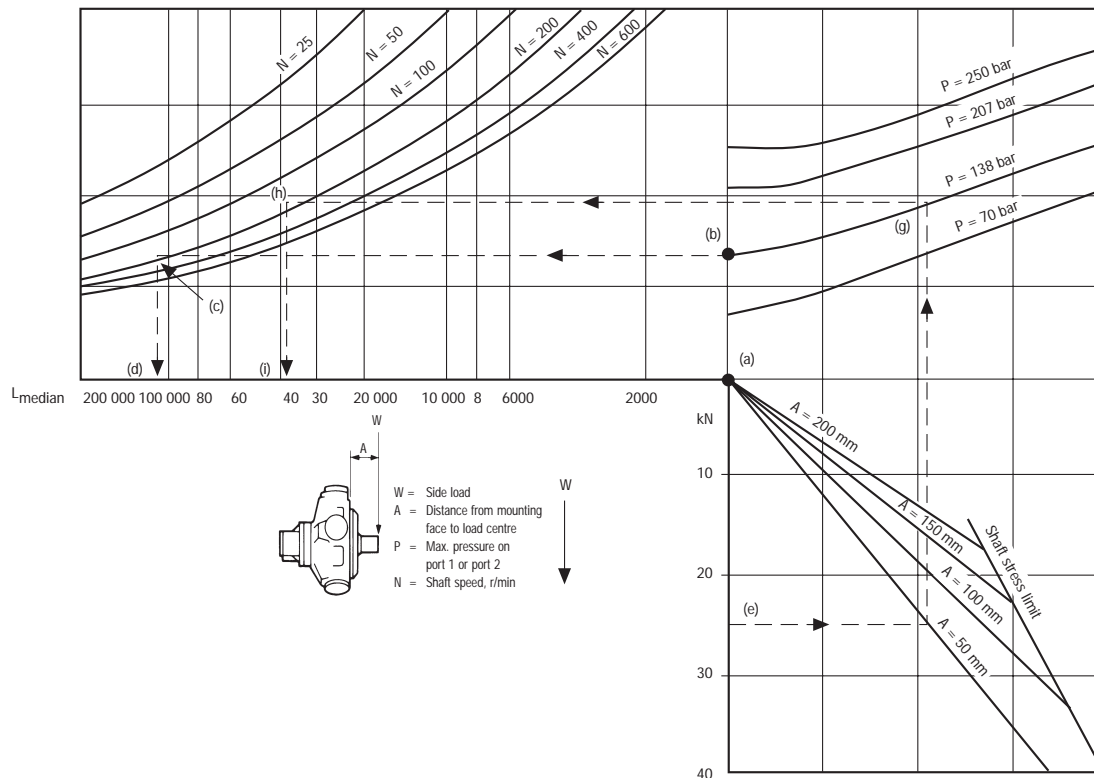


Bearing Life Graphs

HMC030

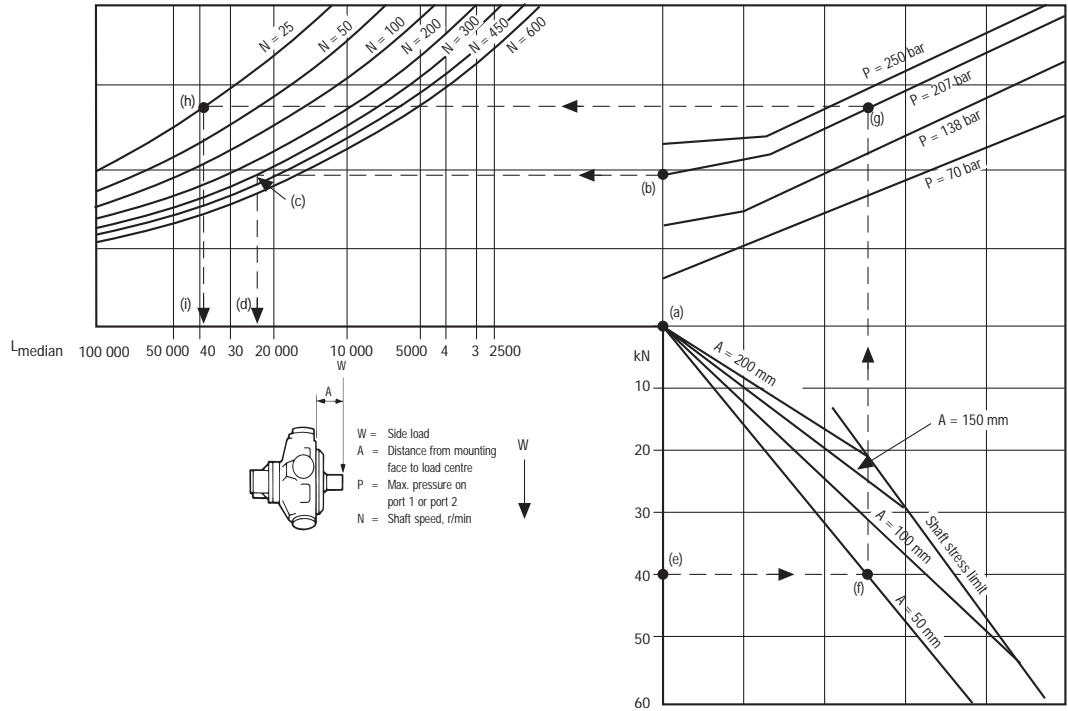


HMC045

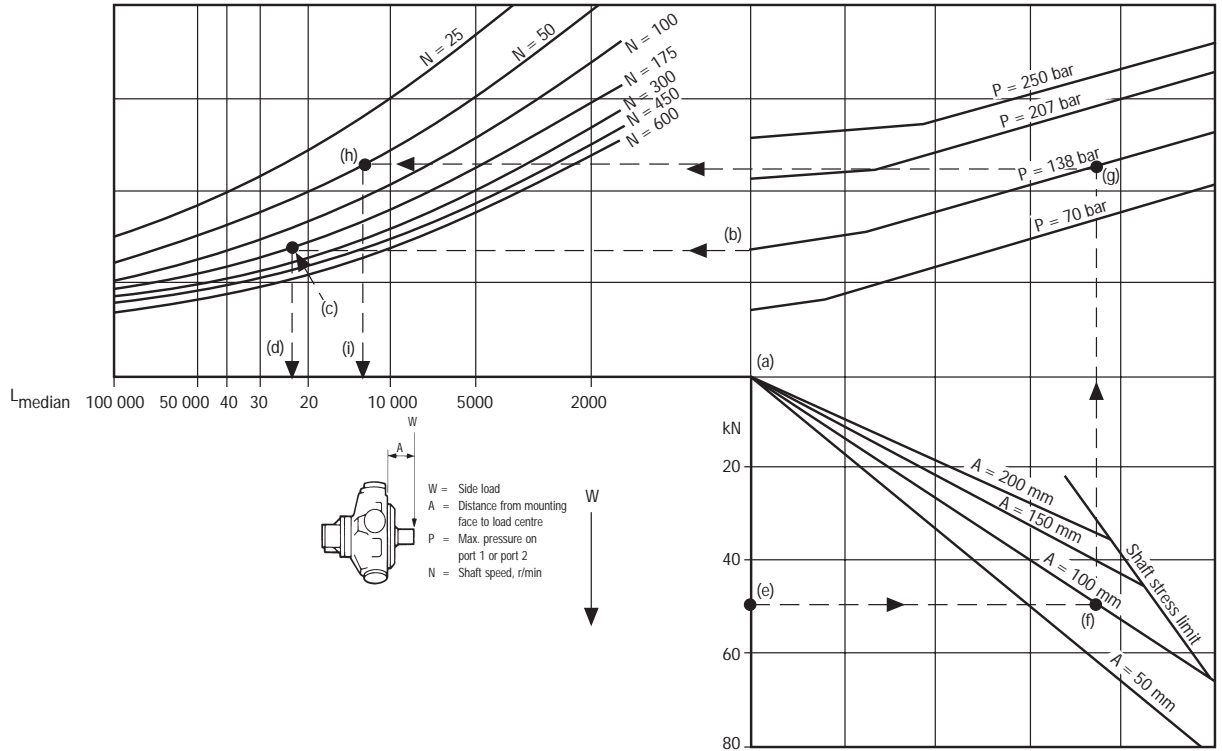


Bearing Life Graphs (continued)

HMC080

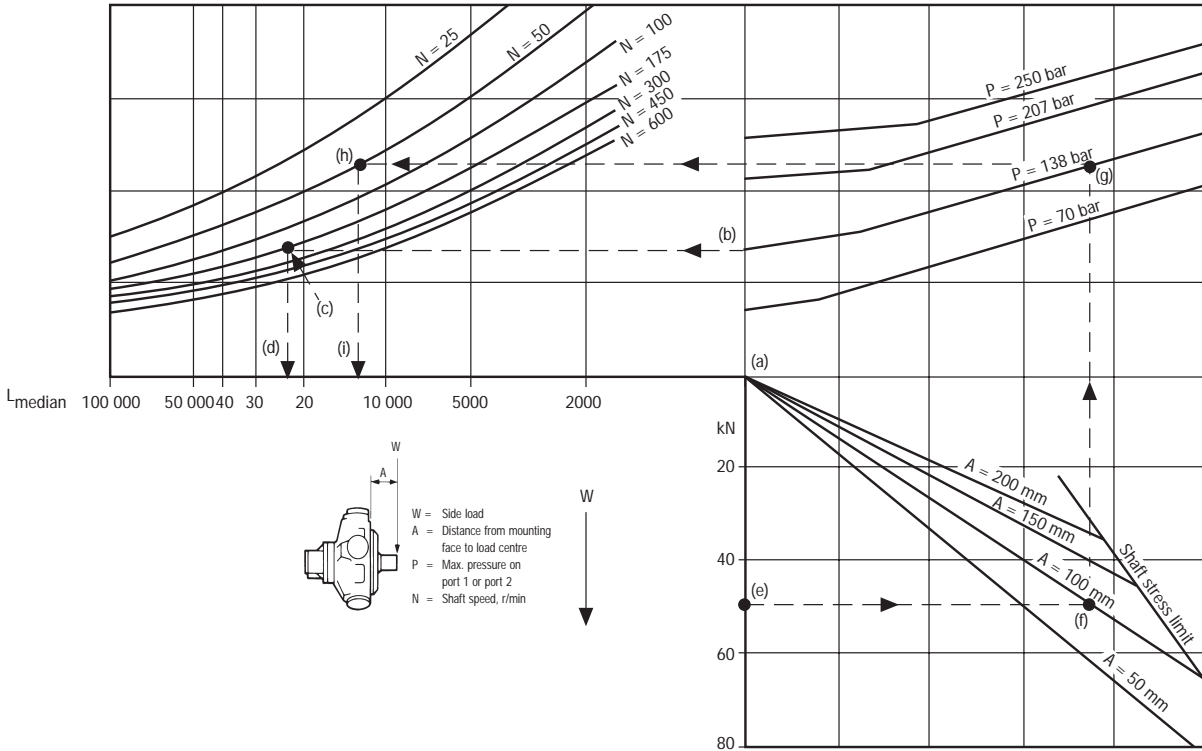


HMC125

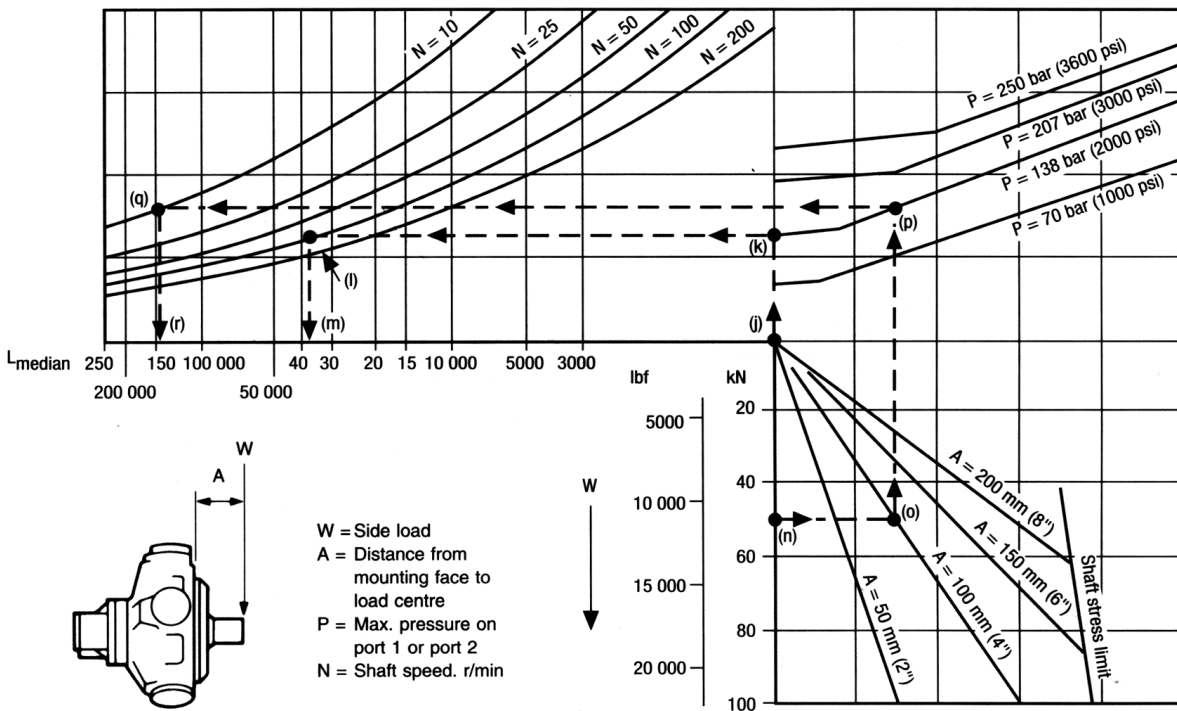


Bearing Life Graphs (continued)

HMC200

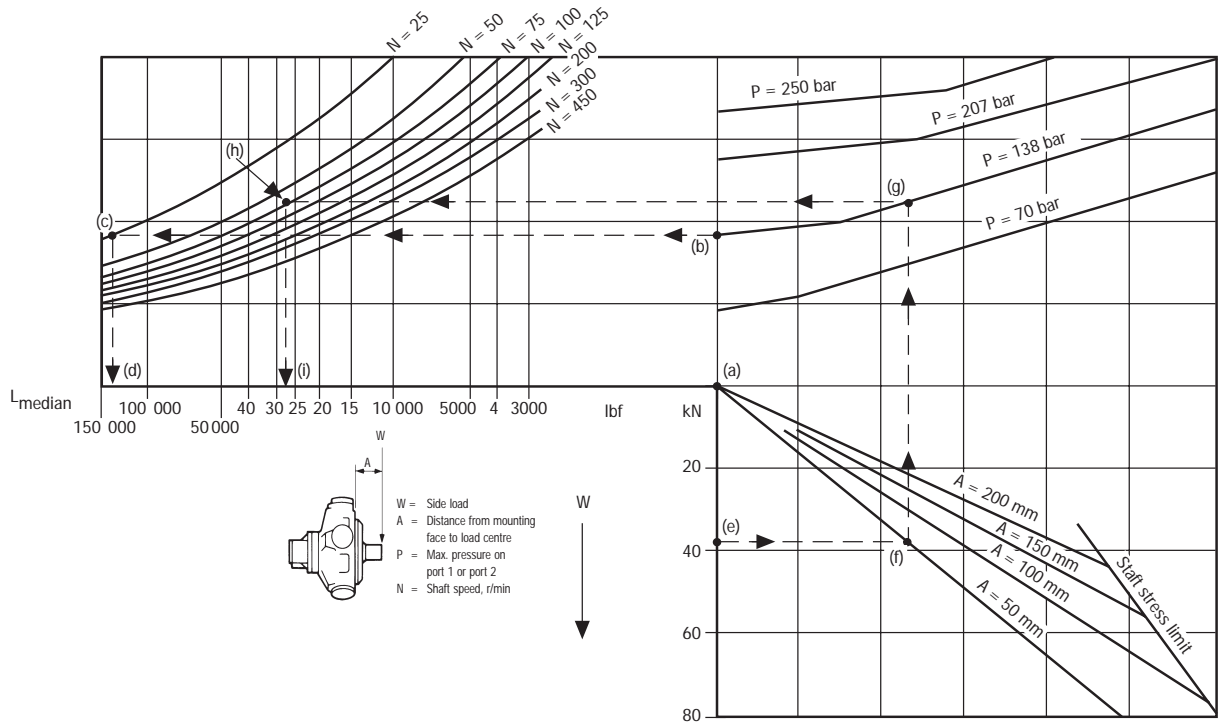


HMHDC200

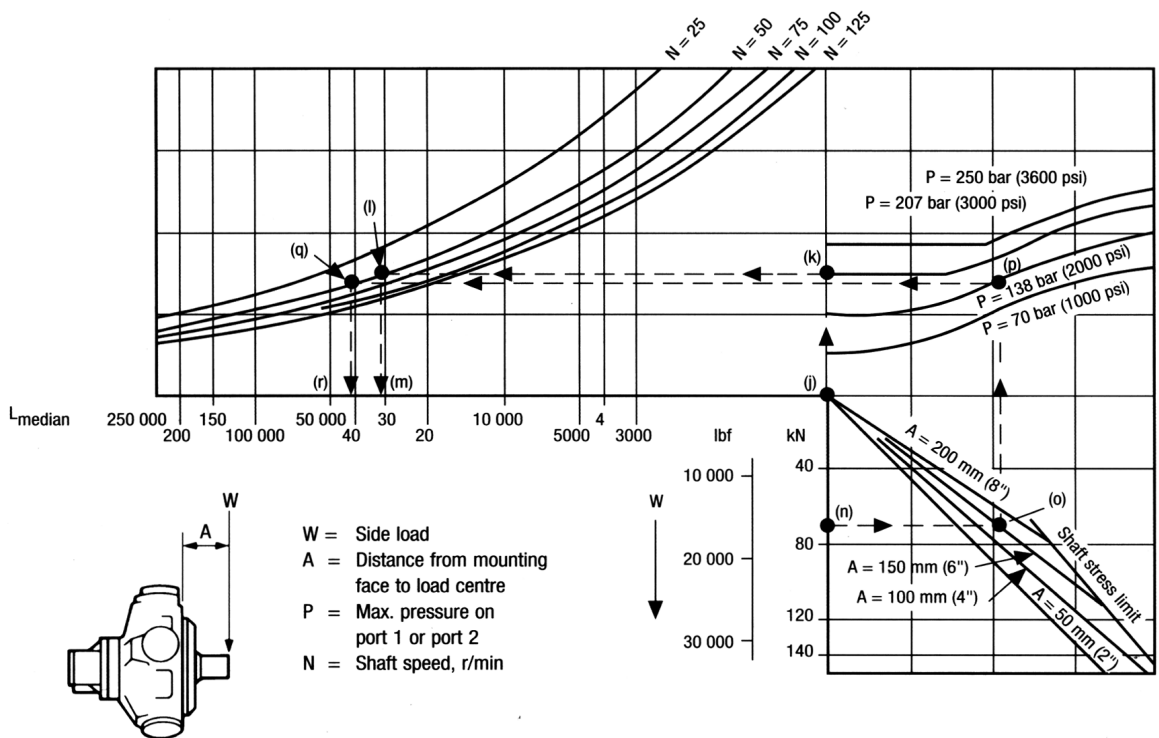


Bearing Life Graphs (continued)

HMC270

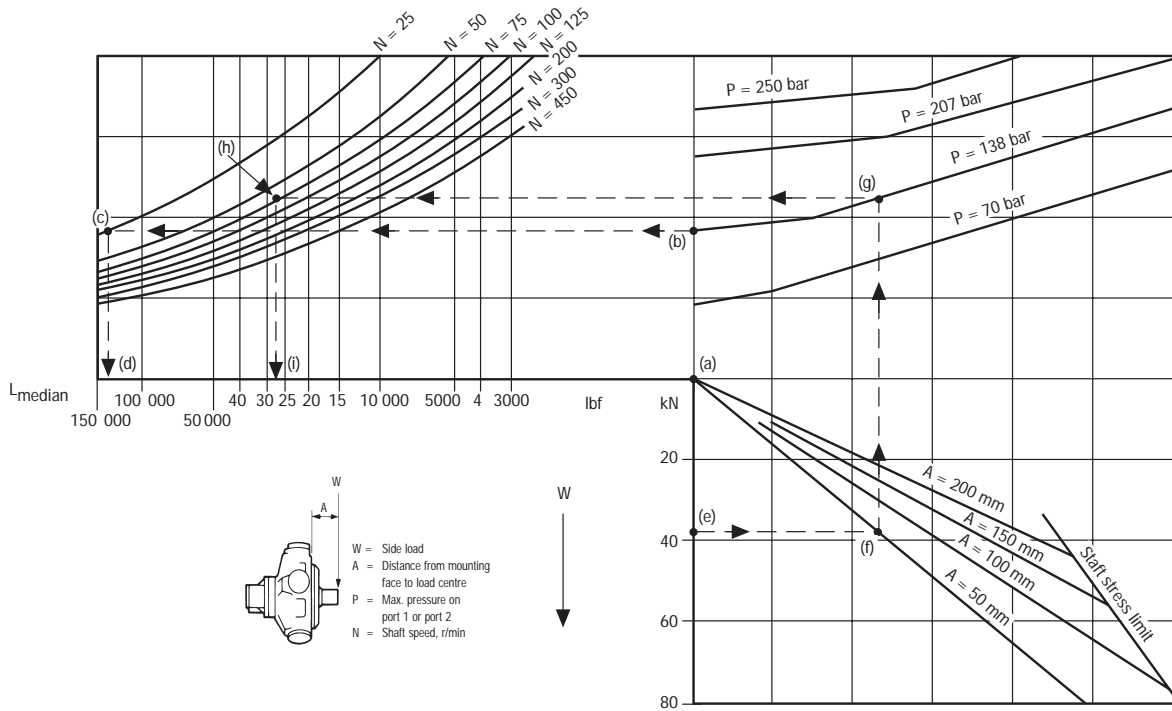


HMHDC270



Bearing Life Graphs (continued)

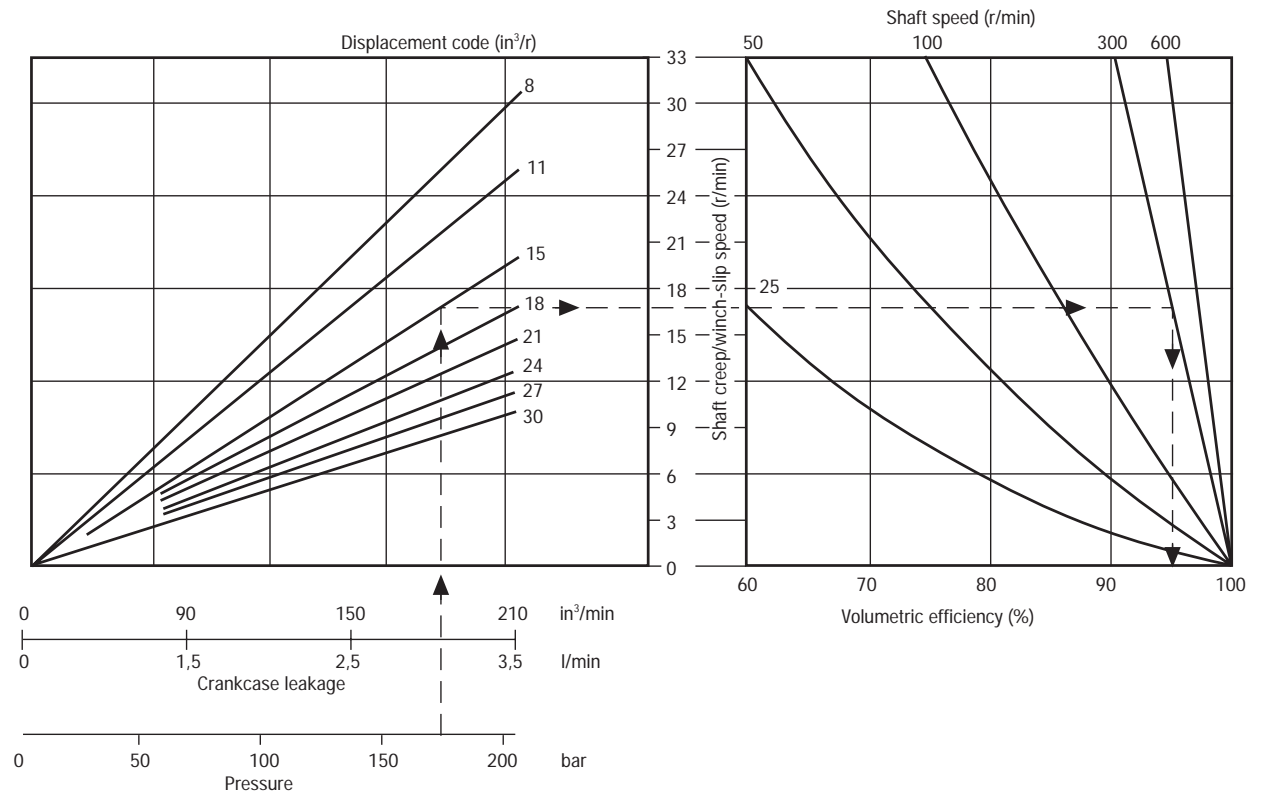
HMC325



Volumetric Efficiency

These nomographs enable the average volumetric efficiency, crankcase (drain) leakage and “winch slip”/shaft creep speed to be estimated. The shaft creep occurs when the load attempts to rotate the motor against the closed ports as may occur. See example against each graph.

C030



Example (follow chain dotted line):

Given:

- 1. Pressure..... 175 bar
- 2. Displacement code..... 15 (in³/r)
- 3. Speed..... 300 r/min

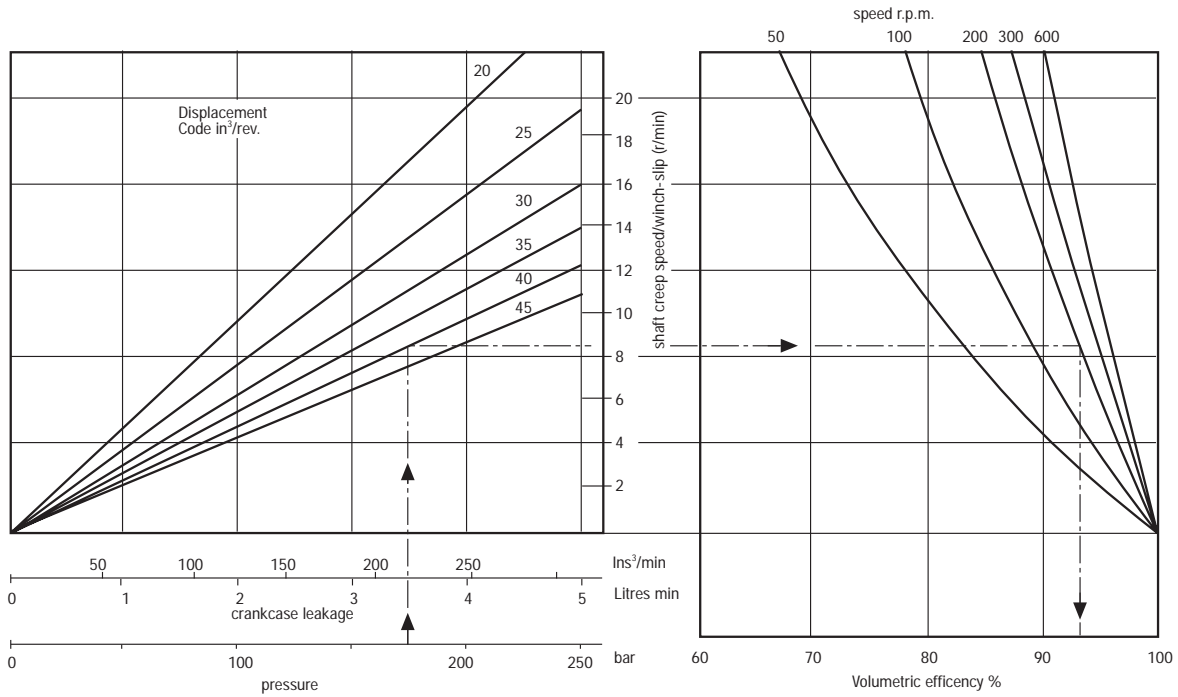
To obtain:

- 4. Volumetric efficiency 94.8%
- 5. Crankcase leakage 3.0 l/min (180 in³/min)
- 6. Shaft creep speed 17 r/min

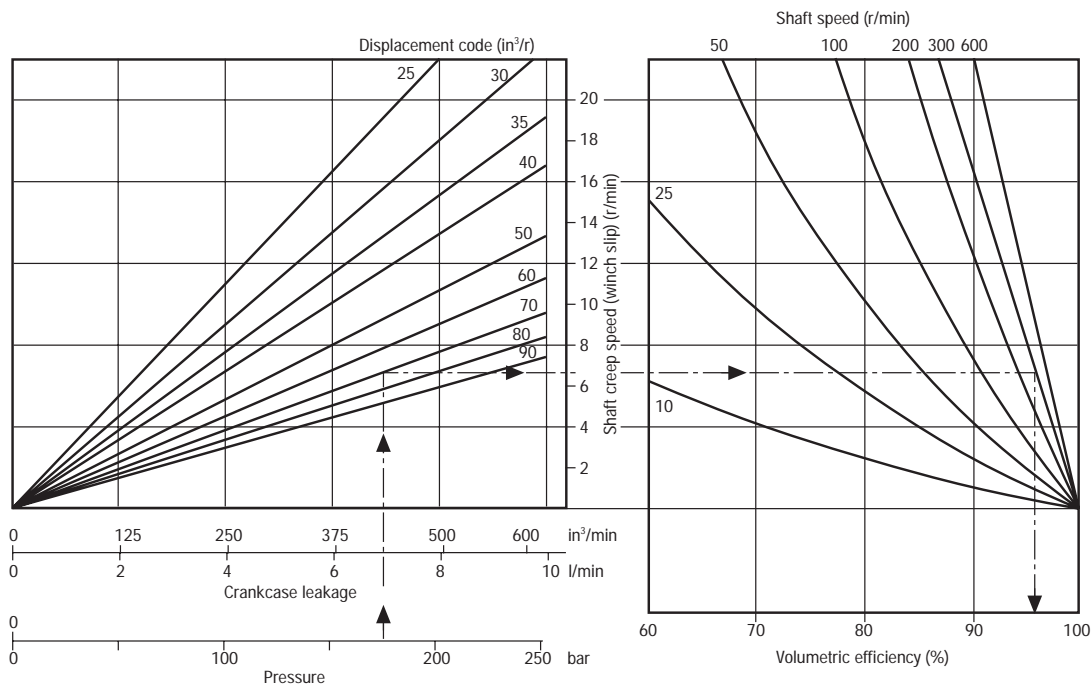


Volumetric Efficiency (continued)

C045

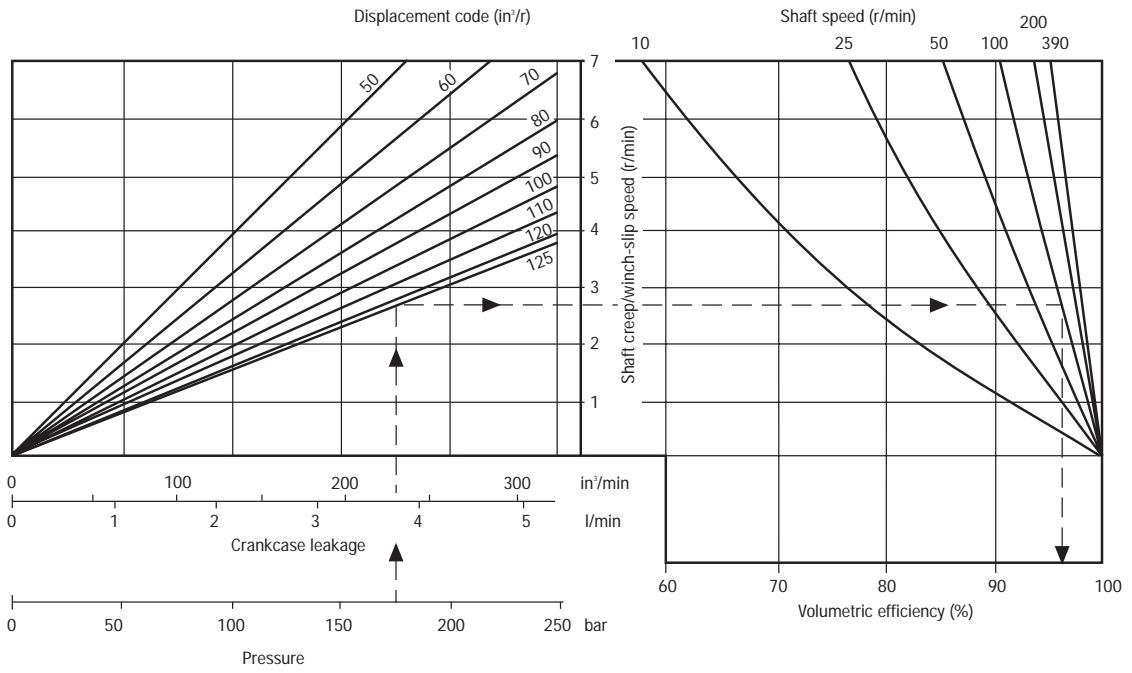


C080

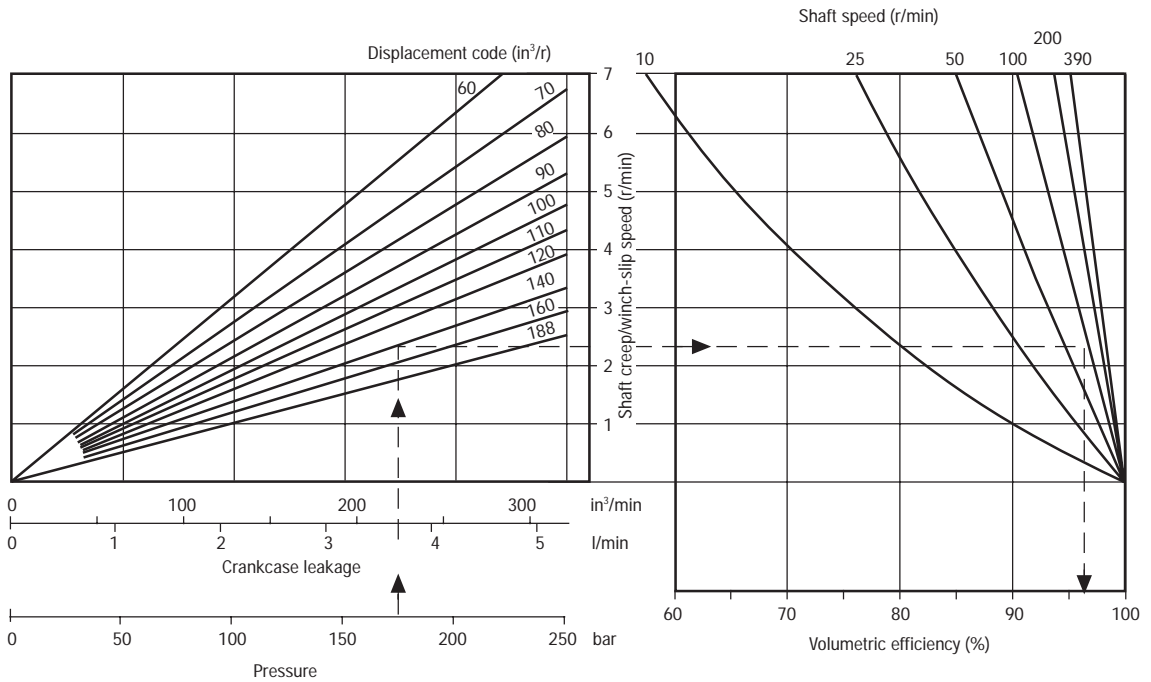


Volumetric Efficiency (continued)

C125

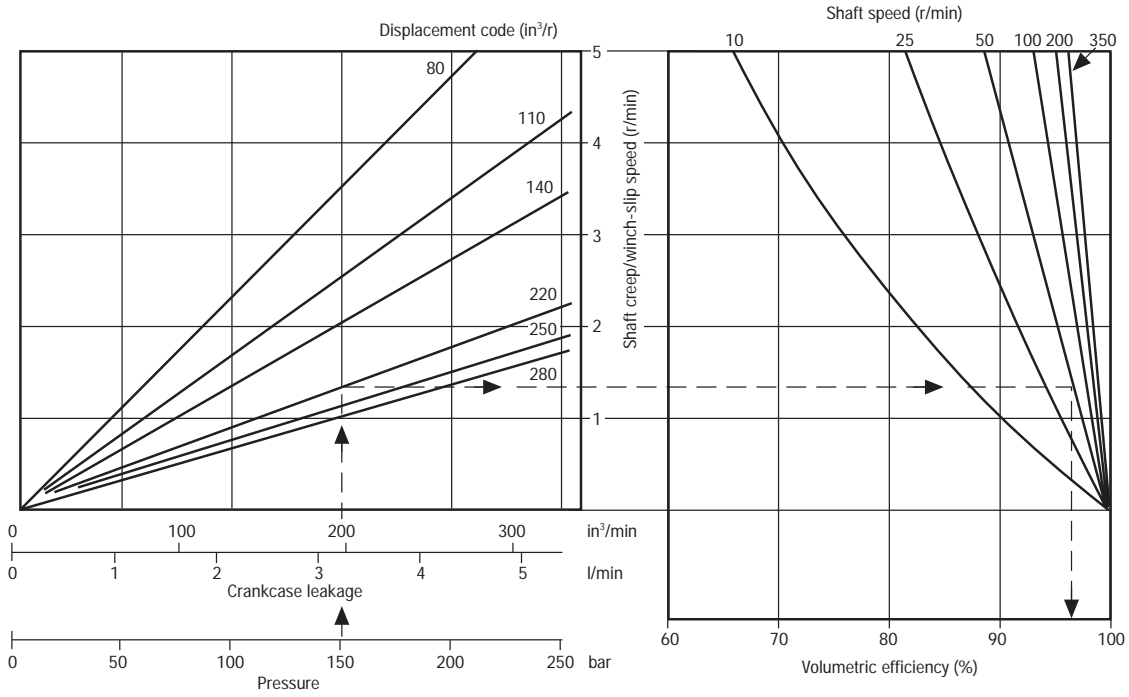


C200

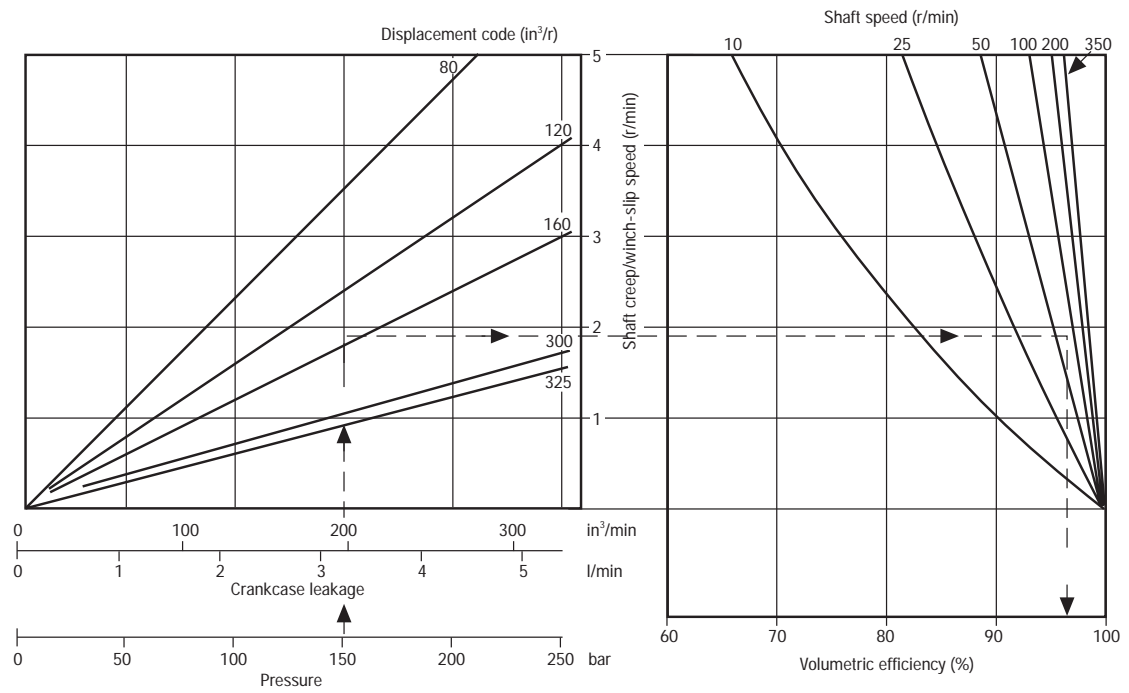


Volumetric Efficiency (continued)

C270



C325



Circuit and Application Notes

Displacement Selection

To select either displacement, a pressure at least equal to $\frac{2}{3}$ of the motor inlet/outlet pressure (whichever is higher) is required. In most applications the motor inlet pressure will be used. For inlet/outlet pressures below 3,5 bar a minimum control pressure of 3,5 bar is required. In the event of loss of control pressure the motor will shift to its highest displacement.

Starting Torque

The starting torque shown on the graph on pages 12 to 15 are average and will vary with system parameters

Low Speed Operations

(High displacement mode) Minimum operating speeds are determined by (load inertia, drive elasticity, etc.) For operating at speeds below 3r/min (6 r/min CO45 only) consult Kawasaki Precision Machinery (UK) Ltd.

Small Displacements

The pressures given in the table on pages 6 to 11 for displacement code "05" (and below) are based on 1000 r/min output shaft speed. These pressures can be increased for shaft speeds less than 1000 r/min; consult Kawasaki for detail. Speeds greater than 1000 r.p.m. may be applied but only after the machine duty cycle has been considered in conjunction with Kawasaki Precision Machinery (UK) Ltd.

A zero swept volume displacement (for free wheeling requirements) is available on request, consult Kawasaki Precision Machinery (UK) Ltd.

High Back Pressure

When both inlet and outlet ports are pressurised continuously, the lower pressure port must not exceed 70 bar at any time. Consult Kawasaki on application beyond this limit. Note that high back pressure reduce the effective torque output of the motor.

Boost Pressure

When operating as a motor the outlet pressure should equal or exceed the crankcase pressure . If pumping occurs (i.e. overrunning loads) then a positive pressure , "P" ,is required at the motor ports .Calculate "P" (bar) from the operating formula

$$\text{Boost Formula } P = 1 + \frac{N^2 \times V^2}{K} + C$$

Where P is in Bar, N = motor speed (RPM), V = motor displacement (cc/rev.), C=Crankcase pressure (BAR) and K=a constant from the table below:

MOTOR	PORTING	CONSTANT
HMC030	F2, F(M)2	3.7×10^9
	SO3, F(M)3, F3	7.5×10^9
HMC045	F2, F(M)2	3.7×10^9
	SO3, F(M)3, F3	1.6×10^{10}
HMC080	F(M)3, S03, F3	1.6×10^{10}
HMC125	F(M)3, S03, F3	1.6×10^{10}
HMC200	F3, F(M)3, S03	1.6×10^{10}
	F4, F(M)4, S04	3.3×10^{10}
HMC270	S04, F4, F(M)4	4×10^{10}
HMC325	S04, F4, F(M)4	4×10^{10}



Circuit and Application Notes (continued)

The flow rate of oil for the make-up system can be estimated from the crankcase leakage figure (see Volumetric Efficiency graphs pages 21 to 27) plus an allowance for changing displacement;

e.g.	C030	To change high to low in 0,2, sec requires 11 l/min
	C045	To change high to low in 0.25 sec requires 15 l/min
	C080	To change high to low in 0.25 sec requires 32 l/min
	C125	To change high to low in 0.5 sec requires 15 l/min
	C200	To change high to low in 0.5 sec requires 15 l/min
	C270	To change high to low in 1 sec requires 24 l/min
	C325	To change high to low in 1 sec requires 20 l/min

Allowances should be made for other systems losses and also for "fair wear and tear" during the life of the motor, pump and system components.

Cooling Flow

Operating within the continuous rating does not require any additional cooling.

For operating conditions above "continuous power", up to the "intermittent power" rating, additional cooling oil may be required.

This can be introduced through the spare crankcase drain holes, or in special cases through the valve spool end cap.

Consult Kawasaki about such applications.

Motor Casing Pressure

With the standard shaft seal fitted, the motor casing pressure should not exceed 3,5 bar. On installations with long drain lines a relief valve is recommended to prevent over-pressurising the seal.

Notes:

1. The casing pressure at all times must not exceed either the motor inlet or outlet pressure.
2. High pressure shaft seals are available to special order for casing pressures of, Continuous; 10 bar. Intermittent; 14 bar.
3. Check installation dimensions (pages 53 to 59) for maximum crankcase drain fitting depth.

Hydraulic Fluids

Dependent on motor (see Model Code position 1.) suitable fluids include:

- (a) Antiwear hydraulic oils.
- (b) Phosphate ester (HFD fluids)
- (c) Water glycols (HFC fluids)
- (d) 60/40% water-in-oil emulsions (HFB fluids).
- (e) 5/95% oil-in-water emulsions (HFA fluids)

Reduce pressure and speed limits, see pages 6 to 11.

Viscosity limits when using any fluid except oil-in-water (5/95) emulsions are;

Max. off load	2000cSt (9270 SUS)
Max. on load	150 cSt (695 SUS)
Optimum	50 cSt (232 SUS)
Minimum	25 cSt (119 SUS)



Circuit and Application Notes (continued)

Mineral oil recommendations

The fluid should be a good hydraulic grade, non-detergent petroleum oil. It should contain anti-oxidant, anti-foam and demulsifying additives. It must contain antiwear or EP additives. Automatic transmission fluids and motor oils are not recommended.

Temperature limits

Ambient min. -30°C
 Ambient max. + 70°C
 Max. operating temperature range.
 Petroleum oil Water- containing
 Min -20°C +10°C
 Max. *+ 80°C +54°C

* To obtain optimum services life from both fluid and hydraulic systems components, 65°C normally is the maximum temperature expected for water-containing fluids.

Filtration

Full flow filtration (open circuit), or full boost flow filtration (close circuit) to ensure system cleanliness to ISO4406/1986 code 18/14 or cleaner.

Noise levels

The airborne noise level is less than 66.7 dB(A) DIN (&) dB (A) NFPA) through the “continuous” operating envelope. Where noise is a critical factor, installation resonances can be reduced by isolating the motor by elastomeric means from the structure and the return line installation . Potential return line resonance’s originating from liquid borne noise can be further attenuated by providing a return line back pressure of 2 to 5 bar.

Polar Moment of Inertia

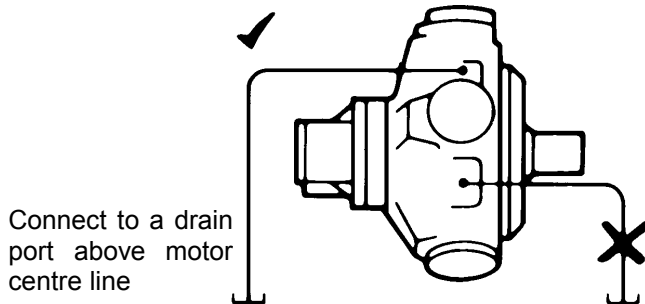
Typical data:

Model Type	Displacement Code	Kg m ²
HMC030	30	0.012
	15	0.0094
HMC045	45	0.044
	30	0.041
HMC080	90	0.052
	45	0.044
HMC125	125	0.20
	50	0.14
HMC200	188	0.23
	75	0.18
HMC270	280	0.83
	100	0.61
HMC325	325	0.87
	100	0.61

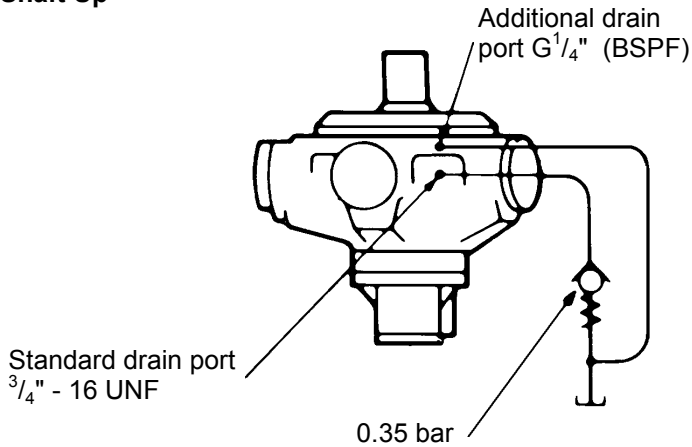
Mass

HMC030 Approx. all models 100kg.
 HMC045 Approx. all models 150kg.
 HMC080 Approx. all models 172kg.
 HMC125 Approx. all models 235kg.
 HMC200 Approx. all models 282kg.
 HMC270 Approx. all models 450kg.
 HMC325 Approx. all models 460kg.

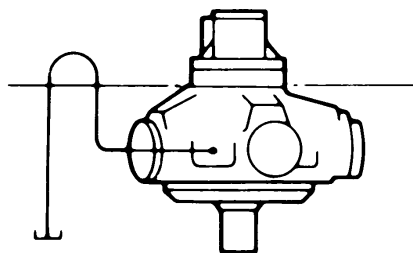


Crankcase Drain**Motor Axis Horizontal**

The recommended minimum pipe size for drain line lengths up to approx. 5m is 12.0mm $\frac{1}{2}$ " bore. for longer drains, increase pipe bore to keep motor casing pressure within specified limits.

Axis Vertical, Shaft Up

Specify "V" at model code position (3) for extra drain port, $G\frac{1}{4}$ " (BSPF). Connect this port into main drain line downstream of a 0.35 bar check valve to ensure good bearing lubrication. Piping arrangement must not allow syphoning from the motor case. Where this arrangement is not practical, please consult Kawasaki.

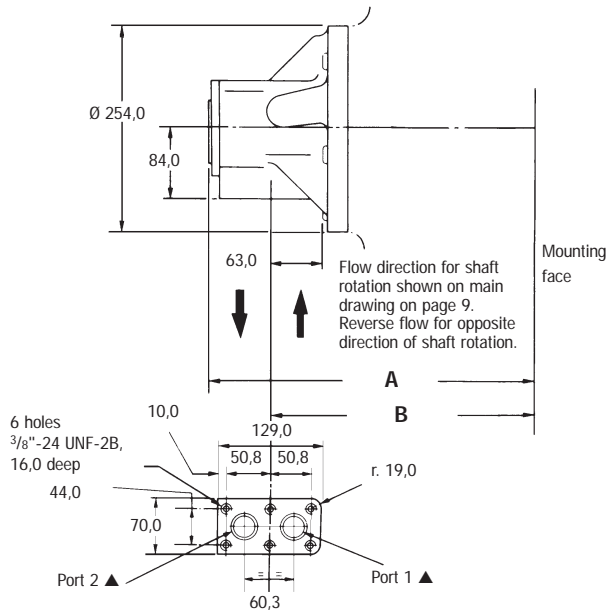
Axis Vertical, Shaft Down

Piping (from any drain port) must be taken above level of motorcase to ensure good bearing lubrication. The arrangement must not allow syphoning from the motorcase.

Kawasaki
Hydraulic Products

Valve Housing Options (continued)

3" Valve Housing with 6 bolt flange "S03" (see ordering code)
 Supplied with 2 'O'-ring seals.



▲ Ø28 with recess for 31,0 i/d x Ø 4 section O-ring

Model	Motor mounting face to rear of valve housing (mm)	Motor mounting face to centre line of port adaptor face (mm)
	(A)	(B)
HMC030	381	307
HMC045	411	336
HMC080	396	321
HMC125	426	351.5
HMC200	439	394

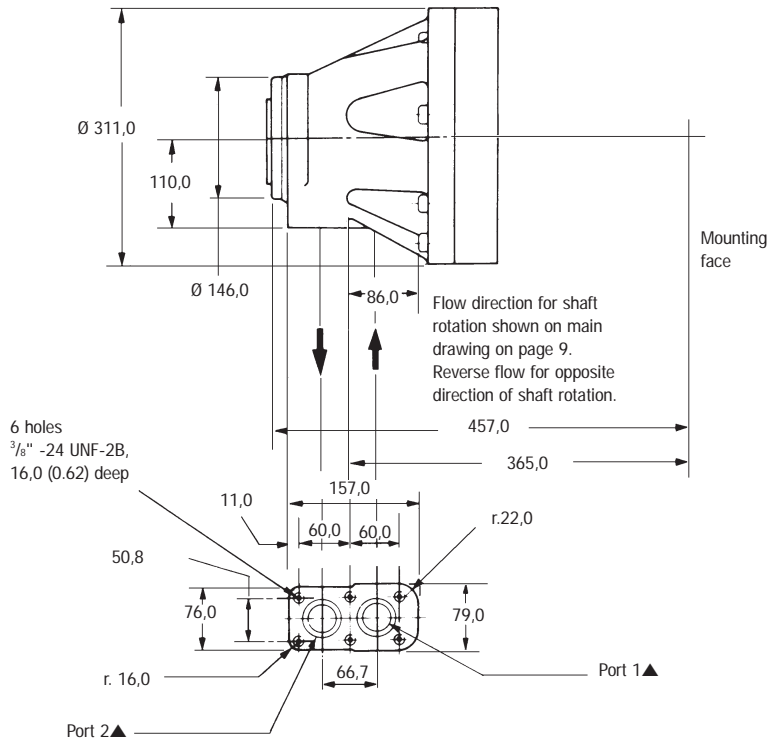


Valve Housing Options

4" Valve housing with 6 Bolt flange "S04".(see ordering code)

Supplied with 2 O-rings seals

For details of port adaptor block see attachment list.



▲ $\varnothing 35,0$ with recess for 38,1 i/d x $\varnothing 3,53$ section O-ring

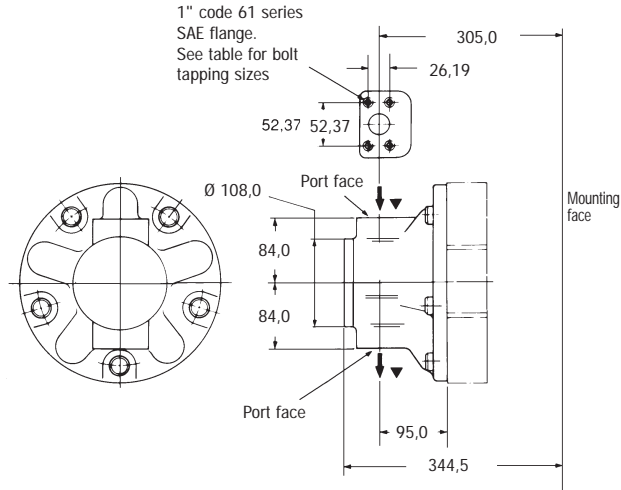
Model	Motor mounting face to rear of valve housing (mm) (A)	Motor mounting face to centre line of port adaptor face (mm) (B)
HMC270	508	415.3
HMC325	508	415.3



Valve Housing Options

1" SAE 4-bolt Flange "F2"/"FM2" (See ordering code)

**1" SAE 4-BOLT FLANGE, "F2"/"FM2" IN
MODEL CODE POSITION **6****



Flange bolt tappings

▼ Flow direction for shaft rotation shown on main drawing.
Reverse flow for opposite direction of shaft rotation.

Non preferred option on C080/C125/C200
Max. flow 205 litres/min

Valve Housing	Bolt Tappings
F2	3/16 –16 UNC-2B x 22.0 (0.875) deep
FM2	M10 x P1,5 x 22,0(0.875deep)

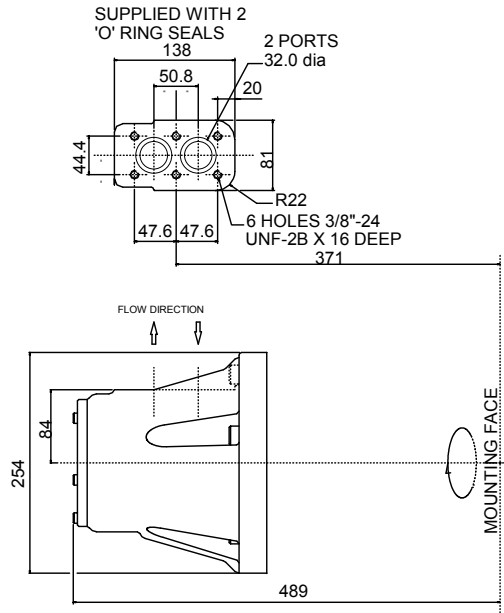
Model	Motor mounting face to rear of valve housing (mm)	Motor mounting face to centre line of port adaptor face (mm)
	(A)	(B)
HMC030	345	305
HMC045	374	335



Valve Housing Options

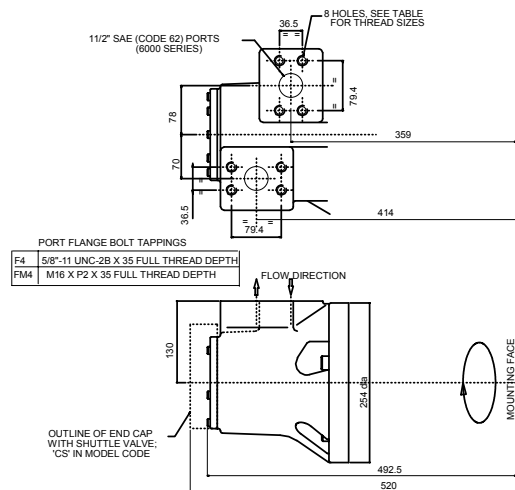
4" Valve Housing with 6-Bolt Flange, "SO4" (see ordering code)

C200 Only (Non preferred option on other five cylinder motors)



4" Valve Housing with SAE 1 1/2" 4-Bolt Flanges "F4" or FM4" (see ordering code)

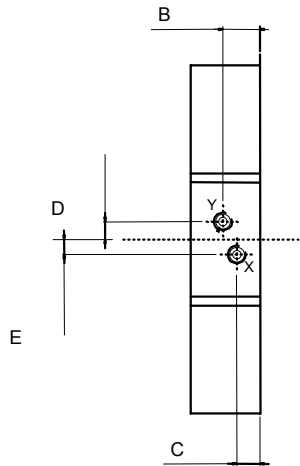
C200 Only (Non preferred option on other five cylinder motors)



Displacement Control Connections

TYPE X DISPLACEMENT CONTROL

2 PORTS G1/4"(BSPF) x 15 FULL THREAD DEPTH.
 DISPLACEMENT SELECTION (VIA REMOTELY LOCATED VALVE*)
 HIGH DISPLACEMENT: P TO Y; X TO T
 LOW DISPLACEMENT: P TO X; Y TO T
 *DISPLACEMENT SELECTOR VALVE IS NOT SUPPLIED WITH MOTOR; SPECIFY & ORDER SEPARATELY

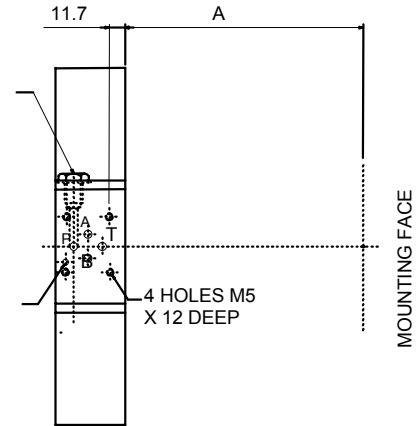


CONNECTION TO P PORT, G1/4" (BSPF) X 15 FULL THREAD DEPTH, SUPPLIED PLUGGED.

4.0 X 6 DEEP HOLE FOR ORIENTATION PIN

TYPES C, CS, C1 & C2 DISPLACEMENT CONTROL

MOUNTING INTERFACE FOR DIRECTIONAL CONTROL VALVE*
 TO: ISO 4401 SIZE 03/ANSI B93.7M SIZE D03
 *DISPLACEMENT SELECTOR VALVE IS NOT SUPPLIED WITH MOTOR; SPECIFY & ORDER SEPARATELY



DISPLACEMENT SELECTION:
 HIGH DISPLACEMENT: P TO B; A TO T
 LOW DISPLACEMENT: P TO A; B TO T
 'C' spacer to ISO 4401 size 3 can be supplied with additional pressure port tapping opposite the one shown on request.

Model	Dimension (mm)				
	A	B	C	D	E
HMC030	159.0	27.2	17.0	13.0	11.0
HMC045	188.5	27.2	17.0	13.0	11.0
HMC080	174.0	27.2	17.0	13.0	11.0
HMC125	203.0	27.2	17.0	13.0	11.0
HMC200	217.5	27.2	17.0	13.0	11.0
HMC270/325	232.0	20.8	10.7	6.5	13.0



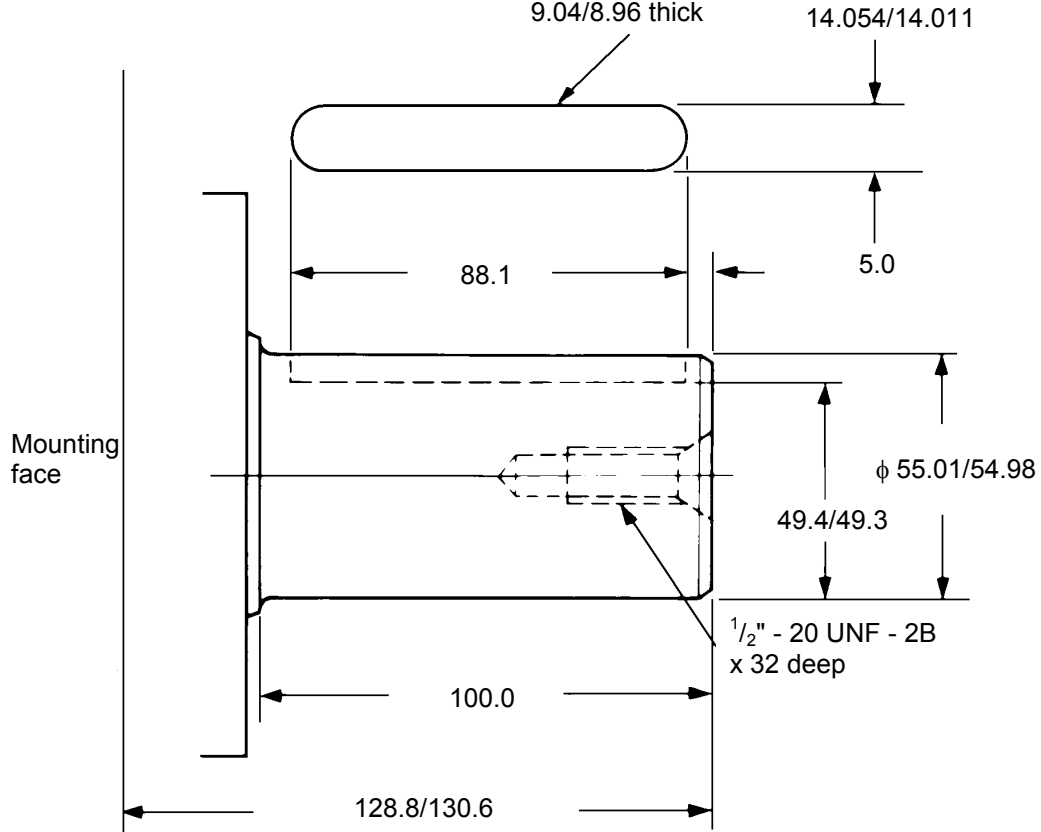
Shaft Specification

Shaft Type "P" (see Ordering Code)

C30

Cylindrical shaft with rectangular key

Key supplied:
14.046/14.028 wide x
9.04/8.96 thick



Shaft Specification (continued)

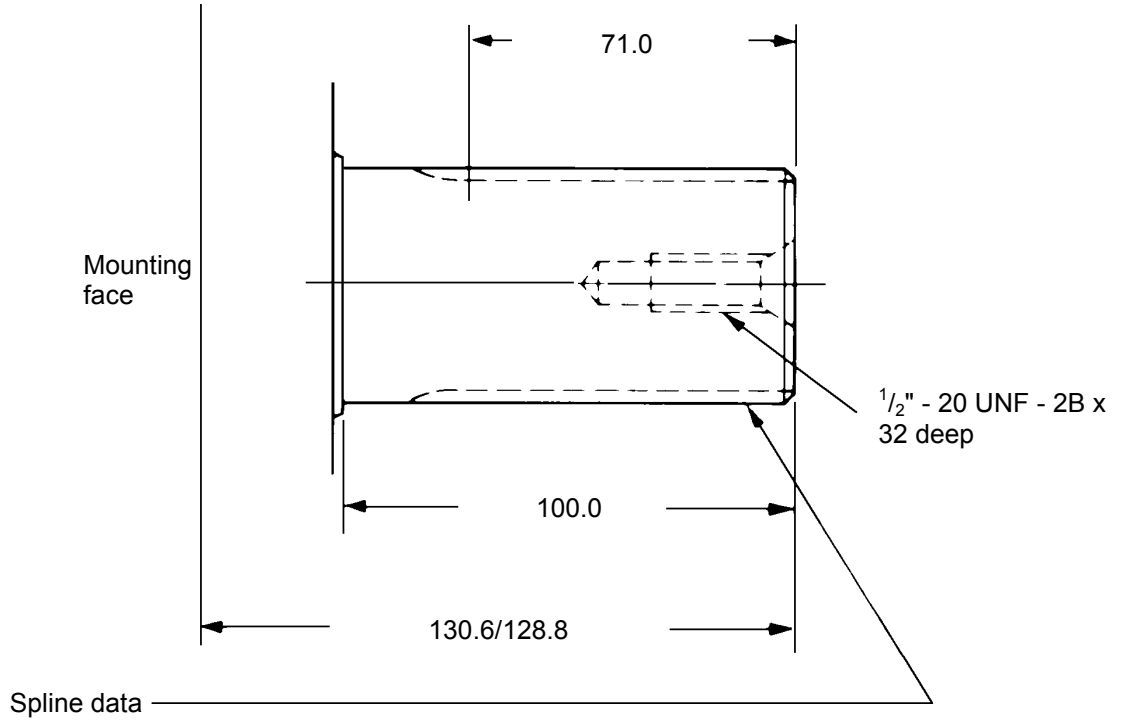
C30 (continued)

Shaft type "S", (see Ordering Code)

Cylindrical shaft with 17 splines to BS 3550

Shaft type "Z", (see Ordering Code)

Cylindrical shaft with splines to DIN 5480



For type S shaft

To BS 3550/SAE J498c (ANSI B92.1-1970, class 5)

Flat root, side fit, class 1

Pressure angle	30°
Number of teeth	17
Pitch	8/16
Major diameter	56.1/56.29
Form diameter	50.703
Minor diameter	50.06/49.60
Pin diameter	6.096
Diameter over pins	62.984/62.931

For type Z shaft

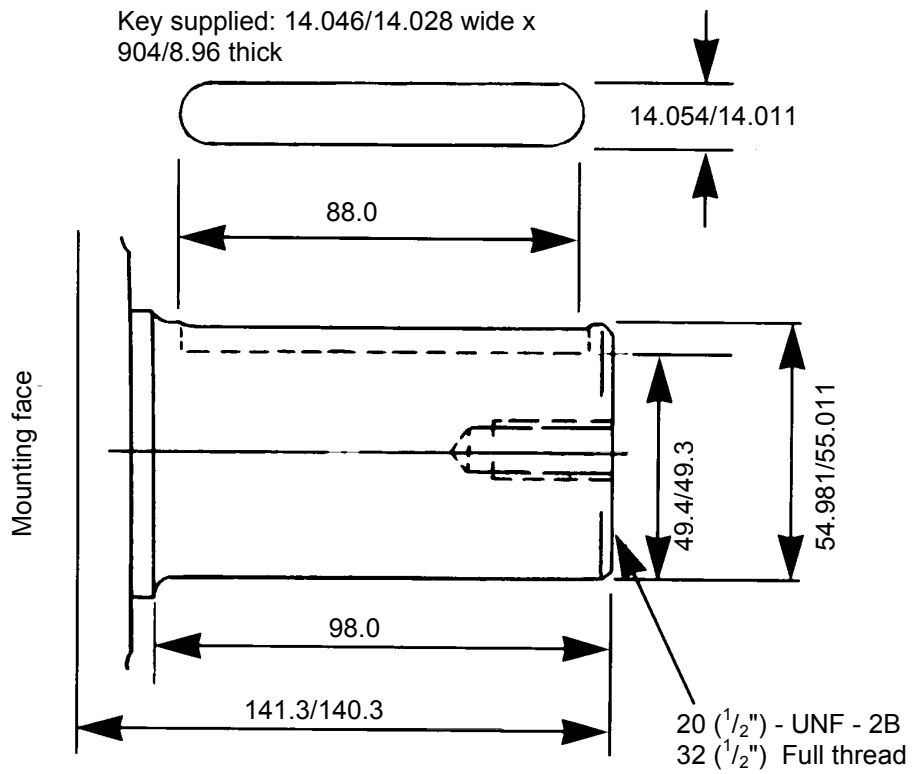
DIN 5480, W55 x 3 x 17 x 7h



Shaft Specification (continued)

C045

Shaft type "P", (see Ordering Code)
Cylindrical shaft with key



Shaft Specification (continued)

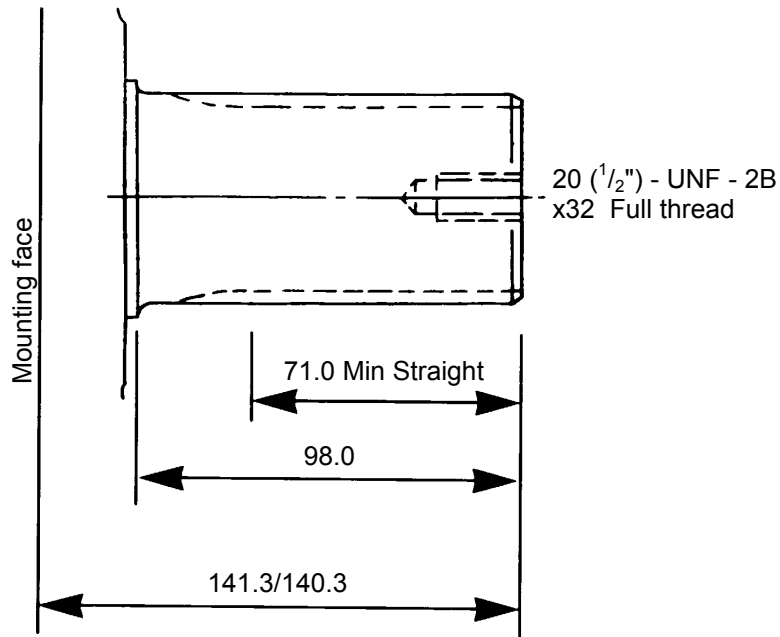
C045 (continued)

Shaft type "S", (see Ordering Code)

Cylindrical shaft with 17 splines to BS 3550-1963

Shaft type "Z", (see Ordering Code)

Cylindrical shaft to DIN 5480



For shaft type "S"

To BS 3550-1963 and ASA.B5. 15-1960

Flat root, side fit, class 1

- Pressure angle 30°
- Number of teeth 17
- Pitch 8/16
- Major diameter 56.41/56.29
- Form diameter 50.70
- Minor diameter 50.06/49.60
- Pin diameter 6.096
- Diameter over pins 62.984/62.931

For shaft type "Z"

DIN 5480, W55 x 3 x 17 x 7h

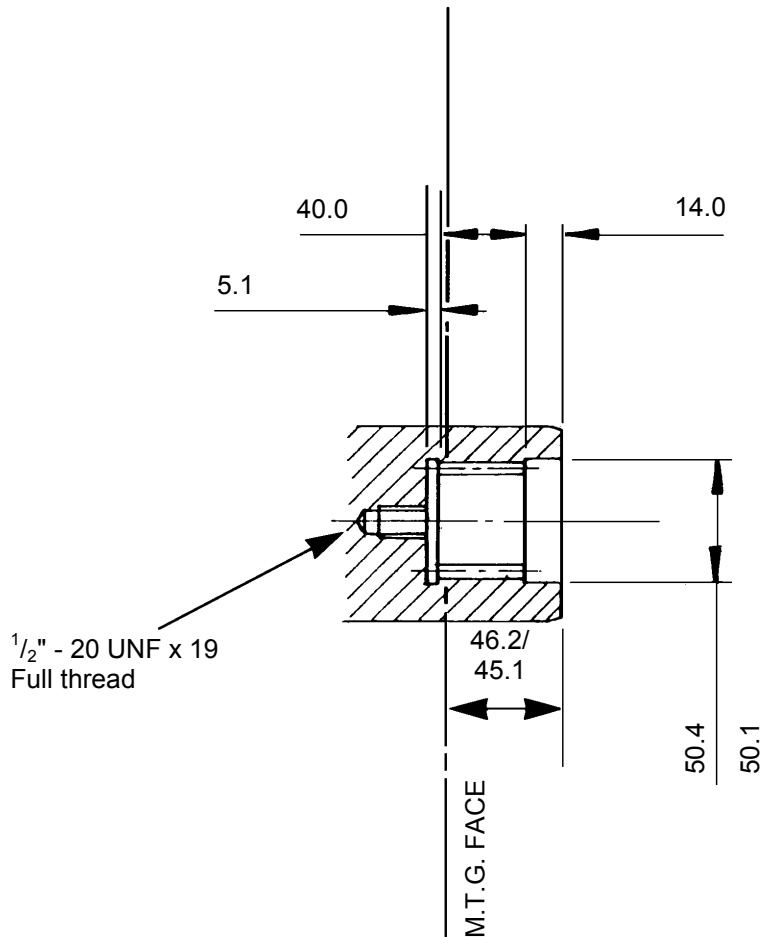


Model Staffa C	Page 39.68	Data Sheet M-1002/10.02
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Shaft Specification (continued)**C045 (continued)****Shaft type "Q", (see Ordering Code)**

Internally splined to BS 3550; 21 splines

Note: The type "Q" shaft will transmit the maximum torque given on page 6. However, customers should ensure that their own mating shaft will transmit the torque required in their application.



Internal spline to BS 3550-1963

Flat root side fit.

Pressure angle 30°

Number of teeth 21

Pitch 12/24

Major diameter 46.566/46.896

Form diameter 46.144

Minor diameter 42.334/42.461

Pin diameter 3.658

Pin flattened to 3.556

Diameter between pins 39.169/39.103

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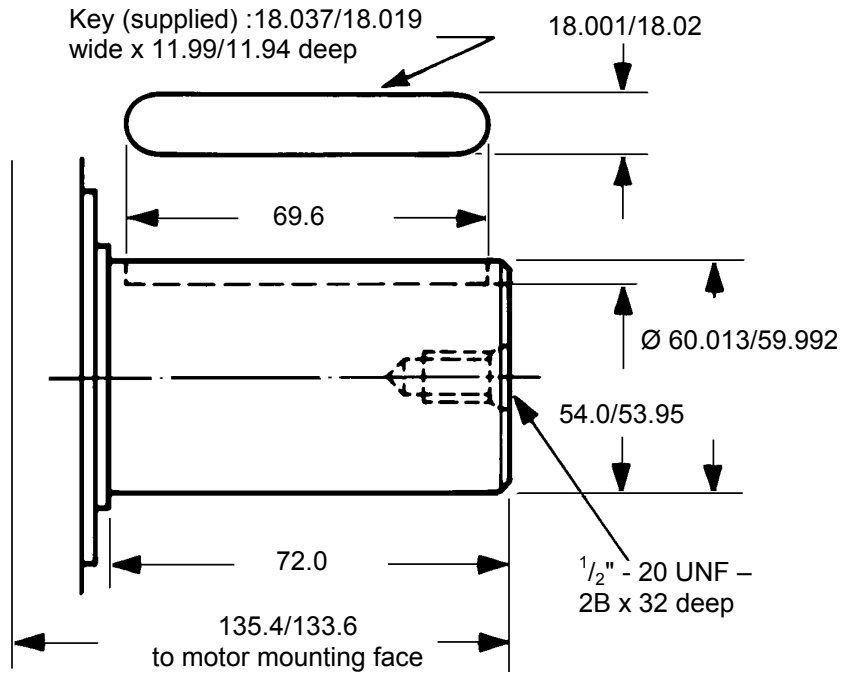
Shaft Specification (continued)

C080

Shaft type "P", (see Ordering Code)

Straight shaft with rectangular key

Warning: Maximum allowable torque for this shaft is 5400 Nm

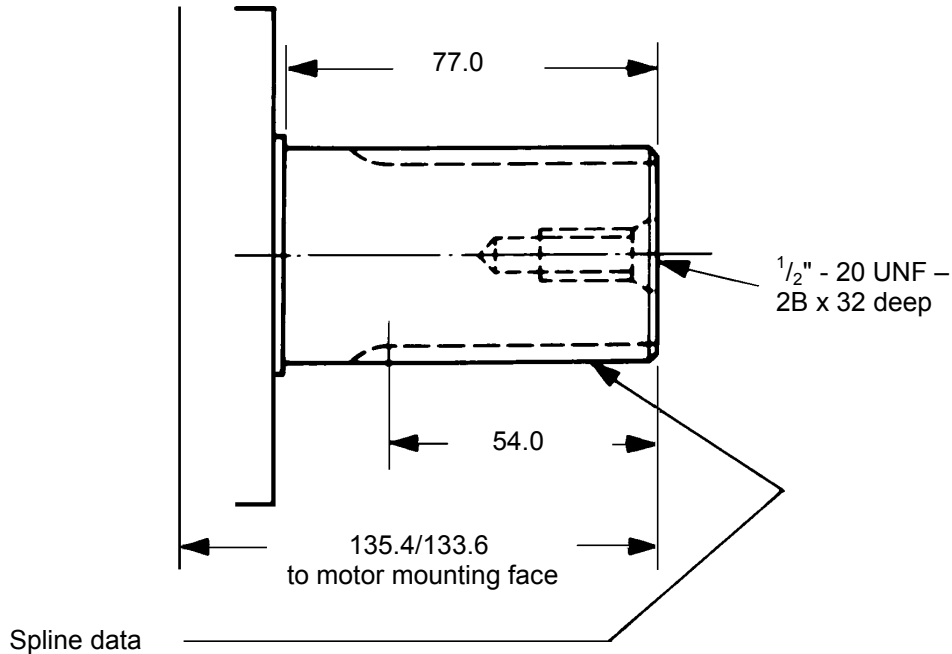


Shaft Specification (continued)**C080 (continued)****Shaft type "S", (see Ordering Code)**

Cylindrical shaft with 14 splines to BS 3550

Shaft type "Z", (see Ordering Code)

Cylindrical shaft to DIN 5480



For type S shaft

To BS 3550/SAE J498c (ANSI B92.1-1970, class 5)

Flat root, side fit, class 1

Pressure angle 30°

Number of teeth 14

Pitch 6/12

Major diameter 62.553/62.425

Form diameter 55.052

Minor diameter 54.085/53.525

Pin diameter 8.128

Diameter over pins 71.593/71.544

For type Z shaft

DIN 5480, W70 x 3 x 22 x 7h



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Hydraulic Products

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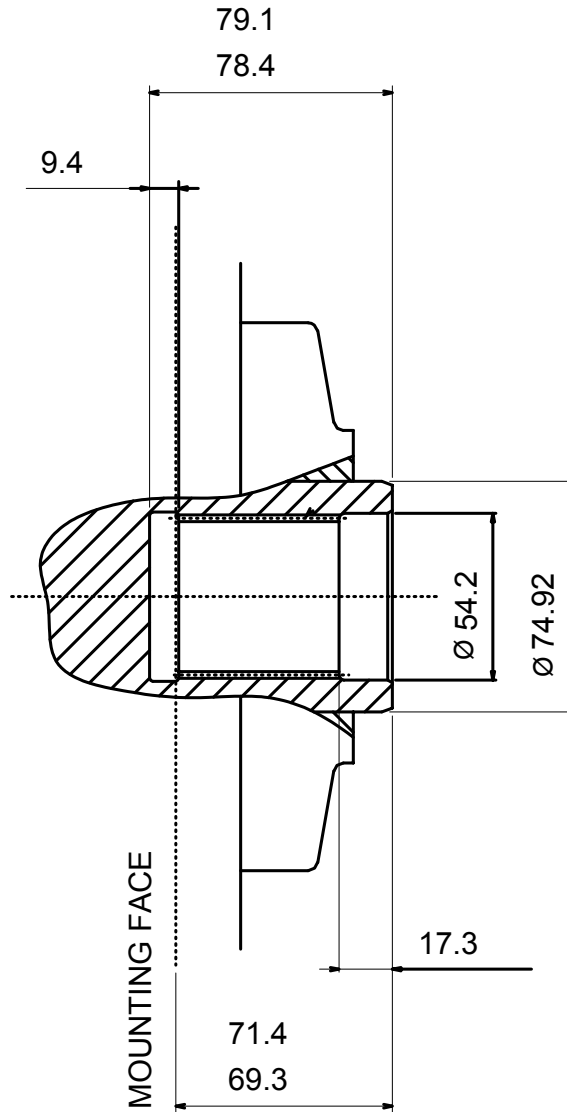
Shaft Specification (continued)

C080 (continued)

Shaft type "Q", (see Ordering Code)

Female straight shaft with 24 splines to BS 3550

Note: The type "Q" shaft will transmit the maximum torque. However, customers should ensure that their own mating shaft will transmit the torque required in their application.



To BS 3550

Flat root, side fit, modified

Pressure angle 30°

Number of teeth 24

Pitch 12/24

Major diameter 53.246/52.916

Minor diameter 48.811/48.684

Pin diameter 3.658

Pin flattened to 3.560

Diameter over pins 45.626/45.550

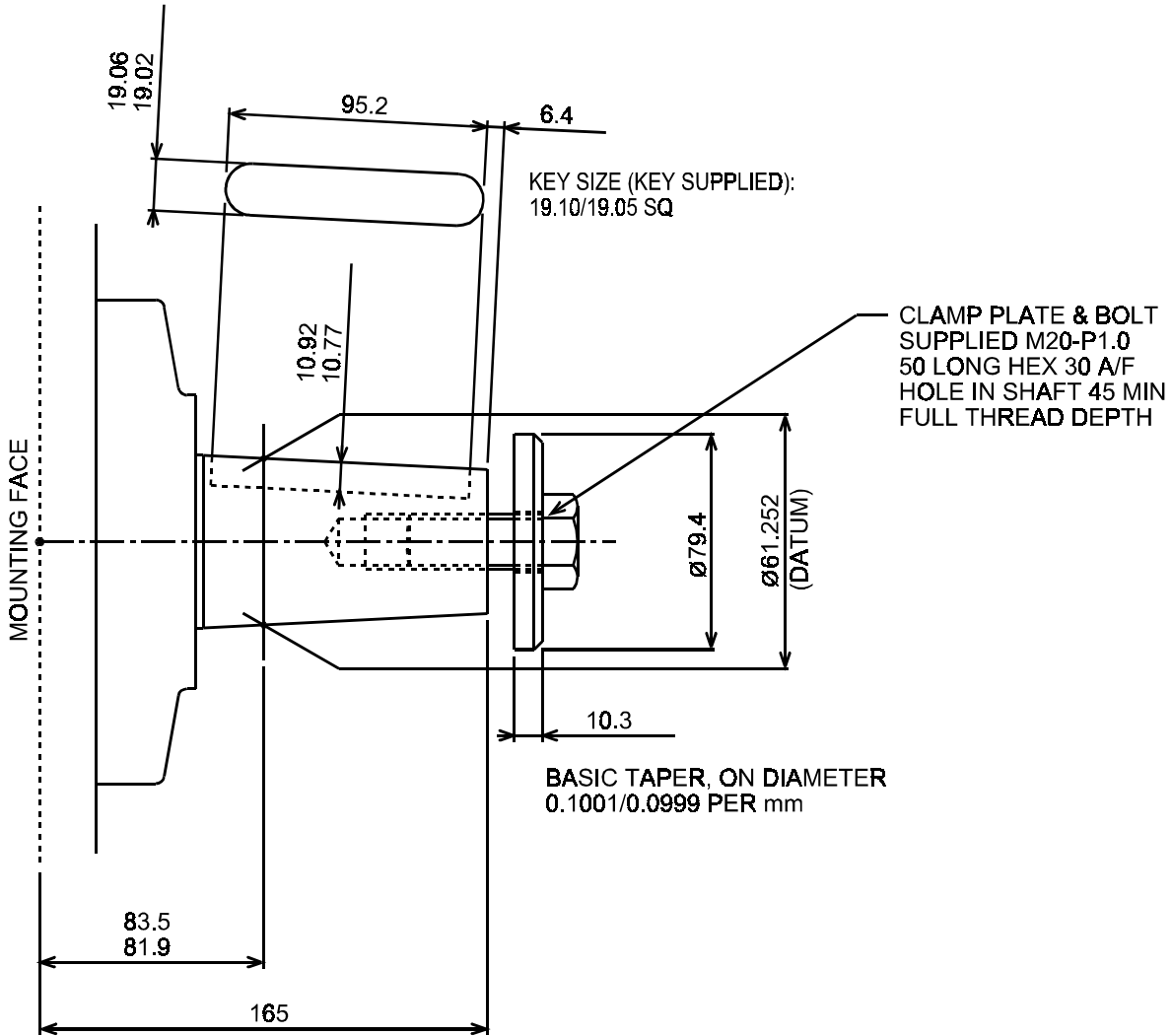
Use mounting face spigot for motor location



Shaft Specification (continued)

C080 (continued)

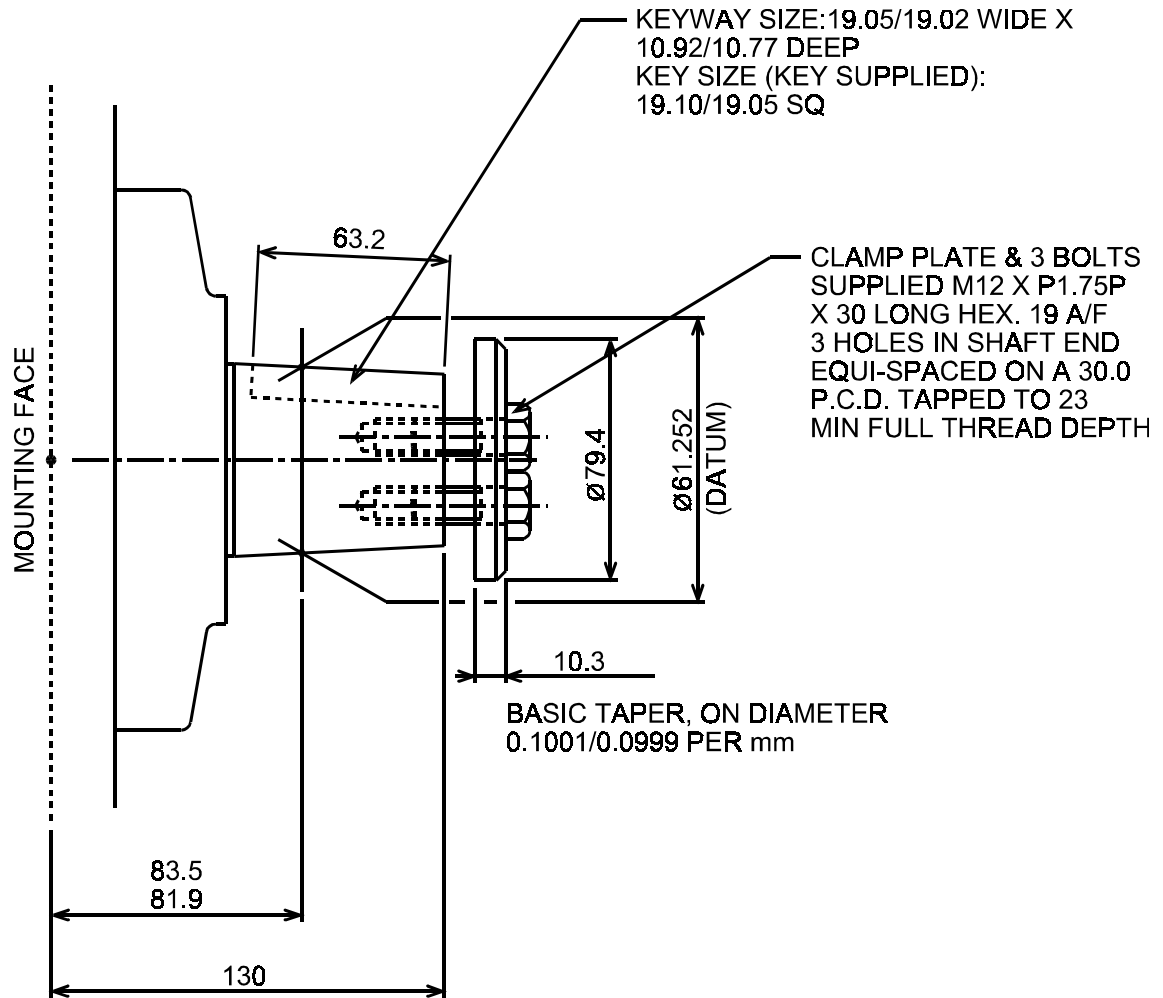
Shaft type "T", (see Ordering Code)



Shaft Specification (continued)

C080 (continued)

Shaft type "X", (see Ordering Code)

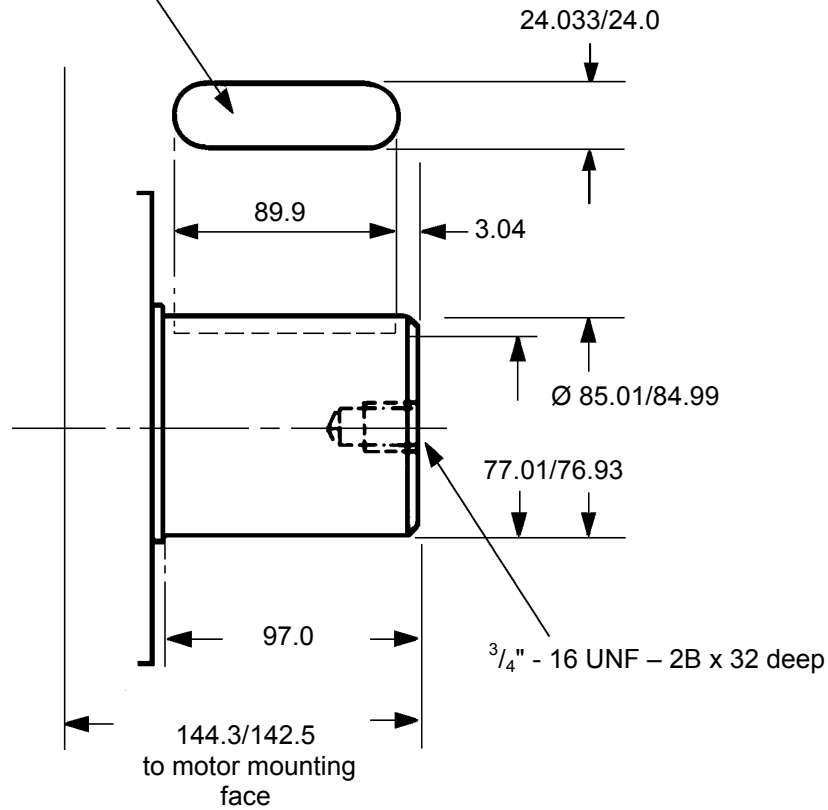


Shaft Specification (continued)

C125

Shaft type "P", (see Ordering Code)
 Straight shaft with rectangular key

Key supplied: 24.066/24.00
 wide x 16.052/16.00 deep

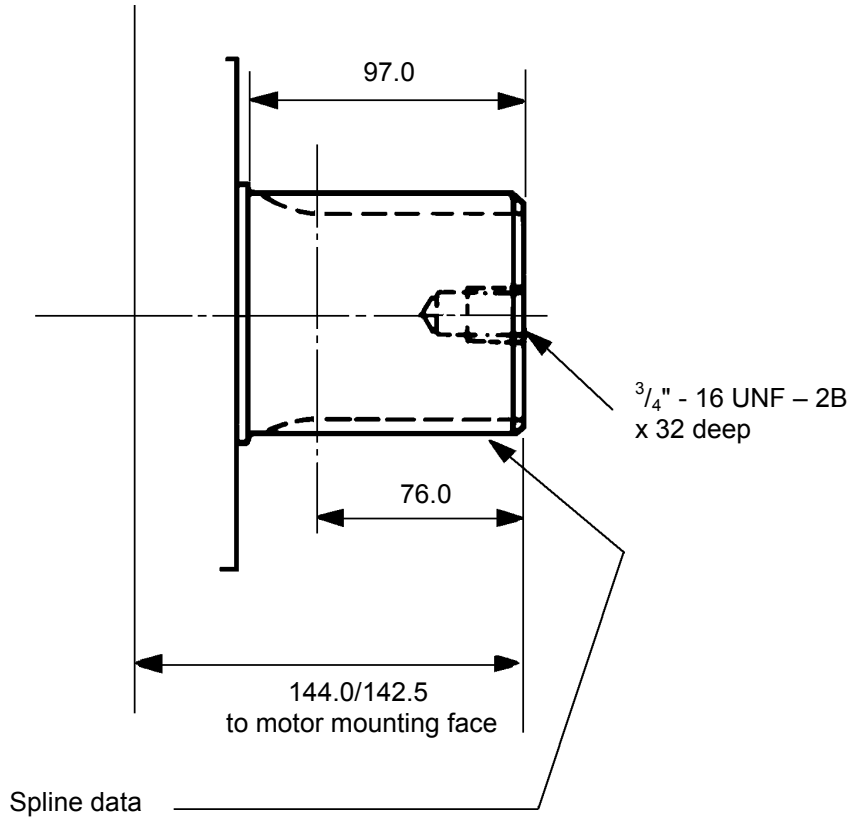


Shaft Specification (continued)

C125 (continued)

Shaft type "S", (see Ordering Code)
 Straight shaft with 20 splines to BS 3550

Shaft type "Z", (see Ordering Code)
 Straight shaft to DIN 5480



For type S shaft
 To BS 3550/SAE J498c (ANSI B92.1-1970, class 5)
 Flat root, side fit, class 1
 Pressure angle 30°
 Number of teeth 20
 Pitch 6/12
 Major diameter 87.953/87.825
 Form diameter 80.624
 Minor diameter 79.485/78.925
 Pin diameter 8.128
 Diameter over pins 97.084/97.030

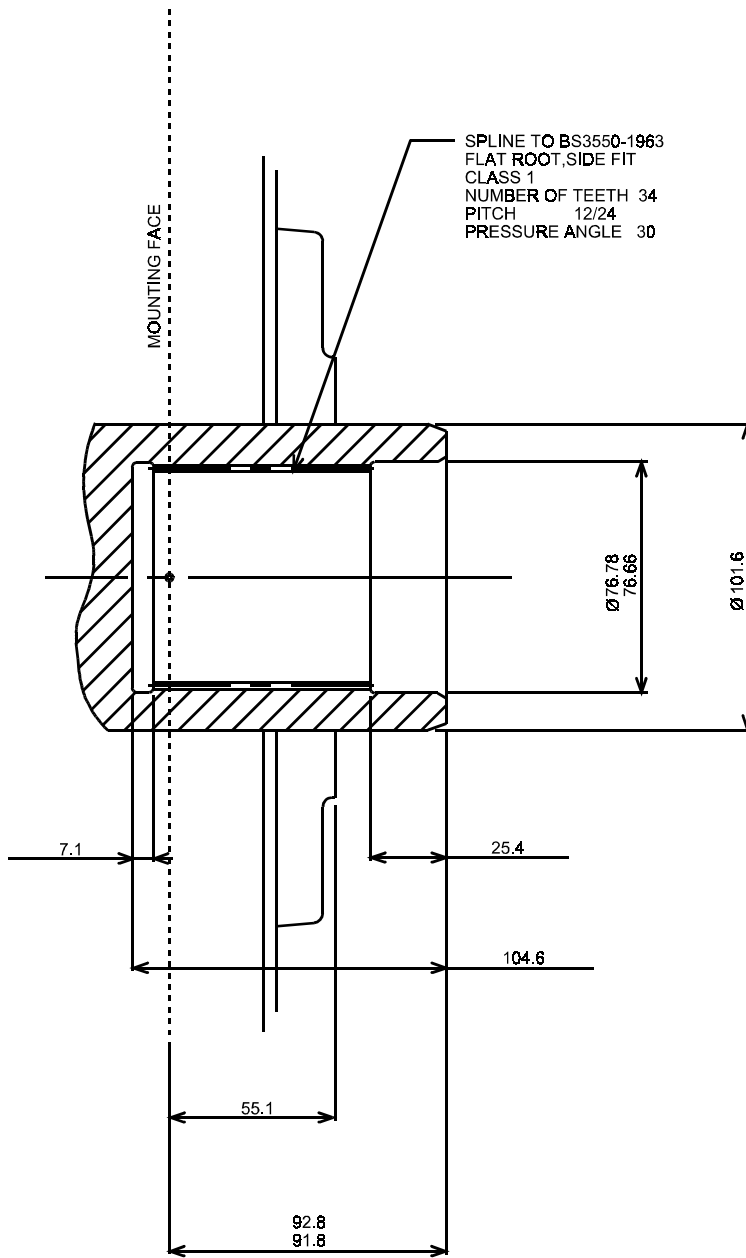
For type Z shaft
 DIN 5480, W85 x 3 x 27 x 7h



Shaft Specification (continued)

C125 (continued)

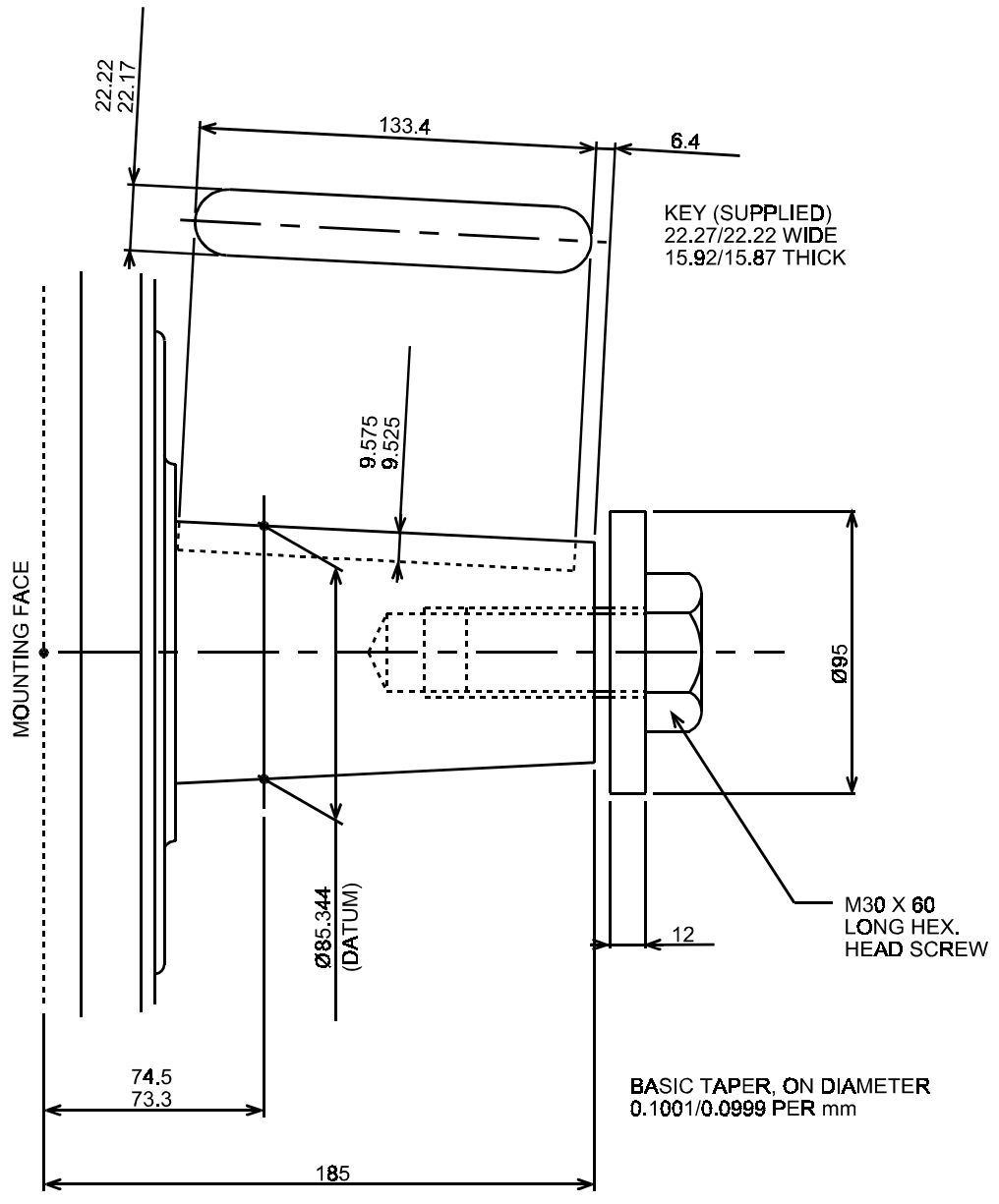
Shaft type "Q", (see Ordering Code)



Shaft Specification (continued)

C125 (continued)

Shaft type "T", (see Ordering Code)



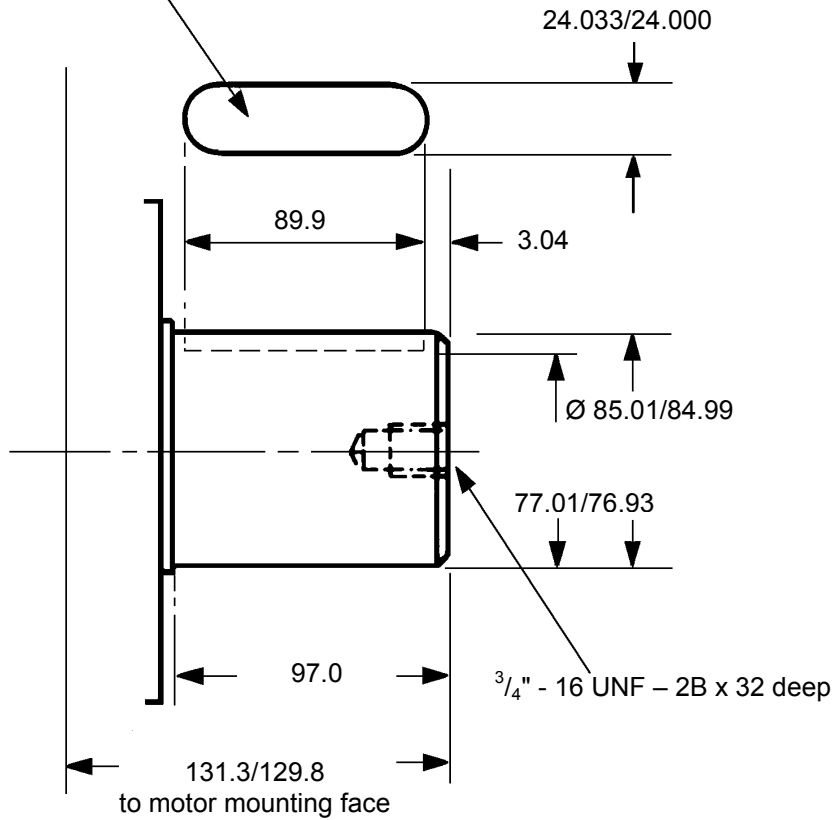
Shaft Specification (continued)

C200

Shaft type "P", (see Ordering Code)

Straight shaft with rectangular key

Key (supplied): 24.066/24.000
wide x 16.052/15.999 deep

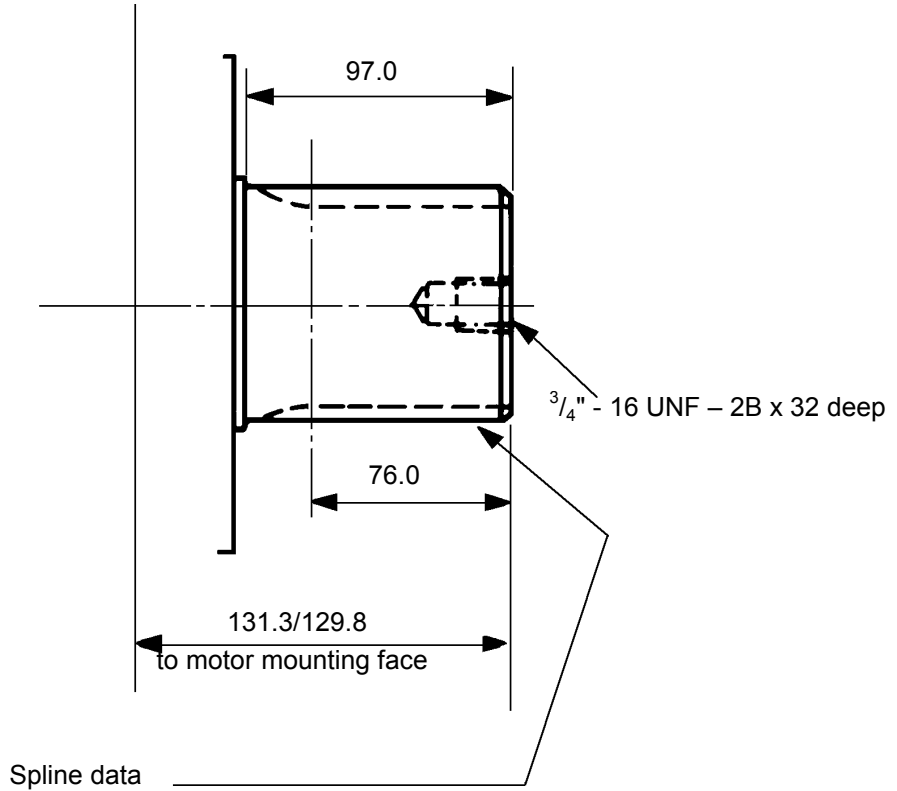


Shaft Specification (continued)

C200 (continued)

Shaft type "S", (see Ordering Code)
 Straight shaft with 20 splines to BS 3550

Shaft type "Z", (see Ordering Code)
 Straight shaft with splines to DIN 5480



For type S shaft
 To BS 3550/SAE J498c (ANSI B92.1-1970, class 5)
 Flat root, side fit, class 1

Pressure angle	30°
Number of teeth	20
Pitch	6/12
Major diameter	87.953/87.826
Form diameter	80.264
Minor diameter	79.484/78.925
Pin diameter	8.128
Diameter over pins	97.084/97.031

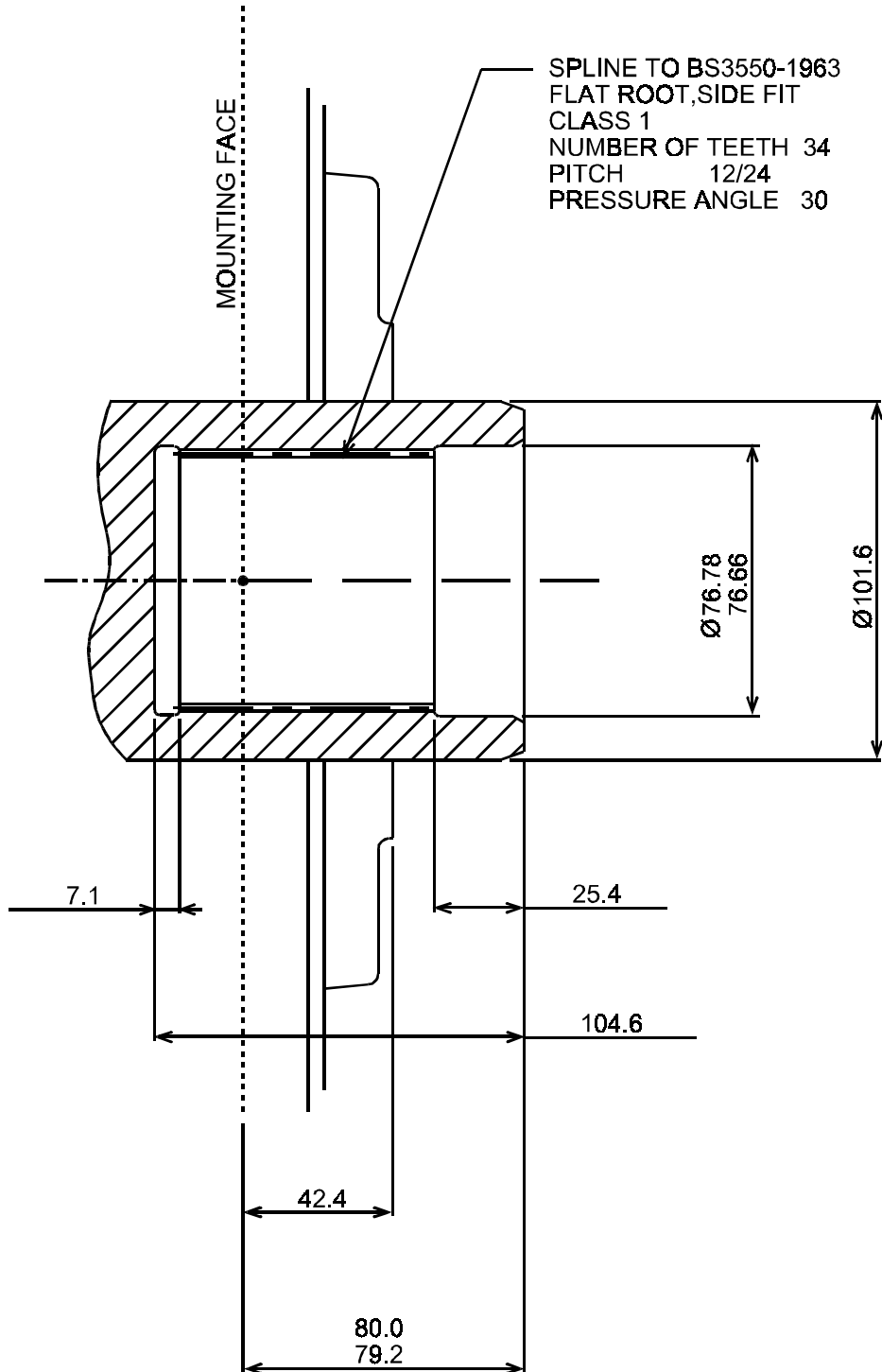
For type Z shaft
 DIN 5480, W85 x 3 x 27 x 7h



Shaft Specification (continued)

C200 (continued)

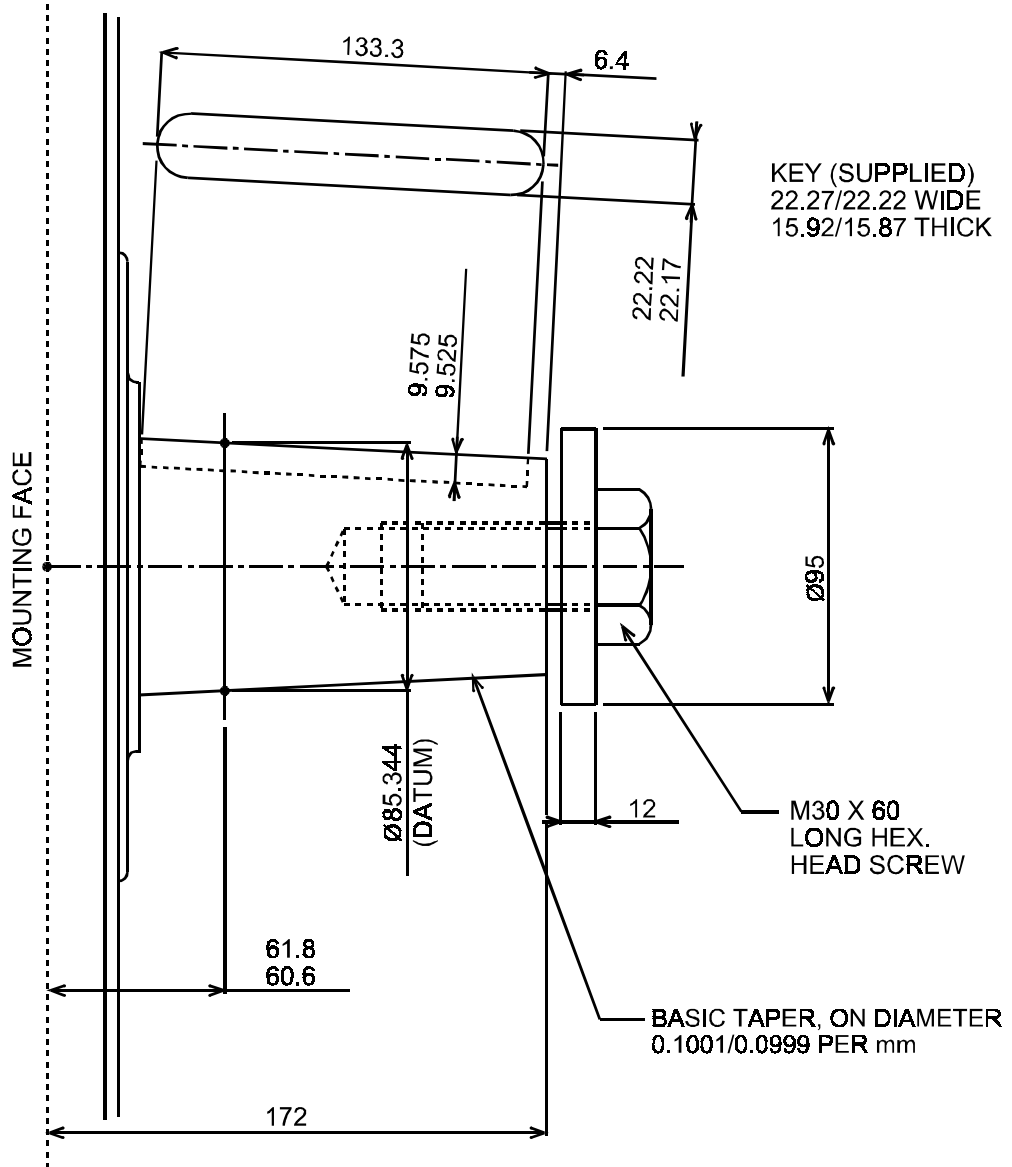
Shaft type "Q", (see Ordering Code)



Shaft Specification (continued)

C200 (continued)

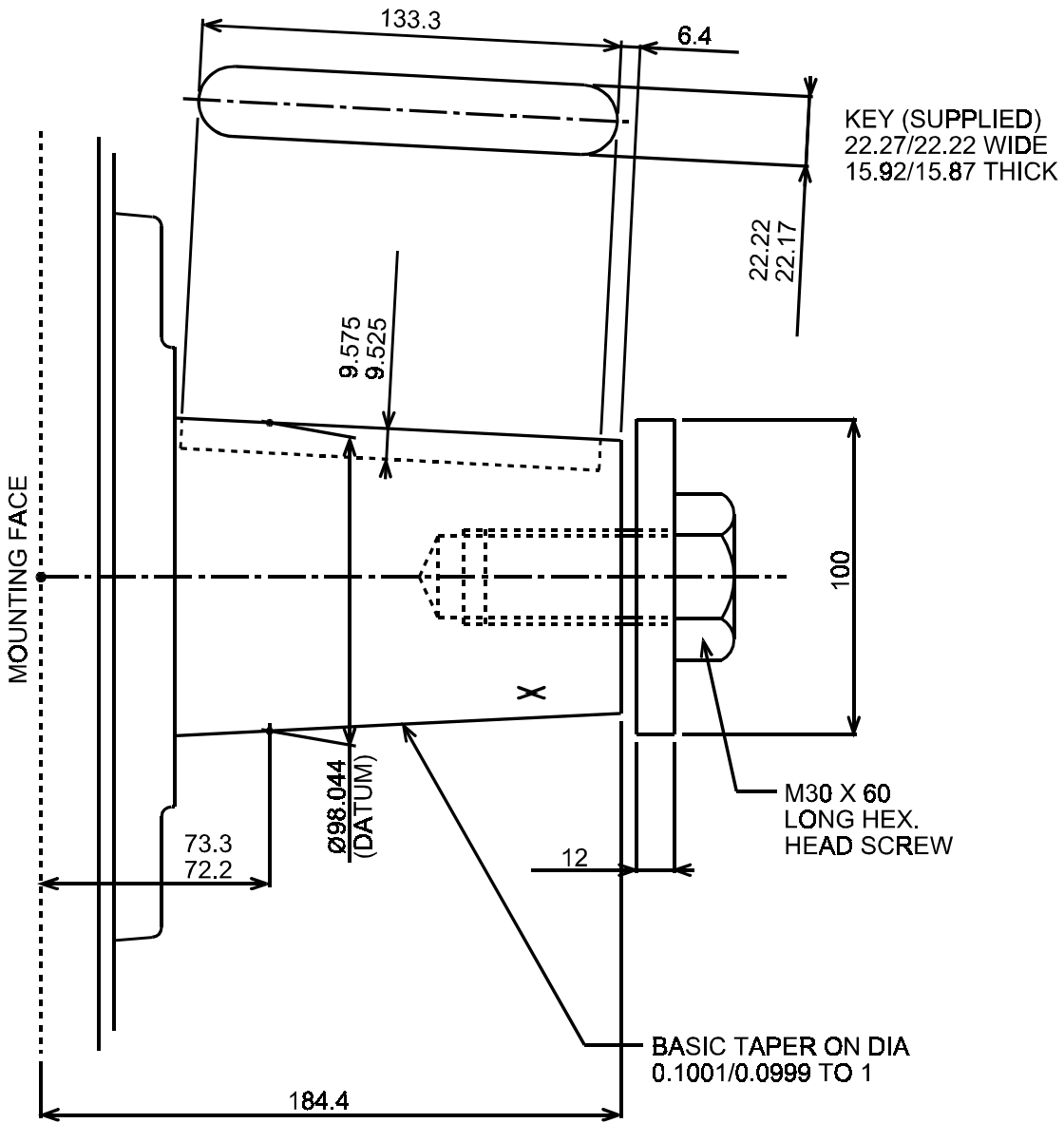
Shaft type "T", (see Ordering Code)



Shaft Specification (continued)

HMHDC200T

Shaft type "T", (see Ordering Code)



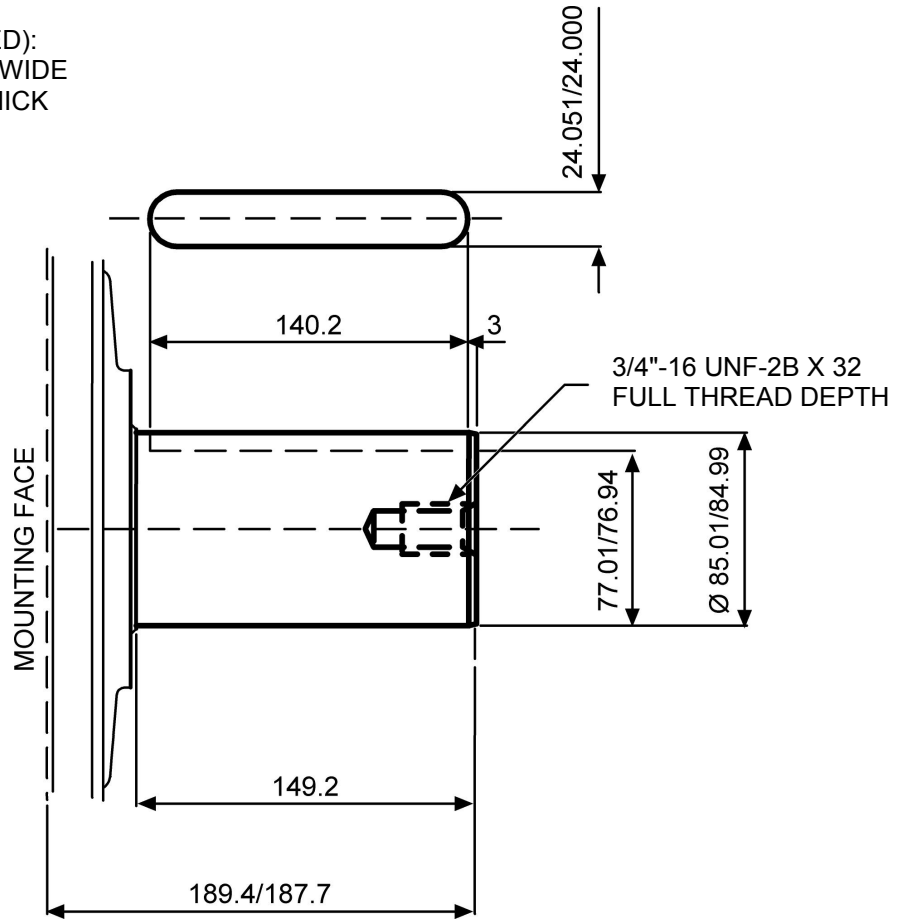
Shaft Specification (continued)

C270 and C325

Shaft type "P", (see Ordering Code)

SHAFT TYPES 'P1'
CYLINDRICAL SHAFT WITH KEY

KEY (SUPPLIED):
24.066/24.000 WIDE
16.05/16.00 THICK



Shaft Specification (continued)**C270 and C325 (continued)**

Shaft type "S", (see Ordering Code)
Straight shaft with 20 splines to BS 3550

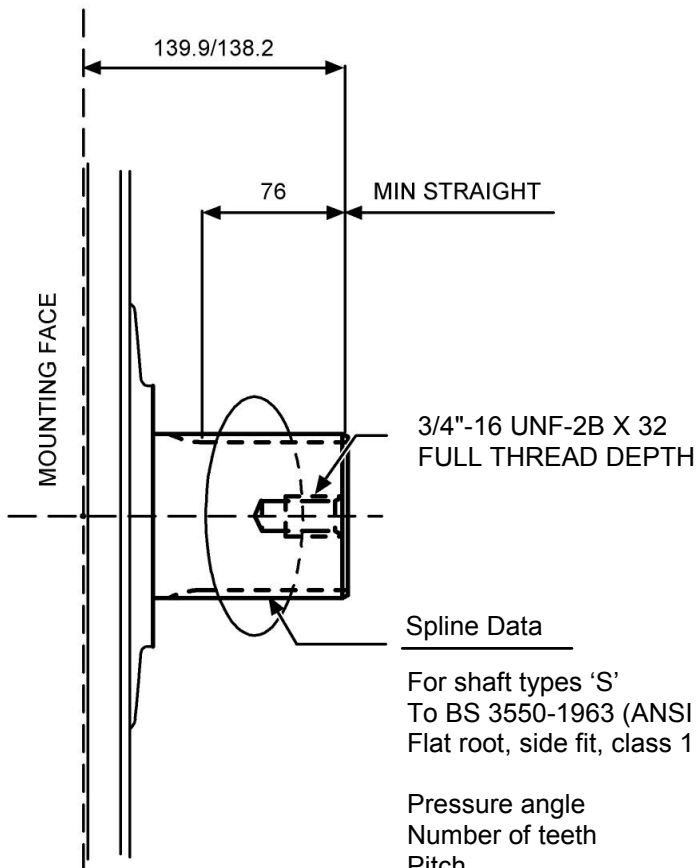
Shaft type "Z", (see Ordering Code)
Straight shaft with splines to DIN 5480

SHAFT TYPE 'S'

20 SPLINES TO BS 3550-1963

SHAFT TYPE 'Z'

24 SPLINES TO DIN 5480

Spline Data

For shaft types 'S'
To BS 3550-1963 (ANSI B92.1-1970, class 5)
Flat root, side fit, class 1

Pressure angle	30°
Number of teeth	20
Pitch	6/12
Major diameter	87.953/87.825
Form diameter	80.264
Minor diameter	79.485/78.925
Pin diameter	8.128
Diameter over pins	97.084/97.030

For shaft types 'Z'
DIN 5480, W90 x 4 x 21 x 7h



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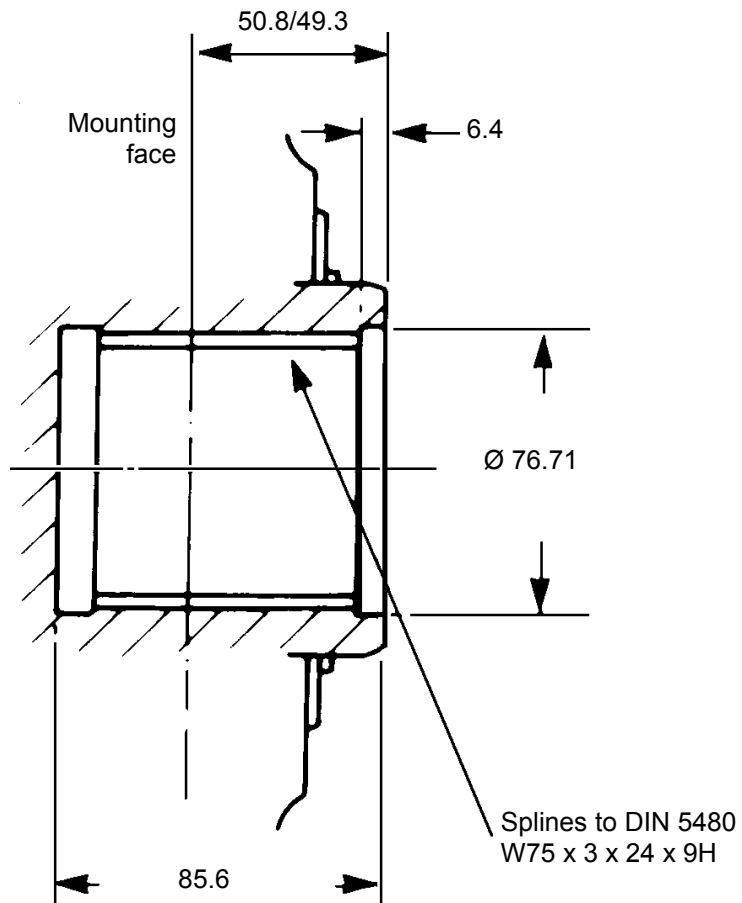
Shaft Specification (continued)

C270 and C325 (continued)

Shaft type “Q”, (see Ordering Code)

Cylindrical, internal splines to DIN 5480

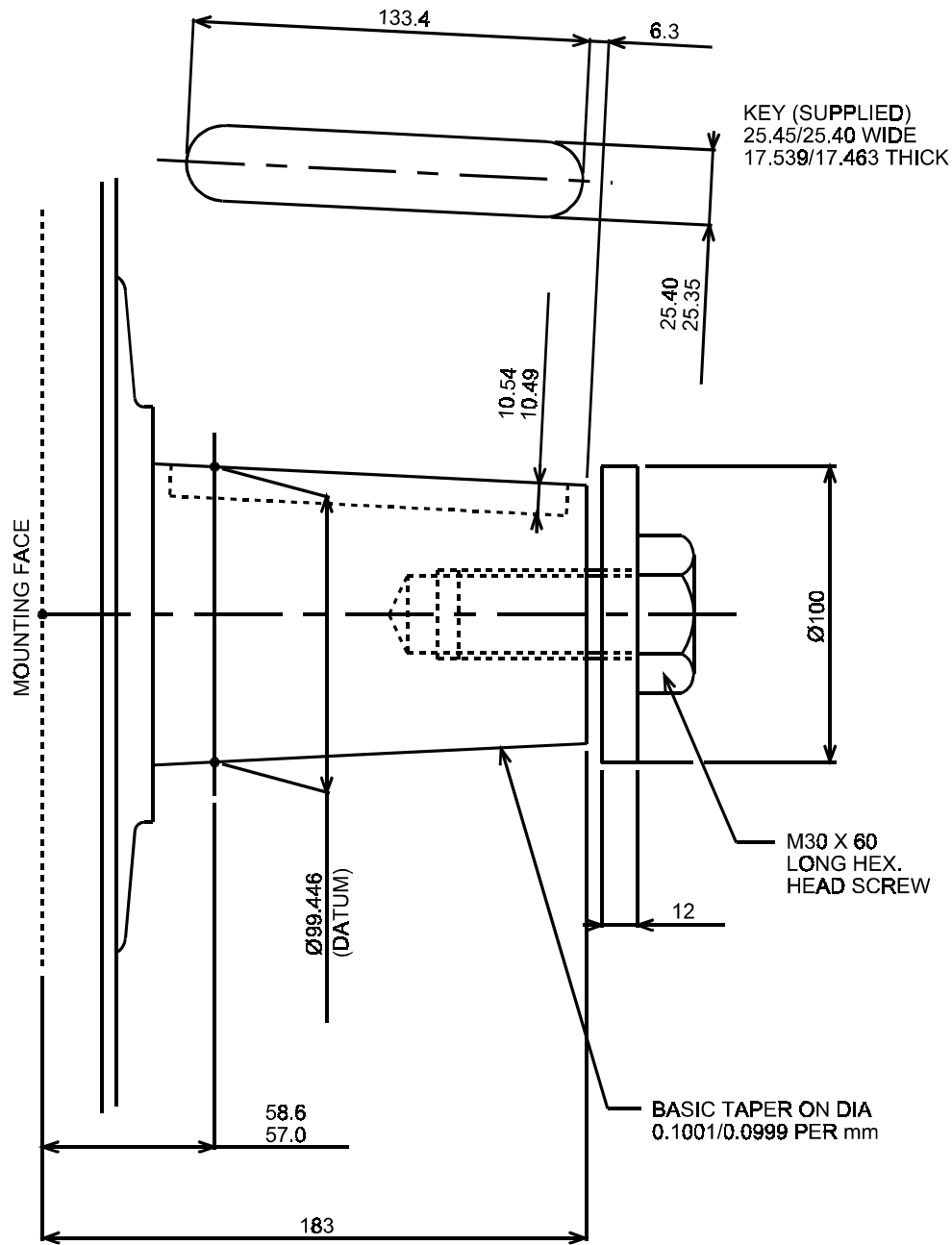
Note: The “Q” shaft will transmit the maximum torque. However, customers should ensure that their own mating shaft will transmit the torque required in their application.



Shaft Specification (continued)

C270 and 325 (continued)

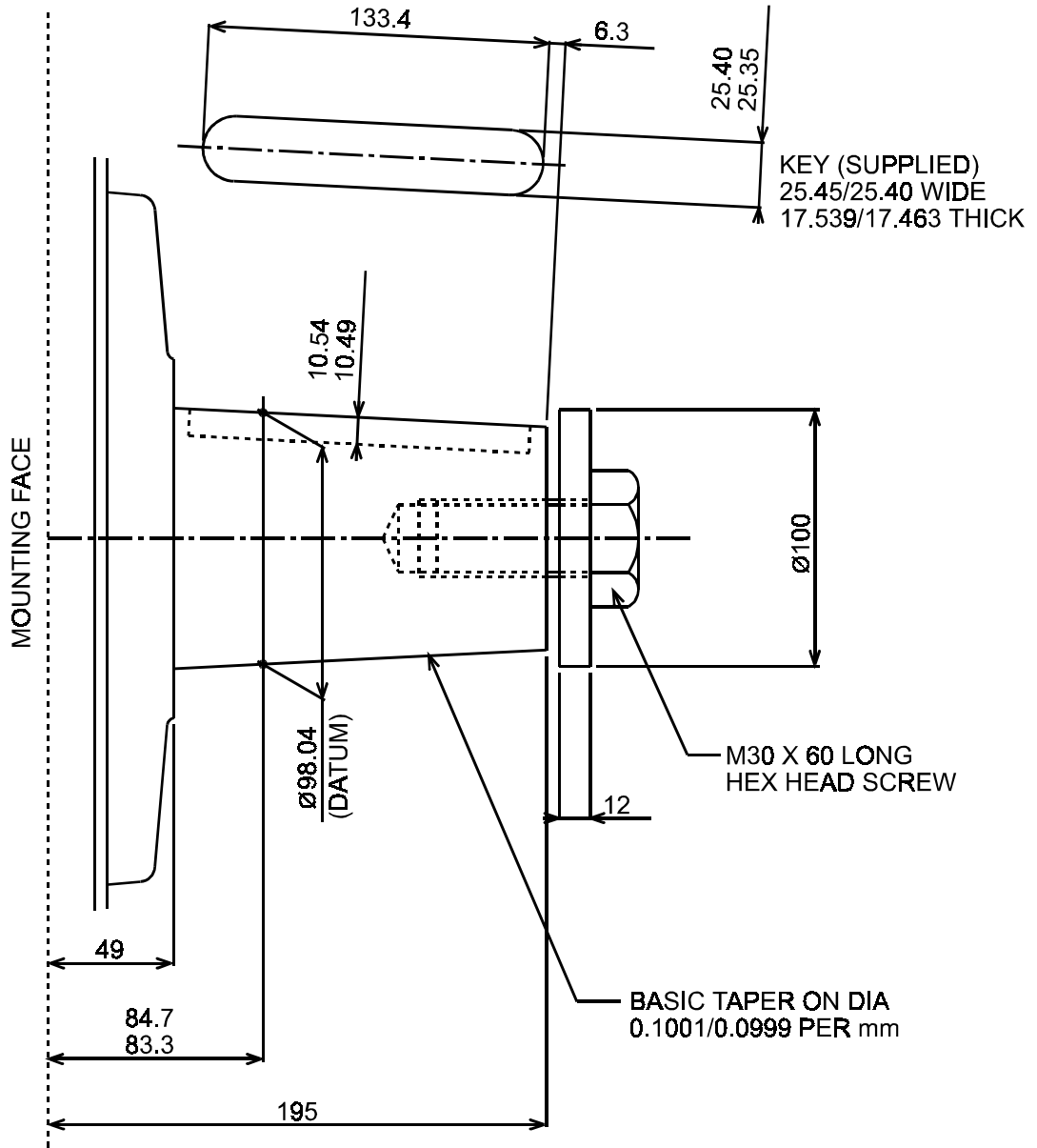
Shaft type "T" (see Ordering Code)



Shaft Specification (continued)

HDC270

Shaft type "T" (see Ordering Code)



Installation Data**GENERAL****Spigot:**

The motor should be located by the mounting spigot on a flat, robust surface using correctly sized bolts. The diametrical clearance between the motor spigot and the mounting must not exceed 0,15mm. If the application incurs shock loading, frequent reversing or high speed running, then high tensile bolts should be used, including one fitted bolt.

Bolt Torque:

The recommended torque wrench setting for bolts are as follows:

M18	312 +/- 7Nm
5/8" UNF	265 +/- 14 Nm
M20	407 +/- 14 Nm
3/4" UNF	393 +/- 14 Nm

Shaft Coupling:

Where the motor is solidly coupled to a shaft having independent bearings the shaft must be aligned to within 0,13mm TIR

Motor Axis Horizontal

An additional G^{1/4}" (BSPF) drain port in the front cover is provided when the "V" (shaft vertically upwards) designator is given after the shaft type letter in position 3 of the model code. This additional drain should be connected into the main motor casing drain line downstream of a 0,35 bar check valve to ensure lubrication of the upper bearing, see above diagram.

The crankcase drain must be taken from a position above the horizontal centre line of the motor.

These details covers models HMCO45 only.

Axis Vertical, Shaft Up

The recommended minimum pipe size for drain line lengths up to approx. 5m (15 ft) is 12.0 mm ^{1/2}" bore. For longer drains increase pipe bore to keep motor casing pressure within specified limits.

Specify "V" at model code position (3) for extra drain port, G1/4" (BSPF). Connect this port into main drain line downstream of a 0.35 bar check valve to ensure good

Axis Vertical, Shaft Down

Piping (from any drain port) must be taken above level of motorcase

Bearing Lubrication. Piping

Arrangement must not allow syphoning from the motorcase. Where this arrangement is not practical, please consult Kawasaki.

Use any drain position. The drain line should be run above the level of the uppermost bearing; if there is risk of syphoning then a syphon breaker should be fitted.

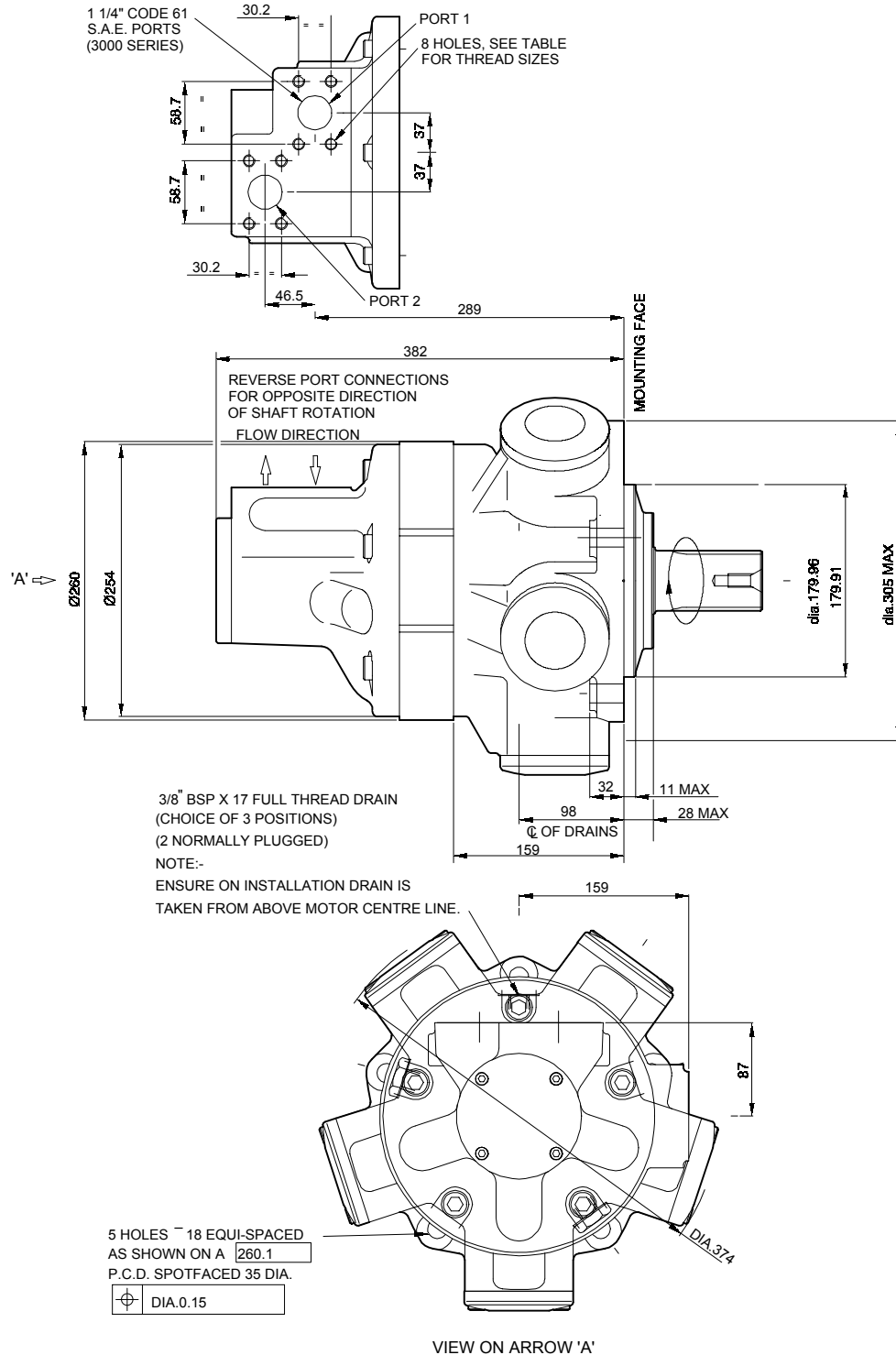
START - UP

Fill the crankcase with system fluids. Where practical, a short period (30 minutes) of "running in" should be carried out with the motor set to its high displacement (pressure to port Y, or to port B of the size 03 pilot valve).



Installation Dimensions HMC030 motor with type "F3"/"FM3" (SAE 1 1/4" 4-bolt flange) main ports

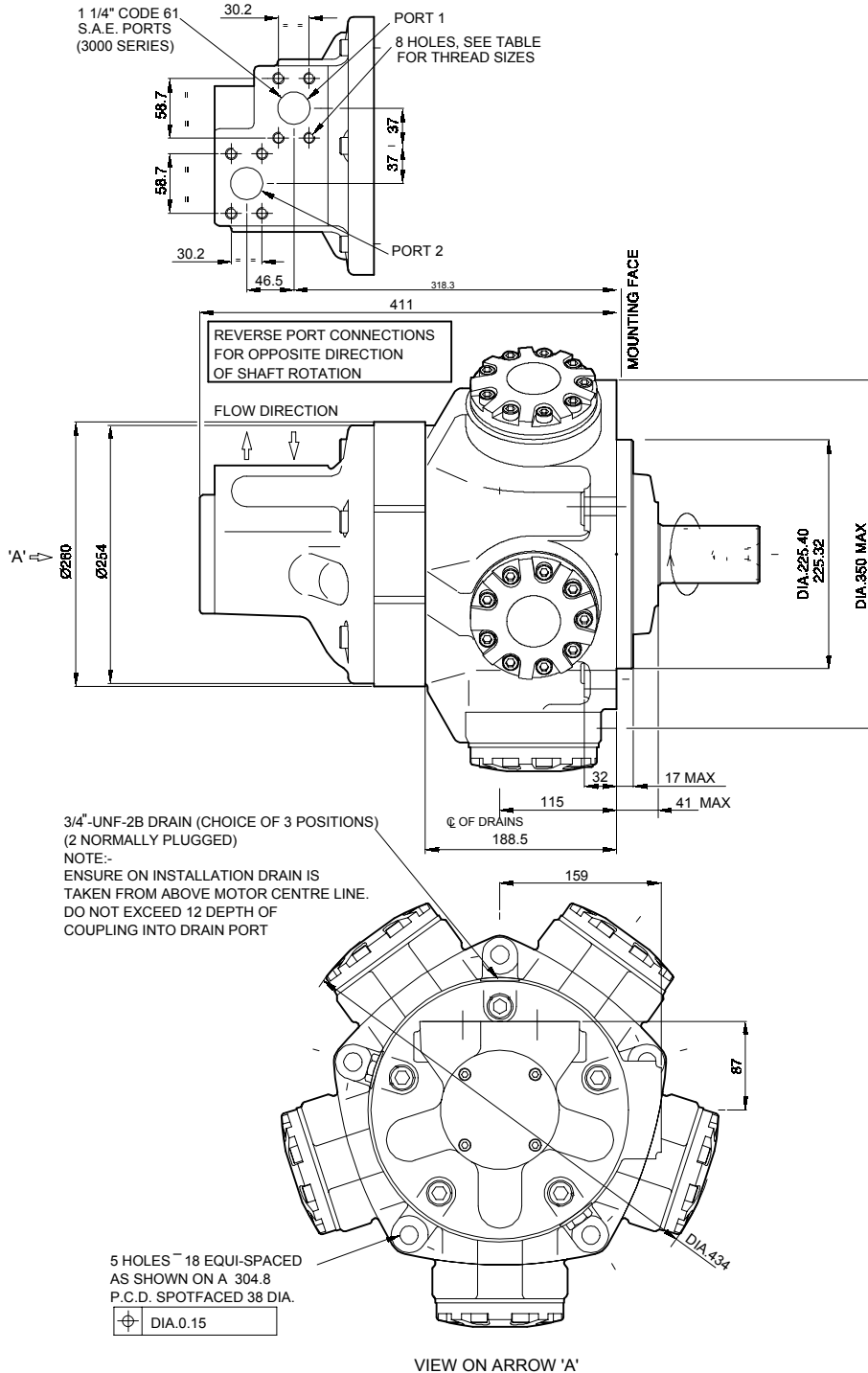
See additional views for: Valve housing options, displacement control connections, all shaft types and alternative main ports connection



Installation Dimensions (continued)

HMC045 motor with type "F3"/"FM3" (1 1/4" SAE) main ports connection

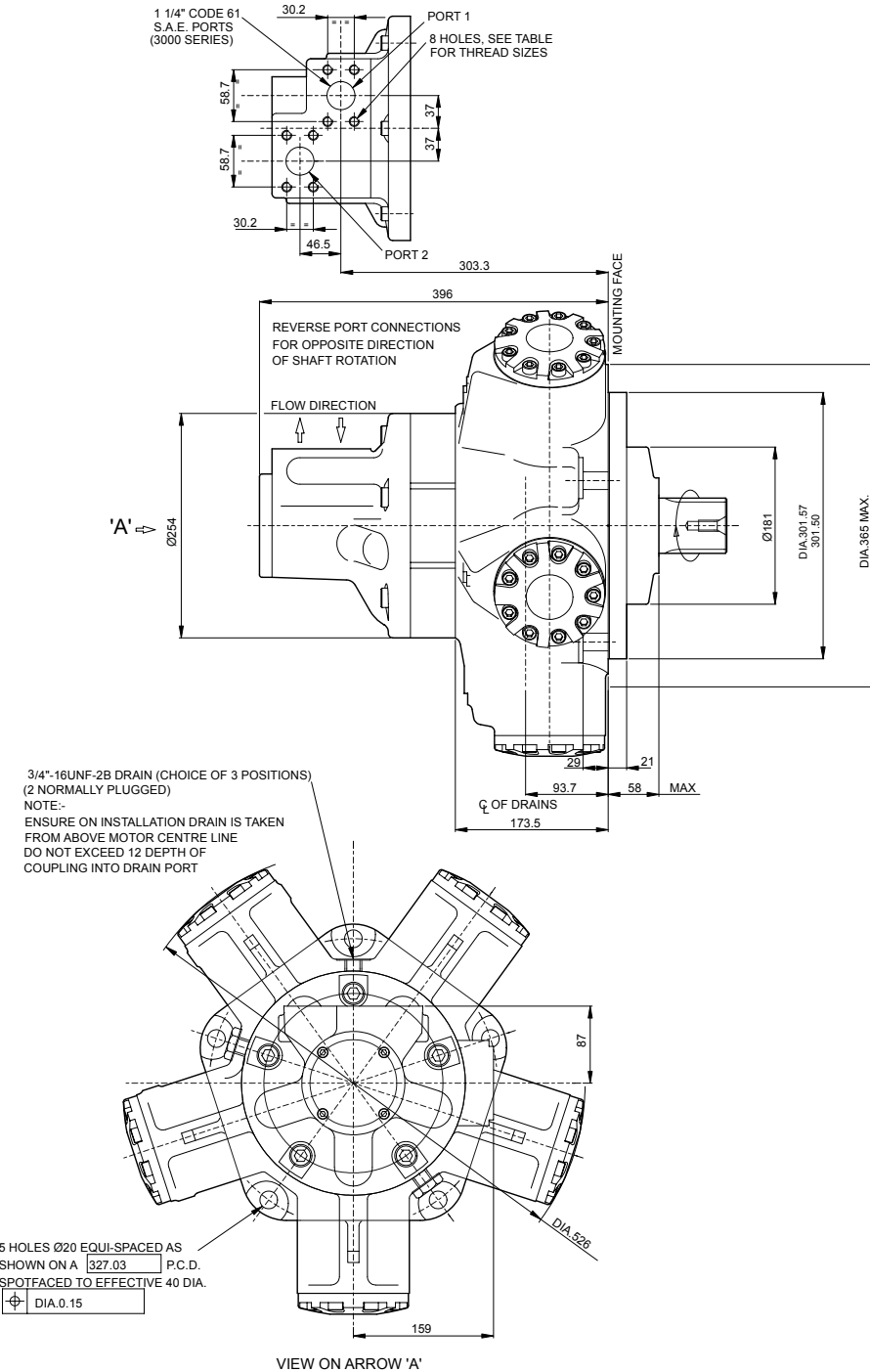
See additional views for: Valve housing options, displacement control connections, shaft types, alternative main port connections for 3" valve, and all port connections with 2 1/4" valve



Installation Dimensions (continued)

HMC080 motor with type "F3"/"FM3" main ports connection

See additional views for valve housing options, displacement control connections, all shaft types and alternative main port connections.



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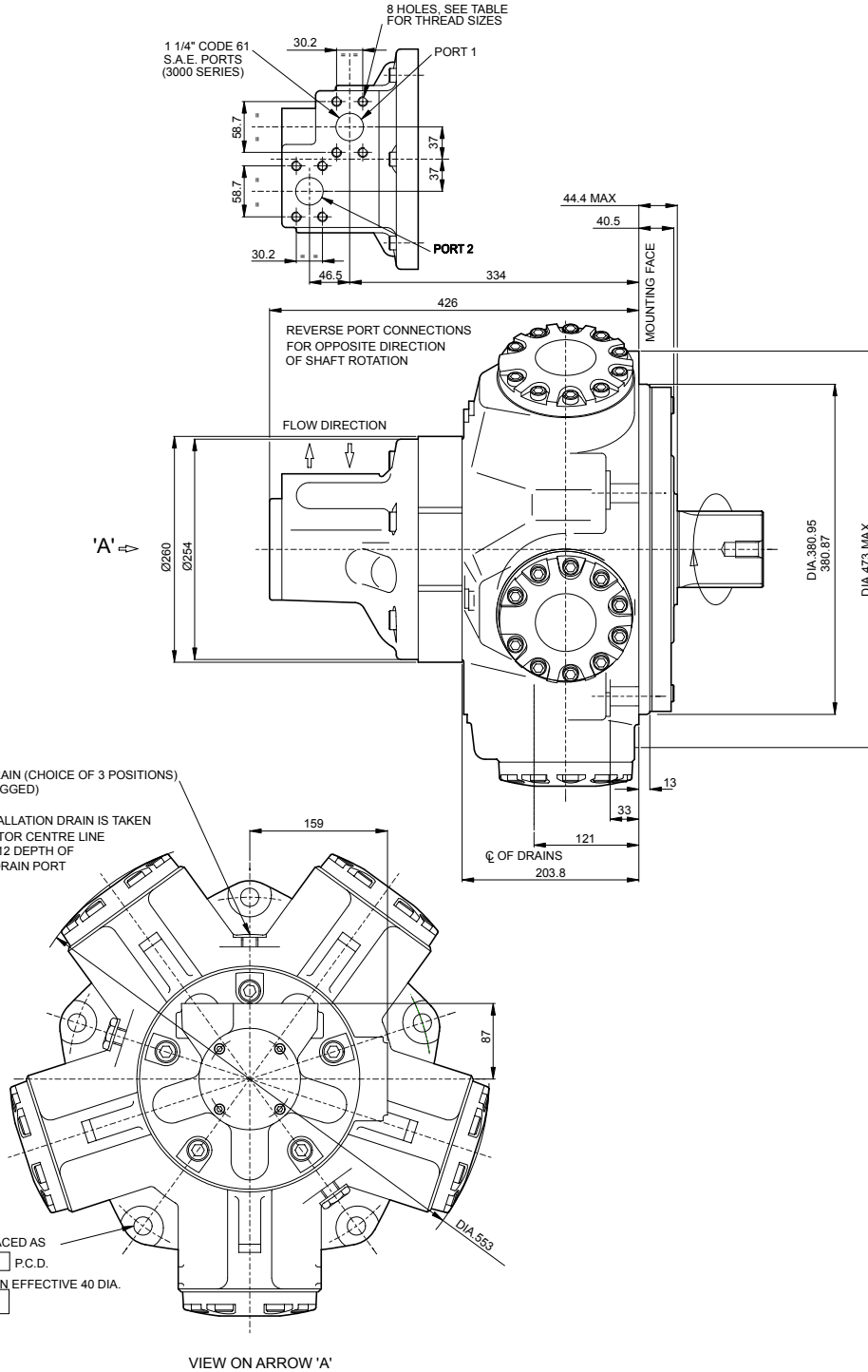


Installation Dimensions (continued)

HMC125 motor with type "F3"/"FM3" main ports connection

See additional views for:

Valve housing options, displacement control connections, all shaft types and alternative main ports connection



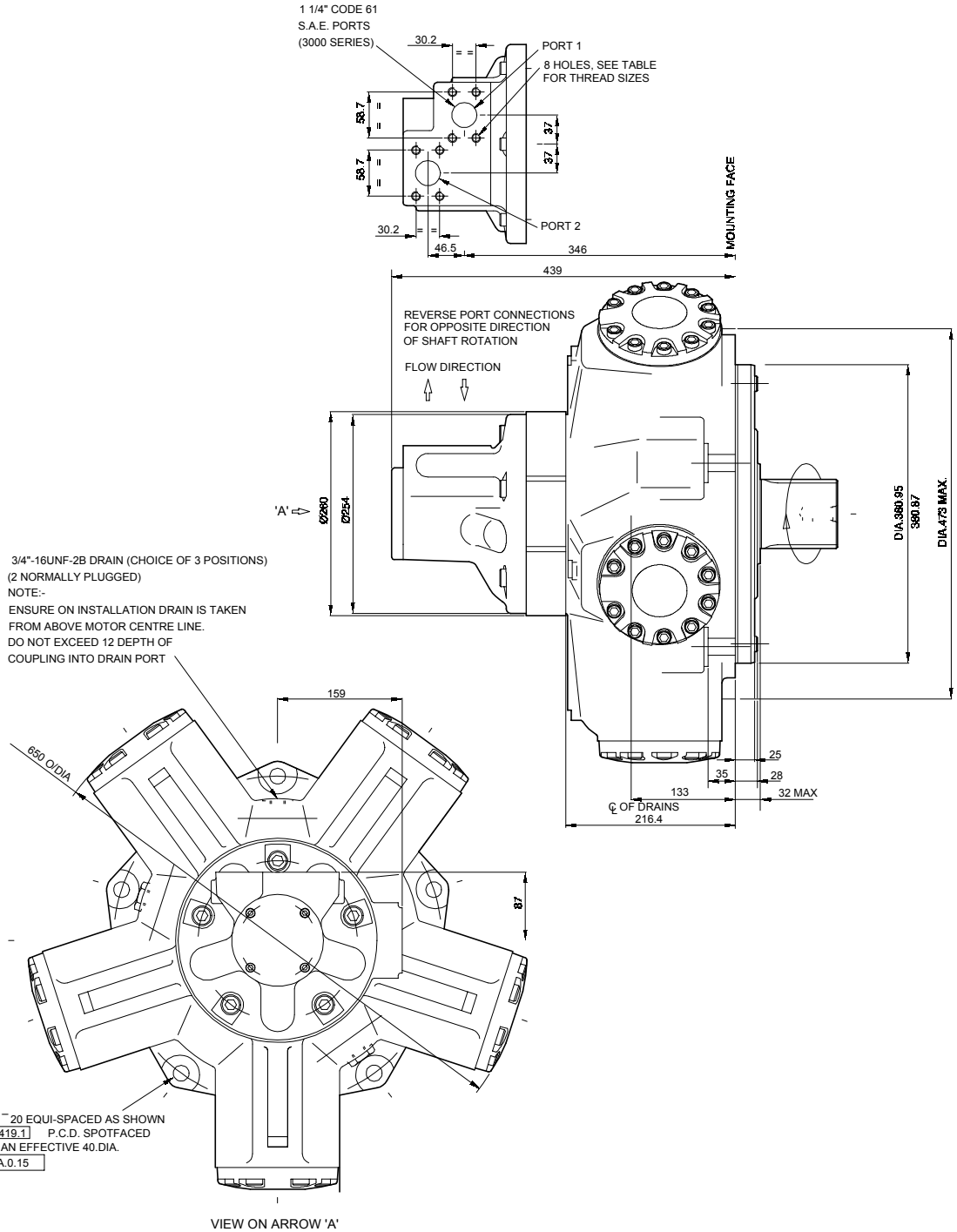
Installation Dimensions (continued)

HMC200 motor with type "F3"/"FM3" (1 1/4" SAE) main ports connection

See additional views for:

Valve housing options, displacement control connections, shaft types, alternative main port connections for

3" valve, and all port connections with 4" valve

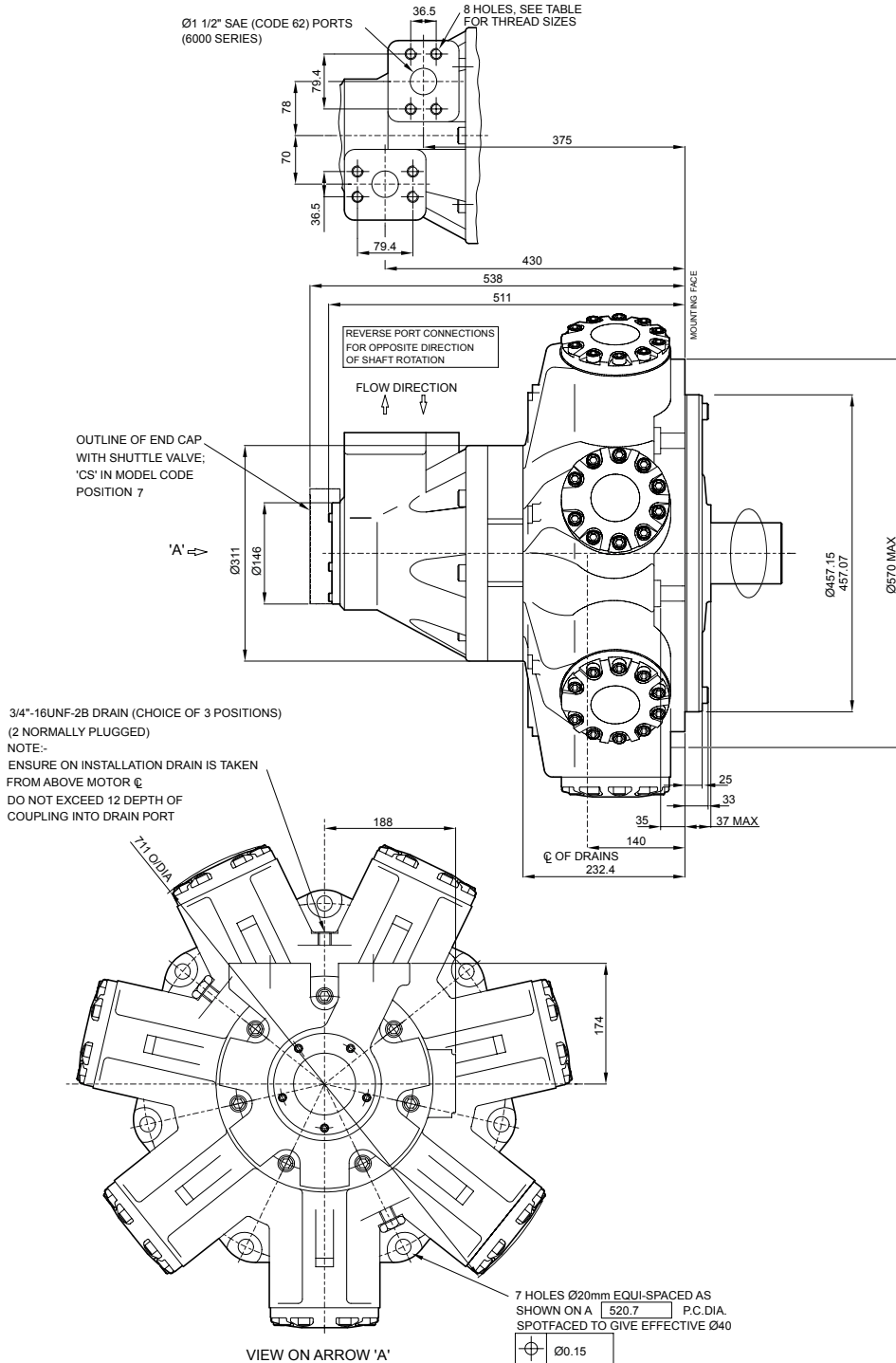


Installation Dimensions (continued)

HMC270 motor with type "F4"/"FM4" main ports connection

See additional views for:

Valve housing options, displacement control connections, all shaft types and alternative main ports connection

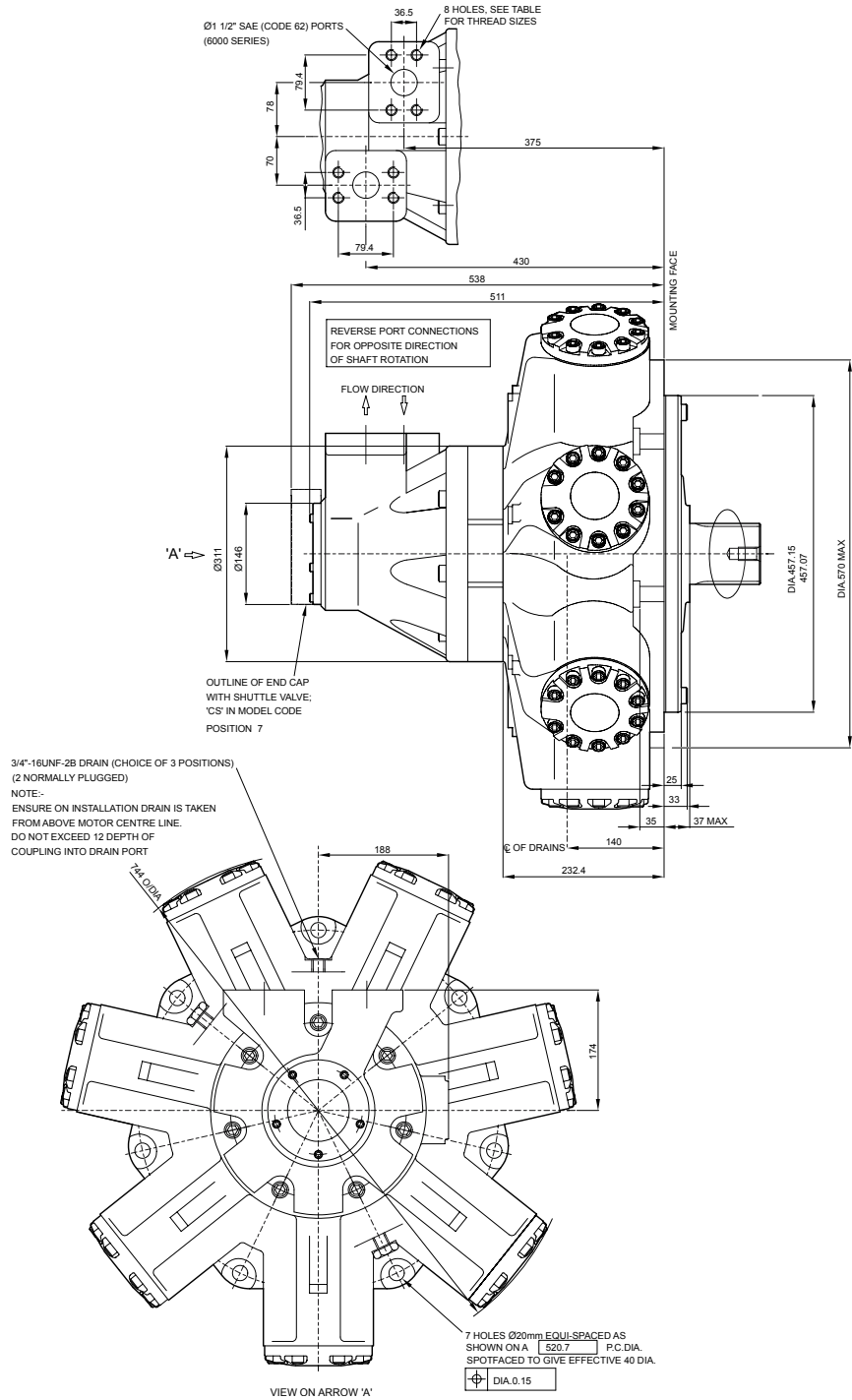


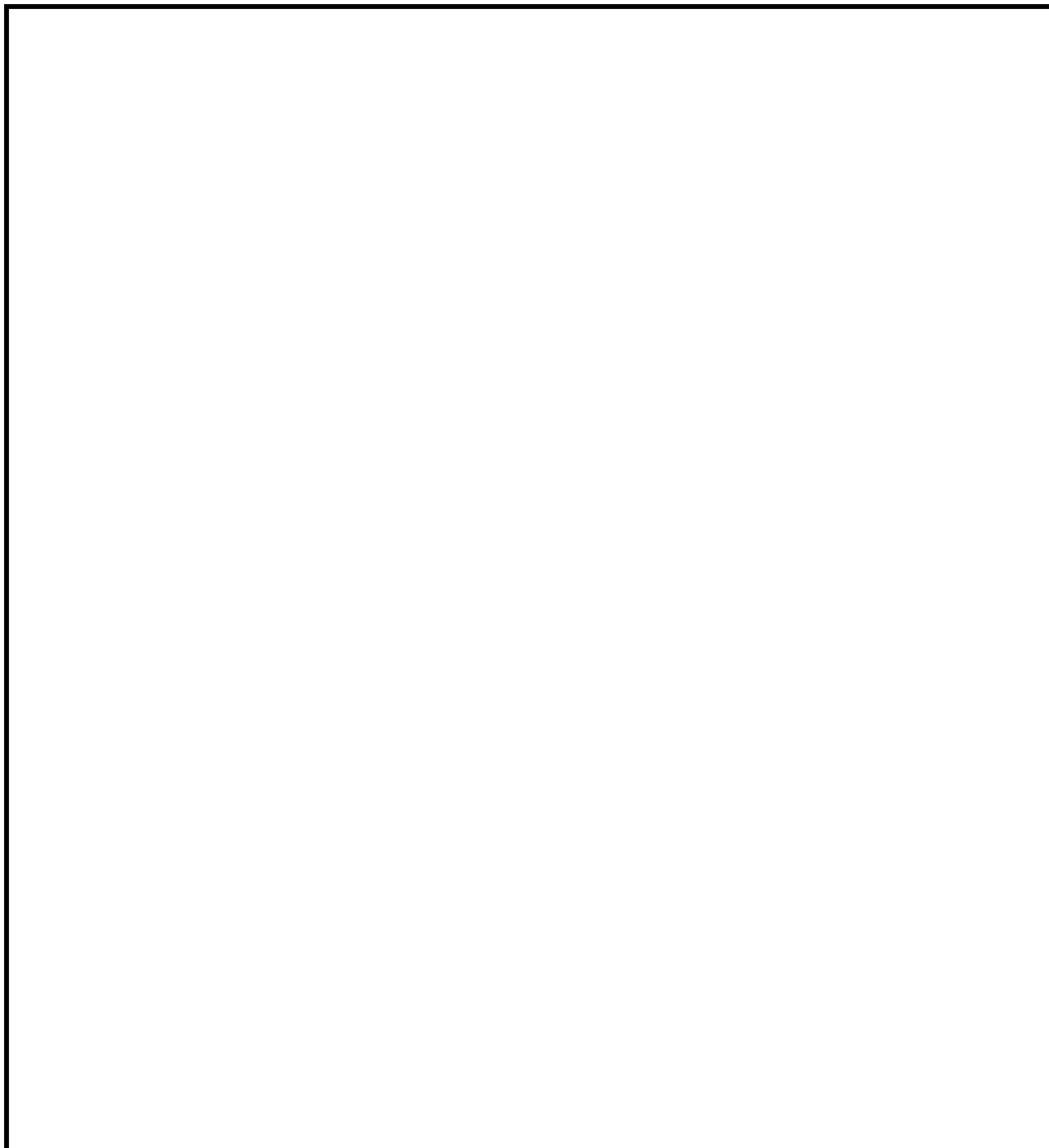
Installation Dimensions (continued)

HMC325 motor with type "F4"/"FM4" main ports connection

See additional views for:

Valve housing options, displacement control connections, all shaft types and alternative main ports connection





KAWASAKI PRECISION MACHINERY (UK) LTD
Ernesettle, Plymouth, Devon, PL5 2SA, England
Tel: +44 1752 364394 Fax: +44 1752 364816
E Mail: info@kpm-uk.co.uk

Web site: <http://www.kpm-uk.co.uk>

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