Specialised Air Motors and Transmission

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SAMT Shaft Mount Speed Reducer

Specialised Air Motors and Transmission

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SAMT SMSR - manufacturing process

SAMT gear units are manufactured using only high quality shaft and gear components which are case carburised to provide good wear characteristics and ground to allow smooth and quiet operation.

All pinions are manufactured from alloy steel SAE 8620 case carburising steel - c/w material test certs.
(SAE 8620 contains nickel to provide maximum strength)

All gears are manufactured from 20MnCr5 case carburising steel forgings - c/w material test certs.

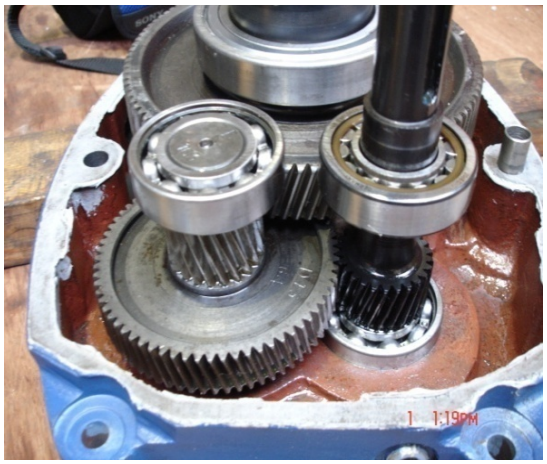
All raw materials purchased are independently batch tested by spectra analysis to verify specification.

All raw materials have additional marking applied to ensure every component can be traced.

Gear components are hobbed to required dimensions prior to heat treatment.

Gears and pinions surface harden by Gas Carburisation to required depth :-

- Pre heat : heat to 790 - 810 deg. C. in an electric furnace.
- Diffusion : case carburise at 790 - 810 C. by injection of "Carbonyl" liquid in an inert atmosphere.
  (Carbonyl is a mixture of carbon & nitrogen)
- Control : carbon saturation levels are constantly monitored throughout process.
- Stabilise : maintain at 790 - 810 deg. C. to stabilise the components.
- Quench : quench in oil to provide surface hardness of 58 - 62 Rc.



Temper to relieve stress :-

- Heat to approx. 200 deg. C.
- Cool slowly to ambient temperature.
- Die Penetrant tests are carried on ALL components.

Grind gears and pinions :-

- Grind to DIN class 6 to provide case depth of approx. 1mm.
- Surface hardness, case depth and core hardness tests on EVERY batch of heat treated components.

CNC machined gear casings :-

- Cast Iron casings are CNC machined to ensure correct gear and pinion centre distance.
- After assembly ALL units are run test and checked for load, noise and lubrication.

- **every component manufacture to exceed ISO 9000 standards**
- **high quality carbon and nickel alloy steel gears**
- **gears heat treated by gas carburisation to improve strength and life**
- **gears ground to DIN class 6 ensuring correct**
- **every shaft and bore machined to strict tolerances**
- **rotating shaft and hub chemically coated to reduce corrosion thus increasing seal life.**

SAMT SMSR - selection procedure

1 Calculate output speed either from prime mover input or driven machine requirements :-

From input prime mover :-

a) Divide prime mover speed by transmission ratio and then by reducer ratio.

Example : 1,450 rpm electric motor, 200mm diameter motor pulley, 250mm diameter reducer pulley and 20:1 ratio reducer.
250 / 200 = 1.25 : 1 transmission ratio reduction,
1,450 / 1.25 = 1,160 rpm reducer input speed,
1,160 / 20 = **58 rpm** output speed.

From driven machine requirements :-

b) Divide driven machine linear speed required by driven component circumference.

Example : 1.4 metres per second conveyor belt speed, 457mm diameter head drum on conveyor.
457mm / 1000 = 0.457m diameter. **- linear units must be the same !**
0.457 x 22 / 7 (pye times dia.) = 1.436m circumference,
1.4m/s x 60 = 84m/min
84m/min / 1.426m = **58 rpm** output speed.

2 Choose a Service Factor :-

Select a suitable service factor from table depending on load type for the driven machine and duty.
Approx. twice the rated capacity can MOMENTARILY be accommodated on start or during operation.
Failure of gear components can occur however if a reducer is continually subjected to input overload when the output or driven shaft is in a locked, jammed or in a braked condition.
Particular attention should be paid to the prime mover before selection where the calculation is to be based on absorbed power. The potentially high starting torque that can occur with electric motors having D.O.L. starters or with hydraulic motors should be taken into consideration.
The torque arm reducer is very effective and versatile drive unit for use on conveyor applications.
Infrequent starting with the belt empty will require a low service factor in comparison to a belt which starts frequently fully loaded - for this a high service factor should be selected.

type of load	**operational hours each day**		
	under 10	**10 to 16**	**over 16**
uniform loading / up to 5 starts per hour	1.0	1.2	1.3
uniform loading / up to 25 starts per hour	1.3	1.5	1.7
moderate shock / up to 5 starts per hour	1.3	1.5	1.7
moderate shock / up to 25 starts per hour	1.7	1.9	2.1
heavy shock / up to 5 starts per hour	1.7	1.9	2.1
heavy shock / up to 25 starts per hour	1.9	2.1	2.3

3 Calculate the Design Power :-

The prime mover power (or absorbed power if accurate details are known), should be multiplied by the Service Factor to establish Design Power.
On conveyor belt application where a hopper or bin is located directly above the belt careful selection should be carried out as the "product shear" requirement can be very high in comparison to the normal absorbed power required for "Belt Capacity" type calculations.

Example : 18.5 Kw motor with 1.3 service factor (assuming service factor selected at 1.3),
18.5 x 1.3 = **24.05 Kw** Design Power.

4 Select unit form tables based on above calculations :-

Example : 58 rpm output speed with 24.05 Kw Design Power.
The reducer chosen should have a power rating equal to or greater than the Design Power at the required output speed **- size H13 or H20** unit would be suitable.

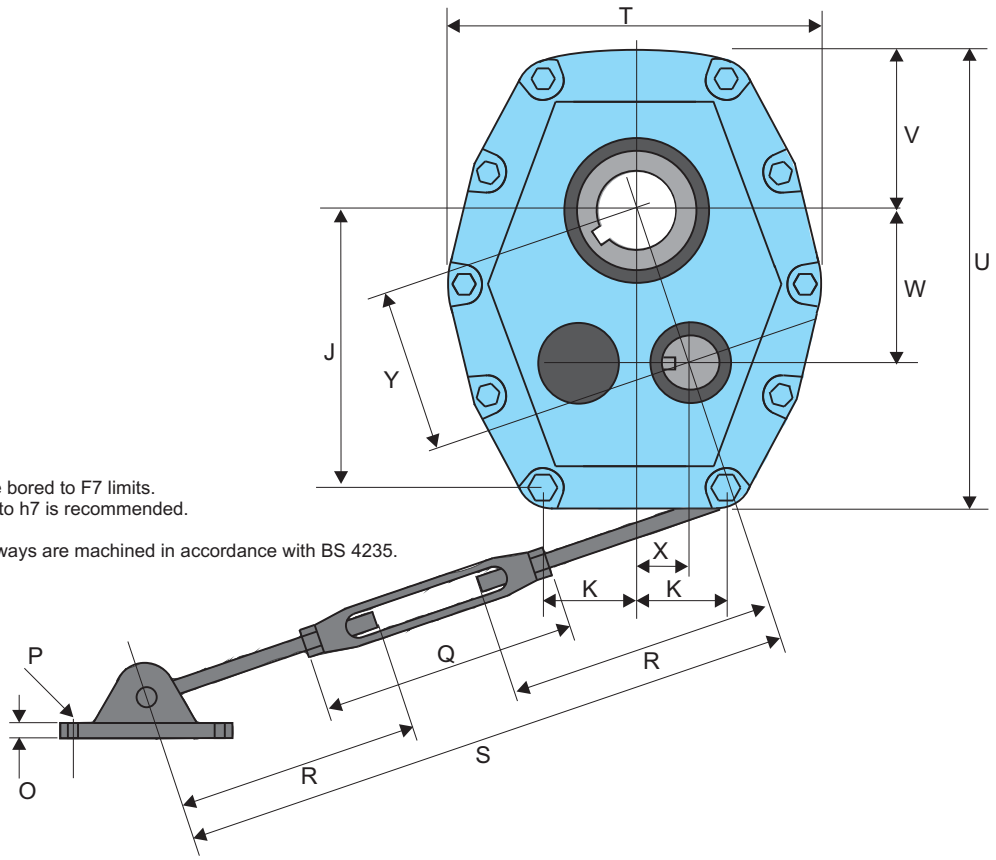
SAMT SMSR - power ratings

Output	SMSR size and ratio									
rev/min	A5	B5	C5	D5	E5	F5	G5	H5	J5	S5
	Power rating in Kw									
50	1.0	1.3	2.0	3.8	5.5	8.2	12.0	19.2	31.0	55.0
60	1.2	1.5	2.4	4.5	6.6	9.8	14.6	23.0	37.2	62.0
70	1.4	1.8	2.8	5.3	7.7	11.5	16.8	26.9	43.4	73.0
80	1.6	2.1	3.2	6.1	8.8	13.1	19.2	30.7	49.6	82.0
90	1.8	2.3	3.6	6.8	9.9	14.7	21.6	34.5	55.8	89.0
100	2.0	2.7	4.1	7.6	11.0	16.5	24.2	38.5	60.0	93.0
150	3.1	3.8	5.7	8.8	14.3	20.9	35.2	50.6	88.0	118.0
200	3.5	4.4	6.6	10.1	15.5	23.6	38.5	57.7	104.5	140.0
250	4.0	5.0	7.1	11.5	17.6	27.0	45.1	66.0	110.0	153.0

Note : **When a 5:1 ratio unit is required with a backstop, the clutch itself can have a torque rating which is less than the reducer. Consult SAMT for individual application selection support.**

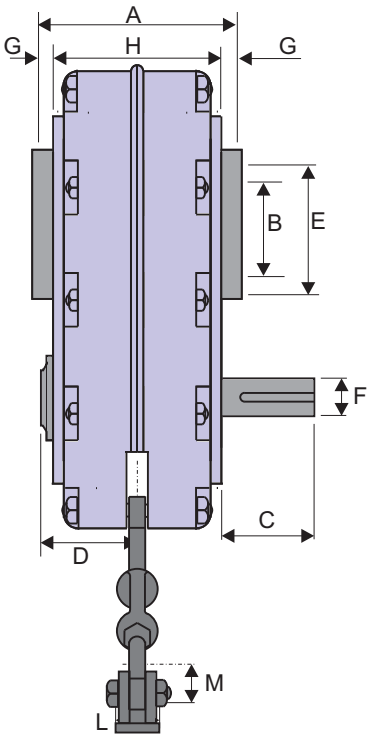
Output	SMSR size and ratio											
rev/min	A13 A20	B13 B20	C13 C20	D13 D20	E13 E20	F13 F20	XF20	G13 G20	H13 H20	J13 J20	XJ13 XJ20	XS13 XS20
	Power rating in Kw											
10	0.22	0.28	0.46	0.75	1.20	1.85	2.40	3.00	4.60	7.40	8.90	13.20
15	0.33	0.45	0.67	1.10	1.80	2.70	3.60	4.50	6.90	11.40	13.70	19.10
20	0.44	0.62	0.88	1.50	2.40	3.74	4.90	6.10	9.20	15.40	18.50	25.60
25	0.55	0.72	1.10	1.90	3.00	4.60	6.10	7.70	11.80	18.70	22.40	31.50
30	0.66	0.82	1.30	2.30	3.63	5.60	7.28	9.30	14.30	22.00	26.40	37.40
35	0.77	1.00	1.50	2.70	4.20	6.50	8.50	11.00	17.30	26.40	31.70	43.20
40	0.88	1.10	1.70	3.10	4.80	7.50	9.75	12.60	20.30	30.80	36.96	49.00
42	0.90	1.15	1.78	3.25	5.03	7.90	10.20	13.20	20.80	32.30	38.80	51.50
44	0.95	1.18	1.87	3.40	5.18	8.25	10.70	13.80	21.40	34.50	40.60	53.90
46	1.00	1.23	2.02	3.55	5.40	8.60	11.20	14.20	21.60	35.40	42.50	56.30
48	1.05	1.26	2.10	3.70	5.55	9.00	11.70	15.10	21.80	36.00	44.00	58.80
50	1.10	1.30	2.20	3.90	5.70	9.30	12.10	15.40	22.00	37.40	44.88	60.10
52	1.11	1.35	2.26	4.14	5.98	9.64	12.50	16.00	23.30	38.50	46.20	61.50
54	1.18	1.40	2.32	4.28	6.28	10.00	13.00	16.70	24.60	39.60	47.50	62.90
56	1.23	1.46	2.38	4.32	6.56	10.34	13.40	17.50	25.90	40.70	48.80	64.40
58	1.28	1.53	2.42	4.46	6.84	10.68	13.80	18.00	27.20	41.80	50.10	65.80
60	1.30	1.60	2.50	4.60	7.10	11.00	14.30	18.70	28.60	42.90	51.48	67.30
62	1.34	1.68	2.60	4.80	7.30	11.40	15.00	19.36	29.70	43.70	52.50	68.00
64	1.38	1.76	2.70	5.00	7.50	11.80	15.60	20.00	30.80	44.50	53.50	69.60
66	1.42	1.84	2.80	5.10	7.70	12.20	16.30	20.60	31.90	45.30	54.50	71.20
68	1.47	1.92	2.90	5.30	7.90	12.60	16.80	21.30	33.10	46.20	55.50	73.90
70	1.50	2.00	3.00	5.50	8.20	13.20	17.16	22.00	34.00	47.00	56.40	75.50
75	1.55	2.05	3.15	5.80	8.50	13.70	17.80	23.10	35.10	51.00	61.00	78.30
80	1.60	2.10	3.30	6.10	9.60	14.30	18.60	24.20	36.30	55.00	66.00	81.20
90	1.80	2.30	3.70	7.00	11.00	15.40	20.00	26.40	40.70	58.80		
100	2.20	2.60	4.10	7.70	11.50	17.60	22.90	29.10	44.00	63.80		

For speeds higher than 70 rpm use 13 : 1 or 5 : 1 ratio units.

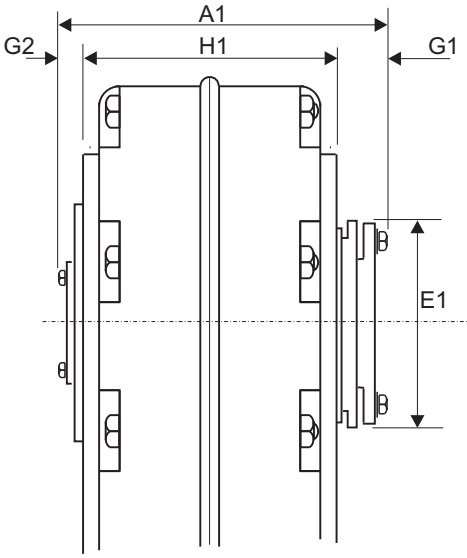


Output hubs are bored to F7 limits.
Shaft tolerance to h7 is recommended.

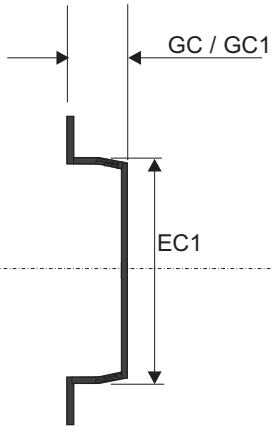
Output hub keyways are machined in accordance with BS 4235.



Standard Hub



Taper Clamp Hub version
(dimension suffix 1)

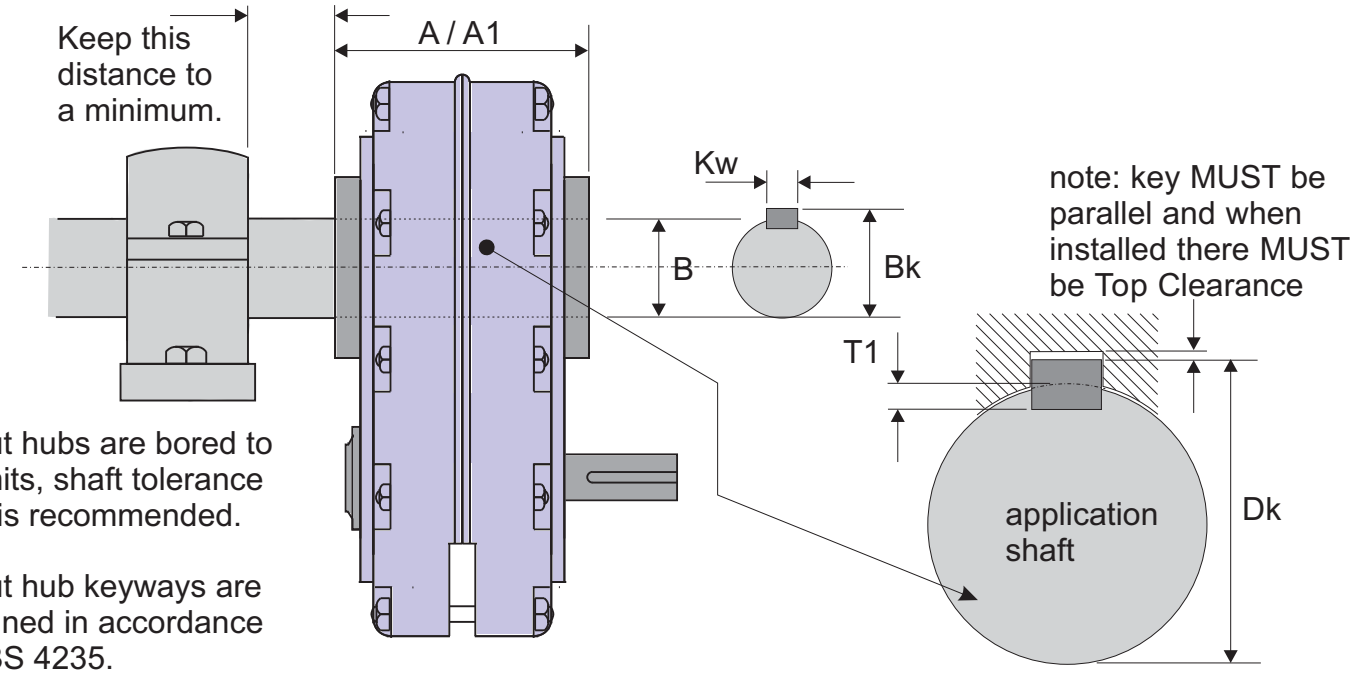


Hub Cover

Specialised Air Motors and Transmission

SAMT SMSR - dimensions

	SMSR size											
ref.	**A**	**B**	**C**	**D**	**E**	**F**	**XF**	**G**	**H**	**J**	**XJ**	**XS**
	dimensions in MM unless indicated											
A	124	134	142	152	175	193	222	215	247	260	280	305
A1		162	168	180	194	213		235	254	275	295	324
B - Std. bore	30	30	40	50	55	65	65	75	85	100	100	120
- keyway	8	8	12	14	16	18	18	20	22	28	28	32
B - Alt. bore		40	50	55	65	75	75	85	100	120	120	125
- keyway		12	14	16	18	20	20	22	28	32	32	32
C	50	63	72	77	85	90	91	105	115	135	117.5	169
D	50	59	65	68	76	87	102	110	115	120	130	153
E	45	55	65	75	85	100	100	110	130	150	150	169
E1		65	75	85	100	113		122	145	155	155	195
EC1		80	95	105	122	148	148	168	178	215	215	220
F - input shaft	14	19	22	25	28	32	32	42	48	55	55	60
- keyway	5	6	6	8	8	10	10	12	14	16	16	18
G	15	15	16	15	21.5	21.5	21	21.5	28.5	25	25	31.5
G1		33	33	33	36	37		37	38	39	39	44
G2		25	25	25	26	26		26	26	26	26	38
GC		24	25	25	29	33	33	29	32	38	38	50
GC1		37	41	43	46	47		45	51	53	53	75
H	92	104	110	122	132	150	180	172	190	210	230	242
H1	92	104	110	122	132	150	180	172	190	210	230	242
J	128	131	156	188	221	242	242	282	330	424	424	491.5
K	51	55	60	75	90	98	98	110	90	100	100	90
L	25	25	25	30	30	35	35	72	72	72	72	72
M	23	23	23	25	25	32	32	32	55	55	55	55
N	65	65	65	75	75	98	98	121	121	121	121	121
O	4.5	4.5	4.5	5	5	5.5	5.5	25	25	25	25	25
P	11	11	11	13	13	17	18	18	18	18	18	18
Q	195	195	195	248	248	254	254	254	254	258	258	258
R	119	119	119	297	297	302	302	302	302	307	307	307
S - min.	253	253	253	606	606	618	618	618	618	633	633	633
S - max.	333	333	333	725	725	740	740	740	740	740	740	740
T	163	185	220	260	280	360	360	370	440	545	545	621
U	215	225	270	325	370	430	430	485	561	702	702	804
V	75	80	95	120	130	158	158	180	195	255	255	287.5
W	67	75	90	110	125	140	140	155	190	255	255	266.5
X	24	25.4	31	37.3	43.5	49.7	49.7	55.9	62.1	74.5	74.5	93.2
Y	70	79	95	116	133	149	149	166	199	266	266	282
ratio						**unit mass in Kg**						
05:01	11.5	18	26	38	47	70		103	160	267	275	
13 & 20:1	12.5	19	27	40	50	75	78	110	170	280	290	
						exact ratio						
05:01	5.286	5.05	5.05	5.047	5.047	5.047	5.047	5.047	5.047	5.047	5.047	
13:01	13.62	13.084	13.596	13.589	13.589	13.589	13.589	13.589	13.589	13.589	13.589	13.645
20:01	20.586	20.997	20.456	20.456	20.456	20.456	20.456	20.456	20.456	20.456	20.456	20.115



Output hubs are bored to F7 limits, shaft tolerance to h7 is recommended.

Output hub keyways are machined in accordance with BS 4235.

	SMSR size											
reference	**A**	**B**	**C**	**D**	**E**	**F**	**XF**	**G**	**H**	**J**	**XJ**	**XS**
	dimensions in MM unless indicated											
A	124	134	142	152	175	193	222	215	247	260	280	305
A1		162	168	180	194	213		235	254	275	295	324
B - Std. bore	30	30	40	50	55	65	65	75	85	100	100	120
h7 tolerance	0	0	0	0	0	0	0	0	0	0	0	0
(micrometers)	-21	-21	-25	-25	-30	-30	-30	-30	-35	-35	-35	-35
Kw	8	8	12	14	16	18	18	20	22	28	28	32
key size	8 x 7	8 x 7	12 x 8	14 x 9	16 x 10	18 x 11	18 x 11	20 x 12	22 x 14	28 x 16	28 x 16	32 x 18
T1	5.0	5.0	5.0	5.5	6.0	7.0	7.0	7.5	9.0	10.0	10.0	11.0
Bk	33.3	33.3	43.3	53.8	59.3	69.4	69.4	79.9	90.4	106.4	106.4	127.4
Dk	33.0	33.0	43.0	53.5	59.0	69.0	69.0	79.5	90.0	106.0	106.0	127.0
B - Alt. bore		40	50	55	65	75	75	85	100	120	120	125
h7 tolerance		0	0	0	0	0	0	0	0	0	0	0
(micrometers)		-25	-25	-30	-30	-30	-30	-35	-35	-35	-35	-40
Kw		12	14	16	18	20	20	22	28	32	32	32
key size		12 x 8	14 x 9	16 x 10	18 x 11	20 x 12	20 x 12	22 x 14	28 x 16	32 x 18	32 x 18	32 x 18
T1		5.0	5.5	6.0	7.0	7.5	7.5	9.0	10.0	11.0	11.0	11.0
Bk		43.3	53.8	59.3	69.4	79.9	79.9	90.4	106.4	127.4	127.4	132.4
Dk		43.0	53.0	59.0	69.0	79.5	79.5	90.0	106.0	127.0	127.0	132.0

	SMSR parallel reducing bush kits						
bush O.D.		**metric bore**				**imperial bore**	
30	25	20			1"	3/4"	
40	35	32	30		1.1/4"		
50	45	42	40	38	1.3/4"	1.1/2"	1.1/4"
55	50	45	42		2"	1.3/4"	1.1/2"
65	60	55	50		2.1/4"	2"	
75	70	65	60		2.3/4"	2.1/2"	2.1/4"
85	80	75	70		3"	2.3/4"	2.1/2"
100	95	90			3.1/2"		
120	110	100	90		4.1/2"	4"	3.1/2"

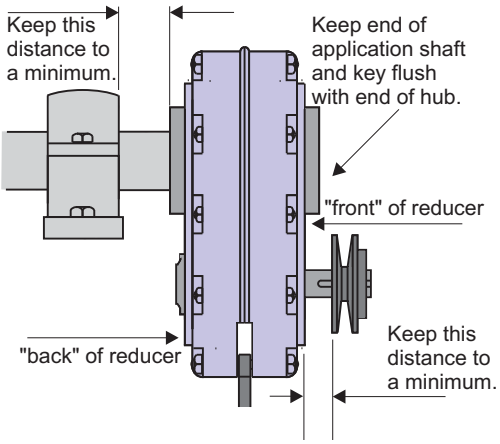
SAMT SMSR - Installation

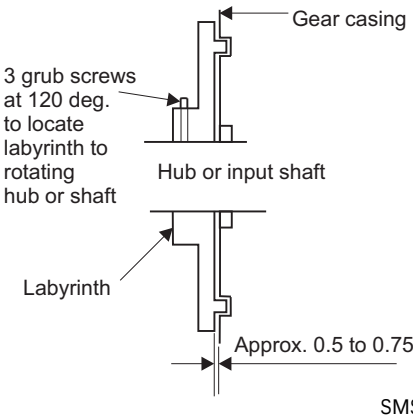
Correct installation of the reducer will increase life, reduce maintenance and make future removal easier. Install as follows :-

step 1)Prepare application shaft by removing key and ensuring surface is clean, smooth and free from burrs. Coat the shaft with "anti seize compound".
Reducing bush kits :-
If a reducing bush kit is required, it must be fitted to reducer before mounting. The plain bush should be fitted to "back" of reducer hub. If labyrinth seals are being used the "back" part of labyrinth must be first removed to allow access to the hub grub screws which locate the plain bush. Ensure the grub screws do not protrude through the inside surface of the bush. Fit the split bush to the "front" of the reducer and align the split with the hub keyway.
Backstop devices :-
If a backstop is required it can be fitted before gear unit installation provided direction of rotation is known. The reducers may have fitted hardened and ground bushes meaning only the sprag clutch requires installation :-

a) Either drain oil from reducer or ensure level is below backstop cover.
b) Remove backstop cover.
c) The sprag clutch can now be fitted into space between outer bush and shaft / inner bush. THE SPRAG MUST BE FITTED BY HAND AND NEVER FORCED IN. The elements in the clutch are slightly angled and point in direction of free rotation. The clutch can be fitted either way to suit direction required.
d) Check that free rotation is obtained in correct direction by rotating input shaft by hand and that reverse direction is prevented.
e) Replace backstop cover with gasket or sealant.

step 2)Align keyways on reducer hub and shaft - slide reducer on to shaft. Keep reducer as close to application shaft bearing as possible to reduce overhung load. Ideally the end of the application shaft should be level with the output edge of reducer output hub.
step 3)Fit the drive key, this should be a parallel key and have a top clearance. The key should protrude at least one third way into length of hub keyway and again be flush with output edge of reducer hub.
step 4)The hub screws can now be tightened on to the shaft and the key. Two screws at each end of hub locate directly on to shaft and one on the key. The nature of this type of reducer / transmission is such that negligible axial loads are produced on the driven shaft - for this reason the three hub screws at the "front" of reducer would be sufficient to locate the gear unit.
Labyrinth seals :-
If labyrinths are supplied and required the kit will be supplied with one labyrinth fitted at input shaft (this need not be removed), and one at the "back" output hub side which can restrict access to hub screws. It is not necessary to use the three "back" hub screws for location of the unit provided the "front" screws are secured and if this option is suitable the labyrinths can be left in place and the unit installed as above using only the three "front" hub grub screws.
Grease should be applied on a regular basis to the labyrinth seal assemblies via the grease nipples adjacent to the seals on the edge of gear casing.
Over greasing can do no harm as the excess can simply be wiped away.
Under greasing will not harm the labyrinth but will reduce it's effect.
step 5)If an input pulley is to be used it should be located on the shaft as close to the reducer front case as possible to reduce radial load on input bearings.
step 6)Fit the torque arm to the appropriate case bolt and locate the fulcrum to a fixed support so that it axis is approx. 90 deg. to a line between the case bolt and centre of hub. Re-tighten case bolt to torque shown.
The torque arm should operate in tension rather than compression.
step 7)The pulley drive can be located at any convenient position to suit the motor. If the torque arm is to be used as a method to adjust the belt drive, it should located at approx. 90 deg. to a line between input shaft and output hub centres.

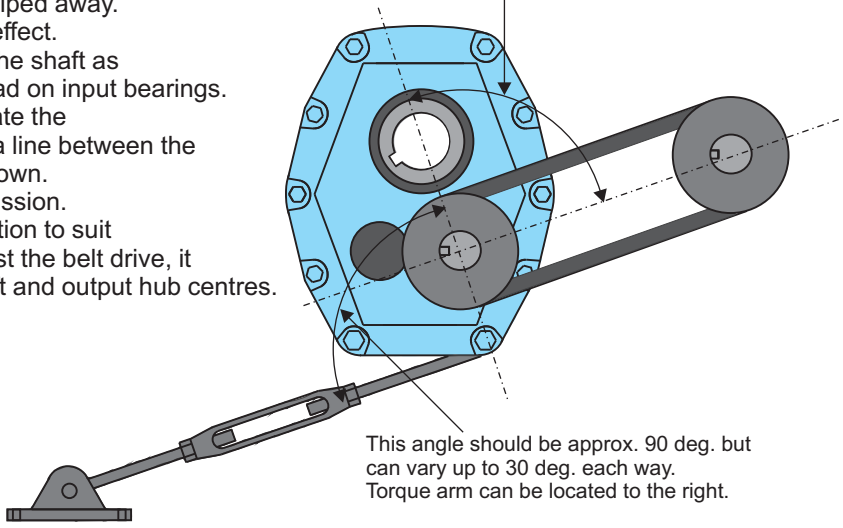




SMSR Size

	A / B	C / D	E	F to J
Casing bolt size	M8	M10	M12	M16
Tightening torque Nm	15 Nm	25 Nm	50 Nm	100 Nm

The Vee - belt dtive can be located at any convenient position but if the torque arm is to be used for belt tension the angle shown below should be approx. 90 deg.
The Vee - belt drive can be located to the left if required.



SAMT SMSR - Lubrication

Shaft Mounted Speed Reducers are supplied **without oil** and must be filled with the required quantity and type of lubricant before use.
Correct quantity and type of oil is crucial to ensure correct operation and long life of the reducer. A breather **must** be used to ensure pressure build up and subsequent seal failure does not occur. A breather is supplied with each gear unit but not fitted.

Viscosity of oil for various ambient temperatures and reducer INPUT speeds are shown below :-

Ambient Temp deg. C	Viscosity (mm^2/s (cSt) at 40 deg. C)	
	Input speed r.p.m.	
	500 to 1,000 r.p.m.	1,000 to 2,000 r.p.m.
-10 to +5	VG 100	VG 100
0 to +40	VG 320	VG 220
+35 to +45	VG 460	VG 320

Maintenance :-
Running in period : After 500 hours drain oil and refill.
Synthetic Oil : Replace every 12,000 hours use.
Mineral Oil : Replace every 2,500 hours use.

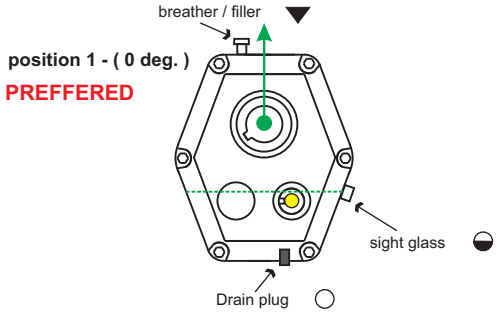
Recommended Synthetic Oils :-

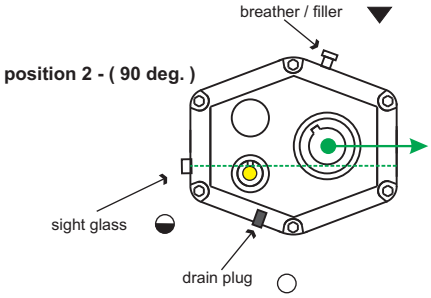
BP EnerSyn HTX	Castrol AlphaSyn T - range	Esso Glycolube	Kluber Klubersynth GH6	Mobil SHC / SHC - XMP	Shell Tivela WA / WB

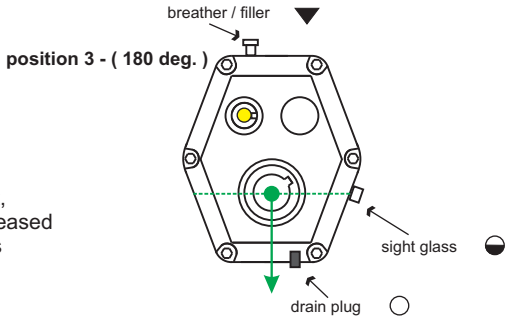
Recommended Mineral Oils :-

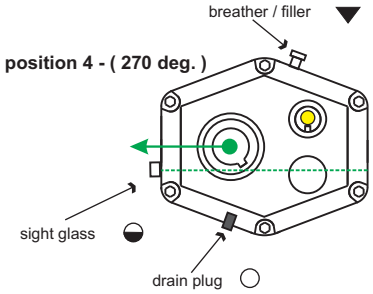
BP Energol GR - XP	Castrol Alpha ZN / SP	Esso Spartan EP	Kluber Kluberoil GEM 1	Mobil Mobilgear	Shell Omala

Quantity of lubricant and position of breather, sight glass and drain plug are shown in diagrams and table below :-









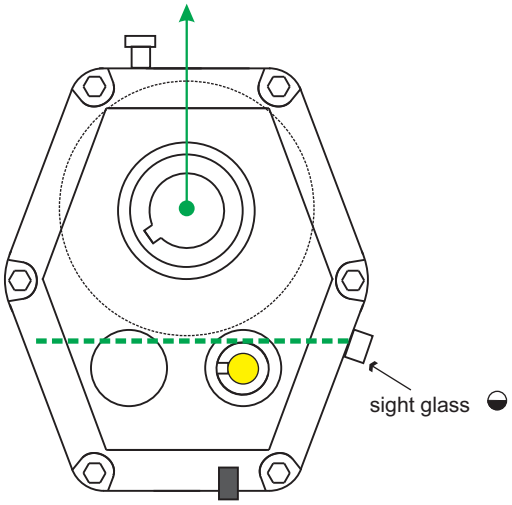
○ = high speed input shaft, gear unit life will be increased if orientation locates this shaft below oil level.

THE SIGHT GLASS CAN ONLY BE USED AS AN OIL LEVEL INDICATOR IN POSITIONS 1,2,3 or 4
- FOR ANY OTHER POSITION USE QUANTITY INDICATED AS ORIENTATION NEAREST IN TABLE BELOW !

gear orientation		SMSR size / Oil quantity - LITRES											
position		A	B	C	D	E	F	xF	G	H	J	xJ	xS
1	0 deg.	0.3	0.4	0.6	1.1	2.0	2.5	4.0	4.0	6.7	11.5	11.0	14.0
	45 deg.	0.4	0.5	0.6	1.2	1.9	2.7	4.0	4.2	6.8	11.4	11.4	15.0
2	90 deg.	0.4	0.6	0.7	1.4	2.0	3.0	4.2	4.5	6.7	11.2	12.0	21.0
	135 deg.	0.4	0.6	0.7	1.3	2.0	2.9	4.3	4.1	6.2	10.1	11.4	19.0
3	180 deg.	0.4	0.6	0.7	1.3	2.3	2.8	4.6	3.7	5.8	9.7	10.9	17.0
	225 deg.	0.4	0.6	0.7	1.3	2.2	2.7	4.8	3.7	6.0	9.9	11.3	17.0
4	270 deg.	0.3	0.6	0.7	1.3	2.1	2.7	5.1	3.7	6.2	10.5	11.5	19.0
	315 deg.	0.3	0.5	0.7	1.2	1.9	2.6	4.6	3.8	6.4	10.9	11.2	17.0

Position 1 - (0 deg.)

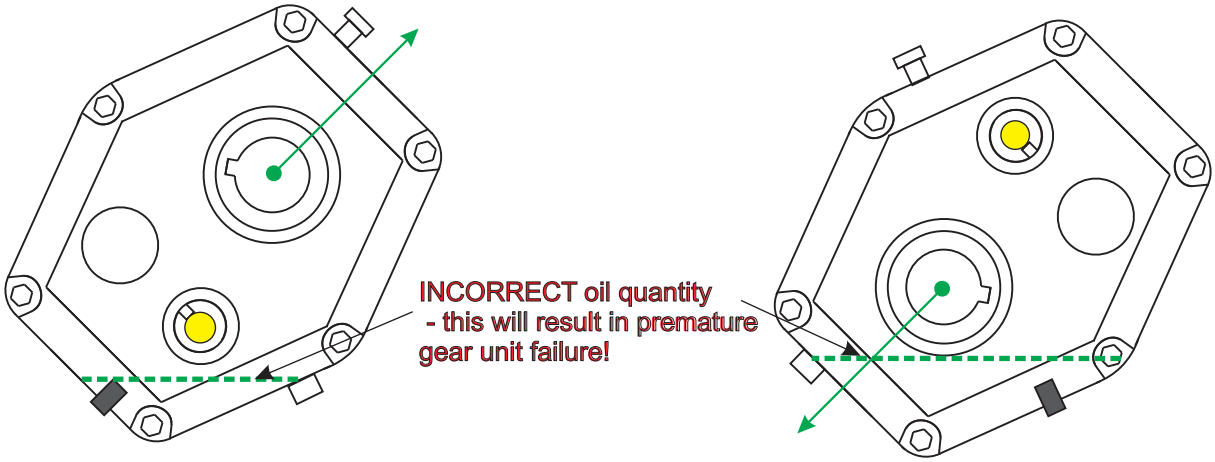
PREFFERED



= high speed input shaft, gear unit life will be increased if orientation locates this shaft below oil level.

THE SIGHT GLASS CAN ONLY BE USED AS AN OIL LEVEL INDICATOR IN POSITIONS 1,2,3 or 4

- IF SIGHT GLASS IS USED FOR LEVEL IN ANY OTHER POSITION OIL LEVEL WILL BE TOO LOW AND PREMATURE GEAR FAILURE WILL OCCUR!



in these positions fill by quantity only - DO NOT USE SIGHT GLASS or LEVEL BUNG!