



Triveni

HIGH SPEED GEARS AND GEAR BOXES

**ISO 9001 & 14001
Accredited**



TRIVENI GROUP

Triveni has always been regarded as a major player in the field of industry.

Beginning with sugar (the relationship now spans over 65 years), the Triveni umbrella presently accommodates other key areas such as steam, gas and hydel turbines, oil and gas field services, sugar plant machineries, gears, condensers, pollution control equipments, couplings, mechanical oil seals and project and engineering consultancy.

The Group provides the right work environment whereby Triveni's family of 4000 personnel are bonded together in their quest for better quality and higher productivity.

Triveni's excellence in its line of business naturally calls for an exploration of the global market. Hence, providing value for money through its reasonably priced and well-engineered products.

Technology and people. Together they empower Triveni on the road to growth.



MYSORE PLANT



This highly specialised unit went into production in 1976, with the objective of fulfilling an in-house demand for high speed gears and gear boxes.

From 1980 onwards, the Mysore unit began catering to outside customers as well. Today, this unit designs and manufactures a complete range of gears and gear boxes of upto 50 MW capacity and speeds upto 40000 RPM under the licence agreement with M/s Lufkin Industries Inc. U.S.A. Triveni has prestigious installations in various industries like Sugar, Refinery, Fertilizer, Steel, Paper, Petrochemical Defence & Marine Establishment for applications like Alternators, Compressors, Pumps, Blowers, Industrial Fans, Test Rigs, etc.

With an accent on product excellence and technological advancement, the unit has the unique distinction of being the first in India to design and manufacture multi-shaft special gear boxes for Test Rigs and Compressors running at 40000 RPM.

The unit is the very first company in India in its field to obtain an ISO-9001 and 14001 certification . The unit is also a frontliner in adopting a concerted programme on Total Quality Management (TQM).

HIGH SPEED GEAR BOXES - HSG/HDG/HTG



1

Triveni's Standard High Speed Gear Boxes of upto 50 MW capacity are used for applications like Alternators, Compressors, Pumps, Fans, etc., in various industries.

1. 5 MW, 8250/1500, HSG-500 Gear Box at assembly with turbine. Gears are single helical, with thrust collar and thrust band to absorb axial thrust. Gear boxes with taper land or tilting pad thrust bearings are also in standards range.



2



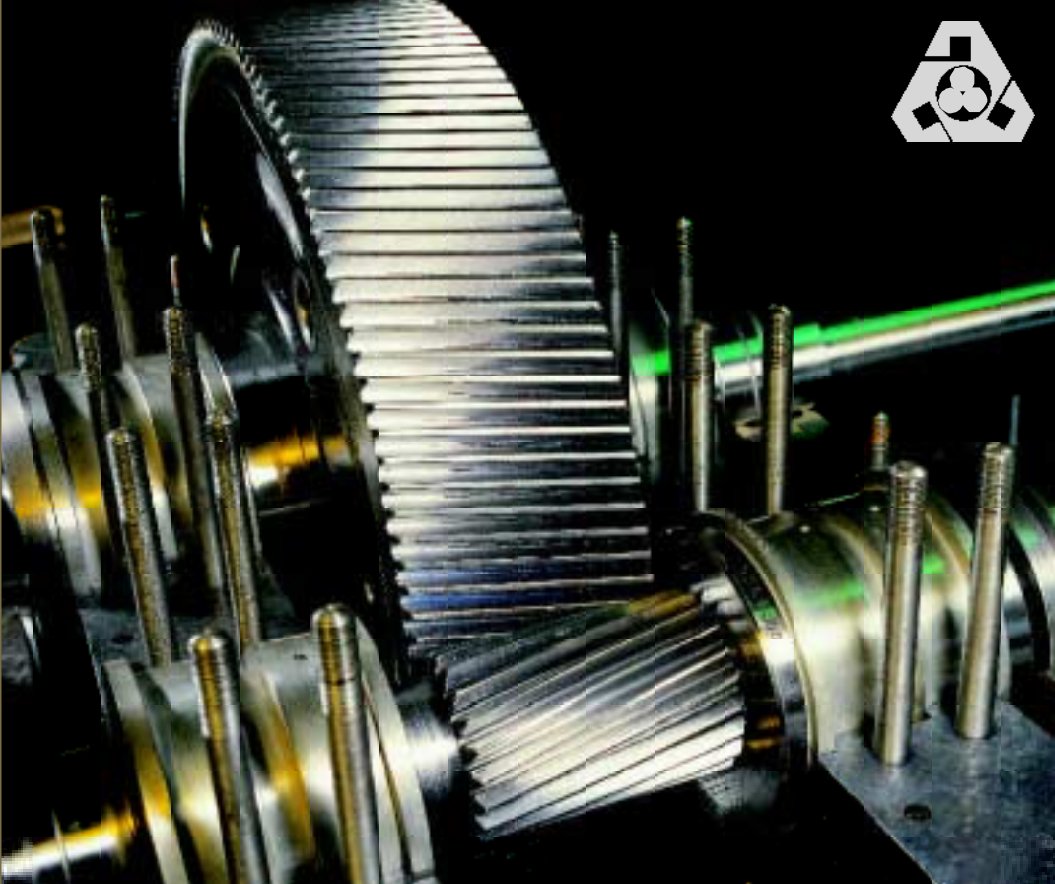
2. Gear Box Model HSG-360, 2000 KW, 6000/1500, with integral flanged HS Shaft. Robust housing of high grade Cast Iron ensures low vibrations. Internal passages in the housing feed pressurised lubricating oil to bearings.

3. 3500 KW, 6240/3160 HSG-320 Gear Box for Centrifugal Compressor on test bed.

Gear Boxes with double/single helical gearing that conform to standards like AGMA, ISO, DIN, API & BS are tested at full speed no-load conditions. Various parameters like shaft vibrations, bearing temperatures and noise level are monitored.

3





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4. 1250 KW, 7300/950, HSG-450 Gearbox with white metal lined journal and taperland thrust bearings, for pump drive. Gears and Pinions are of quality alloy steel, carburised, hardened and ground to DIN-3/4 class of accuracy.

5. Computer programmes are utilised to optimize housing and gearing including profile and helix modifications to compensate elastic and thermal deformation.

RE-ENGINEERING/CUSTOMIZING



Triveni specialises in retrofitting of gears and gear boxes of upto 50MW capacity. This also includes meeting the increased rating requirement by utilizing the existing casing, space and foundation.

Triveni has designed and developed special multi-shaft gear boxes for test rigs and centrifugal compressors for speeds upto 40000 RPM.

1

1. 15MW, Double Helical Gear Internals for Turbo-alternator drive in fertilizer industry. Re-engineered and manufactured to API standards to suit existing casing and bearings.

2. Turbo Gears and Pinions re-designed and manufactured to suit existing casings for various customers.



2





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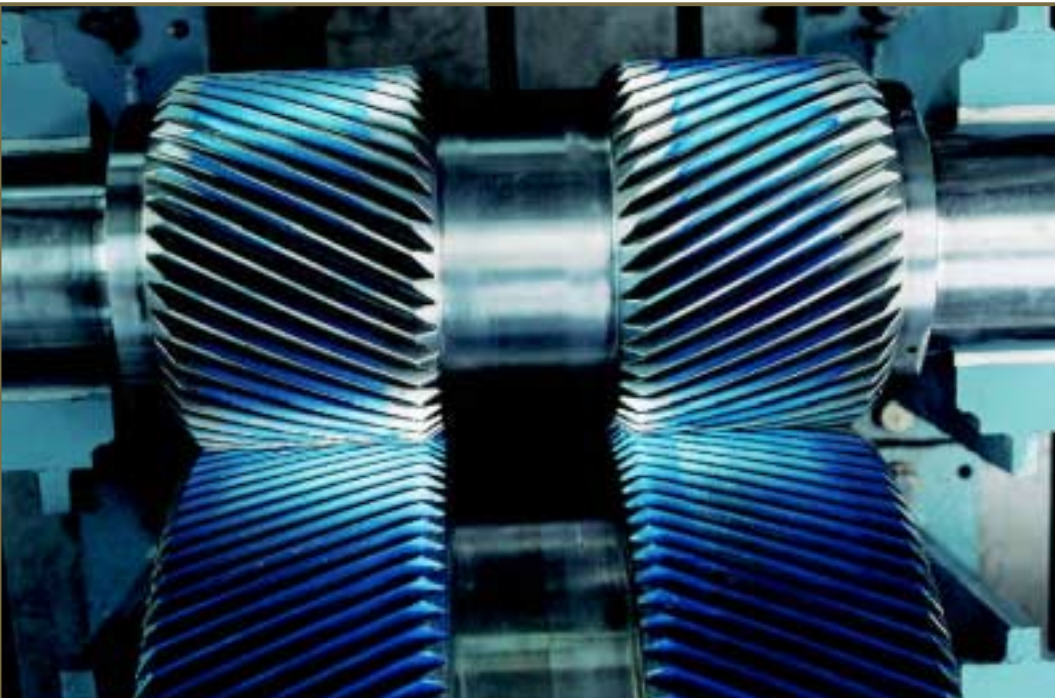


3. A view of re-engineered gear boxes in assembly shop.

Re-engineering is a self sufficient facility that re-designs manufactures and services all makes of gears and gear boxes.

4. Re-engineered gears are tested for tooth contact patterns on Test-stand as per API requirement.

4





MANUFACTURING

1



1. *Hardening of carburised gear. Electronically controlled furnaces ensure optimum metallurgical parameters like case depth, hardness and microstructure. A well equipped laboratory assures that it conforms to prescribed quality standards.*
2. *1.5 Meter diameter double helical gear with minimum tooth gap being cut.*
3. *Precision grinding of gear on CNC Hofler Grinder.*
4. *Gears are dynamically balanced to API/ISO standards as per specification.*

2



3



4



HIGH SPEED GEAR BOXES - HSG/HDG/HTG



SELECTION:

1. Determine Service Factor from Table - 1 (S_f)
2. Multiply the power to be transmitted, P_T by the required Service Factor to get the required rating P_C of the gearbox
3. Refer to tables 2 or 3 and look for the Power (P) at the intersection of Low Speed and High Speed RPM under the different Models, such that $P > P_C$

Example :

$$S_f = 1.1, P_T = 6000 \text{ KW}, n_1 = 6000, n_2 = 1500$$

$$P_C = P_T \cdot S_f = 6600 \text{ KW}$$

According to table 2 (AGMA) Gearbox selected is HSG-450 where P (7040) is $> P_C$ (6600)

According to table 3 (API) Gearbox selected is HSG-500 where P (7625) is $> P_C$ (6600)

TABLE : 1

SERVICE FACTORS (S_f)

APPLICATION	Service Factors		
	Prime Mover		
	Motor	Turbine	Internal Combustion Engine (Multi-Cylinder)
BLOWERS			
Centrifugal	1.4	1.6	1.7
Lobe	1.7	1.7	2.0
COMPRESSORS			
Centrifugal process gas except air conditioning	1.3	1.5	1.6
Centrifugal air conditioning service	1.2	1.4	1.5
Centrifugal air or pipe line service	1.4	1.6	1.7
Rotary axial flow all types	1.4	1.6	1.7
Rotary liquid piston (Nash)	1.7	1.7	2.0
Rotary lobe-radial flow	1.7	1.7	2.0
Reciprocating-3 or more cyl.	1.7	1.7	2.0
Reciprocating 2 cyl.	2.0	2.0	2.3
GENERATORS AND EXCITERS			
Base load or continuous	1.1	1.1	1.3
Peak duty cycle	1.3	1.3	1.7
PUMPS			
Centrifugal (all service except as listed below)	1.3	1.5	1.7
Centrifugal boiler feed	1.7	2.0	-
Centrifugal descaling (with surge tank)	2.0	2.0	-
Centrifugal hot oil	1.5	1.7	-
Centrifugal pipe line	1.5	1.7	2.0
Centrifugal water works	1.5	1.7	2.0
Dredge	2.0	2.4	2.5
Rotary axial flow-all types	1.5	1.5	1.8
Rotary gear	1.5	1.5	1.8
Rotary liquid piston	1.7	1.7	2.0
Rotary lobe	1.7	1.7	2.0
Rotary sliding vane	1.5	1.5	1.8
Reciprocating 3 cyl. or more	1.7	1.7	2.0
Reciprocating 2 cyl.	2.0	2.0	2.3

Recommended Service Factor (extract). Application for selection to AGMA Standard 6011-H-98 and API standard 613-1995.

HIGH SPEED GEAR BOXES - HSG/HDG/HTG

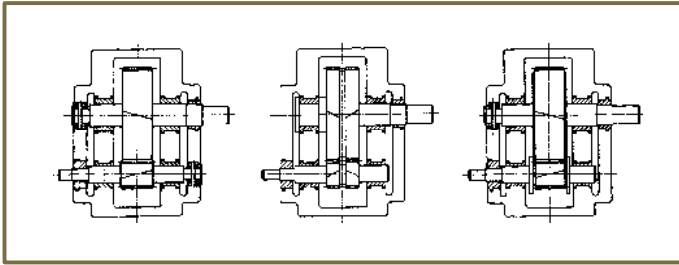


TABLE: 2
POWER RATING TO AGMA STANDARD 6011-H-98

MODEL	HIGH SPEED SHAFT RPM LOW SPEED SHAFT RPM	KILOWATTS (P)								
		10000	9000	8000	7000	6000	5000	4500	4000	3600
HSG 160	3000	750	770	790	800	820	825	820	805	--
	2000	320	470	500	525	560	580	595	600	600
	1500	--	--	--	365	400	430	445	460	470
	1000	--	--	--	--	--	--	275	290	305
	750	--	--	--	--	--	--	--	--	--
HSG 190	3000	1325	1365	1400	1425	1440	1420	1400	1365	--
	2000	755	800	350	900	945	995	1010	1035	1030
	1500	--	--	590	635	685	745	760	815	805
	1000	--	--	--	--	--	--	470	660	520
	750	--	--	--	--	--	--	--	345	365
HSG 220	3000	1935	1990	2040	2080	2100	2070	2040	1980	--
	2000	1090	1150	1205	1280	1330	1395	1425	1440	1450
	1500	--	770	830	890	960	1035	1070	1110	1130
	1000	--	--	--	--	565	625	665	705	730
	750	--	--	--	--	--	215	450	485	515
HSG 250	3000	2775	2855	2930	2985	3010	2975	2920	2840	--
	2000	1565	1645	1725	1815	1900	1970	1990	2000	2015
	1500	1000	1075	1152	1240	1335	1435	1530	1535	1575
	1000	--	--	--	640	780	870	915	970	1010
	750	--	--	--	--	--	525	625	670	710
HSG 280	3000	3875	3990	4095	4175	4205	4155	4085	3970	--
	2000	2185	2305	2420	2545	2660	2760	2790	2800	2790
	1500	1400	1490	1590	1700	1810	1955	2020	2090	2140
	1000	--	--	720	875	1075	1195	1260	1335	1395
	750	--	--	--	--	600	810	862	920	980

HIGH SPEED GEAR BOXES - HSG/HDG/HTG



POWER RATINGS TO AGMA STANDARD 6011-H-98

MODEL	LOW SPEED SHAFT RPM	KILOWATTS (P)								
	HIGH SPEED SHAFT RPM	10000	9000	8000	7000	6000	5000	4500	4000	3600
HSG 320	3000	5710	5885	6035	6145	6195	6125	6025	5850	--
	2000	3215	3390	3565	3750	3910	4065	4110	4130	4115
	1500	2060	2195	2340	2505	2675	2860	2940	3015	3050
	1000	--	--	1110	1395	1535	1705	1850	1905	1990
	750	--	--	--	--	810	1155	1235	1325	1395
HSG 360	3000	7965	8210	8410	8580	8645	8540	8475	8170	--
	2000	4500	4725	4980	5230	5465	5670	5735	5750	5735
	1500	2880	3065	3270	3495	3735	3985	4100	4210	4275
	1000	--	--	1565	1890	2080	2315	2440	2585	2695
	750	--	--	--	--	1260	1570	1675	1795	1890
HSG 400	3000	10860	11180	11465	11685	11775	11640	11440	11120	--
	2000	6130	6445	6780	7120	7450	7720	7810	7835	7820
	1500	3925	4175	4450	4760	5090	5430	5590	5730	5815
	1000	--	--	1915	2535	2780	3060	3235	3425	3580
	750	--	--	--	--	1515	2080	2225	2380	2365
HSG 450	3000	--	--	--	16175	16295	16110	15390	15390	--
	2000	8360	8920	8380	9855	10310	10685	10810	10860	10820
	1500	5430	5725	6155	6585	7040	7515	7735	7930	8055
	1000	--	--	2655	3510	3850	4245	4460	4695	4875
	750	--	--	--	--	2045	2800	2990	3205	3395
HSG 500	3000	--	--	--	21650	21820	21590	21200	20625	--
	2000	11365	11955	12580	13205	13810	14315	14480	14545	14500
	1500	6655	7735	8250	8825	9435	10070	10360	10630	10800
	1000	--	--	3600	4700	5160	5685	5975	6290	6540
	750	--	--	--	--	2680	3655	3900	4180	4425
HSG 560	3000	--	--	--	--	--	--	--	--	--
	2000	15500	16300	17140	18000	18820	19515	19745	19835	19765
	1500	10150	10550	11240	12025	12860	13725	14115	14490	14715
	1000	--	--	5560	6410	7030	7750	8150	8575	8915
	750	--	--	--	--	3640	4955	5270	5620	5930

HIGH SPEED GEAR BOXES - HSG/HDG/HTG



TABLE : 3

POWER RATINGS TO API STANDARD 613-1995

LOW SPEED SHAFT RPM \ HIGH SPEED SHAFT RPM		KILOWATTS								
		10000	9000	8000	7000	6000	5000	4500	4000	3500
HSG 160	3000	570	585	600	610	615	610	595	580	555
	2000	320	335	355	370	390	400	410	410	405
	1500	--	--	--	250	265	285	300	300	305
	1000	--	--	--	--	--	160	170	175	185
	750	--	--	--	--	--	--	--	--	125
HSG 190	3000	895	920	945	960	970	960	940	915	880
	2000	505	530	580	585	610	635	640	645	640
	1500	--	345	370	390	420	450	460	475	480
	1000	--	--	--	--	230	250	265	280	295
	750	--	--	--	--	--	--	170	185	195
HSG 220	3000	1390	1425	1470	1495	1505	1495	1460	1425	1365
	2000	785	825	865	910	950	985	1000	1000	995
	1500	430	530	575	610	650	695	715	735	745
	1000	--	--	--	275	355	390	410	435	455
	750	--	--	--	--	--	215	265	285	305
HSG 250	3000	2035	2095	2155	2190	2205	2190	2145	2090	2000
	2000	1150	1210	1270	1335	1395	1445	1485	1470	1460
	1500	745	780	840	895	955	1020	1045	1075	1095
	1000	--	--	--	595	500	575	605	635	665
	750	--	--	--	--	--	325	325	415	445
HSG 280	3000	2860	2940	3025	3080	3100	3075	3015	2935	2810
	2000	1615	1695	1785	1875	1960	2033	2055	2065	2055
	1500	925	1100	1180	1255	1340	1430	1470	1515	1540
	1000	--	--	--	570	730	805	850	895	935
	750	--	--	--	--	--	460	550	585	625
HSG 320	3000	4270	4320	4520	4600	4625	4590	4495	4380	4195
	2000	2410	2535	2665	2800	2930	3035	3070	3085	3065
	1500	1350	1640	1765	1875	2000	2135	2195	2260	2300
	1000	--	--	685	995	1095	1205	1265	1330	1400
	750	--	--	--	--	750	775	820	875	935

HIGH SPEED GEAR BOXES - HSG/HDG/HTG



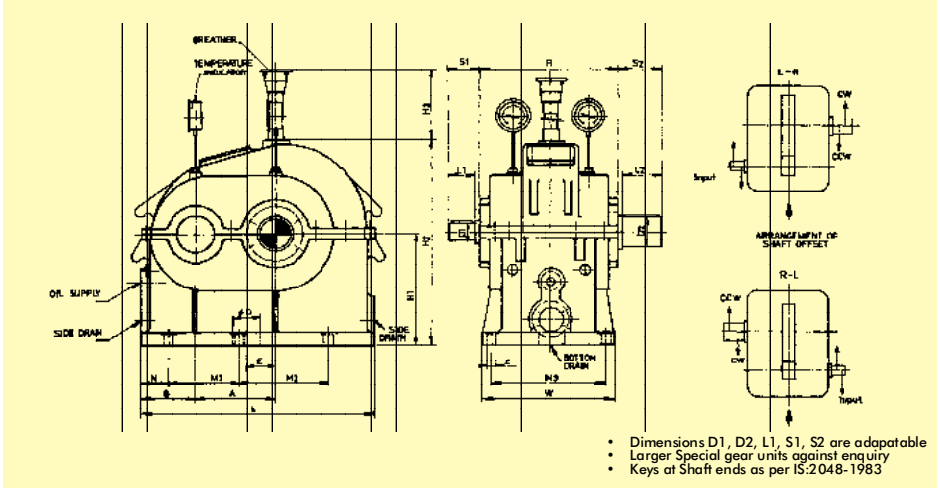
POWER RATINGS TO API STANDARD 613-1995

HIGH SPEED SHAFT RPM LOW SPEED SHAFT RPM		KILOWATTS								
		10000	9000	8000	7000	6000	5000	4500	4000	3500
HSG 360	3000	6080	6255	6433	6545	6590	6535	6405	6325	5970
	2000	3430	3610	3795	3985	4170	4320	4370	4390	4365
	1500	1950	2335	2490	2665	2845	3040	3125	3305	3320
	1000	--	--	1140	1221	1560	1715	2135	1895	1995
	750	--	--	--	--	760	975	1185	1255	1360
HSG 400	3000	8340	8580	8825	8980	9035	8965	8785	8550	8190
	2000	4705	4950	5205	5465	5720	5930	5995	6025	5990
	1500	2710	3200	3450	3660	3905	4170	4290	4415	4490
	1000	--	--	1340	1655	2135	2355	2475	2600	2735
	750	--	--	--	--	1005	1355	1600	1725	1830
HSG 450	3000	11875	12210	12565	12785	12865	12765	12505	12175	11665
	2000	6700	7045	7410	7785	8140	8440	8540	8580	8525
	1500	3815	4560	4910	5210	5560	5940	6105	6285	6395
	1000	--	--	1920	2340	3040	3550	3525	3705	3890
	750	--	--	--	--	1440	1905	2280	2455	2605
HSG 500	3000	--	--	--	--	--	--	--	--	--
	2000	11030	9665	10165	10675	11170	11580	11715	11765	11670
	1500	5180	6250	6735	7145	7625	8145	8375	8620	8770
	1000	--	--	2650	3195	4000	4595	4835	5085	5340
	750	--	--	--	--	1985	2590	3000	3385	3570
HSG 560	3000	--	--	--	--	--	--	--	--	--
	2000	12225	12855	13518	--	--	--	--	--	--
	1500	7380	8315	8955	9500	10140	10630	11140	11460	11660
	1000	--	--	3675	4575	5500	6110	6425	6760	7100
	750	--	--	--	--	2755	3910	4155	4475	4750
HSG 630	3000	--	--	--	--	--	--	--	--	--
	2000	--	--	--	--	--	--	--	--	--
	1500	9900	10520	11332	12025	12831	13705	14905	14503	14750
	1000	--	4290	5313	6396	7015	7735	8135	8555	8985
	750	--	--	--	--	4400	4950	5260	5665	6010

HIGH SPEED GEAR BOXES - HSG



GENERAL DIMENSIONS



Model HSG	A	B	L	W	H1	H2	H3	R	N	M1	M2	M3	E	D	Z	Bolts Size	Weight Kgs
160	160	165	520	330	265	455	200	330	85	150	200	280	-	70	22	M20	300
190	190	190	600	375	280	500	200	375	85	215	215	315	-	70	22	M20	430
220	220	210	670	400	320	570	200	400	85	250	250	320	-	75	26	M24	550
250	250	225	760	440	375	660	300	450	80	300	300	380	95	100	26	M24	700
280	280	240	860	530	400	730	300	500	120	280	280	460	115	110	26	M24	940
320	320	270	930	600	450	775	300	600	120	310	340	520	115	110	33	M30	1200
360	360	240	1050	670	500	915	300	670	120	320	400	580	-	115	33	M30	2000
400	400	270	1150	700	530	950	300	690	125	350	400	600	-	115	40	M36	2600
450	450	270	1270	720	560	1080	300	740	140	430	500	620	-	110	40	M36	2900
500	500	325	1415	760	630	1180	300	780	140	500	500	660	-	110	40	M36	3400
560	560	360	1525	800	710	1330	300	820	150	550	550	700	-	110	40	M36	4800

- ALL DIMENSIONS ARE IN mm
- Above dimensions are not to be used for installation
- USE CERTIFIED INSTALLATION DRAWING ONLY
- Gear boxes can also be supplied with shaft driven main oil pump
- For higher models refer to Triveni - Mysore

QUALITY EVALUATION & DOCUMENTATION



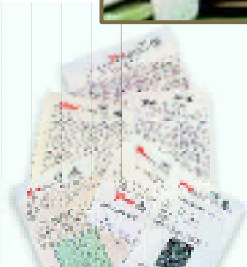
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At Triveni, quality and customer satisfaction provide the guiding principle for all activities. It is our priority to keep ourselves abreast of the changes taking place in this competitive business environment.

2



3



4



1. Bore Measurement
2. Profile & Helix Error Measurement
3. Flank Hardness Checking
4. Pitch Error Measurement.



Triveni - The Name Goes Overseas

- Bangladesh • Egypt • Gabon • Germany • Holland
- Indonesia • Kenya • Nepal • Nigeria
- Papua New Guinea • Phillipines • Seychelles • Sri Lanka
- Surinam • Tanzania • UAE



Triveni

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