INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**SPECIFICATION FOR MOTORIZED GEAR UNITS (MGUs)** *(First Revision)*	**IPSS:1-03-008-03**
	Corresponding IS does not exist	Formerly : IPSS:1-03-008-87

0. FOREWORD

0.1 This Interplant Standard (*first revision*) has been prepared by the Standards Committee on Rotating Electrical Machinery, IPSS 1:3 with the active participation of representatives of steel plants, reputed consulting organizations and established manufacturers of motorized gear units (MGUs); and was adopted in January 2003.

0.2 Interplant Standards for steel industry primarily aim at achieving rationalization and unification of parts and assemblies used in steel plant equipment and accessories, and provide guidance in indenting stores or equipment (or while placing orders for additional requirements) by individual steel plants. For exercising effective control on inventories, it is advisable to select a fewer number of sizes (or types) from among those mentioned in this standard, for the purpose of company standards of individual steel plants. It is not desirable to make deviations in technical requirements.

1. SCOPE

1.1 This Interplant Standard specifies the requirements of coaxial, horizontal, foot mounted, motorized gear units (MGUs) suitable for operation on 415 V, 50 Hz, ac supply. The scope of this standard covers continuous applications (claymill, pugmill, compressor, zig drives, etc) and short time duty applications (S2 duty hoists, conveyors, fans, agitators, etc) only. They shall be provided with the following, if so required by the purchaser:

a) Double shaft extension, or
b) Built-in electromagnetic brakes, duly fitted on the non-driving end.

1.2 This standard does not specify motorized gear units of special types, such as shaft mounted, flange mounted, vertically mounted, etc. Reversible and non-reversible roller table applications are also excluded from the scope of this standard.

2. SITE CONDITIONS

2.1 The ambient temperature and the site conditions for the purpose of this standard shall be according to IPSS:1-02-020-84 `Basic parameters for standardization of steel plant equipment'.

3. RATINGS AND OUTPUT SPEEDS

3.1 The rating (in kW) and preferred output speed of the motorized gear units shall be according to Table 1. The motorized gear units shall be supplied in the combination of kW rating and output speeds as specified by the purchaser.

NOTE: The gear box shall be able to withstand the stall torque of the motor.

3.2 The output speed of the motorized gear unit shall not vary by more than $\pm$ 3% from that given in Table-1.

3.3 The ratings of the motorized gear unit are based on a service factor 1. Depending on the application, the relevant value of service factor shall be chosen from Table-2. The rating of the motorized gear unit shall be decided as per the procedure laid down in IS:7403-1974 `Code of practice for selection of standard worm and helical gear boxes'.

NOTE: For definition of service factor refer to IS 7403:1974.

3.4 Basic steps for selection shall be according to 5 of IS 7403:1974. The motorized gear unit shall be selected from Table 1.

4. DIMENSIONS

4.1 The principal dimensions of the motorized gear units shall be according to relevant Indian Standards.

4.2 The shaft extension dimensions, keys and keyways shall be according to relevant Indian Standards.

5. MATERIAL

5.1 All materials used for the various components shall be selected and suitably heat treated to ensure the required performance commensurate with a long life expectancy.

5.2 *Gear Case* - The gear case of the motorized gear unit shall be made of close grained cast iron conforming to grade FG 200 or FG 300 of IS 210:1993 `Specification for grey iron castings (*third revision*)'. The gear case shall be supplied in mild steel fabricated construction, if mutually agreed to between the supplier and the user.

The gear case shall be oil-tight, to prevent seepage of oil from the gear case.

5.3 *Gears and Pinion* - The first stage reduction of gear and pinion shall be helical and subsequent stages may be helical or spur gears and made of alloy steel suitably heat treated.

6. GENERAL REQUIREMENTS

6.1 *Direction of Rotation* - The motorized gear units shall be suitable for both directions of rotation.

6.2 *Stability* - The motorized gear unit shall be stable when allowed to rest on base and shall not topple due to overhanging weight of the motor. This stipulation may not apply in cases where double gear units are equipped for obtaining very low speed.

6.3 *Motor* - The motor shall be squirrel cage induction motor suitable for operation on 415 V, 3-phase, 50 Hz system and of the flange mounted type. The motor shall conform to IPSS:1-03-001-95 `Specification for general purpose squirrel cage induction motors (*third revision*)' wherever applicable for dimensions to IS 2223:1971 `Dimensions of flange mounted ac induction motors' and for performance IS 325:1996 `Specification for three-phase induction motors (*fourth revision*)' with IP 54 enclosure [see IS 4691:1985 Degrees of protection provided by enclosures for rotating electrical machinery (*first revision*)] and IC 0141 cooling (see IS 6362:1971 Designation of methods of cooling for rotating electrical machines). The windings of the motors shall be insulated with Class B insulation [see IS 1271:1985 `Thermal evaluation and classification of electrical insulation (*first revision*)]. The winding shall be given a protective treatment by eposy base varnish. The motor synchronous speed shall be restricted to 1500 or 1000 r.p.m. only, unless otherwise specified.

6.4 *Shafts and Bearings* - The bearing at the output shaft of the motorized gear unit shall be suitable for pinion drive. The motorized gear units shall be provided with antifriction bearings, the output shaft being provided on roller bearings. The Bearings shall conform to IS 6455:1972 `Specification for single row radial ball Bearing', IS 6457:1972 `Specification for single row cylindrical roller bearings', or IS 7461:1992 `Specification for general plan of boundary dimensions for tapered roller bearings (*first revision*)' as applicable.

The driving pinion shall be keyed on to the motor shaft, or the input shaft, as the case may be and shall not be an integral part of the shaft. Removal of the motor with pinion shall be possible without disturbing other gears. The motorized gear unit shall be supplied with a key on the output shaft adequately secured to prevent falling off during transportation. Rotary shaft oil seals shall be provided in the gear box to prevent oil leakage.

6.5 *Provision for lifting* - The gear casing shall have one or more lifting eye bolts conforming to IS 4190:1984 `Specification for eye bolts with collars (*first revision*)' or a lug provided on the top in such a location that the motorized gear unit is balanced when lifted.

7. LUBRICATION

7.1 The lubricant shall be gear oil conforming to ISO VG 220 of IPSS:1-09-003-97 `Specification for industrial EP gear oil (*first revision*)'.

7.2 All the gears and bearings shall have adequate lubrication. The gear case shall be oil-tight after assembly, and entry of oil into the motor shall be totally prevented.

7.3 The casing of the motorized gear unit shall be provided with oil filling plug on the top and a drain plug to ensure complete drainage of oil. Oil shall not leak from the drain plug. Oil filling plug may be combined with breather system.

7.4 The motorized gear unit shall be provided with an oil level indicator with marking on it to show the minimum and maximum levels of oil. In addition, a dip-stick type oil level indicator with similar markings shall also be provided separately.

8. MARKING

8.1 The motorized gear unit shall carry two name plates, one on the motor and the other on the gear case, bearing the following details.

8.2 The marking on the gear case shall bear the following details:

a) Manufacturer's name/trade-mark (if any), serial number and year of manufacture;

b) Designation (see 9);

c) Output torque of the motorized gear unit;

d) Output speed of the motorized gear unit;

e) Weight of the motorized gear unit including lubricant;

f) Type of lubricant;

g) Quantity of lubricant required; and

h) Recommended life of one filling.

9. DESIGNATION

9.1 The designation of motorized gear unit shall consist of five parts. The first part identifies the application, that is, motorized gear unit and is denoted by MGGM. The second part indicates kW rating, the third part indicates the output speed in rpm, the fourth part the frame number of the motor, and the fifth part the number of poles of the motor.

Example: (A 1.5 kW motorized gear unit with an output speed of 5.5 rpm motor with frame size 90 L and having four poles shall be designated as:

MGGM 1.5 - 5.5 - 90L - 4

10. PAINTING

10.1 The outside of the gear case shall be provided with adequate coats of anti-corrosive paint. The inside of the gear case shall also be coated with oil resistant and anti corrosive paint.

11. TESTING

11.1 The motorized gear unit shall be tested for the rating. A test certificate shall be supplied with every motorized gear unit giving the details of the tests performed and the test results. The motor shall be tested for compliance with IS 325:1996 and a type test report attached. The gear unit shall be tested as follows:

a) *Type tests*:

i) Load test (to deliver specified torque).
ii) Oil temperature.
iii) Noise level | at no load
iv) Vibration |

b) *Routine test* - No load running test (to include measurement of output rpm and observing oil leakage, if any, after minimum two hours).

11.2 Following procedure shall be followed for carrying out various tests specified above.

11.2.1 *Load Test* - Mount the motorized gear unit on its base by using proper foundation bolts in case of foot mounted MGUs and fixing bolts and suitable angles in case of flange mounted MGUs. Use any means of imposing load on MGU such that the load imposed can be measured by means of a spring balance. Conduct the test as follows:

a) *At no load* - Without imposing load start the MGU and allow it to run for one hour, then measure the current drawn by the electric motor. After one hour measure the temperature of oil of the MGU. Note the difference in temperatures of oil measured before and after the test.

b) *AT 50 percent load* - Impose load on MGU such that the spring balance indicates 50 percent of the load. Allow it to run for half an hour in this condition, then measure the current drawn by the motor and the temperature of oil in the gear box.

c) *At 100 percent load* - Now impose the load on MGU such that the spring balance indicates 100 percent load and keep the MGU running for one hour, then note the current drawn by the motor and temperature of oil of the gear box.

d) *At 120 percent load* - Increase the imposed load such that the spring balance indicates 120 percent load and keep the MGU running for five minutes, then note the current drawn by the motor and temperature of oil of the gear box.

Record the readings as under:

Duration of Test	Percent Load	Current A	Voltage V	Oil Temperature, °C	
				Initial	Final
1 hour	No load				
1/2 h	50				
1 hour	100				
5 min	120				

11.2.2 *No load test* - Mount the motorized gear unit on the test bed with the gear box duly filled in with the required amount of lubricating oil and allow the MGU to run. In running condition, check the following:

a) Output rpm,
b) Oil temperature, and
c) Leakage of oil from the shaft seal or casing joints.

11.2.3 *Noise* - Mount the motorized gear unit on test bed. Locate the microphone such that it is perpendicular to the centre of the major vertical surface of the MGU but not less than 30 cm above the test bed. The distance between the gear unit and the microphone shall not be less than 1 m. Note the sound level before starting the MGU. The sound level should not increase as specified in IS 12065:1987 `permissible limit of noise level for rotating electrical machines'. Start the MGU and once it has picked up full speed note the sound level.

11.2.4 *Vibration* - The vibration of the MGU shall be taken by contact measurement in the vertical, horizontal and axial directions. Vibration measurement shall be recorded at the normal operating speed.

A normal unfiltered velocity level of 7.5 mm/sec is permissible with maximum displacement limit of 0.05 mm.

TABLE 1 PREFERRED kW RATINGS AND OUTPUT SPEEDS
(Clauses 3.1, 3.2 and 3.4)

kW Rating	Output Speeds, rpm	
	Double Reduction Single Train	Double Reduction Duplex Train
0.37, 0.55.0.75,1.1, 1.5, 2.2, 3.7, 5.5, 7.5, 11.0, 15.0, 18.5, 22.0	520, 420, 350, 280, 230 190, 155, 125, 100, 84 68, 56, 45, 37, 30, 25, 20	13.5, 11.0, 7.5, 5.0, 3.3, 2.2, 1.5, 1.2, 1.0

TABLE 2 SERVICE FACTORS
(Clause 3.3)

Duration of Service, Hours/Day	Service Factors for Different Types of Load on MGU from Driven Machine		
	Uniform	Moderate Shock	Heavy Shock (Helical & Spur)
2	0.75	0.9	1.4
4	0.80	1.0	1.5
8	0.90	1.1	1.65
12	1.00	1.25	1.75
24	1.25	1.50	2.00

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