XL Right Angle Gearing

The speed reducer shall be suitable for integral gearmotor construction, readily adaptable for C-face mounting, in either integrally cast feet, output flange, multi-mount, or J-mount configurations, and available with single worm or worm/helical reduction ratios.

The reducer housing and covers shall be constructed of corrosion resistant, class 30 gray iron with cast internal ribbing for added strength. All gear and bearing housings shall be either doweled or tenoned, and precision machined to assure accurate alignment for all gear sets.

The input worm and worm shaft shall be one solid piece and straddle mounted in bearings for rigid and accurate support. The worm shafts shall be either rolled and case carburized, or, milled, case carburized and ground for accuracy and durability.

For combination right angle reducers, the worm gear set shall be located in the first stage of gearing to insure greater efficiency, higher torque and more quiet operation. Also, the helical gear of the second stage of the combination reducers shall be crown shaved to provide an ellipsoid tooth form to eliminate tooth end bearing, and assure meshing in the strongest tooth area. These gears shall be case carburized to insure high surface durability and resilient tooth core for greater impact resistance and longer service life.

Reducer bearings shall be the tapered roller and ball type and provide a minimum 25,000 hour average life. Output shaft bearings to be rugged roller bearings for high overhung load capability.

All seals shall be of the spring loaded type made of nitrile compound. The input and output oil seals shall ride on accurately machined and plunge ground sleeves to simplify maintenance and reduce shaft replacement.

Reducer gears and bearings shall be splash lubricated. Reducers are to be supplied with a high quality petroleum based lubricant.

XL Parallel Reducers and Gearmotors

The **MASTER XL** speed reducer shall be suitable for integral gearmotor construction, readily adaptable for C-Face motor mounting, in either integrally cast feet or output flange configurations and available in single, double or triple reduction ratios.

The reducer housing and covers shall be constructed of corrosion resistant, class 30 grey iron with cast internal ribbing for added strength. All gear and bearing housings shall be either dowelled or tenoned and precision machined to assure accurate alignment for all gear sets.

All helical gearing shall be crown shaved to provide an ellipsoid tooth form to eliminate tooth end bearing, and assure meshing in the strongest possible tooth area. These gears shall be case carburized to insure high surface durability and resilient tooth core for greater impact resistance and longer service life.

Reducer bearings shall be the tapered roller and ball type and provide a minimum 25,000 hour average life. Output shaft bearings to be rugged roller bearings for high overhung load capability.

All seals shall be of the spring loaded type made of nitrile compound. The input and output oil seals shall ride on accurately machined and plunge ground sleeves to simplify maintenance and reduce shaft replacement.

Reducer gears and bearings shall be splash lubricated. Reducers are supplied with a high quality petroleum based lubricant.

XL Right Angle and Gearmotors

Many of the XL reducers and gearmotors have part numbers that can be found on the selection pages. Refer to the part number when ordering. Always specify a mounting position if other than standard, and any modifications or accessories, if required.

If a part number is not listed on the selection table please provide the following information when placing your order.

1. Motor H.P., frame enclosure, phase, voltage and frequency.
2. Reducer or gearmotor size.
3. Output RPM and gear ratio.
4. Mounting position.
5. Any modifications or accessories.

SELECTION FACTORS

To apply a Reducer or Gearmotor properly, the following facts must be considered:

1. The kind of load, reversing, amount of shock, duty cycle, etc.
2. Type of transmission: direct connected, sprocket and chain, pinion and gear, V-belt, or flat belt.
3. The point of application of the load if over-hung.
4. Possibility of stalling.
5. Retarding torque of Unibrake or other brake.
6. Size of flywheel if used or WK^2 or inertia effect of the load.
7. Surrounding conditions, normal, dusty, outdoor, hazardous vapor or dust, moisture, or acid or alkali fumes, or abnormal ambient temperatures.
8. Mounting: floor, sidewall, ceiling, vertical or inclined.
9. Electrical characteristics of the motor.
10. Complete duty cycle.
11. Horsepower or torque required.
12. Output shaft rpm.

SELECTION EXAMPLE: A C-face right angle reducer is required to drive a continuous belt conveyor. The prime mover is a 1750 rpm electric motor. The conveyor will see a moderate amount of shock loading. The reducer output shaft must drive the conveyor at approximately 20 rpm. Conveyor load averages 1500 in. lbs. (750 lbs. over 2" radius pulley) and the duty cycle is 24 hours per day.

STEP 1: Reducer Service Factor Table on this page indicates a 1.50 service factor. (Under headings: electric motor, 24 hours per day service and medium load classification). Equivalent load = 1500 in. lbs. x 1.50 = 2250 in. lbs. Ratio is calculated by dividing input speed (1750 rpm) by required output speed (in this case, 20 rpm). 1750 ÷ 20 = 87.5 ratio.

STEP 2: To determine minimum HP required refer to the Right Angle Gearmotor tables on pages D2-28 to D2-36. In our example, find the output torque rating for 86:1 ratio that exceeds our requirement of 1,500 in. lbs. Refer to page D2-30. Note the torque value of 1,766 in. lbs. exceeds our requirement. Also make note of the reducer size... CG16A.

STEP 3: Verify selected reducer is rated for 1.5 Service Factor. As we determined earlier, this will require a torque capability of 2,250 in. lbs. Refer to the rating table for size CM16 reducers on page D2-20. The torque rating for a 86:1 ratio at 1750 RPM is 2,522 in. lbs. which exceeds our requirement.

STEP 4: Select motor frame size and refer to appropriate part number.

STEP 5: If the output shaft is connected by other than a flexible coupling, calculate the OVERHUNG LOAD.

OVERHUNG LOAD

To determine overhung load, divide the torque required by the pitch radius of the sprocket, sheave, etc. and multiply by the appropriate factor as follows:

Chain Drive	1.00	V-Belt	1.50
Synchronous Belt Drive	1.10	Flat Belt	2.50
Spur or Helical Gear	1.25		

The calculated overhung load must not exceed the Output Shaft rating.

For loads acting at more than one shaft diameter from bearing housing, use following conversion factors:

Distance in Shaft Diameters From Brg. Hsg.	Multiply OHL Capacity By This Factor
1D	1.0
2 D	.65
3 D	.45
4 D	.35
5 D	.30

REDUCER SERVICE FACTORS

Prime Mover	Duration of Service Per Day	Driven Machine Load Classification		
		Uniform	Medium Shock	Heavy Shock
Electric Motor	Occasional 1/2 hr.	0.80	0.90	1.00
	Intermittent 2 hrs.	0.90	1.00	1.25
	10 hours	1.00	1.25	1.50
	24 hours	1.25	1.50	1.75
Electric Motor With Frequent Starts and Stops	Occasional 1/2 hr.	0.90	1.00	1.25
	Intermittent 2 hrs.	1.00	1.25	1.50
	10 hours	1.25	1.50	1.75
	24 hours	1.50	1.75	2.00
Multi-cylinder Internal Combustion Engine	Occasional 1/2 hr.	0.90	1.00	1.25
	Intermittent 2 hrs.	1.00	1.25	1.50
	10 hours	1.25	1.50	1.75
	24 hours	1.50	1.75	2.00
Single Cylinder Internal Combustion Engine	Occasional 1/2 hr.	1.00	1.25	1.50
	Intermittent 2 hrs.	1.25	1.50	1.75
	10 hours	1.50	1.75	2.00
	24 hours	1.75	2.00	2.25

XL Reducers and Gearmotors

SERVICE FACTOR CLASSIFICATIONS

Application	Hrs. Per Day 8-10	Hrs. Per Day 24
AGITATORS		
Pure Liquids	I	
Liquids and Solids	II	II
Liquids-Variable Density	II	II
BLOWERS		
Centrifugal	I	II
Lobe	II	II
Vane	I	II
BREWING & DISTILLING		
Bottling Machinery	I	II
Brew Kettles-Continuous Duty	-	II
Cookers-Continuous Duty	-	II
Mash Tubs-Continuous Duty	-	II
Scale Hopper Frequent Starts	II	II
CAN FILLING MACHINES	I	II
CANE KNIVES	II	II
CAR DUMPERS	III	-
CAR PULLERS	II	-
CLARIFIERS	I	II
CLASSIFIERS	II	II
CLAY WORKING MACHINERY		
Brick Press	III	III
Briquette Machine	III	III
Clay Working Machinery	II	II
Pug Mill	II	II
COMPRESSORS		
Centrifugal	I	II
Lobe	II	II
* Reciprocating		
Multi-Cylinder	II	II
Single Cylinder	III	III
CONVEYORS-UNIFORMLY LOAD OR FED		
Apron	I	II
Assembly	I	II
Belt	I	II
Bucket	I	II
Chain	I	II
Flight	I	II
Oven	I	II
Screw	I	II
CONVEYOR-HEAVY DUTY NOT UNIFORMLY FED		
Apron	II	II
Assembly	II	II
Belt	II	II
Bucket	II	II
Chain	II	II
Flight	II	II
‡ Live Roll	‡	‡
Oven	II	II
Reciprocating	III	III

Application	Hrs. Per Day 8-10	Hrs. Per Day 24
CONVEYOR-HEAVY DUTY NOT UNIFORMLY FED (Cont'd)		
Screw	II	II
Shaker	III	III
CRANES & HOISTS		
Main Hoists		
Heavy Duty	III	III
Medium Duty	II	II
Reversing	II	II
Skip Hoists	II	II
Travel Motion	II	II
Trolley Motion	II	II
CRUSHERS		
Ore	III	III
Stone	III	III
DREDGES		
Cable Reels	II	-
Conveyors	II	II
Cutter Head Drives	III	III
Jig Drives	III	III
Maneuvering Winches	II	-
Pumps	II	II
Screen Drive	III	III
Stackers	II	II
Utility Winches	II	-
ELEVATORS		
Bucket-Uniform Load	I	II
Bucket-Heavy Load	II	II
Bucket-Continuous	I	II
Centrifugal-Discharge	I	II
Escalators	I	I
Freight	II	II
Gravity Discharge	I	II
Man Lifts	-	-
‡ Passenger	‡	‡
Service Hand Lift	III	-
FANS		
Centrifugal	I	II
Cooling Towers		
Induced Draft	II	II
‡ Forced Draft	‡	‡
Induced Draft	II	II
*Large (Mine. etc.)	II	II
Large Industrial	I	II
Light (Small Diameter)	I	II
FEEDERS		
Apron	II	II
Belt	II	II
Disc	I	II
Reciprocating	III	III
Screw	II	II
FOOD INDUSTRY		
Beet Slicer	II	II
Cereal Cooker	I	II
Dough Mixer	II	II
Meat Grinders	II	II

Application	Hrs. Per Day 8-10	Hrs. Per Day 24
GENERATORS-		
(Not Welding)	I	II
HAMMER MILLS	III	III
LAUNDRY WASHERS		
Reversing	II	II
LAUNDRY TUMBLERS	II	II
LINE SHAFTS		
Driving Processing Equipment	II	II
Other Line Shafts	I	II
LUMBER INDUSTRY		
Barkers-Hydraulic		
Mechanical	II	II
Burner Conveyor	II	II
Chain Saw and Drag Saw	III	III
Chain Transfer	III	III
Craneway Transfer	III	III
De.Barking Drum	III	III
Edger Feed	II	II
Gang Feed	II	II
Green Chain	II	II
Line Rolls	III	III
Log Deck	III	III
Log.Haul-Incline	III	III
Log-Haul-Well Type	III	III
Log Turning Device	III	III
Main Log Conveyor	III	III
Off Bearing Rolls	II	II
Planer Feed Chains	II	II
Planer Floor Chains	II	II
Planer Tilting Hoist	II	II
Re-Saw Merry-Go-Round Conveyor	II	II
Roll Cases	III	III
Slab Conveyor	III	III
Small Waste Conveyor belt	I	II
Small Waste Conveyor chain	II	II
Sorting Table	II	II
Tipple Hoist Conveyor	II	II
Tipple Hoist Drive	II	II
Transfer Conveyor	II	II
Transfer Rolls	II	II
Tray Drive	II	II
Trimmer Feed	II	II
Waste Conveyor	II	II
MACHINE TOOLS		
Bending Roll	-	II
Notching Press-Belt Driven	I	II
Plate Planer	III	III
Punch Press-Gear Driven	III	III
Tapping Machines	-	III
Other Machine Tools	-	III
Main Drives	II	II
Auxiliary Drives	I	II

(1) This list is not all-inclusive and each individual gearmotor application should be checked to determine if any unusual operation conditions will be encountered

* Classes listed are minimum and normal conditions are assumed in view of varying load conditions. It is suggested that these applications be carefully reviewed before final selection is made.

‡ Check safety codes and consult Application Engineering.

XL Reducers and Gearmotors

SERVICE FACTOR CLASSIFICATIONS

Application	Hrs. Per Day 8-10	Hrs. Per Day 24
METAL MILLS		
Draw-Bench-Carriage	III	III
Draw-Bench-Main Drive	II	III
Forming Machines	III	III
‡ Pinch Dryer & Scrubber		
Rolls Reversing	‡	‡
*Slitters	II	II
Table Conveyors	-	-
Non-Reversing	II	II
*Reversing	-	-
Wire Drawing &		
Flattening Machine	II	II
Wire Winding Machine	-	II
MILLS ROTARY TYPE		
*Ball	II	II
*Cement Kilns	-	II
Dryers & Coolers	II	II
Kilns	II	II
*Pebble	II	II
Rod	III	III
Tumbling Barrels	III	III
MIXERS		
Concrete-Continuous	II	II
Concrete-Intermittent	I	II
Constant Density	I	II
Variable Density	II	II
OIL INDUSTRY		
Chillers	II	II
‡ Oil Well Pumping	‡	‡
Paraffin Filter Press	II	II
Rotary Kilns	II	II
PAPER MILLS		
Agitators (Mixes)	II	II
Barker Auxiliaries Hydraulic	-	III
Barker Mechanical	-	III
Barking Drum	II	II
*Beater & Pulpers	-	II
Bleacher	I	II
*Calenders	-	II
Calenders-Super	-	III
Converting Machines Excec.		
Cutters, Platers	-	II
Conveyors	-	II
*Coach	-	II

Application	Hrs. Per Day 8-10	Hrs. Per Day 24
PAPER MILLS Cont'd.		
Cutters Ptaters	-	III
Cylinders	-	II
*Dryers	-	II
Felt Stretcher	-	II
Fell Whipper	-	III
Jordans	-	III
Log Haul	-	III
*Presses	-	II
Pulp Machines	-	II
Reel	-	II
*Stock Chests	-	II
*Suction Roll	-	II
Washers and Thickeners	-	II
Winders	-	II
PRINTING PRESSES	I	II
PULLERS		
Barge Haul	II	III
PUMPS		
Centrifugal	I	II
*Proportioning	II	II
Reciprocating		
Single Acting		
3 or more Cylinders	II	II
Double Acting		
2 or more Cylinders	II	II
Single Acting		
or 2 Cylinders	‡	‡
*Double Acting		
Single-Cylinder	‡	‡
Rotary-Gear Type	I	II
Lobe Vane	I	II
RUBBER INDUSTRY		
Mixer	III	III
*Rubber Calender	II	II
*Rubber Mill (2 or more)	II	II
*Sheeter	II	II
Tire Building Machines	II	II
Tire & Tube Press Openers	I	I
Tubers and Strainers	II	II
SEWAGE DISPOSAL EQUIPMENT		
Bar Screens		II
Chemical Feeders	I	II

Application	Hrs. Per Day 8-10	Hrs. Per Day 24
SEWAGE DISPOSAL EQUIPMENT Cont'd.		
Collectors Circuline or Straighfline	I	II
Dewatering Screens	II	II
Grit Collectors	I	II
Scum Breakers	II	II
Slow or Rapid Mixers	II	II
Sludge Collectors	I	II
Thickeners	II	II
Vacuum Filters	II	II
SCREENS		
Air Washing	I	II
Rotary-Stone or Gravel	II	II
Traveling Water Intake	I	II
SLAB PUSHERS	II	II
STEERING GEAR	II	II
STOKERS	I	II
TEXTILE INDUSTRY		
Batchers	II	II
Calenders	II	II
*Card Machines	II	II
Cloth Finishing Machines (washers pads enters dryers calenders. etc.)	II	II
Dry Cans	II	II
Dyeing Machinery	II	II
‡ Knitting Machines (Looms. etc.)	‡	‡
Looms	II	II
Mangles	II	II
Nappers	II	II
Range Drives	‡	‡
Soapers	II	II
Spinners	II	II
Tenter Frames	II	II
Winders (other than Batchers)	II	II
Yard Preparatory Machines (Cards Spinners Slashers. etc.)	II	II
WINDLASS	II	II

(1) This list is not all-inclusive and each individual gearmotor application should be checked to determine if any unusual operation conditions will be encountered

* Classes listed are minimum and normal conditions are assumed in view of varying load conditions. It is suggested that these applications be carefully reviewed before final selection is made.

‡ Check safety codes and consult Application Engineering.

XL Parallel Reducers and Gearmotors

Selection tables appear on pages D2-66 - D2-84. These tables list maximum input HP, output speeds, ratios, OHL capabilities and output HP.

Many of the XL reducers and gearmotors have part numbers that can be found on the selection pages. Refer to the part number when ordering. Always specify a mounting position if other than standard, and any modifications or accessories, if required.

If a part number is not listed on the selection table, please provide the following information when placing your order:

- Motor HP, frame enclosure, phase/frequency/voltage
- Reducer or gearmotor size
- AGMA class and application
- Output RPM and/or gear ratio
- Mounting position
- Any required modifications or accessories

Selection Factors:

Correct application of a gearmotor requires consideration of the following factors:

1. Type of load, reversing, amount of shock, duty cycle, etc. Reference Table 2.
2. The point of application of the load, if overhung.
3. Possibility of stalling.
4. Retarding torque of brake
5. Size of flywheel if used or WK2 or inertia effect of the load.
6. Surrounding conditions, normal, dusty, outdoor, hazardous vapor or dust, moisture, or acid or alkali fumes, or abnormal ambient temperatures
7. Mounting: floor, ceiling, vertical or inclined ñ Reference mounting position charts
8. Electrical characteristics of the motor
9. Complete duty cycle
10. Horsepower or torque required
11. Output shaft RPM
12. Type of transmission: direct connected, sprocket and chain, pinion and gear, V-belt or flat belt.

Table 1: AGMA Gear Classification

Prime Mover	Duration of Service per Day	Driven Machine Loads		
		Uniform	Medium Stock	Heavy Stock
		Class ♦		
Electric Motor	Occosional 1/2 Hour	I	I	I
	Intermittent 2 Hours	I	I	II
	10 Hours	I	II	III
	24 Hours	II	III	III
Electric Motor with Frequent Starts/Stops	Occosional 1/2 Hour	I	I	II
	Intermittent 2 Hours	I	II	III
	10 Hours	II	III	III
	24 Hours	III	III	III

♦ See Table 2 for explanation

Table 2: AGMA Load Classification

Class	Definition	Equiv Service Factor
I	Steady loads not exceeding normal rating of the motor and 8 hours a day service. Moderate shock loads where service is intermittent	1.0
II	Steady loads not exceeding the normal rating of the motor for 24 hours a day. Moderate repetitive shock loads for 8 hours a day.	1.4
III	Moderate repetitive shock loads for 24 hours a day. Heavy repetitive shock loads for 8 hours a day	2.0

XL Reducers and Gearmotors

In addition to HP and output speed, MASTER XL Reducers and Gearmotors are identified by a series of numbers and letters as follows:

140 W M 21 A 30

MOTOR FRAME

Motor Frames 56 through 215T are preselected in selection tables.

TYPE OF GEAR TRAIN

W - Single reduction worm Right Angle gearing
C - Double reduction worm/helical Right Angle gearing

TYPE OF GEAR UNIT

G - Gearmotor
M - C-face Reducer

GEAR UNIT SIZE

12 = 1.5” Center Distance
16 = 2” Center Distance 1st stage
21 = 2.62” Center Distance 1st stage
28 = 3.5” Center Distance 1st stage
40 = 5.0” Center Distance

GEAR UNIT MOUNTING

A - Integrally cast foot
B - Multimount
F - Footless Flanged Gearcase
J - J Mount

RATIO

XL Parallel Reducers and Gearmotors

56 S M 16 F 2 5.06 C1

MOTOR FRAME

56 140 180 210

TYPE OF GEAR TRAIN

S - Single Reduction
D - Double Reduction
T - Triple Reduction

TYPE OF GEAR UNIT

G - Gearmotor
M - C-Face Reducer

GEAR UNIT SIZE

16 = 2” Center Distance
21 = 2-5/8” Center Distance
28 = 3-1/2” Center Distance

TYPE OF MOUNTING

A - Foot Mounted
F - Flange Mounted

AGMA CLASS

(Only used for Integral Gearmotors)
2 - AGMA Class II
3 - AGMA Class III

RATIO

Single Reduction - 2.25:1 to 6.20:1
Double Reduction - 5.06:1 to 31.4:1
Triple Reduction - 20.9:1 to 129.7:1

MOUNTING POSITION

SINGLE REDUCTION:

C1 C2 C3
C4 C5 C6

DOUBLE/TRIPLE REDUCTION:

A1 A2 A3
A4 A5 A6