

DYNABOX XL

Right angle
Servo gearheads
For heavy duty applications



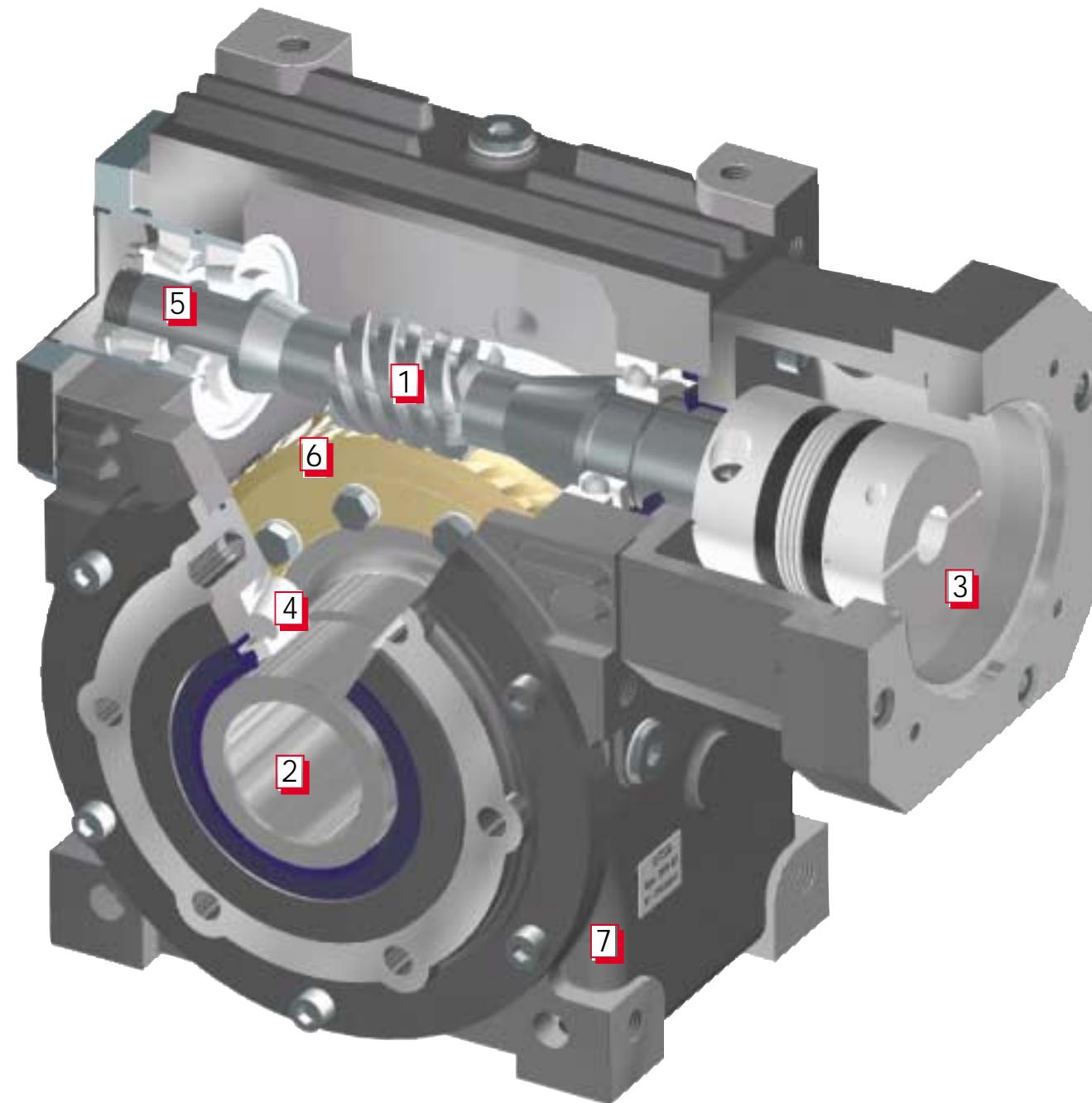
Backlash down to 0,5 arc minute

Torque up to
8000 Nm



GIRARD TRANSMISSIONS introduces :

DYNABOX XL



with 2 precision levels :

EXPERT : backlash < 0,5 arcminute
(adjustable)

MEDIUM : backlash < 5 arcminutes
(fixed)

- 1 Computer optimized gear contact pattern : less stress, longer life.
- 2 Keyless connection : reliable and backlash free connection with shrink disc.
- 3 Universal servo-kit : including high torsional stiffness coupling + flange.
- 4 Oversized taper roller bearings : provide very high permissible loads.
- 5 Constant input bearings preload design : 2 taper roller bearings + 1 floating ball bearings allowing temperature variations with same preload : higher input permissible speeds, longer life.
- 6 Centrifugally cast wheel ring : superior shock and wear resistance.
- 7 Cast iron housing

2 MOUNTING OPTIONS



Hollow shaft



Single output shaft

DYNABOX XL benefits

Low backlash

Space saving configuration : the right-angle design, more compact, is favourable in most cases.

Wormgear : very silent, more important permissible overloads, higher torsional stiffness.

Maintenance free : life-lubricated unit with high performances synthetic lubricant.

DYNABOX XL SELECTION

START/STOP SERVICE S5

Calculate torque S5 on gearbox output :

$$\text{Torque S5} = T_{\max} \times F1 \times F2$$

| GEARBOX RUNNING TIME DURING 1 CYCLE | | | | |
|-------------------------------------|------|------|------|------|
| | 10 % | 30 % | 50 % | 60 % |
| F1 | 0,7 | 0,85 | 1 | 1,15 |

over 60 %, go to CONTINUOUS SERVICE selection

| NUMBER OF CYCLES/HOUR | | | | | |
|-----------------------|------|------|------|------|-------|
| | 1000 | 2000 | 3000 | 5000 | 10000 |
| F2 | 1 | 1,35 | 1,45 | 1,6 | 1,9 |

Pre-select the gearbox size :
in the column Torque S5, at N_{max} input speed

CONTINUOUS SERVICE S1

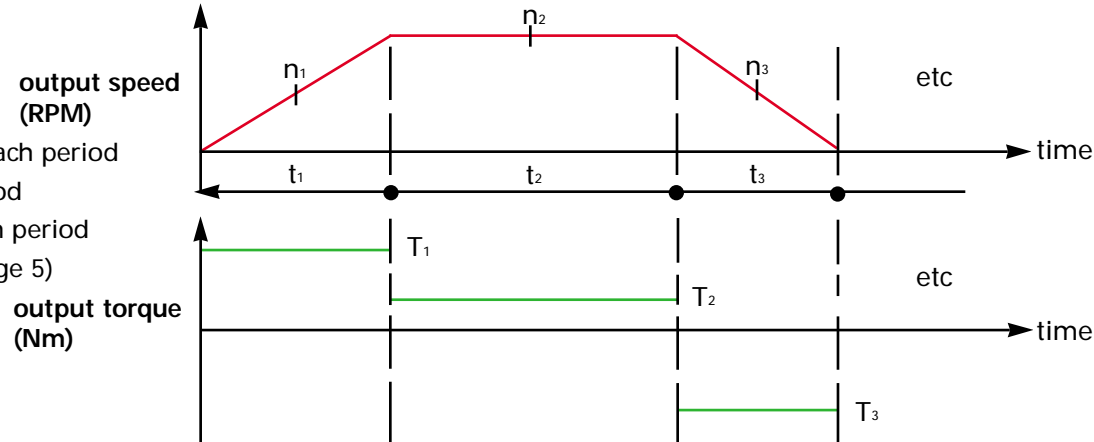
Calculate torque S1 on gearbox output :

$$\text{Torque S1} = T_{\max}$$

Pre-select the gearbox size :
in the column Torque S1, at N_{max} input speed

Calculate the power P_{th} lost during cycle :

n_{1,2,3} : average output speed of each period
T_{1,2,3} : output torque of each period
η_{1,2,3} : average efficiency of each period
(to be calculated from page 5)
t_{1,2,3} : duration of each period



$$P_{th} = 0,105 \times \sqrt[3]{\frac{t_1 \left(\frac{100 - \eta_1}{\eta_1} \times n_1 T_1 \right)^3 + t_2 \left(\frac{100 - \eta_2}{\eta_2} \times n_2 T_2 \right)^3 + t_3 \left(\frac{100 - \eta_3}{\eta_3} \times n_3 T_3 \right)^3 + \dots}{t_1 + t_2 + t_3 + \dots}}$$

P_{th} must be lower than the thermal capacity of the pre-selected gearbox size, otherwise select a larger gearbox.

| Thermal capacities : | DYNABOX XL 125 | 1652W |
|----------------------|----------------|-------|
| | DYNABOX XL 160 | 2479W |
| | DYNABOX XL 200 | 4210W |

LEGEND

T_{max} (Nm) : maximum output torque during operating cycle / continuous operation.
N_{max} (RPM) : maximum input speed achieved during operating cycle.
E-stop (Nm) : gearbox output emergency torque (2 seconds maximum duration, maximum of 25000 times).
i : exact gear ratio.
ig (kgxcm²) : polar moment of inertia on input, without coupling (see coupling inertia page 10).
η (%) : gearbox efficiency.
Fr (N) : maximum radial load applicable at the middle of the output shaft, without any axial load.
Fa (N) : maximum axial load applicable on output shaft, without any radial load.

TECHNICAL SPECIFICATIONS

| N _{max} | i | 6000 | | | 4000 | | | 3000 | | | 2000 | | | 1000 | | | E-stop | ig | Rever. class | Fr | Fa |
|------------------|---------|-----------|----|-----------|-----------|----|-----------|-----------|----|-----------|-----------|----|-----------|-----------|----|------|--------|----|--------------|-------|----|
| | | Torque S5 | η | Torque S1 | Torque S5 | η | Torque S1 | Torque S5 | η | Torque S1 | Torque S5 | η | Torque S1 | Torque S5 | η | | | | | | |
| DYNABOX XL 125 | 5,125:1 | 792 | 97 | 609 | 1005 | 96 | 716 | 1181 | 96 | 884 | 1459 | 95 | 1217 | 2008 | 94 | 3767 | 50 | 1 | 13600 | 12000 | |
| | 7,2:1 | 840 | 97 | 632 | 1043 | 96 | 742 | 1224 | 95 | 907 | 1497 | 95 | 1208 | 1993 | 93 | 3767 | 38 | 1 | 15000 | 15000 | |
| | 10,25:1 | 832 | 96 | 622 | 1026 | 95 | 725 | 1196 | 95 | 887 | 1464 | 94 | 1147 | 1893 | 92 | 3767 | 30,5 | 1 | 16700 | 18000 | |
| | 15,25:1 | 726 | 94 | 542 | 894 | 93 | 625 | 1031 | 92 | 759 | 1252 | 91 | 972 | 1604 | 89 | 3342 | 25 | 1 | 18900 | 22000 | |
| | 20,5:1 | 1026 | 93 | 759 | 1252 | 92 | 877 | 1447 | 91 | 1043 | 1721 | 89 | 1320 | 2178 | 87 | 3767 | 23,4 | 1 | 20600 | 22000 | |
| | 29,5:1 | 869 | 90 | 634 | 1046 | 88 | 731 | 1206 | 87 | 861 | 1421 | 85 | 1079 | 1780 | 81 | 3295 | 23,15 | 2 | 22900 | 22000 | |
| | 45:1 | 1142 | 86 | 833 | 1374 | 84 | 952 | 1571 | 82 | 1104 | 1822 | 80 | 1369 | 2259 | 75 | 3767 | 21 | 3 | 26000 | 22000 | |
| | 60:1 | 980 | 82 | 713 | 1176 | 79 | 815 | 1345 | 77 | 929 | 1533 | 74 | 1150 | 1898 | 69 | 2937 | 20 | 3 | 28000 | 22000 | |
| | 90:1 | 825 | 74 | 598 | 987 | 71 | 680 | 1122 | 68 | 779 | 1285 | 64 | 960 | 1584 | 58 | 2502 | 19 | 3 | 32000 | 22000 | |

| | | | | | | | | | | | | | | | | | | | | |
|----------------|---------|------|----|------|------|----|------|------|----|------|------|----|------|------|----|------|------|---|-------|-------|
| DYNABOX XL 160 | 5,125:1 | 1450 | 97 | 1128 | 1861 | 97 | 1324 | 2185 | 96 | 1648 | 2719 | 96 | 2334 | 3851 | 94 | 7251 | 120 | 1 | 17800 | 15000 |
| | 7,2:1 | 1411 | 97 | 1092 | 1802 | 96 | 1266 | 2089 | 96 | 1569 | 2589 | 95 | 2151 | 3549 | 94 | 7251 | 77 | 1 | 19700 | 19000 |
| | 10,25:1 | 1513 | 96 | 1161 | 1916 | 96 | 1346 | 2221 | 95 | 1650 | 2723 | 94 | 2215 | 3655 | 93 | 7251 | 63 | 1 | 21900 | 24000 |
| | 15,25:1 | 1333 | 95 | 1030 | 1700 | 94 | 1177 | 1942 | 93 | 1443 | 2381 | 92 | 1896 | 3128 | 90 | 5572 | 52,7 | 1 | 24700 | 29000 |
| | 20,5:1 | 1775 | 94 | 1338 | 2208 | 93 | 1530 | 2525 | 92 | 1856 | 3062 | 90 | 2392 | 3947 | 88 | 7251 | 51,5 | 1 | 27000 | 34000 |
| | 29,5:1 | 1492 | 91 | 1111 | 1833 | 89 | 1264 | 2086 | 88 | 1535 | 2533 | 86 | 1945 | 3209 | 83 | 6571 | 52,8 | 2 | 30000 | 34000 |
| | 45:1 | 2219 | 87 | 1630 | 2690 | 85 | 1858 | 3066 | 84 | 2211 | 3648 | 81 | 2765 | 4562 | 77 | 7251 | 46,5 | 3 | 34100 | 34000 |
| | 60:1 | 1740 | 83 | 1272 | 2099 | 81 | 1439 | 2374 | 79 | 1723 | 2843 | 76 | 2127 | 3510 | 71 | 6331 | 40 | 3 | 37200 | 34000 |
| | 90:1 | 1552 | 76 | 1123 | 1853 | 73 | 1261 | 2081 | 70 | 1489 | 2457 | 67 | 1842 | 3039 | 60 | 4933 | 38 | 3 | 42000 | 34000 |

| | | | | | | | | | | | | | | | | | | | | |
|----------------|---------|------|----|------|------|----|------|------|----|------|------|----|------|------|----|-------|------|---|-------|-------|
| DYNABOX XL 200 | 5,125:1 | 2592 | 98 | 2008 | 3313 | 97 | 2392 | 3947 | 97 | 2954 | 4874 | 96 | 4208 | 6943 | 95 | 12826 | 287 | 1 | 37000 | 37500 |
| | 7,2:1 | 2721 | 97 | 2108 | 3478 | 97 | 2462 | 4062 | 96 | 3042 | 5019 | 96 | 4236 | 6989 | 94 | 12826 | 177 | 1 | 41000 | 44500 |
| | 10,25:1 | 2691 | 97 | 2071 | 3417 | 96 | 2408 | 3973 | 96 | 2946 | 4861 | 95 | 4007 | 6612 | 93 | 12826 | 143 | 1 | 46000 | 52600 |
| | 15,25:1 | 2346 | 95 | 1813 | 2991 | 94 | 2083 | 3437 | 94 | 2540 | 4191 | 93 | 3376 | 5570 | 91 | 12448 | 102 | 1 | 51800 | 63000 |
| | 20,5:1 | 3356 | 94 | 2551 | 4209 | 93 | 2909 | 4800 | 92 | 3538 | 5838 | 91 | 4590 | 7574 | 89 | 12826 | 96 | 1 | 56600 | 71000 |
| | 29,5:1 | 2841 | 92 | 2117 | 3493 | 90 | 2410 | 3977 | 89 | 2925 | 4826 | 87 | 3738 | 6168 | 84 | 12277 | 99 | 2 | 63000 | 71000 |
| | 45:1 | 3747 | 88 | 2775 | 4579 | 86 | 3154 | 5204 | 85 | 3788 | 6250 | 83 | 4747 | 7833 | 78 | 12826 | 82,5 | 3 | 71700 | 71000 |
| | 60:1 | 3170 | 85 | 2325 | 3836 | 82 | 2636 | 4349 | 80 | 3159 | 5212 | 77 | 3928 | 6481 | 72 | 11674 | 71 | 3 | 78000 | 71000 |
| | 90:1 | 2714 | 78 | 1985 | 3275 | 75 | 2228 | 3676 | 72 | 2641 | 4358 | 69 | 3316 | 5471 | 62 | 9323 | 69 | 3 | 88000 | 71000 |

REVERSIBILITY CLASSES

Reversibility means the gearbox capability to be back-driven. When selecting an irreversible gearbox, make sure that

during deceleration, load inertia does not create overloads exceeding the maximum permissible torque.

| | |
|---|------------------------|
| 1 | Totally reversible |
| 2 | Uncertainly reversible |
| 3 | Irreversible |

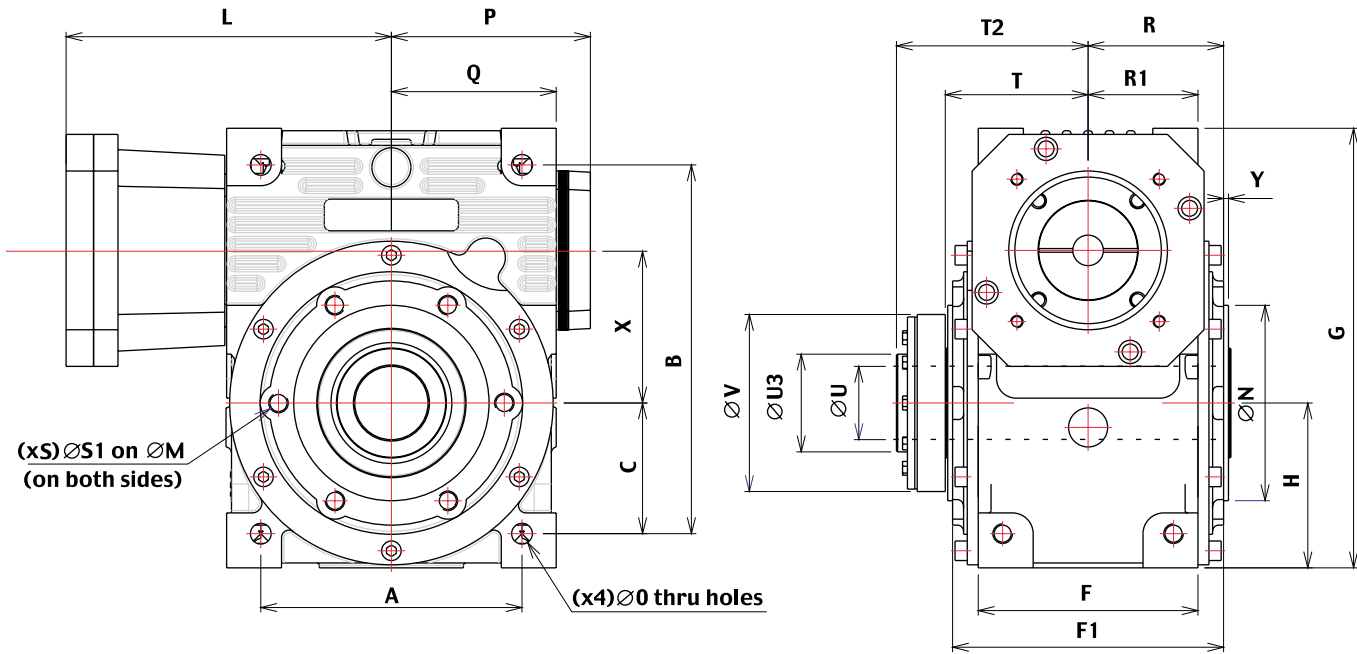
NOTES CONCERNING EFFICIENCY

Efficiency values may be achieved after a minimum of 24 hours at full load operation (running-in-period). Efficiency values are achieved only when gearbox operates at

nominal torque. For gearbox operating under nominal torque, efficiency is lower.

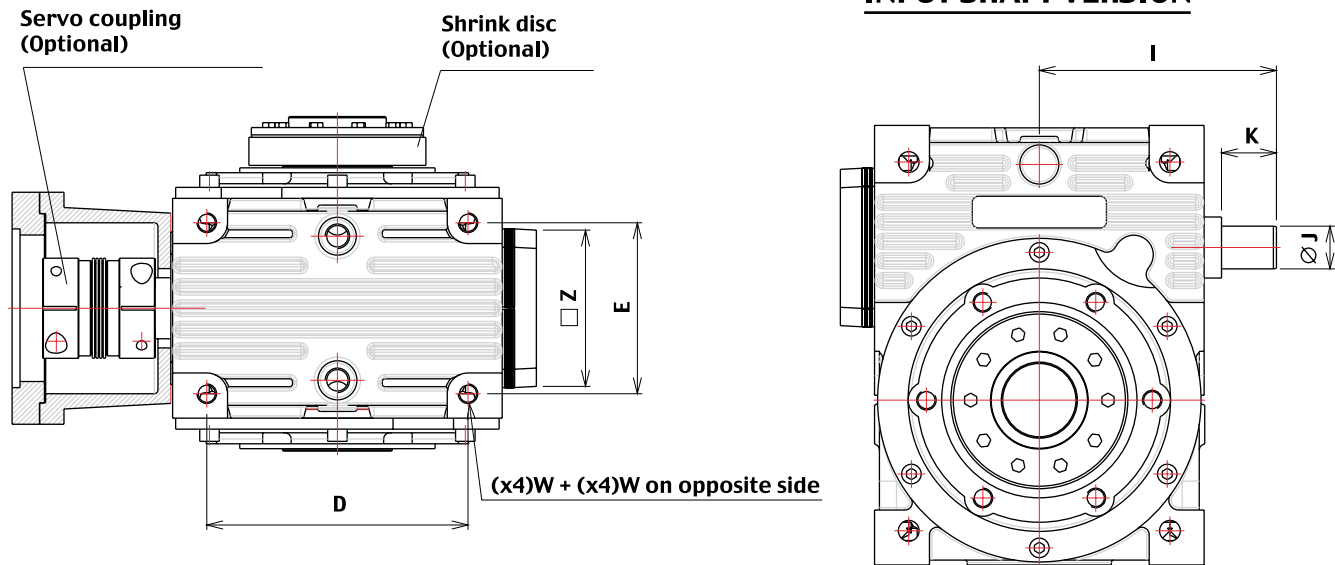
DYNABOX XL HOLLOW SHAFT

SMOOTH SHAFT FOR SHRINK DISC



| DYNABOX XL | 125 | 160 | 200 |
|------------|------------------|-----|-------|
| A | 214 | 284 | 342,5 |
| B | 302 | 377 | 483 |
| C | 107 | 142 | 171 |
| D | 214 | 284 | 342,5 |
| E | 140 | 150 | 224 |
| F | 180 | 198 | 288 |
| F1 | 222 | 246 | 374 |
| G | 360 | 450 | 576 |
| H | 135 | 175 | 216 |
| I | 195 | 240 | 289 |
| J | 35 | 42 | 48 |
| K | 45 | 50 | 55 |
| L | DEPENDS ON MOTOR | | |
| M | 185 | 230 | 300 |
| N | 160 | 190 | 250 |
| O | 17 | 22 | 28 |
| P | 163 | 204 | 251 |
| Q | 135 | 175 | 216 |
| R | 111 | 123 | 187 |
| R1 | 90 | 99 | 144 |
| S | 6 | 6 | 8 |
| S1 | M16 | M20 | M20 |
| T | 117 | 129 | 194 |
| T2 | 157 | 177 | 264 |
| U | 65 | 75 | 100 |
| U3 | 80 | 90 | 140 |
| V | 145 | 155 | 230 |
| W | M16 | M20 | M20 |
| X | 125 | 160 | 200 |
| Y | 4 | 5 | 5 |
| Z | 130 | 140 | 180 |

INPUT SHAFT VERSION



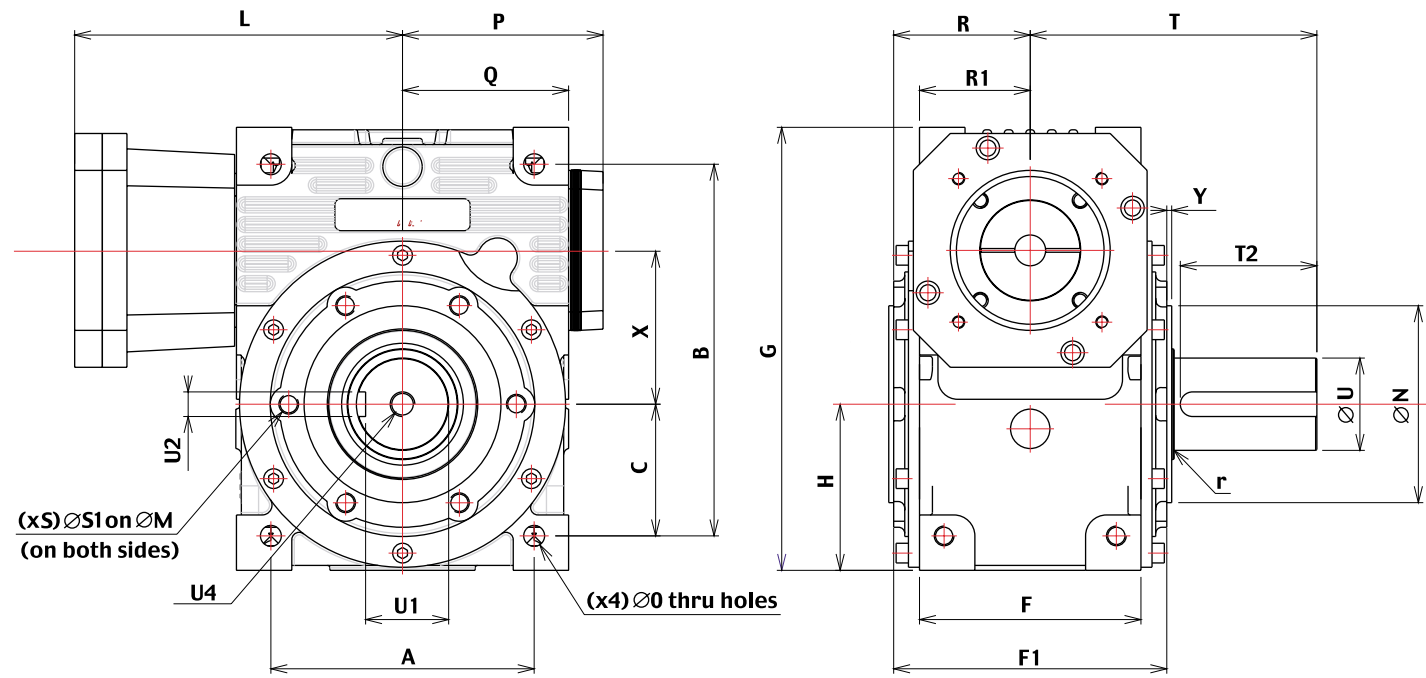
MOUNTING POSITIONS

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| H | | | | |
| V | | | | |
| F | | | | |

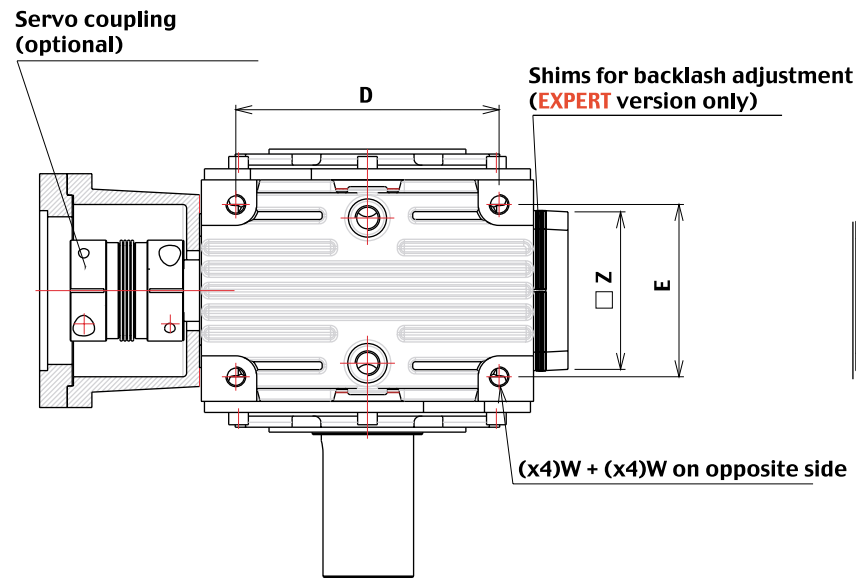
Note : Positions F are shown with shrink disc on back side.

DYNABOX XL OUTPUT SHAFT

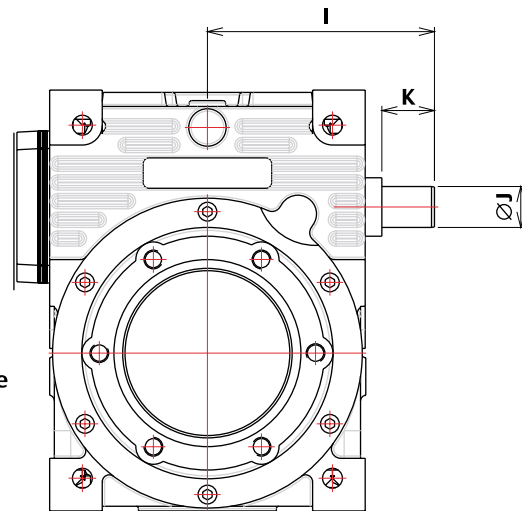
SINGLE OUTPUT SHAFT



| DYNABOX XL | 125 | 160 | 200 |
|------------|------------------|-----|-------|
| A | 214 | 284 | 342,5 |
| B | 302 | 377 | 483 |
| C | 107 | 142 | 171 |
| D | 214 | 284 | 342,5 |
| E | 140 | 150 | 224 |
| F | 180 | 198 | 288 |
| F1 | 222 | 246 | 374 |
| G | 360 | 450 | 576 |
| H | 135 | 175 | 216 |
| I | 195 | 240 | 289 |
| J | 35 | 42 | 48 |
| K | 45 | 50 | 55 |
| L | DEPENDS ON MOTOR | | |
| M | 185 | 230 | 300 |
| N | 160 | 190 | 250 |
| O | 17 | 22 | 28 |
| P | 163 | 204 | 251 |
| Q | 135 | 175 | 216 |
| r | 3 | 3 | 5 |
| R | 111 | 123 | 187 |
| R1 | 90 | 99 | 144 |
| S | 6 | 6 | 8 |
| S1 | M16 | M20 | M20 |
| T | 233 | 269 | 359 |
| T2 | 111 | 135 | 164 |
| U | 75 | 90 | 120 |
| U1 | 67,5 | 81 | 109 |
| U2 | 20 | 25 | 32 |
| U4 | M20 | M24 | M24 |
| W | M16 | M20 | M20 |
| X | 125 | 160 | 200 |
| Y | 4 | 5 | 5 |
| Z | 130 | 140 | 180 |



INPUT SHAFT VERSION

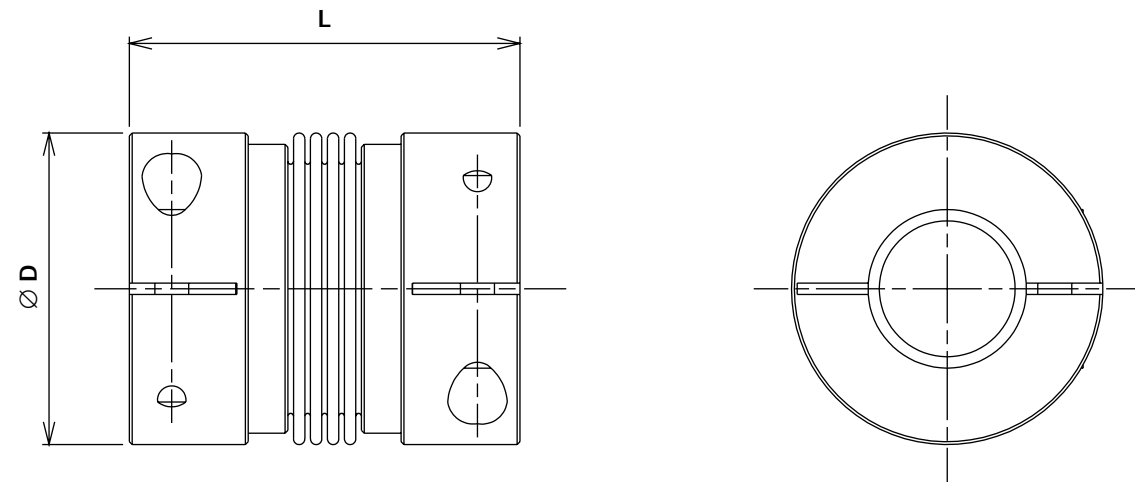


MOUNTING POSITIONS

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| H | | | | |
| V | | | | |
| F | | | | |

CONNECTING KIT *DYNABOX XL* -SERVOMOTOR

TORSION STIFF COUPLINGS



| Coupling reference | | AM N° 60 | AM N° 80 | AM N° 150 | AM N° 300 | AM N° 500 |
|---|-----------------------------------|----------|----------|-----------|-----------|-----------|
| Ø servo shaft and <i>DYNABOX XL</i> shaft | mm | <Ø35 | <Ø42 | <Ø42 | <Ø60 | <Ø62 |
| Servo nominal torque | Nm | 60 | 80 | 150 | 300 | 500 |
| Servo peak torque | Nm | 90 | 120 | 225 | 450 | 750 |
| Ø D | mm | 66 | 82 | 82 | 110 | 123 |
| L | mm | 79 | 92 | 92 | 109 | 114 |
| Polar moment of inertia | 10 ⁻³ kgm ² | 0,18 | 0,54 | 0,65 | 2,68 | 9 |
| Torsional stiffness | Nm/mn | 21 | 23 | 41 | 46 | 85 |

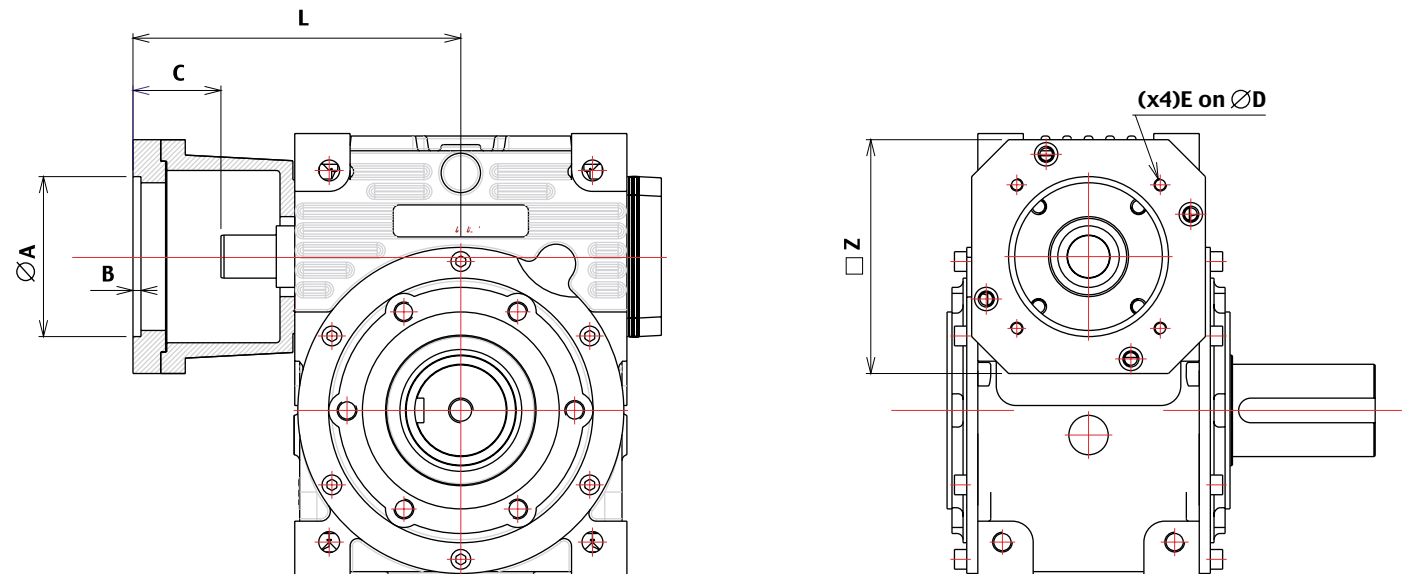
Specify the coupling reference and the servo shaft Ø when ordering.

Exemple : AM n° 150 Ø 42.

To calculate the input total inertia, add the coupling inertia to the gearbox inertia (page 5).

CONNECTING FLANGE

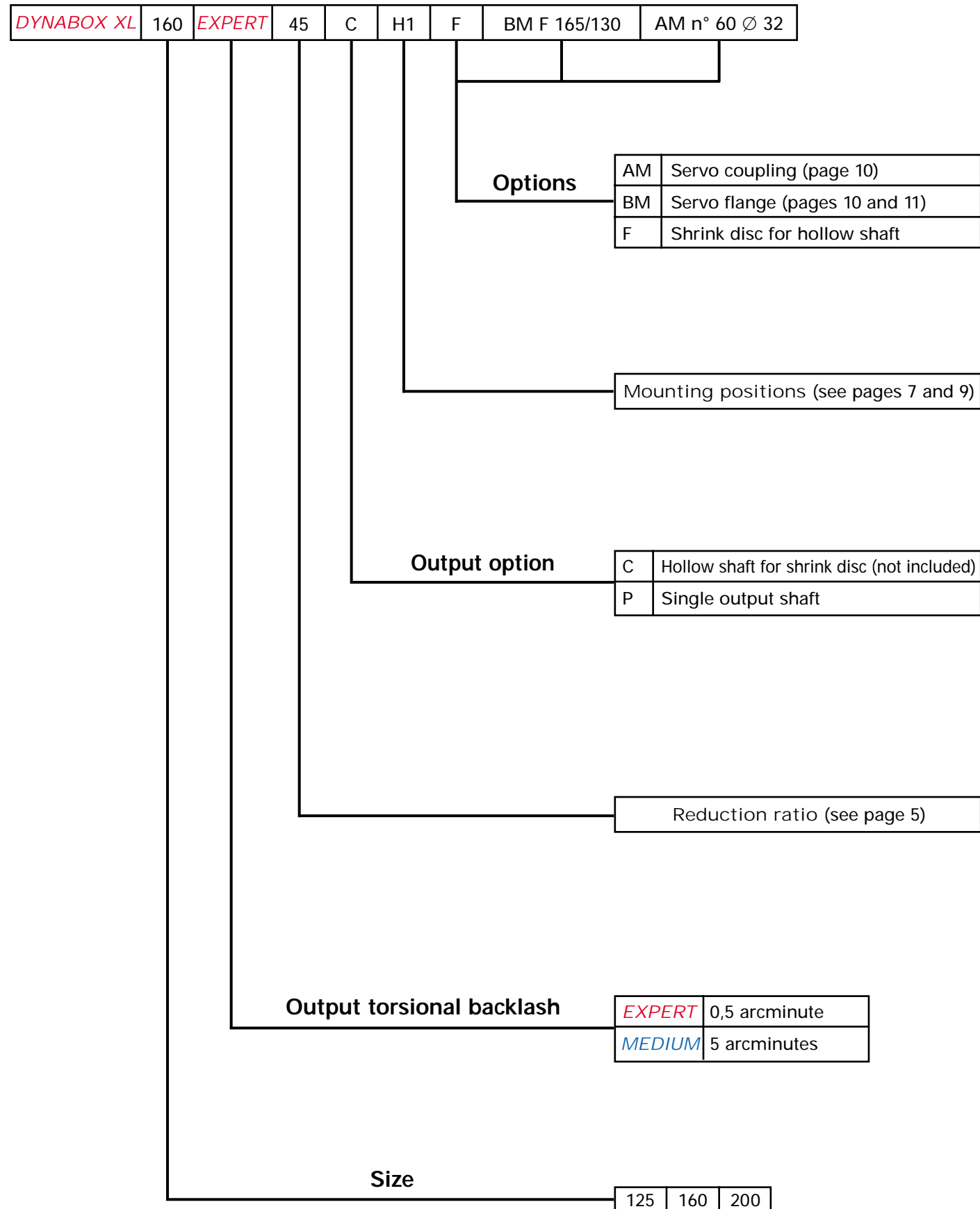
Select the required flange on page 11.



| <i>DYNABOX</i> | Reference | A | B | C mini | D | E | L | Z |
|----------------|---------------|-------|------|--------|-----|-----|-----|-----|
| 125 | BM-F115/95 | 95 | 5 | 42 | 115 | M8 | 247 | 190 |
| | BM-F130/95 | 95 | 5 | 52 | 130 | M8 | 257 | 190 |
| | BM-F130/110 | 110 | 5 | 52 | 130 | M8 | 257 | 190 |
| | BM-F145/110 | 110 | 6,5 | 62 | 145 | M8 | 267 | 190 |
| | BM-F165/110 | 110 | 6,5 | 52 | 165 | M10 | 257 | 190 |
| | BM-F165/130 | 130 | 6,5 | 52 | 165 | M10 | 257 | 190 |
| | BM-F200/114,3 | 114,3 | 6,5 | 82 | 200 | M10 | 287 | 190 |
| | BM-F215/130 | 130 | 6,5 | 62 | 215 | M12 | 267 | 190 |
| | BM-F215/180 | 180 | 6,5 | 62 | 215 | M12 | 267 | 190 |
| | BM-F265/230 | 230 | 6,5 | 85 | 265 | M12 | 290 | 260 |
| | BM-F300/250 | 250 | 6,5 | 85 | 300 | M14 | 290 | 260 |
| | BM-F350/300 | 300 | 8,5 | 112 | 350 | M16 | 317 | 360 |
| 160 | BM-F165/130 | 130 | 6,5 | 52 | 165 | M10 | 321 | 200 |
| | BM-F200/114,3 | 114,3 | 6,5 | 82 | 200 | M10 | 351 | 200 |
| | BM-F215/130 | 130 | 6,5 | 62 | 215 | M12 | 331 | 200 |
| | BM-F215/180 | 180 | 6,5 | 62 | 215 | M12 | 331 | 200 |
| | BM-F265/230 | 230 | 6,5 | 85 | 265 | M12 | 331 | 260 |
| | BM-F300/250 | 250 | 6,5 | 85 | 300 | M14 | 354 | 260 |
| | BM-F350/300 | 300 | 8,5 | 112 | 350 | M16 | 381 | 360 |
| 200 | BM-F165/130 | 130 | 6,5 | 52 | 165 | M10 | 365 | 200 |
| | BM-F200/114,3 | 114,3 | 6,5 | 82 | 200 | M10 | 399 | 200 |
| | BM-F215/130 | 130 | 6,5 | 62 | 215 | M12 | 379 | 200 |
| | BM-F215/180 | 180 | 6,5 | 62 | 215 | M12 | 379 | 200 |
| | BM-F265/230 | 230 | 6,5 | 85 | 265 | M12 | 402 | 260 |
| | BM-F300/250 | 250 | 6,5 | 85 | 300 | M14 | 402 | 260 |
| | BM-F350/300 | 300 | 8,5 | 112 | 350 | M16 | 429 | 360 |
| | BM-F400/350 | 350 | 10,5 | 142 | 400 | M16 | 460 | 420 |

HOW TO ORDER

Use following codification to order your **DYNABOX XL**.



SERVO GEARSETS **DYNASET XL** WITH ADJUSTABLE BACKLASH

When **DYNABOX XL** servo gearheads cannot be used, the **DYNASET XL** servo gearsets, to be mounted in customized housing, are an interesting alternative.

Their performance are comparable to complete reducers, assuming following recommendations :

MOUNTING

Wormshaft : housing and bearing design should allow an axial shifting, necessary for backlash adjustment. The total adjustment range is obtained with a permissible displacement equal to W, as per page 14.

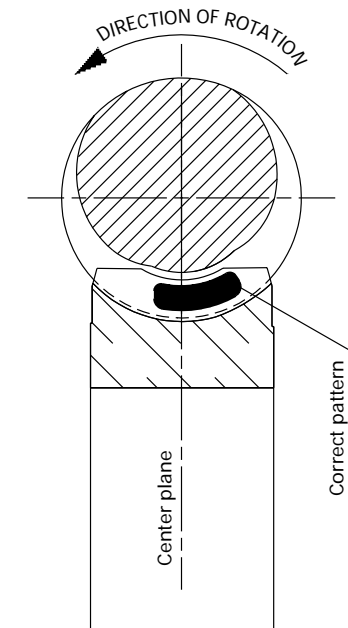
It is recommended, whenever possible, to use our backlash adjustment device, which is delivered preset (see page 15). The front ball bearing (see page 15) must be engaged on the shaft after the complete gear assembly, and before the backlash adjustment operation.

Wheel ring : Arrows shown on wormshaft and wheel ring must be lined up during assembly (see page 14). As the bore ØA tolerance is H6, it is recommended to grind the shaft with a tolerance k5. This will eliminate any runnout between the wheel ring and the shaft. In order to facilitate the connection between the 2 parts, heat the wheel ring up to 50°C.

After cooling, check that the wheel ring is no buckled, by applying a dial indicator on its face, while rotating the shaft.

It is recommended to use taper roller bearings on output shaft, in order to allow an axial displacement of the wheel, during the mounting operations, to center the gear

correctly. The contact pattern can be checked with Prussian blue or any similar product. A good pattern should be located slightly on the right side of the wheel tooth flanks (on both sides). It is normal to have no contact on the left side of the flanks. This gap is necessary for a good oil film forming. See sketch below.



LUBRICATION

The best gear performances in terms of efficiency, life, temperature, will be achieved with a synthetic lubricant such as MOBIL SHC 634 or equivalent. The ratings shown

on page 5 can be considered only if this kind of lubricant is used.

BACKLASH ADJUSTMENT

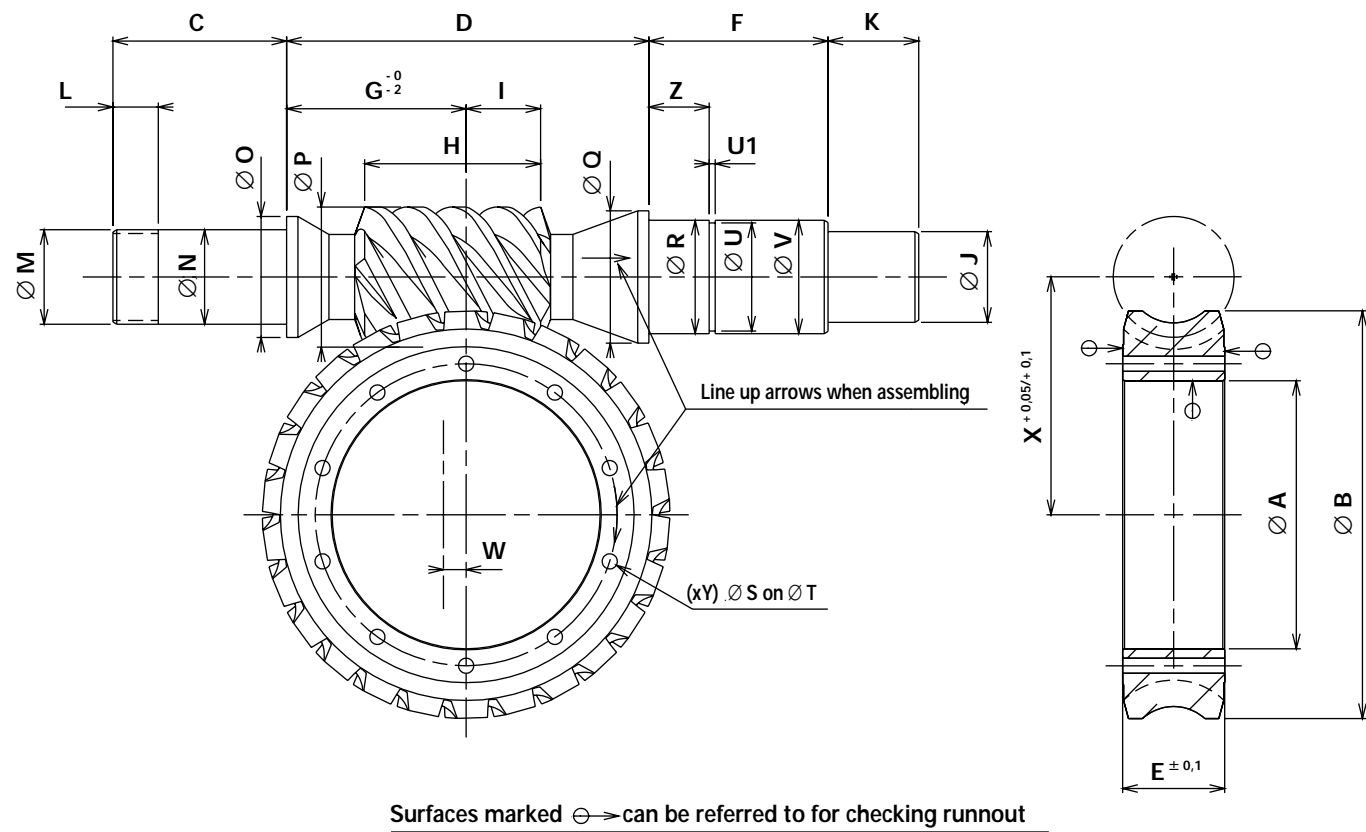
The accuracy of our servo gearsets **DYNASET XL** allows them to be set to less than 0,5 arcminute of backlash, without any efficiency or torque capacity losses (it is assumed than custom machined parts and mounting are correct).

If our backlash adjustment device is used, simply remove some shims (delivered) between the bearing bush and

the housing, until the desired backlash value is obtained. For high speed applications, a backlash between 0,5 to 1 arcminute is recommended.

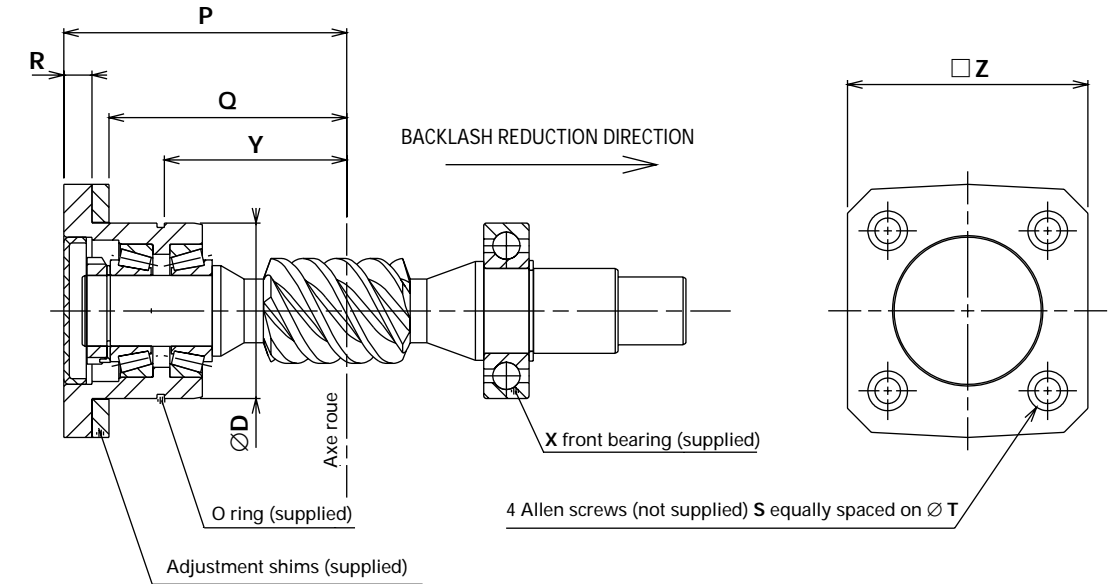
For very intermittent applications (rotary tables or milling heads of CNC machines for ex.), a backlash down to zero is tolerated, as soon as the no load input torque does not vary more than ± 30 % around the average value.

SERVO GEARSET *DYNASET XL*



| <i>DYNASET XL</i> | 125 | 160 | 200 |
|-------------------|-----------|-----------|-----------|
| A (H6) | 136 | 190 | 226 |
| B Maxi | 219 | 280 | 351 |
| C | 63 | 75 | 91 |
| D | 175 | 230 | 302,5 |
| E | 40 | 46 | 58 |
| F | 60,75 | 81 | 86,5 |
| G | 85,75 | 121 | 155 |
| H Maxi | 82 | 103,4 | 115 |
| I Maxi | 33,5 | 43,85 | 46,78 |
| J (h6) | 35 | 42 | 48 |
| K | 45 | 50 | 55 |
| L | 12 | 15 | 18 |
| M | M35 x 1,5 | M45 x 1,5 | M60 x 1,5 |
| N (k6) | 35 | 45 | 60 |
| O | 44 | 55 | 72 |
| P Maxi | 53 | 72 | 84 |
| Q | 56,5 | 68 | 71 |
| R (k6) | 50 | 60 | 60 |
| S | 10,5 | 12,5 | 12,5 |
| T | 154 | 214 | 260 |
| U | 47 | 57 | 57 |
| U1 | 2,15 | 2,15 | 2,15 |
| V (c7) | 50 | 60 | 60 |
| W | 10 | 10 | 10 |
| X | 125 | 160 | 200 |
| Y | 10 | 12 | 12 |
| Z | 20 | 22 | 35 |

BACKLASH ADJUSTMENT DEVICE FOR *DYNASET XL*



| <i>DYNASET XL</i> | 125 | 160 | 200 |
|-------------------|-------|-------|-------|
| D | 90 | 110 | 150 |
| Y Maxi | 111,4 | 150,9 | 191,1 |
| Y Mini | 101,4 | 140,9 | 181,1 |
| P Maxi | 163 | 204 | 251 |
| P Mini | 153 | 194 | 241 |
| Q | 135 | 175 | 216 |
| R | 18 | 19 | 25 |
| S | M12 | M12 | M16 |
| T | 115 | 135 | 180 |
| Z | 130 | 140 | 180 |
| X | 6210 | 6212 | 6412 |

The backlash adjustment device is delivered mounted and preset.
 Bearings are factory preloaded.
 Backlash adjustment is operated with shims located between the housing and the bearing bush.

HOW TO ORDER

Use following codification to order your *DYNASET XL*.



Visit our website : www.girard-transmissions.com to :
Contact our international sales network
Discover our **DYNABOX** range (torque up to 1300 Nm)

