3467594 ·

STEEL UNIVERSAL JO[illegible]

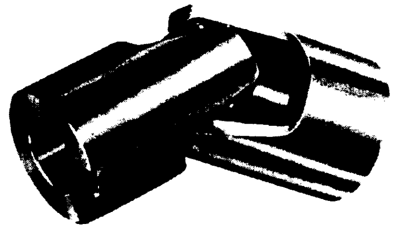
standard bored joints with plain bearings

A comprehensive range of good quality steel universals available in a range of standard sizes from stock. Alternative bores, round, keywayed or square, etc. can be produced to order. Also available in stainless steel. Please call Technical Sales for assistance with non-standard requirements.

Maximum working angle is 40° for single and 80° for double joint sizes 13 – 45. This reduces to 30° and 60° respectively for size 50 and upwards.

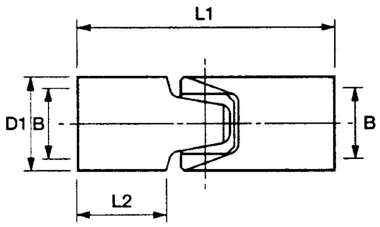
Maximum speed 1200 rpm, see performance charts on page 15.

These plain bearing universal joints must be lubricated.
The use of gaiters is recommended.

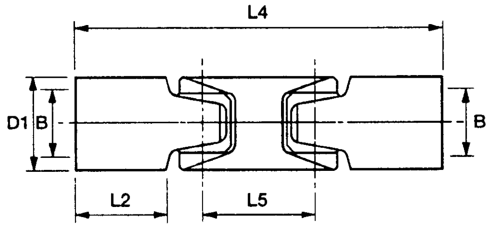


2

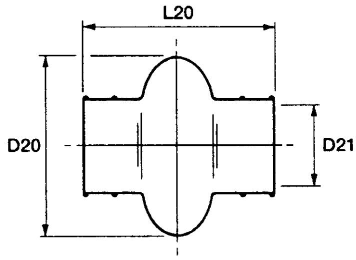
type TS single joint



type TS double joint



type T gaiter



Order Code	h7 Bores B	D1	L1	L2	Static Torque at Break (Nm)
134.13.2222	6 × 6	13	34	11	65
134.17.2828	8 × 8	17	40	12	120
134.20.3232	10 × 10	20	45	13	150
134.23.3535	12 × 12	23	50	14	210
134.26.3838	14 × 14	26	56	16	290
134.29.4242	16 × 16	29	65	18	480
134.32.4545	18 × 18	32	72	20	850
134.35.4848	20 × 20	35	82	24	1000
134.40.4949	22 × 22	40	95	28	1350
134.45.5252	25 × 25	45	108	35	1750
134.50.5656	30 × 30	50	122	40	2500
134.55.6060	35 × 35	55	140	45	4000
134.60.6363	40 × 40	60	160	50	5000
134.70.0000	unbored	70	175	50	8000
134.80.0000	unbored	80	190	55	11500
134.90.0000	unbored	90	210	65	13500
134.99.0000	unbored	100	230	70	16000

Order Code	h7 Bores B	D1	L2	L4	L5	Static Torque at Break (Nm)
136.13.2222	6 × 6	13	11	57	23	65
136.17.2828	8 × 8	17	12	67	27	120
136.20.3232	10 × 10	20	13	75	30	150
136.23.3535	12 × 12	23	14	84	34	210
136.26.3838	14 × 14	26	16	92	36	290
136.29.4242	16 × 16	29	18	106	41	480
136.32.4545	18 × 18	32	20	119	47	850
136.35.4848	20 × 20	35	24	132	50	1000
136.40.4949	22 × 22	40	28	151	56	1350
136.45.5252	25 × 25	45	35	176	68	1750
136.50.5656	30 × 30	50	40	194	72	2500
136.55.6060	35 × 35	55	45	219	79	4000
136.60.6363	40 × 40	60	50	248	88	5000
136.70.0000	unbored	70	50	264	89	8000
136.80.0000	unbored	80	55	286	96	11500
136.90.0000	unbored	90	65	310	100	13500
136.99.0000	unbored	100	70	360	130	16000

Order Code	D20	D21	L20
–	–	–	–
143.17	32	16.5	40
143.20	39	20.5	47
143.20	39	20.5	47
143.26	47	24.5	52
143.29	51	27.5	58
143.32	56	30.5	67
143.35	66	35.5	74
143.40	75	40.0	84
143.45	83	45.0	97
143.50	93	50.0	110
143.50	93	50.0	110
143.60	100	56.0	122
–	–	–	–
–	–	–	–
–	–	–	–
–	–	–	–

NB -
INTERNAL REFS -
(P = Packaging
FAR = FARNELL)

types TL & TS, plain bearings – 1200 rpm max – 200 rpm for sizes 60-100

(Please note that the nomograms do not apply to joints assembled as telescopic drive shafts)

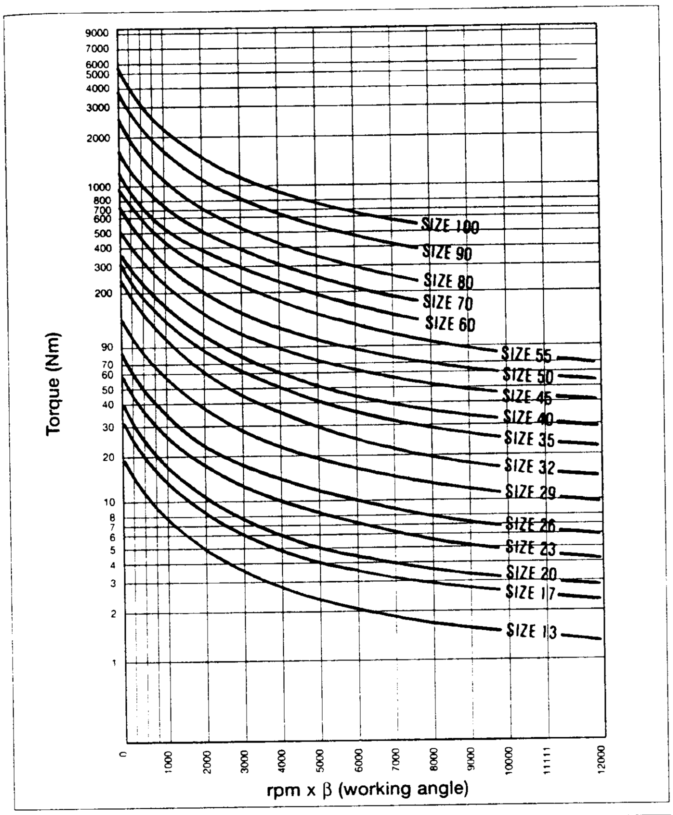


Table	A			B		
rpm × β	250 or less			more than 250		
Operating conditions hrs per day	< 3	8	> 8	< 3	8	> 8
Uniform load SF	2.5	3.0	3.5	3.0	3.6	4.0
Intermittent load SF	3.0	3.5	4.0	3.6	4.0	5.0
Severe Intermittent load SF	3.5	4.0	4.5	4.0	5.0	6.0

using the nomogram

The nomogram charts the maximum dynamic moment for each size of joint. The curves represent the limit of performance and must not be exceeded, however momentarily, by peak impulse loads.

The product of speed of rotation x working angle is given for values from 250–12000. The upper speed limit for this series is 1200 rpm and this corresponds to a maximum working angle of 10° at this speed.

Working angles up to 45° are practicable provided the corresponding speeds are held within the limits of the nomogram. A double joint working at 90° is considered the equivalent of two singles working at 45°.

selection

1. Determine the driving torque of the application in Newton metres (Nm) and the speed of rotation in revolutions per minute (rpm). If converting from other units:

   1 lbf ft = 1.36 Nm
   1 kpm = 9.81 Nm

   The relationship between driving torque, speed of rotation and power transmitted is expressed by the formulæ:

   $$\text{torque (Nm)} = \frac{7120 \times \text{HP}}{\text{rpm}} \quad \text{or} \quad \frac{9550 \times \text{kW}}{\text{rpm}}$$

2. Find the product of rpm × working angle (β) and select the appropriate service factor (SF) from table A or B after identifying the nature of the loading on the transmission.

   'Uniform' loads – typically electric motors driving fans, centrifugal pumps or conveyors under constant load conditions.

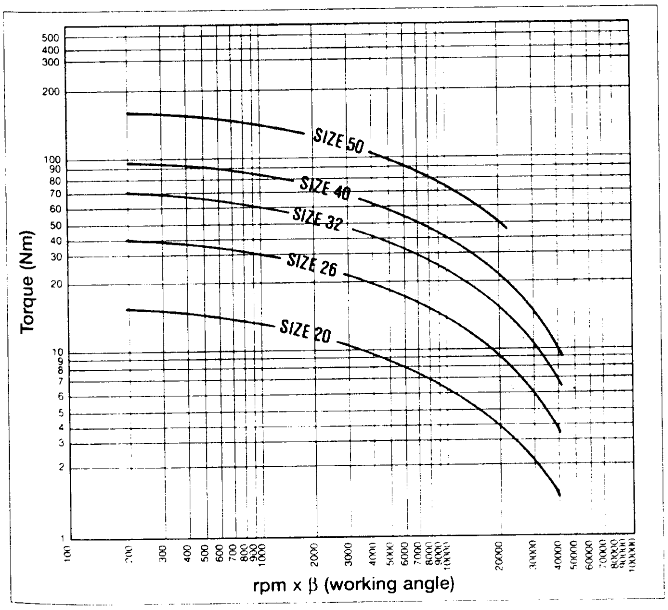
   'Intermittent' loads – presses, shears, radial displacement pumps or compressors, all driven by electric motors.

   'Severe Intermittent' loads – typically rolling mills or crushers or 'intermittent' type loads driven by I.C. motors with less than 4 cylinders.

3. If table A is relevant, multiply Nm × SF and select a joint with a static torque figure in excess of this value.

   If table B is relevant, apply the products of Nm × SF and rpm × β to the nomogram and select the joint with the performance curve immediately above the point of intersection.

type TR, needle roller bearings – 6000 rpm max – 3000 rpm for sizes 40 and 50



using the nomogram

The nomogram charts the maximum dynamic moment for each size of joint. The curves represent the limit of performance and must not be exceeded, however momentarily, by peak impulse loads.

The product of speed of rotation × working angle is given for values from 200–40000. The upper speed limit for this series is 6000 rpm and this corresponds to a maximum working angle of 6° 30' at this speed.

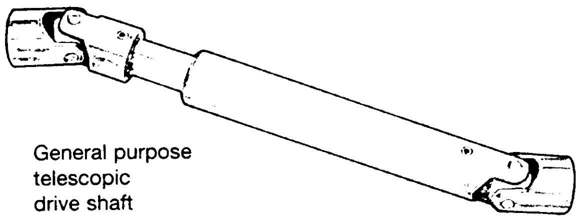
Working angles up to 45° are practicable provided the corresponding speeds are held within the limits of the nomogram. A double joint working at 90° is considered the equivalent of two singles working at 45°.

selection

1. Determine the driving torque of the application in Newton metres (Nm) and the speed of rotation in revolutions per minute (rpm)
2. Find the product of rpm × working angle (β) and check that the result is within the limits of the nomogram.
3. Apply the values obtained in 1) and 2) to the nomogram and select the joint with the performance curve immediately above the point of intersection. Normal safety factors are built into the nomogram which is based on tests conducted with joints operating under arduous conditions.

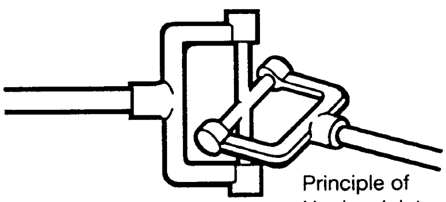
basic principles

Universal joints (U/J's) transmit rotation from one shaft placed end to end with another. They will operate at a much larger angle than is permissible with a misalignment coupler and are commonly used in pairs to take a drive train through laterally displaced axes. The ability to change angle while operating under load gives U/J's a further advantage and in these applications, a telescopic drive shaft is used to accommodate accompanying changes in length.



General purpose telescopic drive shaft

Although constructional details can differ widely between one maker's product and the next, U/J's fall into two groups identified as constant velocity or non-constant velocity joints. Constant velocity types are most often seen on front wheel drive vehicles. They are relatively costly to produce and are generally purpose designed for the application. The joints featured in this catalogue work on the Hookes or Cardan principle and are of the non-constant velocity type.



Principle of Hookes joint

What this means is that for a given operating angle the output velocity fluctuates even though the input velocity is constant. These fluctuations result in the output gaining, then lagging with respect to the input, twice in each revolution to an extent governed by the operating angle. The fluctuation is predictable and varies between

$$\omega \cos \alpha$$

and $\omega \sec \alpha$

where ω = angular velocity (speed rev/min)

and α = operating angle

Thus at an operating angle of 5°, the fluctuation is ±0.4%, at 7° ±0.8% and at 10° ±1.5%. For example, a motor shaft turning at a constant 1000 rpm, driving through a single universal joint set at an operating angle of 5°, will produce an output that fluctuates between 996 and 1004 rpm twice every revolution. At low speed or on manual operation, the fluctuations will be of interest only in calibrated applications; at higher speeds, they will increasingly give rise to torsional vibration.

Constant velocity output can be restored by using a double joint or by connecting two single joints back to back. Two rules must be observed:

1. The operating angle must be the same at the input end as at the output end (Figs. 1 & 2).
2. When connecting two single joints, they must be orientated so that the inboard lugs are in line (Fig. 3).

Under these conditions the fluctuations in the first joint will for all practical purposes be cancelled out by the complementary fluctuations in the second.

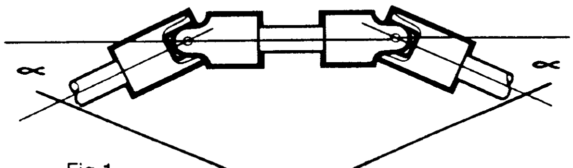


Fig 1 These angles must be equal

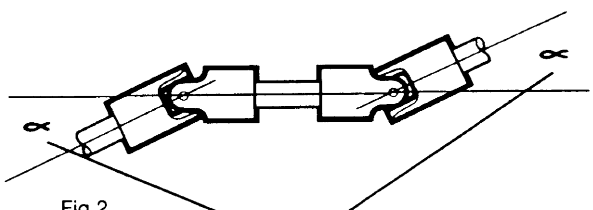


Fig 2 These angles must be equal

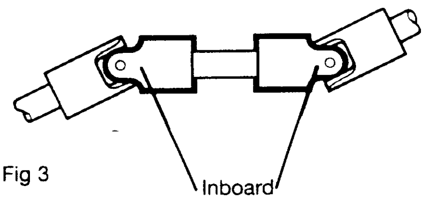
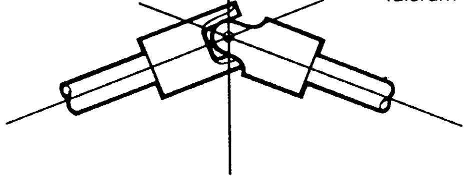


Fig 3 Inboard lugs in line

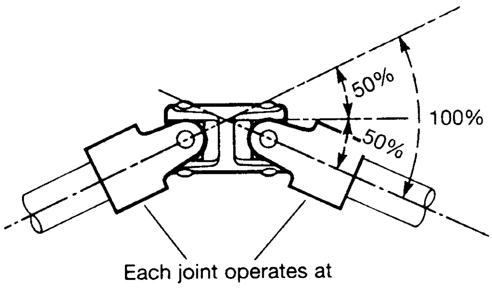
application

Universal joints are typically used to transmit positive rotation through intentional offsets where the power source is some way from the load. It is important to note that a U/J is essentially a pivot and that it cannot accommodate any parallel displacement between shafts if used singly. Moreover, the installation must allow for some adjustment when mounting the joint so that the shaft centre lines can be made to converge at the fulcrum of the joint. This is essential if the joint is to function correctly and not impose excessive radial loads on adjacent bearings.

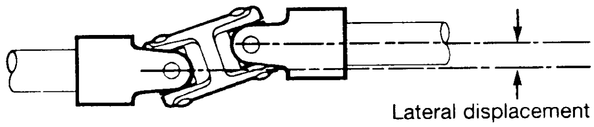


Correctly installed, the shaft centre lines converge at the fulcrum of the joint.

Most applications however, demand a pair of U/J's. This yields several advantages including constant velocity output, a less critical installation procedure, a shared operating angle (each joint works at 50% of the total), and the ability to drive through laterally displaced shafts. A pair of joints can comprise a drive shaft with a U/J at each end or a double U/J for close coupled applications. A double U/J offers greater misalignment compensation than a misalignment coupler and runs at higher efficiency. For a given torque rating however, it is usually significantly longer.



Each joint operates at 50% of total offset



Lateral displacement

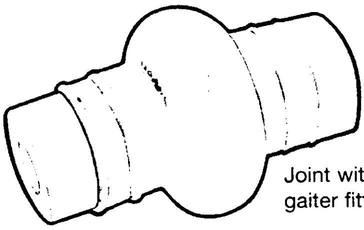
Telescopic drive shafts with a single U/J fitted at each end are used to power mechanisms that move in relation to the power source. The most common example is the drive shaft connecting the gearbox to the rear axle on a road vehicle. Another is the power take-off fitted at the rear of a tractor to power-up ancillaries towed behind it. There are many more applications in machine tools, packaging machinery and the like. As the driven mechanism moves, the distance between the U/J centres changes and since U/J's cannot accommodate end movement, a telescoping facility is built into the drive shafts. Typically, this takes the form of a splined shaft with matching broached tube. For lightly loaded or less critical applications, nesting tubes cut from square material are adequate for the purpose. It should be noted that although a pair of U/J's connected by a drive shaft and correctly set up will produce a constant velocity output, the connecting shaft turns in sympathy with the output of the first joint and is therefore subject to the fluctuations governed by the working angle of the first joint.

selection

U/J's are selected for size on the basis of the torque to be transmitted, the speed of rotation and the operating angle. These variables give rise to a performance chart on which the values can be read off and a suitable joint selected. Factors relating to the nature of the power source or load are sometimes applied. A single cylinder internal combustion engine for example is more punishing to the transmission than an electric motor. An even load is less onerous than an intermittent one.

In principle, a U/J works harder as the operating angle increases. The larger the operating angle, the lower the torque or the speed at which it can be transmitted, or both.

In selecting the best type of universal joint for a given application, the intended duty and life requirement are the determining factors. High speeds and/or operating angles are best handled by U/J's fitted with roller bearings. These are lubricated for life but it is nevertheless a good plan to protect the moving surfaces with a gaiter which prevents the ingress of dust, moisture and other foreign matter. Roller bearing joints are generally specified where sustained rotational speeds exceed 1200/1500 rpm.

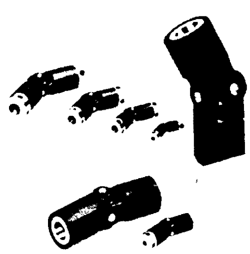


Joint with protective gaiter fitted

The most commonly specified joints are those fitted with plain bearings. These are better at withstanding shock loads and are adequate for speeds up to 1200/1500 rpm. Journals and bearings are usually heat treated then ground and honed respectively. On larger U/J's , the bearing may be manufactured separately and pressed into the parent metal before assembly. To ensure an adequate service life, U/J's should be regularly lubricated. Where this is difficult due to inaccessibility, gaiters will retain the lubricant and afford protection in aggressive environments. For low speed or manual operation only, an 'economy series' joint may be adequate. These are manufactured to looser tolerances and dispense with the hardening, grinding and honing of bearings.

Lastly, U/J's manufactured in plastics combined with non-ferrous metals offer economy plus a set of properties not found in steel joints. Foremost among these are their light weight, resistance to corrosion electrical non-conductivity and freedom from both lubrication and backlash. A supreme advantage of the moulding technique is the cost-saving opportunities it offers. Examples are the ease of producing non-circular bores and the ability to integrate related components in the moulding process, typically gear forms and toothed belt pulleys.

Compared with similarly sized steel joints, plastics U/J's have a significantly lower torque carrying capability.



Huco-Pol U/J's and telescopic drives are manufactured in acetal and non-ferrous metals for cost-effective use in light duty applications. Bored Ø3mm to 16mm, the joints feature backlash-free articulation.

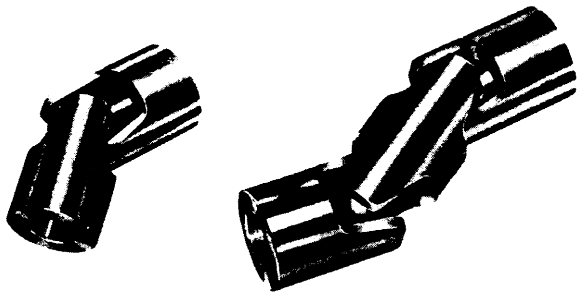
Catalogue available on request.

features

Huco universal joints feature a comprehensive range of sizes manufactured in good quality steels. Plain bearing and needle roller types are available and either can be supplied with square, hexagonal or keywayed bores to order. The joints are also manufactured with quick release collars and in telescopic form to order.

types TL & TS, plain bearings - 1200 rpm max

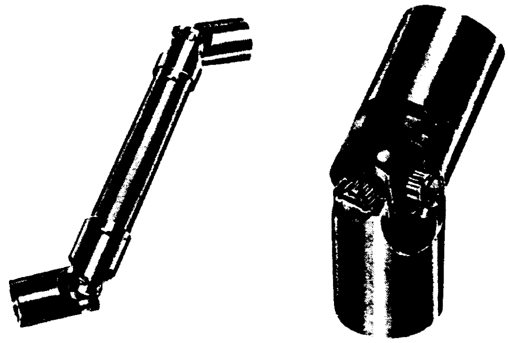
These joints feature hardened journals of generous proportions. In joint sizes 13 - 60 (external diameter in mm) they are retained in the forks and pivot in holes provided in the central core. A large bearing surface is thus achieved which helps to reduce wear and tear and prolongs the operational life of the joint.



By virtue of the increased wall thickness available in the larger joints, pins fitted to sizes 70 - 100 are retained in the central core and pivot in treated bushes housed in the fork ends.

type TR, needle roller bearings - 6000 rpm max

This series is intended for applications demanding high rotational speeds (up to 6000 rpm) and large working angles where operation is without benefit of periodic lubrication.



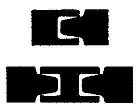
They are constructed with hardened and ground journals pivoting between caged needle roller bearings housed in the fork ends. Four bronze thrust rings interface between the central core and the inner surfaces of the forks. These help to achieve greater load capacities by minimising friction generated by side loads.

Although the joints are pre-lubricated, rubber gaiters are recommended as a protective measure in abrasive or damp environments and to prevent ingress of foreign matter. Note that good heat dissipation becomes important under conditions of high working angles and high rotational speeds.

Type TR joints are suitable for all high speed applications or where periodic lubrication is difficult, typically machine tools, textile machines, multi-spindle drilling and tapping machines, packaging machines, special purpose machines and mechanical applications generally.

styles & sizes

U/J's are produced in 17 sizes, identified by their outside diameter in mm. All sizes are available in single and double form.

Style	Outline	Sizes
Extended unbored series with plain bearings		13 to 60 with 10 intermediate sizes
Standard bored series with plain bearings		13 to 100 with 15 intermediate sizes
Standard bored series with needle roller bearings		20 to 50 with 3 intermediate sizes

Any of these can be manufactured as a telescopic drive shaft.
The range of practical bore diameters corresponding with universal joints is 5.00 - 60.00 mm.