Typical Applications

CON-VEL[R] Constant Velocity Joints are ideally suited for applications where unequal joint angles are encountered, and low vibration generation is needed. Typical industrial and mobile equipment applications for Constant Velocity Joints are:

Industrial

- -Steel Mills
- -Paper Mills
- -Dynamometers
- -Machine Tools
- -Specialty Equipment
- -Windmills
- - Glass Manufacturing Equipment

Mobile Equipment

- -Steering Axles
- -Marine Propulsion
- -Mining Machines
- -Railroad Equipment
- Military Vehicles
- -Agricultural Equipment
- -Construction Equipment

Industrial Disc

The CON-VEL[R] Constant Velocity Joint is available in a disc design for stationary industrial applications. Connecting two rotating shafts, of almost any design, can be accomplished by selecting a coupling from the wide range of CON-VEL[R] joints available. Our mid-slip or solid-shaft designs meet practically any coupling requirements. A variety of end-fitting configurations allow ease of installation and mounting.

Bell Joint

The original Rzeppa design is the basis for the CON-VEL[R] Bell Joint. Designed specifically for all-wheel drive steering axle applications. Due to the true constant velocity characteristics at all angles, the CON-VEL[R] Bell Joint provides improved tire wear. Low vibration generation reduces operator fatigue while increasing the life of the bearings and their supporting structures.

Table Of Contents

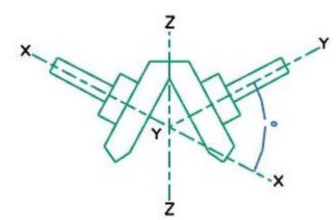
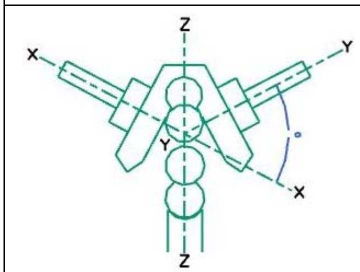
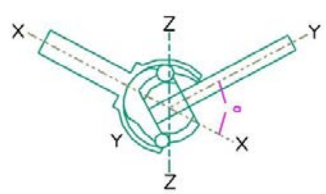
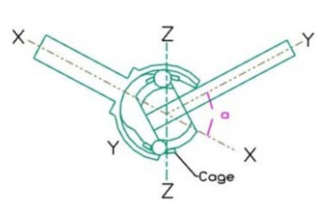
General Warnings

Heavy components should be handled carefully. If dropped they can cause serious bodily injury.
Consult CON-VEL Installation and Maintenance Bulletin for proper disassembly and assembly procedures.
Rotating driveshafts can be dangerous. All drive shafts should be covered with a shaftguard to prevent injury.
Disable all power sources (electrical, pneumatic, mechanical, etc.) before servicing equipment.

Fundamental Principles

Bevel gears at fixed angles (Figure 1) provide smooth and constant power transmission from input to output shafting. The balls in the CON-VEL[R] Constant Velocity Universal Joints (Figure 2) are positioned to allow joint members to mesh in much the same manner as the bevel gear.

Both the outer race (Figure 3) and the inner race are precision machined, allowing the six balls to freely traverse throughout the operating angle of the joint. The cage (Figure 4) is designed to hold the balls in a constant relative position between the inner and outer races. This permits an angle change at installation and during operation.

	**Figure 1: Constant Velocity Bevel Gear** (Fixed Angle)
	**Figure 2: Constant Velocity Gear** (Fixed Angle) Gear teeth are substituted by driving balls that mesh with pockets in gears.
	**Figure 3: Constant Velocity Joint** (Variable Angle) Pockets are replaced by transverse Grooves in driving and driven members.
	**Figure 4: "Rzeppa" Constant Velocity Joint** Driving balls are en-gaged in transverse grooves, and maintained in an angle bisecting plane (Z-Z) by ball cage (C).

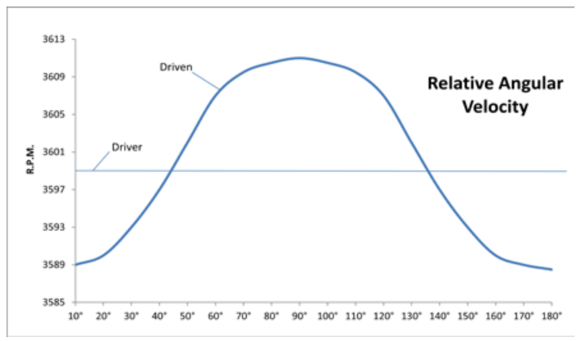
All couplings perform two basic functions:

1) Transmit power.
2) Accommodate misalignment.

When misalignment requirements range from 3°-35°, only two coupling types are commercially available, the cardan-style universal joint and the constant velocity CON-VEL[R] joint.

When a Cardan style Joint is operated at an angle, non-uniform motion output is generated, which produces a variety of unwanted vibrations (Figure 5).

To minimize these troublesome vibrations, Cardan U-Joints must be used in pairs with yokes phased and with equal working angles.



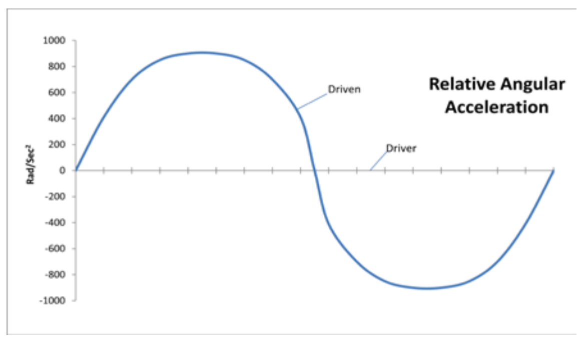


Figure 5: Motion Characteristics

Cardan-style 4 1/2° joint angle at 3600 rpm.

A CON-VEL joint, when operated at the same angle and speed transfers 100% true constant velocity with no velocity or acceleration changes.

In reality it is difficult to maintain equal angles in today's industrial and mobile equipment. Soft mounting of components, settling of foundations, movement due to loose bearings and end fitting tolerances all cause drive shaft angles to vary during operation and cause vibrations in the equipment.

Cardan-style driveshafts generate troublesome vibrations three different ways:

1) Torsional excitation produced by non-uniform transmission of velocity of center member (Figure 5)

2) Internal excitation produced by the oscillating torque loads of the driveshaft inertia being accelerated and decelerated.

3) Secondary couple excitation caused by the transmission of torque when operating a Cardan-style joint at an angle.

CON-VEL[R] constant velocity joints and driveshafts solve the vibration problems generated by Cardan-style driveshafts.

Features And Benefits

CON-VEL[R] Constant Velocity joints and driveshafts have no torsional or inertial excitations inherent in Cardan style driveshafts. The smooth torque transmitted from a CON-VEL[R] driveshaft occurs even when the operating angles are unequal. The CON-VEL[R] joints can successfully accommodate an unequal angle condition better than any other coupling device.

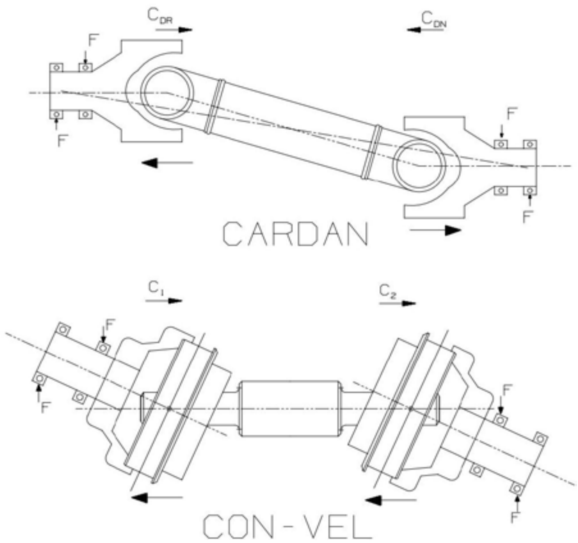


Figure 6: Secondary couple effect on support bearings, parallel output and input shafts.

Secondary Coupling Force

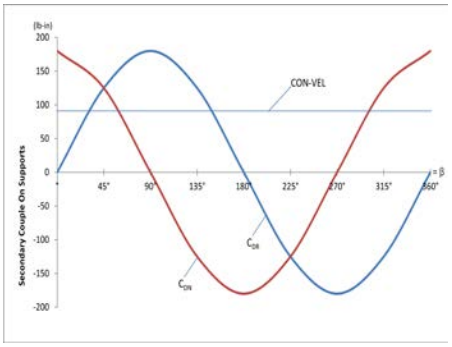
All couplings that transmit torque through an angle generate secondary coupling forces into the supporting structure. (Figure 6)

In a CON-VEL[R] Constant Velocity driveshaft, the secondary coupling forces react as static non-vibrating forces only. The magnitude of these couples are equal in both driving and driven shafts. For a given torque direction and joint angle, both couples are sensed in the same direction. The values of these secondary couples are:

$$C_1 = C_2 = T\tan(\frac{\theta}{2})$$

Approximately 50% less secondary coupling force is generated with CON-VEL[R] than with Cardan-style designs operating under the same conditions (Figure 7). This eliminates sinusoidal fluctuations that produce troublesome vibrations in equipment. The following graph clearly shows the CON-VEL[R] advantage.

Figure 7



Torque = 1800 lb-in
Angle = 6°

T = Torque Transmitted By Joint
θ = Joint Angle
β = Angle Of Rotation Of Drive Yoke From Normal Position To The Plane Of The Joint Angle.

—— Cardan Driver = $T \tan \theta \cos \beta = C_{DR}$
—— Cardan Driven = $T \tan \theta \cos \beta = C_{DN}$
—— CON-VEL^{R} = $T \tan (\theta/2) = C_1 = C_2$

Industrial Disc
The CON-VEL^{R} Constant Velocity Joint is available in a disc design for industrial applications. Connecting two rotating shafts, of almost any design, can be accomplished with a wide range of available CON-VEL^{R} mid-slip, tubular, or solid shaft designs. A variety of end-fitting configurations allow for easy installation and mounting.

The CON-VEL^{R} Disc Driveshaft is ideal for situations where high misalignment is possible due to movement of equipment during operation.

Vibration problems caused by secondary coupling force of Cardan style joints can be virtually eliminated when replaced by CON-VEL^{R} Driveshafts.

Advantages

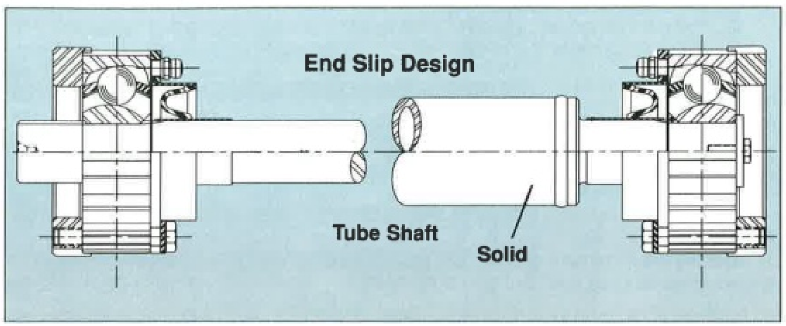
- True constant velocity even with unequal angles
- Low vibration generation
- Low maintenance “single point lube”
- Ease of installation
- Smooth operation

End Slip CON-VEL^{R} Driveshaft

End Slip CON-VEL^{R} Driveshafts provide for minimal slip (up to 2 inches for most joint sizes). This is to accommodate a majority of installation clearance requirements and application operating angle changes.

The slip disc slides on a splined shaft, which can either be a splined solid shaft or a splined stub shaft if a tubular shaft is used. The opposite disc joint is the fixed joint and is help in position on the shaft by disc retainer and shaft stop ring.

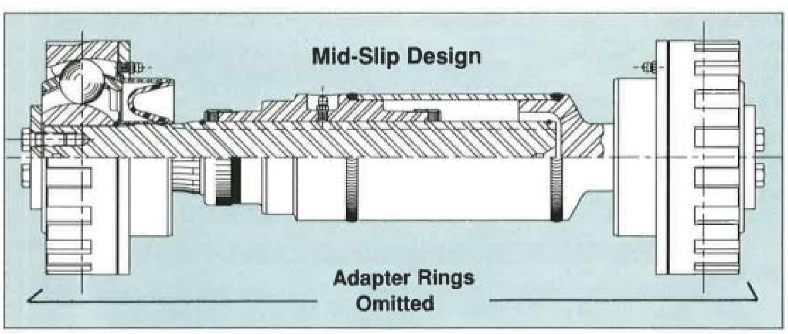
Companion flanges are mounted to the disc joints by either bolt or bolt and splined adapter ring methods. The companion flange is designed to allow for clearance of the constant velocity joint components and shafting during angle change and joint to joint distance changes.



Mid-Slip Or Inboard Slip CON-VEL^{R} Driveshaft

The Mid-Slip design is ideal for slip requirements longer than 2 inches. CON-VEL^{R} joints are locked in position on each end of the shafting and slip is a function of the splined sleeve and splined shaft.

Companion flanges are mounted to the disc joints by either bolt or bolt and splined adapter ring methods. Unlike the end slip design, slip clearance is not required in designing companion flanges. However, clearance for the constant velocity joint during angle changes must be present.



Seals

Elastomeric and mechanical seal designs are available for a wide variety of applications and operating conditions.

Selecting A CON-VEL[R] Disc Joint Driveshaft*

In order to select the proper CON-VEL[R] Disc Joint Driveshaft for an application, the following information is required:

1) The maximum continuous horsepower or torque the driveshaft is expected to transmit.
2) The maximum speed at which the driveshaft will run.
3) The angle(s) at which the driveshaft is expected to operate on a continuous basis.
4) The MAXIMUM angle the driveshaft will see in operation AND at installation.
5) The total distance, or space, between flanges or shaft ends.
6) The duty cycle of the installation.

Example

An induction motor, rated 50 hp at 1780 rpm, is driving a pinch roll at a 3:1 reduction. The pinch roll will operate continuously at angular displacements between 3° and 6° for about 8 hours per day. The distance between the output shaft of the reduction gear and the input shaft of the roll stand is 48 inches.

Procedure

1) Identify the maximum continuous hp or torque, speed, angular displacement and duty cycle.

   50 hp, 6°, 8 hours/day for 5 days/week.

2) Determine the Torque Factor for speed at angle (Table B).

   At 6° and 600 rpm, the Torque Factor is 0.88

3) Calculate the Application Load in lb-ft.

   The Application Load equals:

$$\frac{\textbf{Maximum Continuous hp} \times \textbf{5250}}{\textbf{Speed}}$$

$$= \frac{\textbf{50} \times \textbf{5252}}{\textbf{600}} = \textbf{438 lb} - \textbf{ft}$$

4) Select the smallest CON-VEL[R] Disc Joint size (Table A) which will effectively carry the Application Load.

   Size E, with a continuous torque capacity of 663 lb-ft, is correct.

5) Determine the maximum operating speed for the driveshaft. (Applies to steel shafting and tubing only.)

$$\frac{(\mathbf{4.8 \times 10^6}) \times \boldsymbol{SF} \times \sqrt{\mathbf{OD^2 + ID^2}}}{\mathbf{EL^2}}$$

   For a seamless tube of 3.0 OD, 0.25 wall thickness, and EL (effective length) of 44 inches, the maximum operating speed is:

$$\frac{(\mathbf{4.8 \times 10^6}) \times \mathbf{0.68} \times \sqrt{\mathbf{3.0^2 + 2.5^2}}}{\mathbf{44^2}} = \mathbf{6,584\ rpm}$$

6) Calculate the life in hours.

$$\mathbf{1500} \times \left(\frac{\mathbf{1000}}{\mathbf{Speed}}\right) \times \left(\frac{\textbf{Joint Torque Capacity} \times \textbf{Torque Factor}}{\textbf{Application Torque}}\right)^{\mathbf{3}}$$

$$\mathbf{1500} \times \left(\frac{\mathbf{1000}}{\mathbf{600}}\right) \times \left(\frac{\mathbf{663 \times .88}}{\mathbf{438}}\right)^{\mathbf{3}} = \textbf{5,909 hrs}$$

7) Evaluate calculated life in hours to duty cycle to determine if the size selected provides hours needed to meet the applciation demand.

   For this application, 8 hours per day x 5 days per week = 2,080 hours per year of operation. The “E” size Con-Vel at 5,909 hours life provides 2.8 years of service.

* Example is for preliminary sizing only. Contact CON-VEL[R] engineering for final selection.

Seal Selection-- CON-VEL[R] offers two choices of seals for the industrial disc joints: elastomeric and mechanical. For standard industrial apllications, elastomeric seals perform best. In extreme environmental conditions, either temperatures of over 180°F or a caustic environment, CON-VEL[R] offers rugged mechanical seals. Please contact CON-VEL[R] engineering with applications in extreme environmental conditions.

TABLE A

CON-VEL Disc Joint Size	Rating hp/100 rpm	CON-VEL Torque Capacities						Rating kW/rpm	CON-VEL Disc Joint Size
		Continuous		Short Duration		Maximum Static			
		lb-ft	kNm	lb-ft	kNm	lb-ft	kNm		
R	3.22	169	0.23	845	1.15	1099	1.50	0.024	R
B	5.37	282	0.38	1410	1.90	1833	2.47	0.040	B
C	6.90	363	0.49	1815	2.45	2360	3.19	0.051	C
E	12.67	663	0.90	3315	4.50	4310	5.85	0.095	E
G	20.00	1050	1.42	5250	7.10	6825	9.23	0.149	G
J	30.45	1617	2.19	8085	10.95	10511	14.24	0.227	J
L	47.50	2467	3.34	12335	16.70	16036	21.71	0.354	L
N	60.00	3150	4.27	15750	21.35	20475	27.75	0.448	N
P	90.00	4725	6.41	23625	32.05	30713	41.67	0.672	P
For applications requiring larger or smaller joint capacities than listed above, contact the CON-VEL Engineering Department. For calculating the maximum operating speed of a CON-VEL Disc Joint Driveshaft; SF=100 for solid shafting, SF=0.75 for welded tubing, or SF=0.68 for seamless tubing. (Applies to steel shafting and tubing only.)									

Continuous Torque Capacity-- The maximum torque a CON-VEL[R] Disc Joint can transmit 24 hours a day, i.e., industrial rating.

Short Duration Torque Capacity-- The maximum vibratory, or oscillatory torque that can be transmitted without fatiguing any part of a CON-VEL[R] Disc Joint, i.e., wheel drive rating.

Maximum Static Torque Capacity-- The maximum torque a CON-VEL[R] Disc Joint assembly can transmit instantaneously without brinelling or yielding any part during start-up, shut-down, shock loads, and transient conditions, i.e., maximum shock load limit.

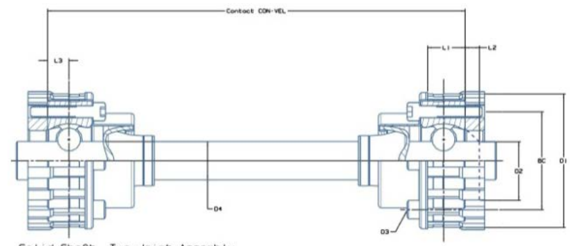
TABLE B

Operating Angle (Degrees)	Recommended Maximum Speed At Angle Speed (rpm) For CON-VEL By Joint Series				Torque Factor For Speed At Angle	
	R, B (rpm)	C, E, G (rpm)	J, L (rpm)	N, P (rpm)	<1000 rpm	>1000 rpm
1 - 4	4000	3000	2500	2000	0.90	0.70
5	3500	2800	2200	1800	0.89	0.69
6	3000	2600	2100	1700	0.88	0.68
7	2800	2400	2000	1600	0.86	0.66
8	2500	2100	1850	1500	0.84	0.64
9	2200	1900	1650	1300	0.82	0.62
*10	2000	1700	1500	1200	0.80	0.60
*11	1800	1550	1350	1100	0.78	0.59
*12	1650	1400	1200	975	0.76	0.57
*13	1500	1200	1000	750	0.74	0.56
*14	1300	1050	800	650	0.72	0.54
*15	1200	950	700	550	0.70	0.53
*16	1100	850	600	500	0.68	0.51
*17	950	700	500	450	0.66	0.49
*18	800	600	450	400	0.64	0.48

* Mechanical seals recommended for continuous operation at these angles. Non-rotating elastomeric seals are also available for specific applications and operating conditions. Consult CON-VEL Engineering for information about special sealing and applications at speeds greater than those listed above.

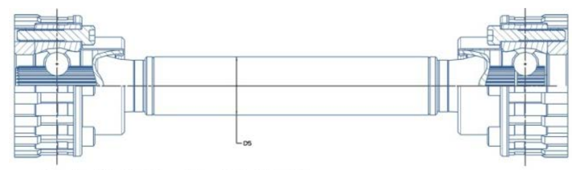
The maximum operating angle of a CON-VEL^{R} Constant Velocity Disc Joint is 18°; however, in certain applications larger angles can be accomodated. Please contact CON-VEL^{R} with your requirements.

CON-VEL® offers Constant Velocity Disc Joint Driveshaft assemblies in three configurations to meet a variety of operational considerations. Each self-supporting CON-VEL® Disc Joint permits angular displacements up to 18°*, allowing a considerable amount of parallel offset between driving and driven equipment.



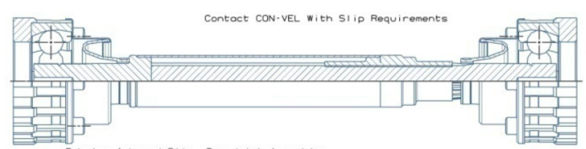
Solid Shaft, Two-Joint Assembly

Solid-Shaft Design-- Transmits power from one CON-VEL® Disc Joint to another through a solid steel driveshaft. A slip spline at one end of the driveshaft provides length compenation for installation, removal, and operational considerations.



Tubular Shaft Slip, Two-Joint Assembly

Tubular-Shaft Design-- Transmits power from one CON-VEL® Disc Joint to another through a tubular steel driveshaft. A slip spline at one end of the driveshaft provides length copmensation for installation, removal, and operational considerations. A driveshaft constructed of steel tubing can be designed to operate at rotational speeds much higher than those of a solid steel driveshaft.

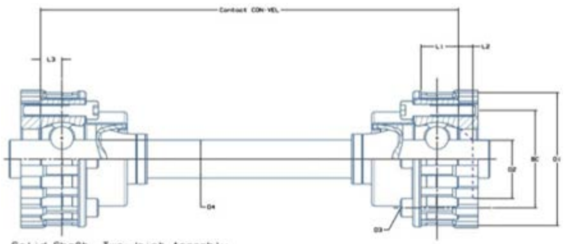


Tubular Inboard Slip, Two-Joint Assembly

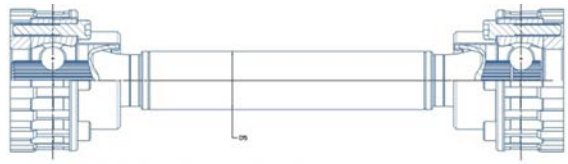
Mid-Slip Design-- Transmits power from one CON-VEL® Disc Joint to another through a driveshaft consisting of a pair of coaxial shafts with a spline interface for length compensation. A mid-slip spline design is used in applications where a considerable amount of length adjustment is required.

*Contact CON-VEL® for operating angles greater than 18°.

CON-VEL^R Disc Joint Dimensions



Solid Shaft, Two-Joint Assembly



Tubular Shaft Slip, Two-Joint Assembly

TABLE C

CON-VEL Disc Joint Size	Disc Diameter & Length				Number Of External Splines	Face To Centerline Of Joint		Bolt Pattern, Size & Number (2)				
	D1		L1			L3		BC		D3		Number
	in	mm	in	mm		in	mm	in	mm	in	mm	
R	3.56	90.5	1.13	28.7	18	0.56	14.3	3.031	76.99	0.34	8.7	6
B	4.25	106.0	1.44	36.6	18	0.72	18.3	3.563	90.49	0.41	10.3	6
B	4.25	106.0	1.44	36.6	[1]	0.72	18.3	3.563	90.49	0.41	10.3	6
C	4.75	120.7	1.53	38.9	18	0.77	19.4	3.938	100.01	0.47	11.9	6
C	4.75	120.7	1.53	38.9	[1]	0.77	19.4	3.938	100.01	0.47	11.9	6
E	6.63	142.9	1.91	45.5	18	0.95	24.2	4.703	119.46	0.56	14.3	6
G	6.50	165.1	2.00	50.8	18	1.00	25.4	5.500	139.70	0.56	14.3	6
J	7.50	190.5	2.31	58.7	18	1.16	29.4	6.250	158.75	0.56	14.3	6
L	8.38	212.7	2.50	63.5	18	1.25	31.8	7.125	180.98	0.56	14.3	6
N	9.00	228.6	2.88	73.2	18	1.44	36.5	7.750	196.85	0.69	17.5	6
P	10.50	266.7	3.00	76.2	24	1.50	38.1	8.875	225.43	0.69	17.5	6

TABLE D

CON-VEL Disc Joint Size	Clearance In Adapter (3)				Solid Shaft (4) Diameter		Tubular Shaft (4) OD x Thickness	CON-VEL Disc Joint Size
	D2		L2		D4		D5	
	in	mm	in	mm	in	mm	in	
R	2.47	62.70	0.50	12.7	1.31	33.3	2.00 x 0.125	R
B	2.81	71.40	0.50	12.7	1.31	33.3	2.25 x 0.188	B
C	3.01	76.50	0.59	15.1	1.50	36.1	2.25 x 0.188	C
E	3.75	95.30	0.59	15.1	1.69	42.9	3.00 x 0.250	E
G	4.31	109.50	1.00	25.4	1.88	47.8	3.00 x 0.250	G
J	5.00	127.00	0.91	23.0	2.13	54.1	3.75 x 0.438	J
L	5.00	127.00	1.25	31.8	2.53	64.3	3.75 x 0.438	L
N	6.25	158.80	1.13	28.6	2.75	69.9	5.00 x 0.500	N
P	7.00	177.80	1.75	44.5	3.36	85.7	5.00 x 0.500	P

Notes:
1) Turned, no splines.
2) Six holes equally spaced.
3) Clearance requirred to accommodate angular displacement of joint.
4) Steel seamless tubing DOM.

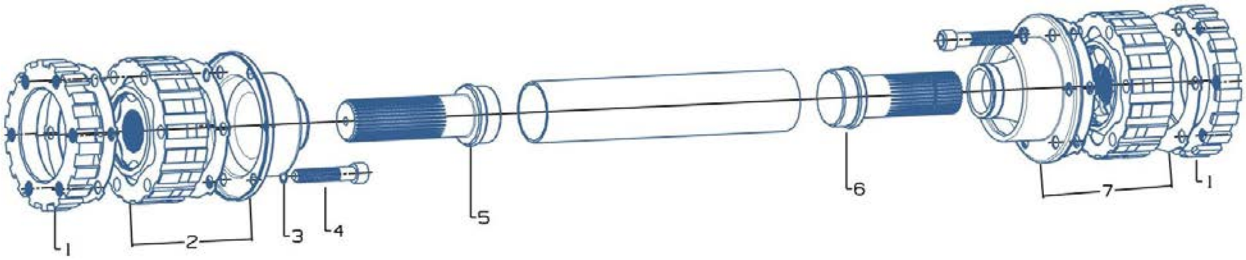


TABLE E

CON-VEL Disc Joint Size	Adapter Ring*	Disc Assembly With		Lockwasher	Cap Screw	Slip Stub Shaft	CON-VEL Disc Joint Size
		Elastomeric Seal**	Mechanical Seal**				
	1	2	2	3	4	5	
R	R2-101-11	R950573	--	500357-10	500397-16	R2-52-191-4	R
B	B2-101-21	B950058	--	500357-11	500196-20	B2-52-171-1	B
C	C3-101-41	C950531	--	500357-12	500399-22	C3-52-201-2	C
E	E3-101-31	E950417	E951499	500357-13	500100-26	E3-52-81-2	E
G	G4-101-11	G950197	G950359	500357-14	500400-26	G4-52-221-5	G
J	J4-101-21	J950125	J951022	500357-15	500400-29	J4-52-251-1	J
L	L5-101-11	L950035	L950606	500357-16	990043-1	L5-52-211-3	L
N	N6-101-11	N950053	N951064	500357-17	500402-27	N6-52-121-1	N
P	P7-101-11	P950021	P951204	500357-18	990055-1	P7-52-21-3	P

*** Adapter Rings--** Available with a variety of hubs, bores and keyways.
**** Seals--** Special seals are available upon request.

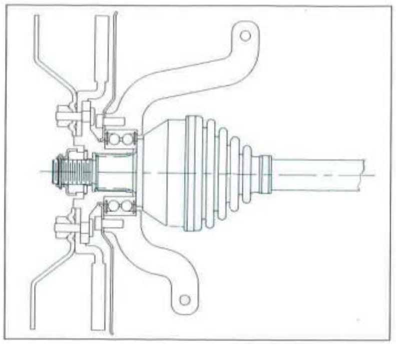
TABLE F

CON-VEL Disc Joint Size	Tubing Size***	Locking Stub Shaft	Disc Assembly With		Adapter Ring	CON-VEL Disc Joint Size
			Elastomeric Seal	Mechanical Seal		
	in	6	7	7	1	
R	2.00 x 0.125	R2-52-41	R950572	--	R2-101-11	R
B	2.25 x 0.188	B2-52-161	B950057	--	B2-101-21	B
C	2.25 x 0.188	C3-52-191	C950530	--	C3-101-41	C
E	3.00 x 0.250	E3-52-91	E950418	E951498	E3-101-31	E
G	3.00 x 0.250	G4-52-581	G950196	G950359	G4-101-11	G
J	3.75 x 0.438	J5-52-241	J950137	J951024	J4-101-21	J
L	3.75 x 0.438	L5-52-201	L950034	L950605	L5-101-11	L
N	5.00 x 0.500	N6-52-131	N950052	N951065	N6-101-11	N
P	5.00 x 0.500	P7-52-41	P950020	P951203	P7-101-11	P

**** Tubing Size**-- CON-VEL^R provides steel seamless tubing DOM as standard.

Advantages Of Bell Type Joints:

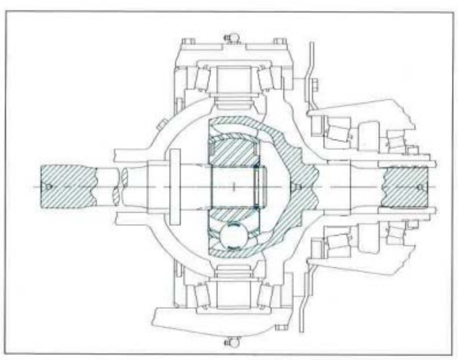
- Low maintenance
- Compact design
- Low vibration generation
- High angle capability
- Improved tire life



In open wheel drives, CON-VEL^R Bell Joints are equipped with elastomeric seals, or boots, which protect the Joints from environmental contamination while retaining the lubrication.

CON-VEL^R Bell-Type Constant Velocity Joints will perform in either open or enclosed wheel drives.

Enclosed steering axles provide CON-VEL^R Bell Joints with a continuous supply of lubrication and protection from contamination without requiring any additional sealing devices.



Selecting A CON-VEL^R Bell Joint For A Wheel Drive

In order to select the proper CON-VEL^R Bell Joint for an application, the following information is required:

1) The maximum weight on the steering axle.
2) The rolling radius of the loaded wheel.

Example

A 4X4 utility vehicle with a gross weight of 16,000 lbs has 6,000 lbs on the front axle. Steering angle is 25°, and the rolling radius of each wheel is 20 inches.

Procedure

1) Calculate the weight on each steerable wheel:

$$W_w = \frac{Total\ Weight\ On\ Steering\ Axle}{2}$$

$$= \frac{6{,}000}{2} = 3{,}000\ lb$$

2) Identify the Rolling Radius of the steerable wheel.

$$R_r\ is\ given = 20\ in$$

3) Calculate the Wheel Slip Torque at the steerable wheel.

$$T_{ws} = \frac{W_w \times R_r}{12} = \frac{3{,}000 \times 20}{12} = 5{,}000\ lb - ft$$

Select the smallest CON-VEL^R Bell Joint Size (Table G) which will effectively carry the Wheel Slip Torque.

Size G with a Short Duration Torque Capacity of 5,250 lb-ft is the correct selection.

Note: For 4×4 or 6×6 highway trucks with auxilary front drive, select a Bell Joint size using Short Duration Torque in Table G. For off-highway trucks, road machinery, tractors, and vehicles without inter-axle differentials, apply a service factor of 1.2 to 2.0, depending on vehicle design and use, to the Wheel Slip Torque before selecting a Bell Joint size from Table G, Short Duration Torque Capacity.

TABLE G

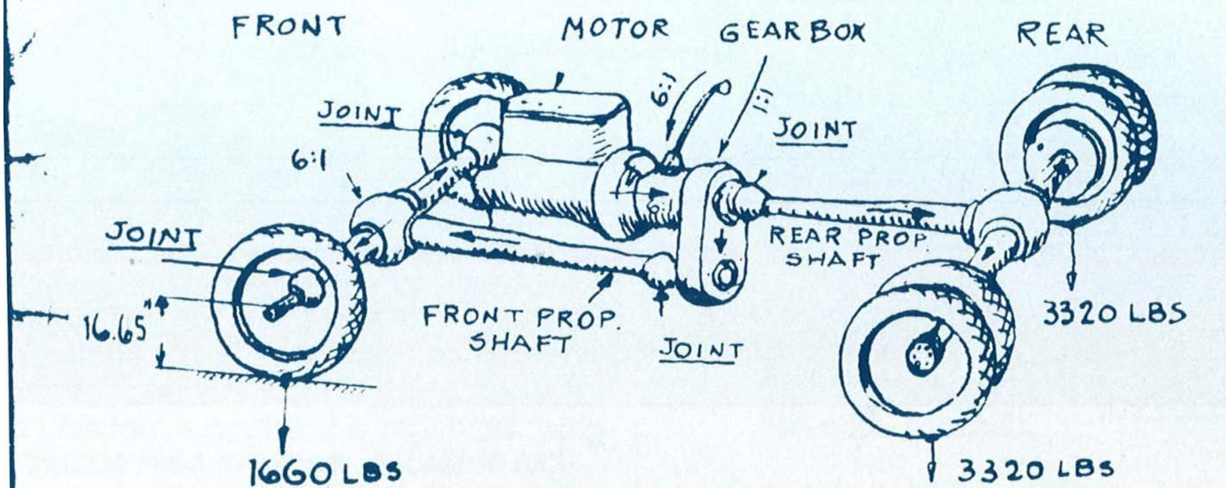
CON-VEL Bell Joint Size	Rating hp/100 rpm	CON-VEL Torque Capacities						Rating kW/rpm	CON-VEL Bell Joint Size
		Continuous		Short Duration		Maximum Static			
		lb-ft	kNm	lb-ft	kNm	lb-ft	kNm		
R	3.22	169	0.23	845	1.15	1099	1.50	0.024	R
C	6.90	363	0.49	1815	2.45	2360	3.19	0.051	C
D	9.29	488	0.66	2440	3.30	3172	4.29	0.089	D
E	12.60	663	0.90	3315	4.50	4310	5.85	0.094	E
G	20.00	1050	1.42	5250	7.10	6825	9.23	0.149	G
J	30.80	1617	2.19	8085	11.00	10511	14.20	0.230	J
L	47.00	2467	3.34	12335	16.70	16036	21.70	0.351	L
N	60.00	3150	4.27	15750	21.40	20475	27.80	0.448	N
For applications requiring joints larger or smaller than the capacities listed above, contact CON-VEL Engineering.									

Continuous Torque Capacity-- The maximum torque a CON-VEL^{R} Bell Joint can transmit 24 hours per day, i.e., industrial rating.

Short Duration Torque Capacity-- The maximum oscillatory, or vibratory, torque that can be transmitted without fatiguing any part of a CON-VEL^{R} Bell Joint, i.e., wheel drive rating.

Maximum Static Torque Capacity—The maximum torque a CON-VEL^{R} Bell Joint assembly can transmit momentarily during start-up, shut-down, shock loads, and transient conditions without brinelling ot yielding any part, i.e., maximum shock load rating.

TYPICAL CALCULATION FOR UNIVERSAL JOINTS
4 WHEEL DRIVE



4 WHEEL DRIVE TRUCK.

① FRONT AXLE STEERING JOINTS – 35° MAX ANGLE –

a) WEIGHT ON WHEEL x ROLL. RAD. = 1660 × 16.65 = 27700 IN.LBS.

b) SELECT JOINT SIZE "C" (1¼") FROM CHART: CH-10

JOINT CAPACITY = 20000 – 30000 (IN LBS) AT 100% ADHESION

c) MAX JOINT TORQUE EXERTED FROM ENGINE IN LOW GEAR, ASSUMING POWER DISTRIBUTION OF 60% ON FRONT AND 40% ON REAR WHEELS WHEN SLIPPING.

$\frac{1}{2} \times 0.6 \times 2000 \times 36 = 21600$ IN LBS.

d) REQUIRED ADHESION ON FRONT WHEELS $\mu = \frac{21600}{27700} = 78\%$

e) SHAFT STRENGTH – ULTIMATE = 60000 IN LBS (CHART. CH-10)

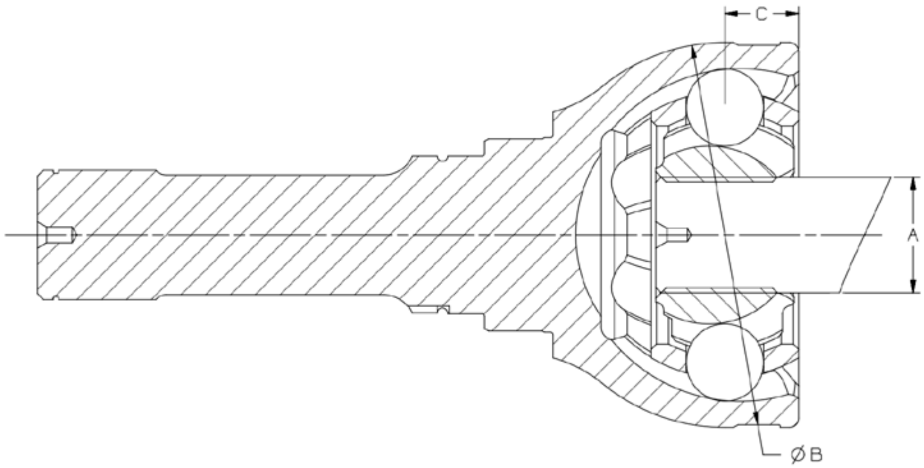
f) SAFETY FACTOR $S = \frac{60000}{21600} = 2.77$

g) SHAFT SECTION $d = 1.27''$ SECT. MODULUS $= 0.2d^3 = 0.408$

h) SHAFT STRESS AT 21600 INLBS $= \sigma = \frac{21600}{0.408} = 53000$ LBS/IN²

SCALE –		GEAR GRINDING MACH. CO. DETROIT, MICH.
DRAWN – AWR		
CHECKED –	UNIVERSAL JOINT CALC'N FOR 4 WHEEL DRIVE TRUCK	CH – 12
DATE – JUNE 1.39.		

Since our beginning in 1927, the Rzeppa Constant Velocity Joint has been solving problems for moblie equipment builders world wide. CON-VEL[R] wheel-drive bell joints deliver thoroughly proven, dependable power transmission. Careful selection of the highest quality materials, precision manufactured by experienced craftsmen, conscientious assembly; and rigid adherence to detail guarantee a reliable, quality product.



The maximum operating angle of CON-VEL[R] Constant Velocity Bell-Type Joints is 35°; however, in certain applications, larger angles can be accommodated.

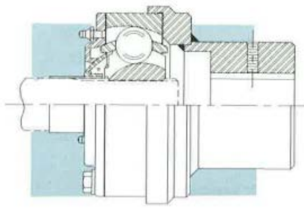
TABLE H

CON-VEL Joint Series	Nominal Shaft Diameter (A)		Nominal Swing Diameter (B)		Face To Centerline Of Joint (C)		CON-VEL Joint Series
	in	mm	in	mm	in	mm	
R	0.95	24.1	3.37	85.6	0.64	16.3	R
C	1.25	31.8	4.43	112.5	0.76	19.3	C
D	1.38	35.1	4.93	125.2	0.87	22.1	D
E	1.50	38.1	5.25	133.4	0.95	24.1	E
G	1.75	44.5	6.12	155.4	1.12	28.4	G
J	2.00	50.8	7.12	180.8	1.25	31.8	J
L	2.25	57.2	8.00	203.2	1.43	36.3	L
N	2.50	63.5	8.62	218.9	1.43	36.3	N

With long-life high angle capability and high power density, the CON-VEL[R] wheel drive joint offers greater performance than cardan designs. Contact CON-VEL[R] engineering with your specific requirements.

Lubrication Information

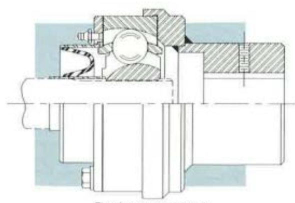
CON-VEL[R] joints are precision-built to provide long life and low maintenance. Therefore minimizing contamination, as well as proper lubrication, is important. A #1 or a #2 consistency high-grade E.P. lubricant is recommended.



Mechanical Seal

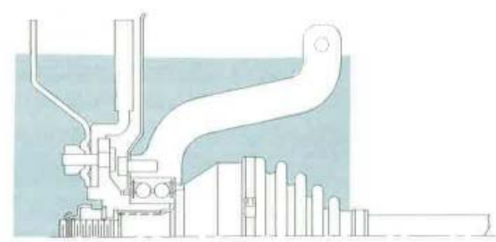
Lubrication periods will vary, and should be determined for each application. On inspection, if no loss is evident, relubrication should be minimal. However, in some applications, if lubricant is being lost, it may be necessary to relubricate more frequently.

While lubricant is added, it is important that joints not be filled to excess. Excessive lubricant will deform the flexible seal and shorten its life. Also, when adding lubricant, it is recommended that fingers be placed in the fold of the seal until pressure is felt.*

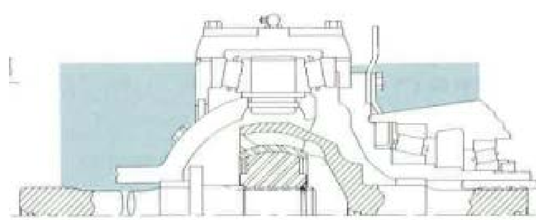


Elastrometric Seal

In the steering axles, lubrication for CON-VEL[R] Bell-Type Joints will be either grease for open wheel drives or oil for enclosed systems. Periodic inspection of the volume of lubricant and condition of the elastomeric seals in open wheel drives is necessary for proper Joint performance.



Open



Closed

* Disable all power sources (electrical, pneumatic, mechanical, etc.) before servicing equipment.