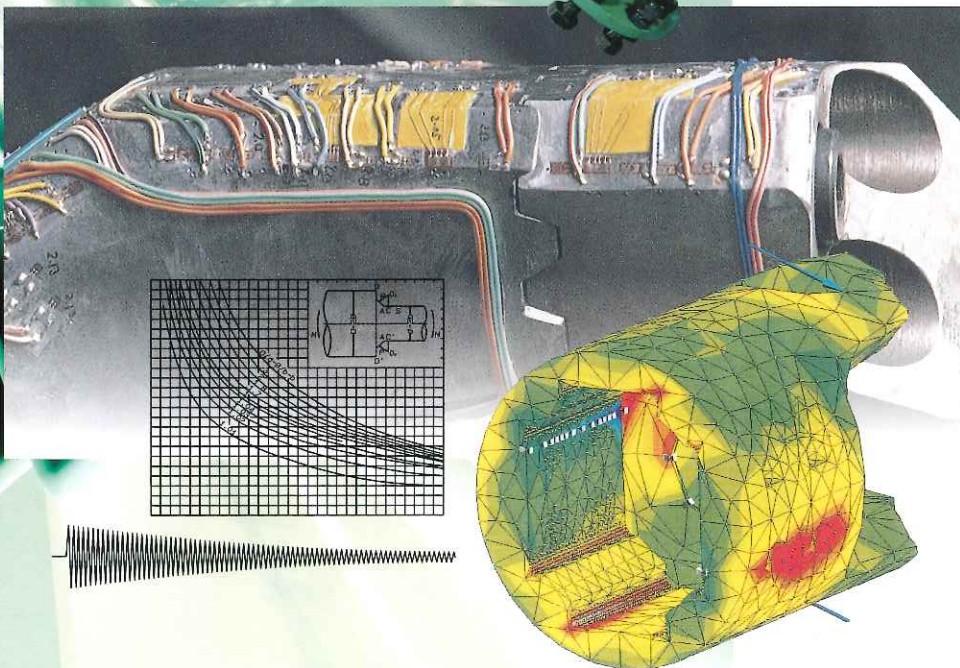


UNIVERSAL JOINTS SAFETY FIT



ClassNK



ISO 9001

CM 005

Universal Joints – 65-Year History

- 1949 Order received for universal joints in National Railways diesel locomotives
- 1952 Development of original design started Adoption of plain bearings
- 1953 Production of original design launched
- 1956 Adoption of roller bearings Adoption of involute spline
- 1976 Development of special carburizing steel for cross members
- 1980 Development of G Series, H Series
- 1981 Development of S Series
- 1983 Development of special NiCrMoV carburizing steel for cross members (in cooperation with a steel maker)
Presentation in the Iron and Steel Institute of Japan
- 1989 Introduction of 3-D FEM analyzer
- 1990 Development of serrated cap bolts
- 1994 Development of P Series (improved H Series)
- 1997 Development of A Series (renewed G series)
- 2000 R&D in heat treatment for cross materials
Presentation in the Iron and Steel Institute of Japan
Improvement of S Series bearing caps
- 2011 Drive shafts for rail vehicles won JSME Excellent Product Award
Development of split UJ
- 2013 Ferrography-based diagnosis of large UJ cross members started

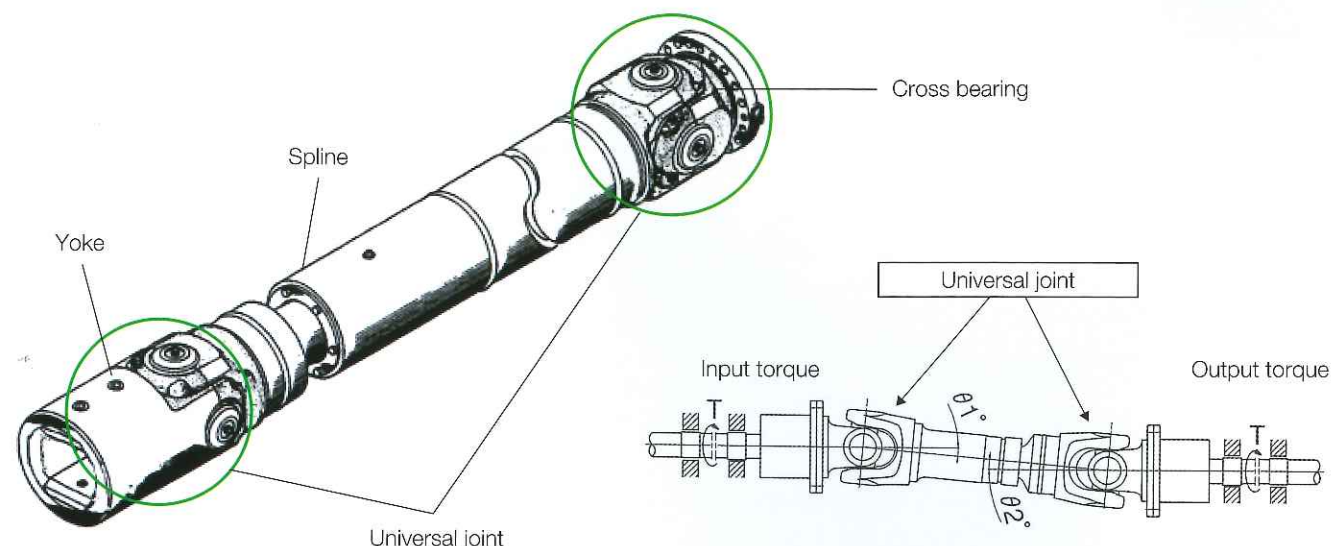


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Overview of NAJICO Universal Joints

NAJICO universal joints are couplings (devices) that transmit power between non-aligned shafts.



Technology to Transmit Rotation



NAJICO universal joints are used worldwide as a transmission gear in steel making equipment, rail vehicles, paper making machines, watercraft, etc. We also actively pursue cooperation with overseas enterprises. The distinguished craftsmanship ensures reliable products.

Powerful, smooth transmission

Technology to Support Quality



We are engaged in R&D using leading-edge technology and equipment in order to support quality of NAJICO products. We use solid data acquired through material tests, performance tests, and endurance strength tests of universal joints, as well as through various simulations to meet specific needs, to provide reliability via product development.

World-class leading-edge technology

NAJICO Universal Joints Spreading Across the Globe



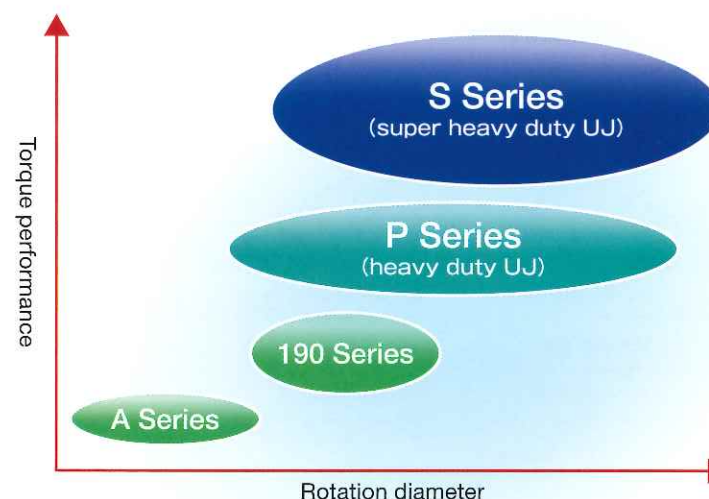
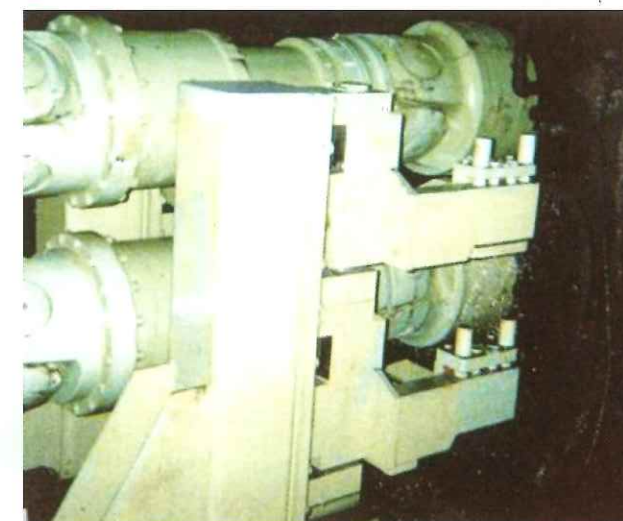
NAJICO universal joints are used in 34 countries and regions (as of August 2015)

Lineup and Main Application Examples of NAJICO Universal Joints

Rail vehicle



Iron works



Gondola lift



Marine propeller shaft



Integrated Type

A series

1 Cross	6 Spline shaft
2 Bearings	7 Weld yoke
3 Flange yoke	8 Tube
4 Snap ring	9 Packing
5 Sleeve yoke	10 Dust cap

Cap Split Type

190series | P series | S series

1 Cross	6 Bearings cap
2 Bearings	7 Weld yoke
3 Flange yoke	8 Tube
4 Spline shaft	9 Capbolt
5 Spline sleeve	10 Packing

Series			A Series	190 Series	P Series	S Series
			Light load, High revolution, High angle use	Medium load, High revolution, Medium angle use	Heavy use, Medium revolution, Medium angle use	Heavy load, Low revolution use, Low angle use
The relevant page			P.6~8	P.9~10	P.11~13	P.14
Joint swing diameter			100~180mm	225~350mm	180~1200mm	315~1200mm
Maximum torque range			2.3~12kNm	16.7~80kNm	29~8660kNm	205~12000kNm
Max. angle			25°	15°	10°	3°
Features	Structure	Yoke	Flange type	○	○	○
			Welding type	○	○	○
		Bearings	High sealability, high durability	○	○	○
		Spline	High-precision rotation transmission (involute spline)	○	○	○
		Flange key	Large torque transmission		○	○
Main applications	Steel making machines		○	○	○	○
	Industrial machinery		○	○	○	
	Paper making machines		○	○		
	Rail vehicle		○	○		
	Shipping		○	○		
	Carrier machines		○			
	Printing machines		○			
	Other general machinery		○	○	○	

5 basic models of Universal Joints

1 Flexible stretch Spline Type 0.01

2 Fixed Spline Type 0.03

3 Flexible stretch Spline with Shortened form Type 9.01, 9.02, 9.03

4 Fixed Spline with Double Flange Type 9.04

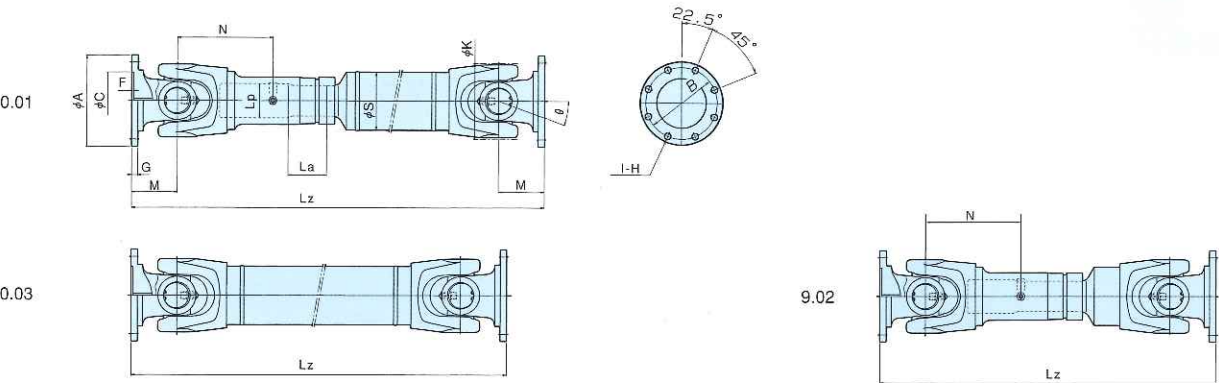
5 Fixed Spline with Single Flange Type 7.02

Options of Universal Joints

Structure	Options	Effect	A Series	190 Series	P Series	S Series
Combined methods of the spindle	Flange key	Reinforcement of combined part	○	○	○	We can propose options that meets your requirement.
	Combination by intermediate plate	Option of combination method	○	○	○	
	Combination by face gear	Option of combination method			○	
	Combination by End York Spindle	Integrated combination		○	○	
	Coupling	One touch Coupling	○	○	○	
		Quick disconnect	○	○	○	
Cross	Cross with 4-points lubrication	Improvement for greasing	○	○	○	
Spline	Cover	Effect on the dust-proof	○	○	○	
	Cover	Performance Improvement by coating	○	○	○	

Universal Joints (UJ) — A Series

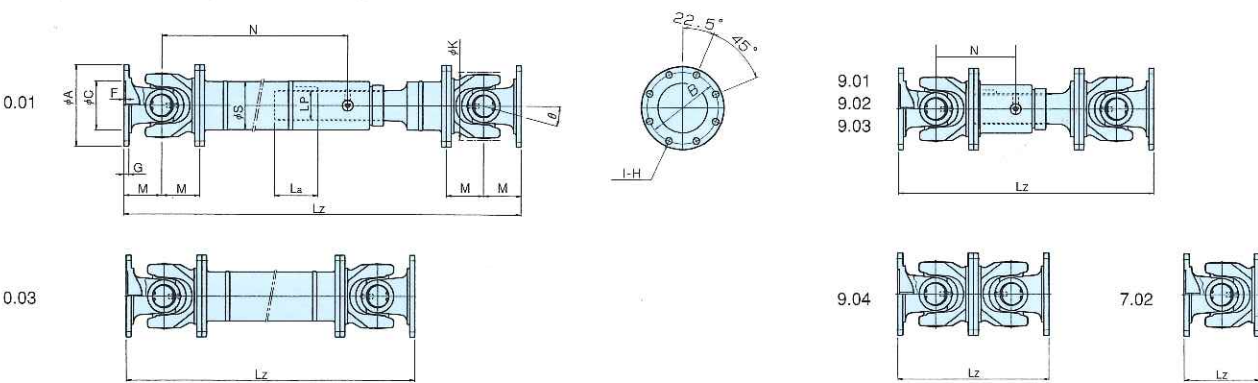
Basic types A-T



Size				A100T	A125T	A160T	A180T
Joint swing diameter		K	mm	100	125	160	180
Max. transmission torque		Ty	Nm	2300	3900	7800	12300
Fatigue limit torque		Tw	Nm	1600	2800	5600	8400
2RC value		2RC	Nm	1900	3500	6600	9100
Max. joint angle		θ	°	25	25	25	25
Principal Dimensions	0.01	Lzmin	mm	560	638	684	756
		La	mm	45	50	55	60
		N	mm	125	142.5	172.5	192.5
	0.03	Lzmin	mm	350	388	484	526
		La	mm	0	0	0	0
		N	mm	125	142.5	172.5	192.5
	9.02	Lzmin	mm	530	608	624	676
		La	mm	45	50	75	100
		N	mm	125	142.5	172.5	192.5
		Lzmin	mm	480	548	559	616
		La	mm	60	70	85	80
		N	mm	125	142.5	165	182.5
		Lzmin	mm	410	468	524	576
		La	mm	75	90	45	50
		N	mm	125	142.5	147.5	165
	Principal Dimensions	Lzmin	mm	370	418		
		La	mm	35	40		
		N	mm	105	117.5		
		A	mm	120	150	180	225
		B	mm	101.5±0.1	130±0.1	155.5±0.1	196±0.1
		C	mm	75H7	90H7	110H7	140H7
		F	mm	2.5	3	3	5
		G	mm	8	9	12	15
		I-H	pcs.mm	8-10C12	8-12C12	8-14C12	8-16C12
Principal Dimensions	0.01	Lp	mm	45	56	75	84
		M	mm	60	69	87	98
		S	mm	76.2	88.9	114.3	130
	0.03	m	kg	11.1	19.1	40.2	59
		mt	kg	7.8	11.7	18.3	24
		J	kgm ²	0.0141	0.0361	0.121	0.239
	9.02	Jt	kgm ²	0.0101	0.0203	0.053	0.090
		Kp	kNm/rad	52.3	111	252	378
		Kpt	kNm/rad	104	210	548	932
	0.01	m	kg	8.1	13.1	27.2	40
		J	kgm ²	0.0121	0.0321	0.104	0.208
		Kp	kNm/rad	67.5	141	304	455
Principal Dimensions	0.03	m	kg	12.2	21.2	40.7	57.9
		J	kgm ²	0.0132	0.0356	0.116	0.228
		Kp	kNm/rad	45	95	261	375
	9.02	m	kg	11.7	20.3	37.5	54
		J	kgm ²	0.0131	0.0353	0.112	0.221
		Kp	kNm/rad	49	103	274	405
	0.01	m	kg	11.3	18.4	35.2	50.9
		J	kgm ²	0.0127	0.0341	0.11	0.216
		Kp	kNm/rad	54	113	298	430
	9.02	m	kg	9.7	16.8		
		J	kgm ²	0.0121	0.033		
		Kp	kNm/rad	62	132		

Universal Joints (UJ) — A Series

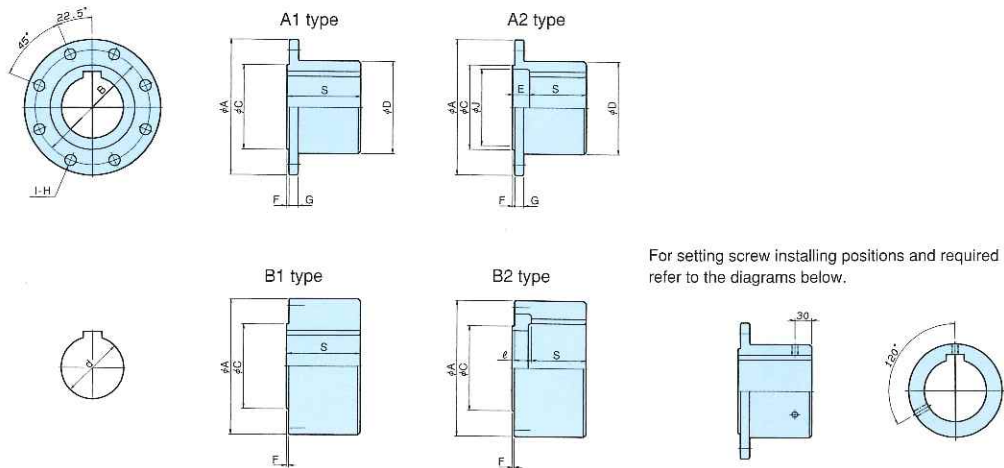
Flange connection type A-R (Single Joint)



Size				A100R	A125R	A160R	A180R
Joint swing diameter		K	mm	100	125	160	180
Max. transmission torque		Ty	Nm	2300	3900	7800	12300
Fatigue limit torque		Tw	Nm	1600	2800	5600	8400
2RC value		2RC	Nm	1900	3500	6600	9100
Max. joint angle		θ	°	25	25	25	25
Principal Dimensions	0.01	Lzmin	mm	570	670	810	900
		La	mm	80	80	80	80
		N	mm	245	281	335	362
	0.03	Lzmin	mm	380	430	530	590
		La	mm	0	0	0	0
		N	mm	185	221	275	302
	9.01	Lz	mm	510	610	750	840
		La	mm	80	80	80	80
		N	mm	185	221	275	302
	9.02	Lz	mm	450	520	635	720
		La	mm	80	95	110	115
		N	mm	165	191	244.5	262
Principal Dimensions	9.03	Lz	mm	400	470	570	665
		La	mm	40	45	50	60
		N	mm	130	151	182.5	207
	9.04	Lz	mm	240	276	348	392
		La	mm	0	0	0	0
		N	mm	120	138	174	196
	7.02	Lz	mm	120	138	174	196
		La	mm	0	0	0	0
		N	mm	120	150	180	225
	Principal Dimensions	A	mm	120	150	180	225
		B	mm	101.5±0.1	130±0.1	155.5±0.1	196±0.1
		C	mm	75H7	90H7	110H7	140H7
Principal Dimensions	0.01	F	mm	2.5	3	3	5
		G	mm	8	9	12	15
		I-H	pcs.mm	8-10C12	8-12C12	8-14C12	8-16C12
	0.03	Lp	mm	45	56	75	84
		M	mm	60	69	87	98
		S	mm	76.2	88.9	114.3	130
	9.01	m	kg	18	31	60	93
		mt	kg	7.8	11.7	18.3	24
		J	kgm ²	0.0181	0.0481	0.150	0.340
	9.02	Jt	kgm ²	0.0101	0.0203	0.053	0.090
		Kp	kNm/rad	53	109	241	353
		Kpt	kNm/rad	104	210	548	932
Principal Dimensions	0.03	m	kg	12	21	41	66
		J	kgm ²	0.0141	0.0391	0.120	0.280
		Kp	kNm/rad	59	124	269	393
	9.01	m	kg	17	30	59	91
		J	kgm ²	0.0170	0.0460	0.140	0.330
		Kp	kNm/rad	55	112	247	359
	9.02	m	kg	16	27	53	82
		J	kgm ²	0.0160	0.0430	0.130	0.300
		Kp	kNm/rad	55	114	252	364
	9.03	m	kg	14	25	49	78
		J	kgm ²	0.0150	0.0410	0.120	0.290
		Kp	kNm/rad	56	116	257	369
Principal Dimensions	9.04	m	kg	10	16	32	52
		J	kgm ²	0.0106	0.0280	0.0860	0.200
		Kp	kNm/rad	63	133	286	413
	7.02	m	kg	5	8	16	26
		J	kgm ²	0.0050	0.0140	0.0430	0.100
		Kp	kNm/rad	126	266	571	827

●Lz for Types 0.01 and 9.01 through 9.03 shows a length when the spline is collapsed.
●W, J and Kp are obtained with corresponding Lz.
W : Weight, Wt : Weight of a 1,000 mm-long tube, J : Mass moment of inertia of 1,000 mm-long tube, Jt : Mass moment of inertia of 1,000 mm-long tube, Kpt : Torsional rigidity of 1000 mm Length tube, Kp : Torsional rigidity
※All specifications and design characteristics are subject to change without notice.

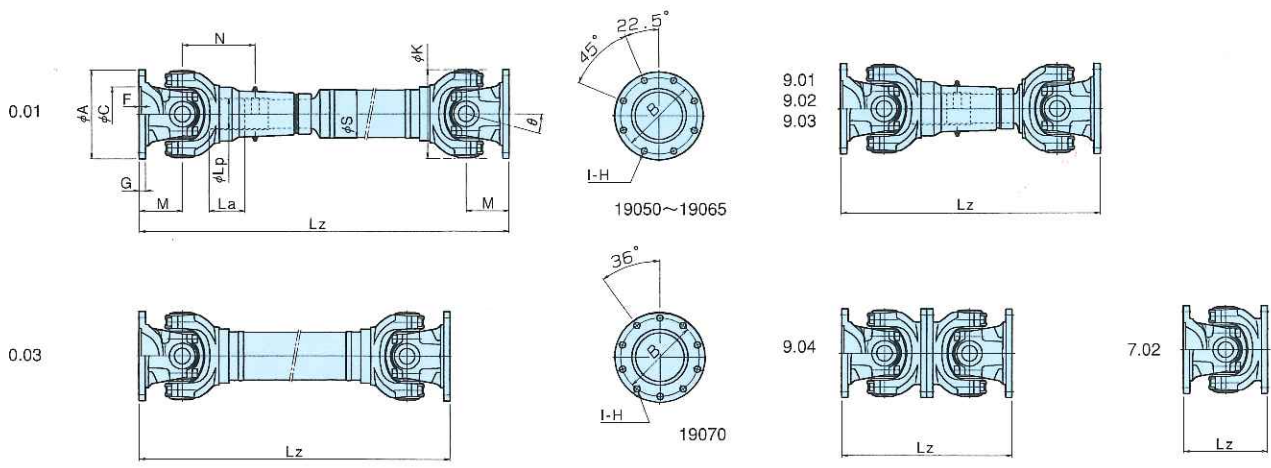
Companion Flanges (CF) — Series for A-T, A-R



Size		A100	A125	A160	A180
Flange O.D.	A mm	120	150	180	225
Bolt hole pitch circle diameter	B mm	101.5±0.1	130±0.1	155.5±0.1	196±0.1
Pilot diameter	C mm	75h7	90h7	110h7	140h7
Pilot dia height	F mm	2	2	2	4
Flange thickness	G mm	8	9	12	15
Bolt hole diameter	I-H mm	8-10C12	8-12C12	8-14C12	8-16C12
Boss O.D. D mm	type A1, A2	82	108	130	160
	type B1, B2	120	150	180	225
Boss MAX I.D. d max mm	type A1, A2	55	70	85	105
	type B1	70	85	105	135
	type B2	80	100	120	150
Boss prepared hole diameter	dmin mm	25	30	40	50
Length of engagement	Smax mm	65	85	100	125
Recess length	ℓ mm	9	10	13	16
Counterbore diameter	J mm	65	80	100	130
Flange bolt dbxmm	Strngth class	10.9	10.9	10.9	10.9
	type A1, A2	M10×30	M12×35	M14×40	M16×50
	type B1, B2	M10×20	M12×25	M14×30	M16×35
Tightening torque [machine oil coating]	Nm	73	127	196	304
	(kgfm)	(7.4)	(13)	(20)	(31)
Setting screw	ds mm	M8	M8	M12	M12

●When preparing mounting bolts at user side, please use Hexagon head bolts grade Finished or Semi-finished with 10.9 tensile strength rank prescribed by JIS B1180 annex JA, and install the whirl stop. And also, About mounting nuts, please use self lock nuts or Hexagon head bolts Grade Finished or Semi-finished with 8 tensile strength rank prescribed by JIS B1181 annex JA, and install the whirl stop. About tightening torque, please refer to the table above.

Universal Joints (UJ)—190 Series

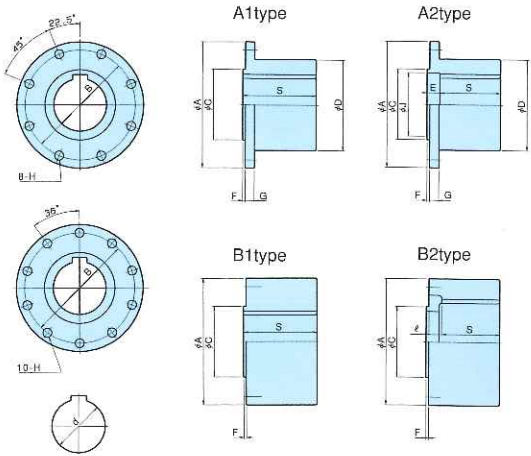


Size		19050	19055	19060	19065	19070
Joint swing diameter	K	225	250	285	315	350
Max. transmission torque	Ty	16700	24300	32900	49500	80400
Fatigue limit torque	Tw	9500	16900	19900	34500	55800
2RC value	2RC	17000	23700	34600	48700	67800
Max. joint angle	θ	15	15	15	15	15
Principal Dimensions	0.01	Lz	800	965	1050	1250
	0.03	La	75	90	100	120
		N	183	235	245	285
	9.01	Lz	635	750	810	910
		La	0	0	0	0
	9.02	Lz	600	780	795	950
		La	45	50	60	70
	9.03	Lz	550	710	735	880
		La	40	40	60	85
	9.04	Lz	432	520	540	600
		La	0	0	0	0
	7.02	Lz	216	260	270	300
Principal Dimensions	Principal Dimensions	A	225	250	285	315
		B	196±0.1	218±0.1	245±0.1	280±0.1
		C	140H7	140H7	175H7	175H7
		F	5	6	7	8
		G	15	18	20	22
		I-H	8-16C12	8-18C12	8-20C12	8-22C12
		Lp	80	102	102	130
		M	108	130	135	150
		S	121	152.4	165.2	216.3
		m	80	133	174	278
		mt	30	35	45	70
		J	0.360	0.780	1.370	2.300
Principal Dimensions	Principal Dimensions	Jt	0.091	0.180	0.270	0.720
		Kp	562	876	1180	1820
		Kpt	922	1810	2707	7261
	0.03	m	62	97	135	196
		J	0.280	0.610	1.050	1.680
	9.01	Kp	708	1130	1530	2500
		m	74	124	168	245
	9.02	J	0.350	0.760	1.280	2.100
		Kp	637	929	1200	2100
	9.03	m	71	118	156	230
		J	0.340	0.750	1.260	2.090
	9.04	Kp	667	981	1310	2240
Principal Dimensions	Principal Dimensions	m	71	115	155	224
		J	0.340	0.700	1.180	2.090
		Kp	749	1080	1470	2298
	7.02	m	64	96	130	191
		J	0.481	0.894	1.213	2.640
		Kp	1174	1413	2298	3125
		m	32	48	65	96
		J	0.241	0.894	0.608	1.320
		Kp	2348	2825	4595	6251

●Lz for Types 0.01 and 9.01 through 9.03 shows a length when the spline is collapsed.
●W, J and Kp are obtained with corresponding Lz.
W: Weight, Wt: Weight of a 1,000mm-long tube, J: Mass moment of inertia of a 1,000mm-long tube, Jt: Torsional rigidity of 1000mm Length tube, Kp: Torsional rigidity

※All specifications and design characteristics are subject to change without notice.

Companion Flanges (CF)—190 Series

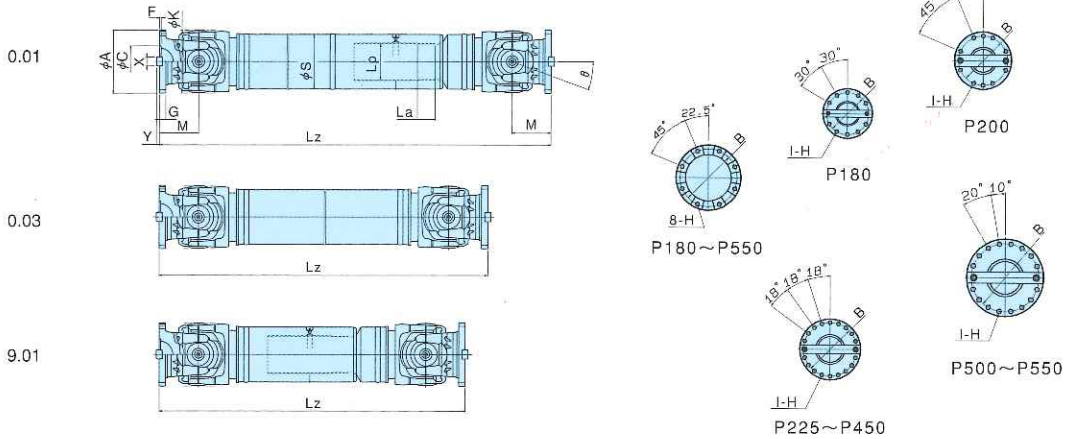


Size		19050	19055	19060	19065	19070
Flange O.D.	A mm	225	250	285	315	350
Bolt hole pitch circle diameter	B mm	196±0.1	218±0.1	245±0.1	280±0.1	310±0.1
Pilot diameter	C mm	140h7	140h7	175h7	175h7	220h7
Pilot dia height	F mm	4	5	5	5	5
Flange thickness	G mm	15	18	20	22	25
Bolt hole diameter	I-H mm	8-16C12	8-18C12	8-20C12	8-22C12	10-22C12
Boss O.D. D mm	type A1、A2	160	180	200	225	240
	type B1、B2	225	250	285	315	350
Boss MAX I.D. d max mm	type A1、A2	105	120	130	150	160
	type B1	135	135	170	170	215
	type B2	150	165	190	210	230
Boss prepared hole diameter	dmin mm	80	90	100	115	120
Length of engagement	Smax mm	125	145	155	180	190
Recess length	ℓ mm	20	23	25	27	30
Counterbore diameter	J mm	130	130	165	165	210
Flange bolt db×ℓ mm	Strngth class	10.9	10.9	10.9	10.9	10.9
	type A1、A2	M16×55	M18×65	M20×70	M22×75	M22×80
	type B1、B2	M16×35	M18×45	M20×50	M22×50	M22×55
Tightening torque [machine oil coating]	Nm	304	412	579	775	775
	(kgfm)	(31)	(42)	(59)	(79)	(79)
Setting screw	ds mm	M12	M12	M12	M16	M16

●When preparing mounting bolts at user side, please use Hexagon head bolts grade Finished or Semi-finished with 10.9 tensile strength rank prescribed by JIS B1180 annex JA, and install the whirl stop. And also, About mounting nuts, please use self lock nuts or Hexagon head bolts Grade Finished or Semi-finished with 8 tensile strength rank prescribed by JIS B1181 annex JA, and install the whirl stop. About tightening torque, please refer to the table above.

Universal Joints (UJ)—P Series

Basic type P-T

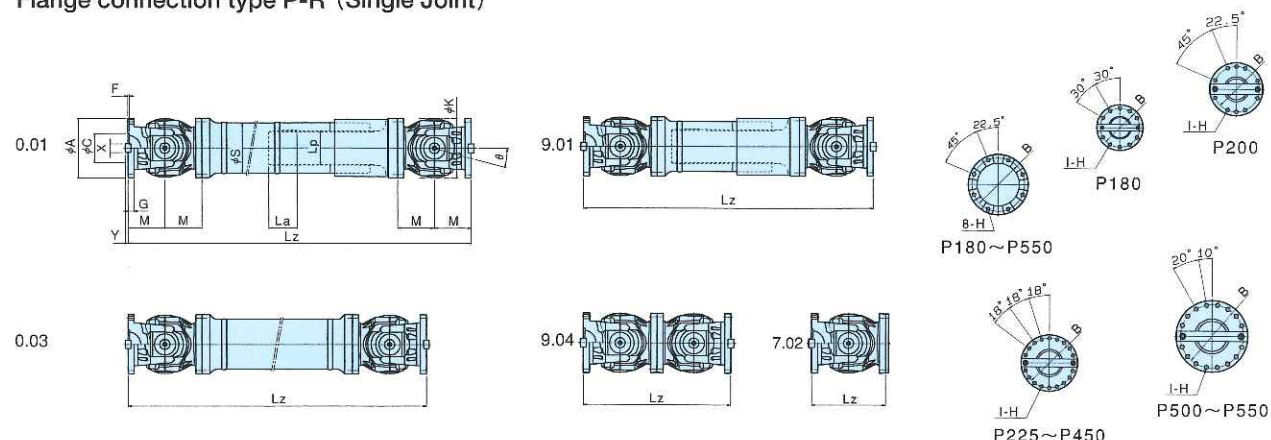


Size		P180T	P200T	P225T	P250T	P280T	P315T	P355T	P400T	P450T	P500T	P550T
Joint swing diameter	K mm	180	200	225	250	280	315	355	400	450	500	550
Max. transmission torque	Ty kNm	29	46	63	83	126	173	258	359	508	672	948
Fatigue limit torque	Tw kNm	20	25	42	57	86	118	175	243	338	454	619
2RC value	2RC kNm	12.9	16.3	25.3	34.6	48.2	68.4	96.0	134	182	252	322
Max. joint angle	θ °	10	10	10	10	10	10	10	10	10	10	10
Principal Dimensions	0.01	Lz mm	965	1115	1190	1305	1480	1630	1825			
		La mm	50	60	65	70	75	85	95			
		Lp mm	580	660	710	785	890	990	1120			
	0.03	Lz mm	0	0	0	0	0	0	0			
		La mm	0	0	0	0	0	0	0			
		Lp mm	0	0	0	0	0	0	0			
	9.01	Lz mm	885	1025	1100	1210	1350	1500	1675			
		La mm	50	60	65	70	75	85	95			
		Lp mm	580	660	710	785	890	990	1120			
	Principal Dimensions	A mm	180	200	225	250	280	315	355			
		B mm	154	172	199	222	248	280	317			
		C mm	90H8	95H8	110H8	125H8	140H8	155H8	175H8			
		F mm	5	5	6	6	7	7	8			
		G mm	19	20	23	25	28	32	36			
		I-H pcs.mm	10-16	10-16	18-16	18-18	18-20	18-22	18-24			
		Lp mm	102	120	130	150	170	190	210			
		M mm	115	135	140	155	170	195	220			
		S mm	152.4	177.8	190.7	216.3	241.8	267.4	298.5			
		X mm	26	40	32	36	42	48	54			
		Y mm	9	10	11	12	14	16	18			
Principal Dimensions	0.01	m kg	111	171	217	300	424	576	814			
		mt kg	60	71	84	118	134	150	200			
		J kgm/rad	0.420	0.822	1.28	2.20	3.92	6.63	11.8			
	0.03	Jt kgm/rad	0.275	0.460	0.620	1.100	1.590	2.218	3.630			
		Kp kNm/rad	850	1160	1679	2391	3327	4688	6744			
		Kpt kNm/rad	2760	4640	6290	11100	16100	22380	36600			
	9.01	m kg	62	94	123	171	242	336	486			
		J kgm/rad	0.270	0.495	0.815	1.40	2.49	4.35	7.89			
		Kp kNm/rad	1057	1406	2066	2877	3995	5640	8172			
	9.01	m kg	105	165	208	284	402	554	780			
		J kgm/rad	0.393	0.778	1.21	2.08	3.66	6.31	11.1			
		Kp kNm/rad	870	1186	1719	2440	3417	4816	6931			

※All specifications and design characteristics are subject to change without notice.

Universal Joints (UJ)—P Series

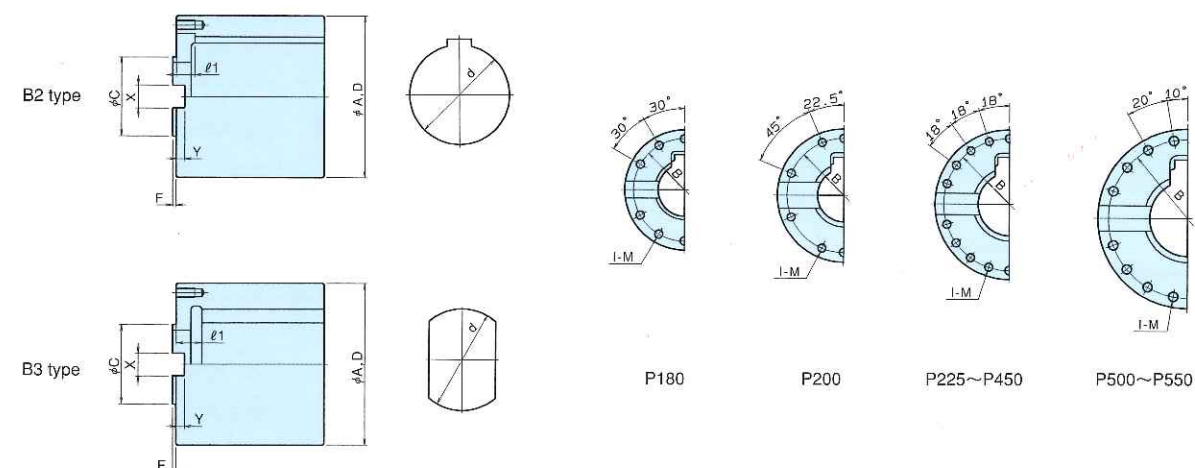
Flange connection type P-R (Single Joint)



Size				P180R	P200R	P225R	P250R	P280R	P315R	P355R	P400R	P450R	P500R	P550R
Joint swing diameter		K	mm	180	200	225	250	280	315	355	400	450	500	550
Max. transmission torque		Ty	kNm	29	46	63	83	126	173	258	359	508	672	948
Fatigue limit torque		Tw	kNm	20	25	42	57	86	118	175	243	338	454	619
2RC value		2RC	kNm	12.9	16.3	25.3	34.6	48.2	68.4	96.0	134	182	252	322
Max. joint angle		θ	°	10	10	10	10	10	10	10	10	10	10	10
Principal Dimensions	0.01	Lz	mm	1005	1145	1200	1330	1480	1630	1840	2100	2340	2565	2775
		La	mm	90	105	115	130	145	150	170	190	220	245	260
	0.03	Lz	mm	680	790	830	940	1030	1150	1300	1460	1640	1810	1960
		La	mm	0	0	0	0	0	0	0	0	0	0	0
	9.01	Lz	mm	925	1055	1100	1210	1350	1500	1690	1940	2160	2375	2575
		La	mm	90	105	115	130	145	150	170	190	220	245	260
	9.04	Lz	mm	460	540	560	620	680	780	880	1000	1120	1240	1360
		La	mm	0	0	0	0	0	0	0	0	0	0	0
	7.02	Lz	mm	230	270	280	310	340	390	440	500	560	620	680
		La	mm	0	0	0	0	0	0	0	0	0	0	0
Principal Dimensions		A	mm	180	200	225	250	280	315	355	400	450	500	550
		B	mm	154	172	199	222	248	280	317	358	402	446	492
		C	mm	90H8	95H8	110H8	125H8	140H8	155H8	175H8	200H8	225H8	250H8	275H8
		F	mm	5	5	6	6	7	7	8	8	10	11	
		G	mm	19	20	23	25	28	32	36	40	45	50	55
		I-H	pcs./mm	10-16	10-16	18-16	18-18	18-20	18-22	18-24	18-26	18-30	16-33	16-36
		Lp	mm	102	120	130	150	170	190	210	240	270	300	340
		M	mm	115	135	140	155	170	195	220	250	280	310	340
		S	mm	152.4	177.8	190.7	216.3	241.8	267.4	298.5	339.7	381	426	460
		X	mm	26	40	32	36	42	48	54	60	66	74	80
		Y	mm	9	10	11	12	14	16	18	20	22	25	27
0.01	m	kg	126	181	235	323	462	630	923	1360	1960	2620	3440	
	mt	kg	60	71	84	118	134	150	200	263	336	381	461	
	J	kgm ²	0.462	0.830	1.42	2.39	4.05	7.34	13.1	24.0	42.7	70.7	112	
	Jt	kgm ²	0.275	0.460	0.620	1.100	1.590	2.218	3.630	6.180	9.930	14.3	20.1	
	Kp	kNm/rad	879	1230	1720	2380	3390	4810	6860	9730	13700	26500	23800	
	Kpt	kNm/rad	2760	4640	6290	11100	16100	22380	36600	62500	100000	145000	203000	
0.03	m	kg	81	114	151	208	295	411	618	895	1320	1770	2330	
	J	kgm ²	0.342	0.570	1.02	1.68	2.80	5.32	9.75	17.3	32	52.9	83.9	
	Kp	kNm/rad	990	1350	1910	2620	3700	5230	7490	10700	15100	21600	28900	
9.01	m	kg	124	176	227	316	447	614	896	1320	1920	2580	3370	
	J	kgm ²	0.450	0.8	1.38	2.32	3.90	7.13	12.7	23.2	41.8	69.0	109	
	Kp	kNm/rad	889	1230	1740	2410	3440	4800	6970	9900	13900	16800	24300	
9.04	m	kg	60	80	110	144	214	298	454	664	1010	1330	1770	
	J	kgm ²	0.240	0.380	0.740	1.20	2.00	3.82	7.06	12.4	23.5	38.4	61.6	
	Kp	kNm/rad	1030	1400	2000	2230	3880	5500	7850	11100	15700	22700	30300	
7.02	m	kg	30	40	55	72	107	149	227	332	504	667	886	
	J	kgm ²	0.120	0.190	0.370	0.590	0.98	1.91	3.53	6.18	11.8	19.2	30.8	
	Kp	kNm/rad	2050	2810	4010	5450	7750	11000	15700	22200	31500	45300	60500	

● Lz for Types 0.01 and 9.01 shows a length when the spline is collapsed.
 ● W, J and Kp are obtained with corresponding Lz.
 W : Weight, WT : Weight of a 1,000mm—long tube, J : Mass moment of inertia of a 1000mm—long tube, Jt : Torsional rigidity of 1000mm Length tube, Kp : Torsional rigidity

Companion Flanges (CF)—P Series for P-T,P-R



Size			P180	P200	P225	P250	P280	P315
Flange O.D.	A mm		180	200	225	250	280	315
Bolt hole pitch circle diameter	B mm		154	172	199	222	248	280
Pilot diameter	C mm		90h8	95h8	110h8	125h8	140h8	155h8
Pilot dia height	F mm		4	4	5	5	6	6
Bolt hole diameter	I-M mm		10-M14	10-M14	18-M14	18-M16	18-M18	18-M20
Keyway width	X mm		26P9	40H8	32H8	36H8	42H8	48H8
Keyway depth	Y mm		9	10	11	12	14	16
Recess length	$\phi 1$ mm	type B2	20	20	25	25	30	35
		type B3	40	40	45	45	50	55
Boss O.D.	D mm		180	200	225	250	280	315
Boss Max I.D.	dmax mm	type B2	120	130	150	165	185	210
		type B3	110	125	140	155	175	195
Flange bolt	Strength class		10.9	10.9	10.9	10.9	10.9	10.9
		db x ϕ mm	M14x35	M14x35	M14x40	M16x45	M18x50	M20x55
Tightening torque	[machine oil coating]	Nm	196	196	196	304	412	579
		(Kgfm)	(20)	(20)	(20)	(31)	(42)	(59)

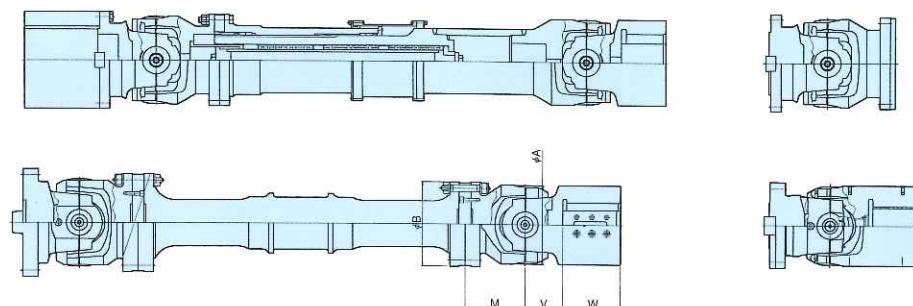
Size			P355	P400	P450	P500	P550
Flange O.D.	A mm		355	400	450	500	550
Bolt hole pitch circle diameter	B mm		317	358	402	446	492
Pilot diameter	C mm		175h8	200h8	225h8	250h8	275h8
Pilot dia height	F mm		7	7	7	8	8
Bolt hole diameter	I-M mm		18-M22	18-M24	18-M27	16-M30	16-M33
Keyway width	X mm		54H8	60H8	66H8	74H8	80H8
Keyway depth	Y mm		18	20	22	25	27
Recess length	$\phi 1$ mm	type B2	35	40	45	50	55
		type B3	55	60	65	80	85
Boss O.D.	D mm		355	400	450	500	550
Boss Max I.D.	dmax mm	type B2	235	265	300	330	365
		type B3	220	250	280	310	340
Flange bolt	Strength class		10.9	10.9	10.9	10.9	10.9
		db x ϕ mm	M22x60	M24x65	M27x75	M30x80	M33x95
Tightening torque	[machine oil coating]	Nm	775	1000	1461	1991	2677
		(Kgfm)	(79)	(102)	(149)	(203)	(273)

● When preparing mounting bolts at user side, please use Hexagon head bolts grade Finished or Semi-finished with 10.9 tensile strength rank prescribed by JIS B1180 annex JA, and install the whirl stop. And also, About mounting nuts, please use self lock nuts or Hexagon head bolts Grade Finished or Semi-finished with 8 tensile strength rank prescribed by JIS B1181 annex JA, and install the whirl stop. About tightening torque, please refer to the table above.

※ All specifications and design characteristics are subject to change without notice.

Universal Joints (UJ)—S Series

Example Structure



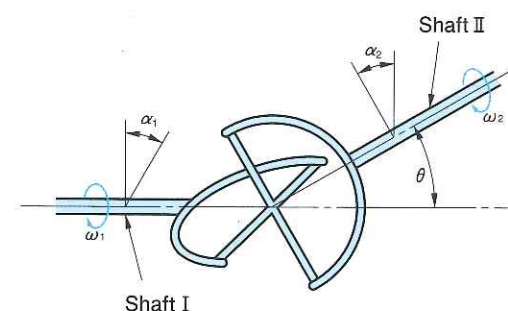
Size			S315T	S355T	S400T	S450T	S500T	S550T
Joint swing diameter	K	mm	315	355	400	450	500	550
Max. transnission torque	Ty	kNm	205	295	390	650	980	1180
Fatigue limit torque	Tw	kNm	135	205	270	450	590	780
2RC value	2RC	kNm	51	76	117	153	200	270
Max. joint angle	θ	°	3	3	3	3	3	3
Principal Dimensions	A	mm	315	355	400	450	500	550
	B	mm	315	355	400	450	500	550
	M	mm	215	240	270	300	335	370
	V	mm	140	165	190	210	230	260
	W	mm	240	270	300	340	375	415

Size			S600T	S650T	S700T	S740T	S800T	S850T
Joint swing diameter	K	mm	600	650	700	740	800	850
Max. transnission torque	Ty	kNm	1470	1960	2450	3010	3630	4310
Fatigue limit torque	Tw	kNm	980	1270	1570	1960	2450	2940
2RC value	2RC	kNm	340	430	570	670	770	920
Max. joint angle	θ	°	3	3	3	3	3	3
Principal Dimensions	A	mm	600	650	700	740	800	850
	B	mm	600	650	700	740	800	850
	M	mm	400	435	470	495	540	570
	V	mm	280	300	300	345	380	400
	W	mm	450	490	530	560	600	640

Size			S900T	S950T	SK00T	SK10T	SK20T
Joint swing diameter	K	mm	900	950	1000	1100	1200
Max. transnission torque	Ty	kNm	5200	6080	7260	9220	12000
Fatigue limit torque	Tw	kNm	3630	4220	4900	6370	8240
2RC value	2RC	kNm	1100	1290	1450	1950	2500
Max. joint angle	θ	°	3	3	3	3	3
Principal Dimensions	A	mm	900	950	1000	1100	1200
	B	mm	900	950	1000	1100	1200
	M	mm	600	640	670	740	800
	V	mm	430	450	500	550	600
	W	mm	675	715	750	830	900

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Universal Joints—Principle of Operation



In a joint pair as shown in the figure above in which the driving shaft1 and the driven shaft2 are interconnected with each other at an angle θ (referred to as shaft angle), if the shaft1 runs at a constant speed, shaft2 will have a variable motion and therefore, there occurs a variation in the angular velocity, angular acceleration and torque. In this case, shaft2 changes its rotating angle twice (lead and lag angle in relation to the shaft1) during a single revolution. This difference in angle of rotation is called difference angle or Cardan difference. The relationship of angle of rotation and shaft angle between the shafts1 and2 and the maximum value α_{dmax} of the Cardan difference are obtained as follows.

$$\tan \alpha_2 = \cos \theta \cdot \tan \alpha_1$$

$$\alpha_{dmax} = \tan^{-1} \left(\pm \frac{1 - \cos \theta}{2 \sqrt{\cos \theta}} \right)$$

α_1 : angle of rotation of shaft I in radians
 α_2 : angle of rotation of shaft II in radians
 θ : shaft angle in radians

In addition, variation in angular velocity is expressed as follows.

$$\omega_2 = \frac{\omega_1 \cos \theta}{1 - \sin^2 \theta \cdot \sin^2 \alpha_1}$$

$$\omega_{2max} = \frac{1}{\cos \theta} \quad (\alpha_1 = 90^\circ)$$

$$\omega_{2min} = \cos \theta \quad (\alpha_1 = 0^\circ)$$

ω_1 : angular velocity shaft I (rad/s)
 ω_2 : angular velocity of shaft II (rad/s)

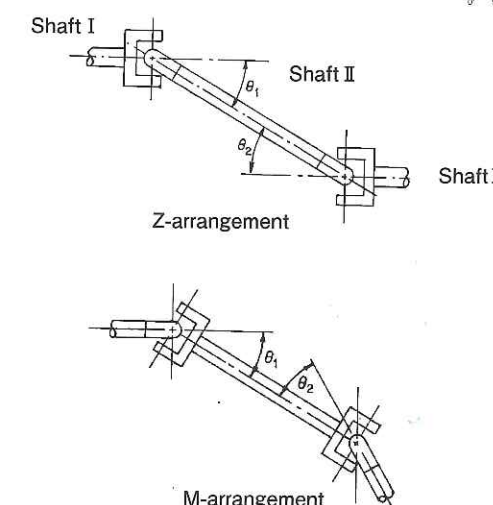
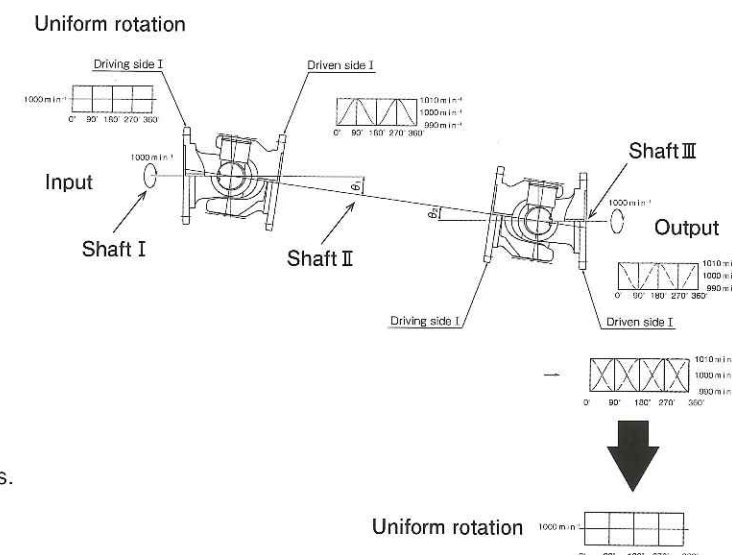
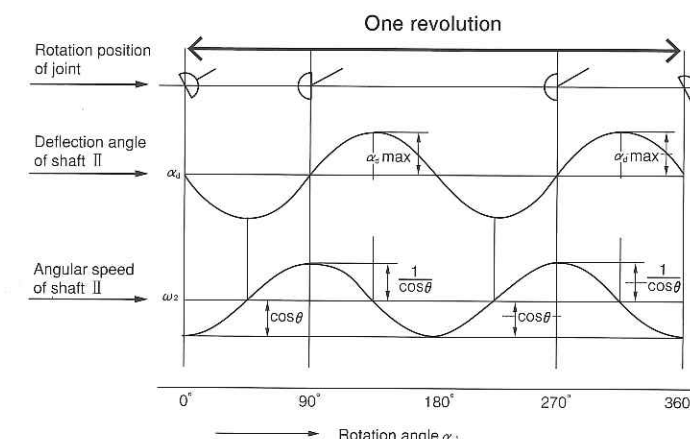
However, when the input cardan shaft I (bend angle θ_1) and output cardan shaft III (bend angle θ_2) are arranged regularly ($\theta_1 = \theta_2$), non-uniform motion of the input cardan shaft II is compensated by the output cardan shaft III, and uniform motion is obtained on the output side.

The conditions for uniform rotation are:

$$1) \theta_1 = \theta_2$$

- 2) Phases of both yokes of shaft II are in same plane
- 3) Shafts I, II, III must be in same plane

Normally, universal joints are used in pairs, and must be installed in Z-arrangement or M-arrangement.



Universal joint installation

Universal Joints—Selection

A universal joint is a rotating shaft designed to transfer kinetic energy. To assure steady and stable energy transfer, an optimum universal joint must be selected taking particular application needs, loading torque, speed of rotation (rpm), joint angle, swing diameter, critical rpm and other such factors into consideration. The basic steps for the selection of optimum universal joint are described below.

1. Cataloged torque
2. Setting of loading conditions
3. Maximum torque
4. Normal torque
5. Bearings life time
6. Joint angle
7. Speed of rotation
8. Engagement length
9. Applied load to bearings
10. Mass moment of inertia and torsional rigidity

1. Cataloged torque

Maximum transmission torque T_v :

A maximum transmission torque shown in the table is equal to the selected standard torque for maximum torque $T_{\max}$ which is loaded on the universal joint.

Fatigue limit torque T_w :

A fatigue limit torque shown in the table is equal to the selected standard torque for normal torque T_n which is loaded on the universal joint at reversing.

2RC value

Dynamic torque capacity of bearings.

2. Setting of loading conditions

Proceeding to selection of optimum universal joint, set the following loading conditions.

Max. torque $T_{\max}$

A peak torque occasionally applied to a universal joint, allowing for possible overloading and impact.

Normal torque T_n

A torque constantly applied to a universal joint, allowing for possible overloading and impact.

Average torque T_m

Applied to a universal joint over the life time.

Max. speed of rotation $n_{\max}$

A maximum speed of rotation at which a universal joint may be running.

Mean speed of rotation n

A mean speed of rotation to determine a life time.

Joint angle θ

An angle at which shafts are interconnected with each other.

Bearings life time L

An expected life time of bearings (at a reliability of 90%)

3. Max. torque $T_{\max}$

Selection should be made to satisfy the relationship shown below between a max. torque $T_{\max}$ and a max. transmission torque T_v listed in the table "Universal Joints Performance Characteristics".

$$\text{Maximum Torque } T_{\max} \times 1.5 \sim 2.5 \leq \text{Maximum Transmission Torque } T_v$$

A maximum torque is obtained from the following formula for a given motor rated capacity.

$$T_{\max} = \frac{9552 \times P}{N \times r} \times K$$

$T_{\max}$: max. torque (Nm)

P : motor rated capacity (kW)

N : motor rated speed of rotation (min^{-1})

K : max. load coefficient

r : reduction ratio

4. Normal torque T_n

Selection should be made to satisfy the relationship between a normal torque determined here and a fatigue limit torque listed in the table "Universal Joints Performance Characteristics".

$$\text{Normal Torque } T_n \times 1.5 \leq \text{Fatigue Limit Torque } T_w$$

A normal torque is obtained from the following formula.

$$T_n = \frac{9552 \times P}{N \times r} \times K_1$$

T_n : normal torque (Nm)

P : motor rated capacity (kW)

N : motor rated speed of rotation (min^{-1})

K_1 : normal load coefficient

r : reduction ratio

5. Bearings life time

An expected life time for a selected universal joint is determined from the following formula.

For "A" Series universal joints :

$$L = \frac{1.5 \times 10^6}{\theta \times n} \left(\frac{2RC}{T_m \times K_2} \right)^{\frac{10}{3}} \times a$$

For universal joints other than "A" Series :

$$L = \frac{1.5 \times 10^6}{\theta \times n} \left(\frac{2RC}{T_m \times K_2} \right)^{\frac{10}{3}}$$

L : expected life time of a reliability of 90% (h)

n : mean speed of rotation (min^{-1})

θ : joint angle ($^\circ$)

2RC : dynamic torque capacity (Nm)

T_m : average torque (Nm)

K_2 : impact coefficient

Motor	$K_2=1.00$
Engine (Four or more cylinders)	
Gasoline	$K_2=1.25$
Diesel	$K_2=1.30$

a : A value of 'a' is found from the table below.

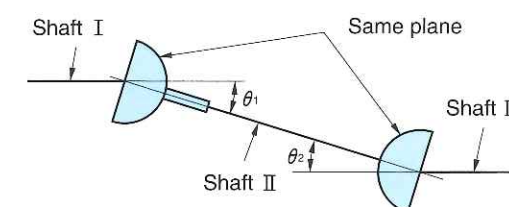
	specific angle θ_i ($^\circ$)	value of 'a'	
		$\theta \leq \theta_i$	$\theta > \theta_i$
A100	12.8	0.5	0.6
A125	15.6		
A160	13.8		
A180	12.4		

Universal Joints—Selection

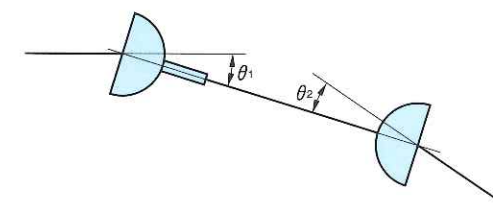
6. Joint angle

In the practical application of universal joint, the arrangement of shafts interconnection is available in two types as shown below.

Z Arrangement



M Arrangement



Requirements to ensure uniform transmission of rotational motion are ;

- 1) The yokes at the both ends of the shaft II be in the same plane.
- 2) Two angles θ_1 and θ_2 be equal to each other.
- 3) The three shafts, I, II and III, be in the same plane. A composite (solid) angle constituted in the both planes, horizontal and vertical, may be obtained from the following formula.

$$\theta = \tan^{-1} \sqrt{(\tan^2 \theta_h + \tan^2 \theta_v)}$$

θ : composite joint angle ($^\circ$)

θ_h : component joint angle in the horizontal plane ($^\circ$)

θ_v : component joint angle in the vertical plane ($^\circ$)

Joint angles are limited by a speed of rotation to be used. A mass moment of acceleration depends on speed of rotation, shaft angle and mass moment of inertia and it provides a relationship as listed below for a constant length.

$$n \theta = \text{constant}$$

n : speed of rotation to be used (min^{-1})

θ : joint angle to be used ($^\circ$)

Depending on an engagement length (L_z) of a universal joint, an allowable joint angle is determined from the diagrams on the next page.

Universal Joints—Selection

7. Seed of rotation

● Allowable speed of rotation

A universal joint is a flexural elastic body and it must thus be operated within an allowable speed of rotation.

$$\text{Working RPM} \leq n_a$$

Allowing for possible deflection, a critical min^{-1} and an allowable min^{-1} are calculated as follows.

$$n_a = 0.7 \times n_c \quad (\text{min}^{-1})$$

$$n_c = \frac{1.206 \times 10^8 \times \sqrt{D^2 + d^2}}{L_c^2} \quad (\text{min}^{-1})$$

n_a : allowable speed of rotation (min^{-1}) n_c : critical speed of rotation (min^{-1})

D : tube outside diameter (mm) d : tube inside diameter (mm)

L_c : center-to-center dimension of cross (mm)

From the above, a critical speed of rotation is determined as a function of length and diameter of a universal joint.

For the application for universal joints longer than the critical length, such arrangement is required in which multiple universal joints are interconnected.

● Balance quality

Balance quality should be adjusted to assure smooth rotation of universal joints without any vibration. According to the past experience, adjustment of balance quality may be omitted to obtain safe operation for application at a speed of rotation of 800 min^{-1} or less.

For operation at a speed of rotation above 800 min^{-1} , balance quality should be adjusted to Grade 'G16'.

In the JIS B 0905 standard, the balance quality of Grade 'G16' is recommended for universal joints.

If a higher grade than 'G16' is adopted as balance quality, the selected balance quality may not be reproduced.

8. Engagement length

When the universal joints with extension splines for telescopic coupling are used with the machine or equipment, the engagement length should be determined as follows taking safety allowance for installation and possible dimensional changes during operation into consideration.

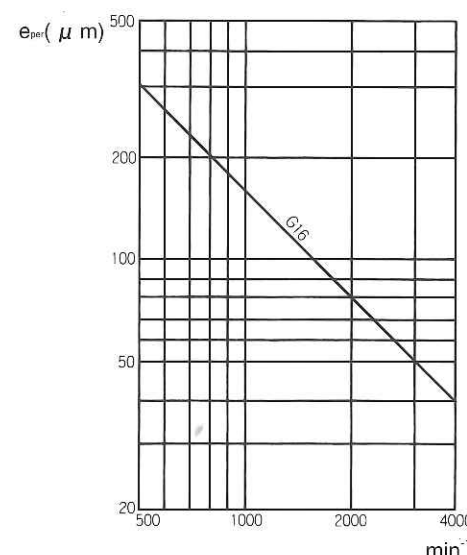
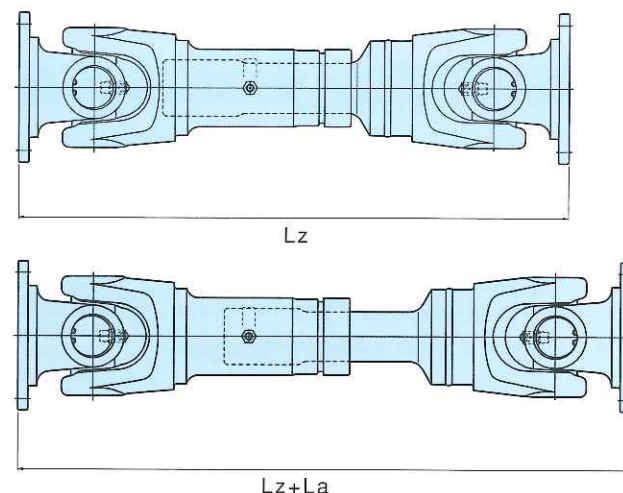
$$\text{Engagement length} = L_z + L_a \times \frac{1}{2}$$

L_z : available shortest length with the spline set retracted

L_a : available max. extension of the spline

$L_z + L_a$: allowable max. length

In practical application, L_z should be determined in units of 10 mm.



9. Applied load to bearings

When a universal joint is set to rotate at an angle, the following loads may be applied to the bearings of the engaged shafts.

● Thrust load caused by spline sliding friction

When a spline is set to slide while the universal joint is subjected to a torque, the spline friction drag causes a thrust force. This thrust force may be determined as follows.

$$F = \left(\frac{2 \times T \times \mu}{dp} \right) \cos \theta$$

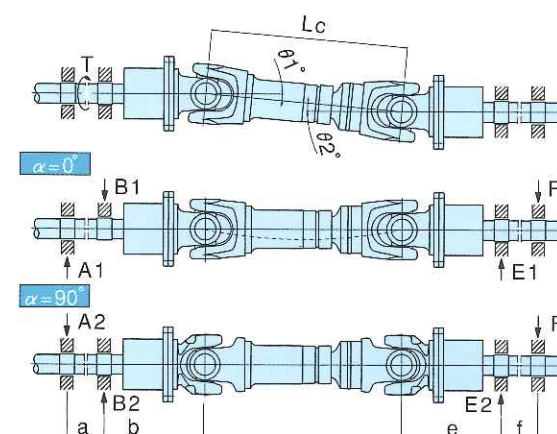
T : applied torque (Nmm)

μ : friction coefficient (Generally $\mu = 0.15$)

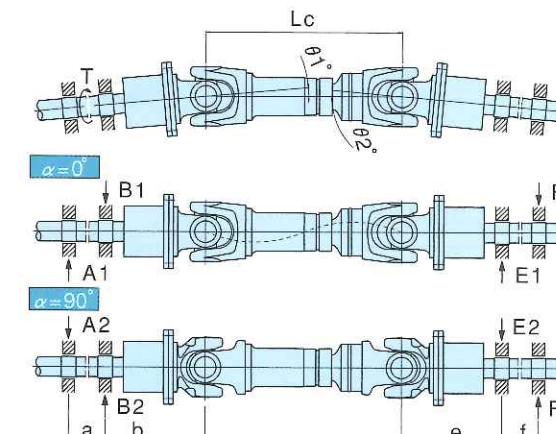
dp : spline engagement diameter (mm)

θ : joint angle ($^\circ$)

Z Arrangement



M Arrangement



$\alpha = 0^\circ$	$A_1 = T \times \frac{b \times \cos \theta_1}{L_c \times a} \times (\tan \theta_1 - \tan \theta_2)$ $B_1 = T \times \frac{(a+b) \times \cos \theta_1}{L_c \times a} \times (\tan \theta_1 - \tan \theta_2)$ $F_1 = T \times \frac{e \times \cos \theta_1}{L_c \times f} \times (\tan \theta_1 - \tan \theta_2)$ $E_1 = T \times \frac{(e+f) \times \cos \theta_1}{L_c \times f} \times (\tan \theta_1 - \tan \theta_2)$	$A_1 = T \times \frac{b \times \cos \theta_1}{L_c \times a} \times (\tan \theta_1 + \tan \theta_2)$ $B_1 = T \times \frac{(a+b) \times \cos \theta_1}{L_c \times a} \times (\tan \theta_1 + \tan \theta_2)$ $F_1 = T \times \frac{e \times \cos \theta_1}{L_c \times f} \times (\tan \theta_1 + \tan \theta_2)$ $E_1 = T \times \frac{(e+f) \times \cos \theta_1}{L_c \times f} \times (\tan \theta_1 + \tan \theta_2)$
$\alpha = \frac{\pi}{2} = 90^\circ$	$A_2 = B_2 = T \times \frac{\tan \theta_1}{a}$ $F_2 = E_2 = T \times \frac{\sin \theta_2}{f \times \cos \theta_1}$	

● Radial load due to weight

A weight of a universal joint acts as a radial load on the bearings of the driving and the driven shafts.

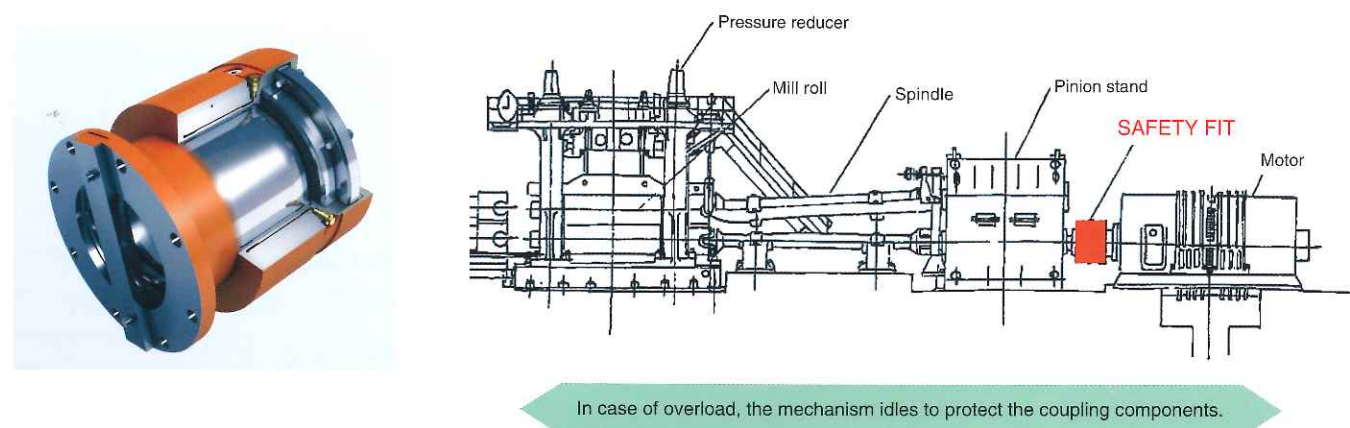
● Radial load resulting from secondary couple of force

When a torque is transmitted through a universal joint set at an angle, there occurs secondary couple of force twice a rotation. This couple of force acts as a bending moment on the interconnected shafts, causing reaction on the bearings. Possible reactions for Z and M arrangements are determined as follows.

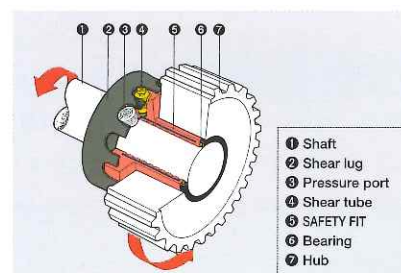
NAJICO SAFETY FIT is a safety device provided for rotating parts.

Hydraulic Expansion Type Torque Limiter

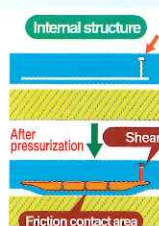
In case of abnormal rotation, torque transmission between shafts is interrupted, thus protecting a whole mechanism.



Structure and Operation

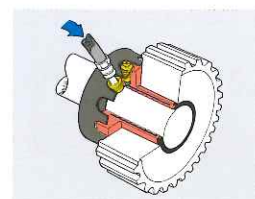


- 1 Shaft
- 2 Shear lug
- 3 Pressure port
- 4 Shear tube
- 5 SAFETY FIT
- 6 Bearing
- 7 Hub



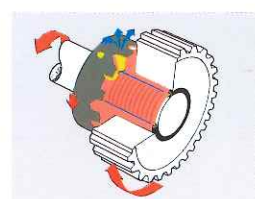
The device is placed between the shaft (1) and the hub (7) to control rotation transmission force via hydraulic pressure.

Inside of the sleeve (5) is filled with lubricating oil, and the shear tube is fixed after pressurization.



Normal operation

The sleeve (5) is expanded by pressurization to both the shaft (1) and the hub (7) (friction force grows) to increase rotation transmission force.

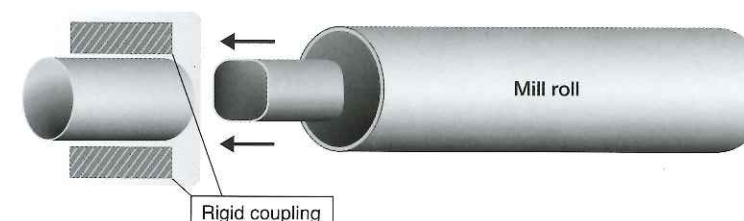


Abnormal operation (Excess of set torque)

The shear lug (2) cuts off the tip of shear tube (4), and the lubricating oil is discharged at once in about 1/100 second; pressure chamber of the SAFETY FIT (5) contracts, thus forming a clearance with the hub (7) to provide idle rotation.

Technology to Ensure Safer Rotation

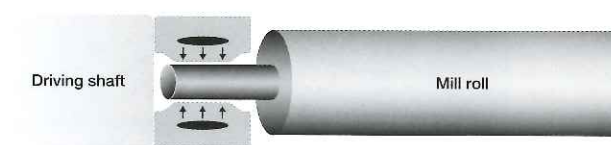
Rigid Coupling



The rigid coupling (1) is set in the place of contact between the driving shaft and the mill roll.

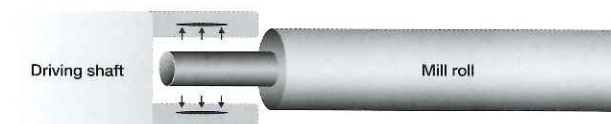
Structure and Operation

1. Roll clamping (hydraulic pressure is applied to lock up the roll shaft)



As the mill roll has been set on the driving shaft, the rigid coupling is expanded by pressure to adhere tightly to the mill roll shaft. As a result, clearance between the driving shaft and the mill roll disappears to suppress eccentricity ratio of the mill roll.

2. Roll replacement



When replacing the mill roll, hydraulic pressure is released, and the rigid coupling contracts, thus forming a clearance to facilitate replacement.

SAFETY FIT Lineup

	Hydraulic Torque Limiter	Hydraulic Rigid Coupling
Overview	A safety device to interrupt torque transmission by releasing hydraulic pressure when transmitted power unexpectedly exceeds its set value.	A device to stabilize roll center trajectory by applying hydraulic pressure when the roll is inserted, thus providing a tight fit between the driving shaft and the roll.
Supported shaft diameter	30~720mm	30~720mm
Transmitted torque	0.3~7180kNm	0.3~372kNm
Features	- Torque transmission is controlled through friction, thus ensuring long-term maintaining of a set torque - Realization of quick reset operation - Small size, light weight, low inertia - High-capacity torque transmission	- Elimination and alleviation of roll marks (chatter marks) - Prevention of friction in roll oval portions - Reduction of clearance control operations - Reduction of roll replacement time
Application examples	- Compressors - Crushers - Alternative to shear pin type couplings (protection of machines from excessive torque)	- Cold mills - Temper mills - Piercing mills
Applicable types	STB STBK SRP SRA	SRA

SAFETY FIT Features

SAFETY FIT Features

Torque limiters using shear pins and other similar components are prone to metal fatigue, and require frequent maintenance and component replacement. This results in decline of equipment productivity.

For example, it is assumed that in steel making industry, 75% of equipment downtime is caused by metal fatigue of components, while the remaining 25% is due to excessive torque. With shear pin couplings, shear torque can be set accurately only in case that pins are destroyed by a pure shear load. When a seating surface wears out, appropriate shear load conditions cannot be maintained any longer, torque transmission capacity of the coupling inevitably drops, and shear pins are cut off sooner than normal.

With our SAFETY FIT couplings, metal fatigue does not occur because torque is transmitted via friction as shown in the T-N diagram (Fig. 1).

In addition, SAFETY FIT does not include any tear and wear parts other than shear tubes, which means very small amount of cost and time for maintenance.



Fig. 1 T-N diagram

These features of SAFETY FIT, in combination with quick restoration, promise dramatic labor saving as compared to other torque limiters. As regards investment efficiency, the payback period proves very short in many cases.

SAFETY FIT can be easily mounted in many drive systems due to the small size, light weight, and low inertia. These couplings have a wide range of applications.

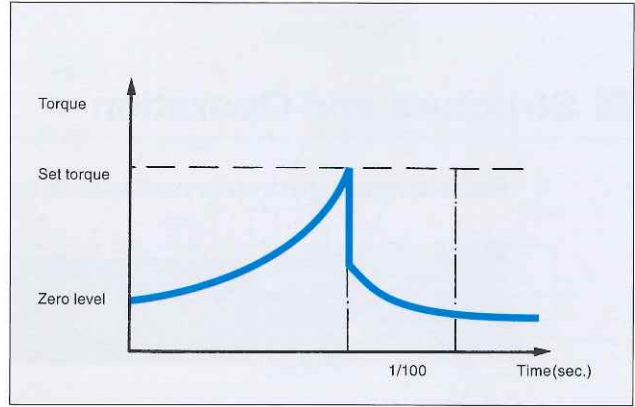


Fig. 2 Relationship between set torque and load torque

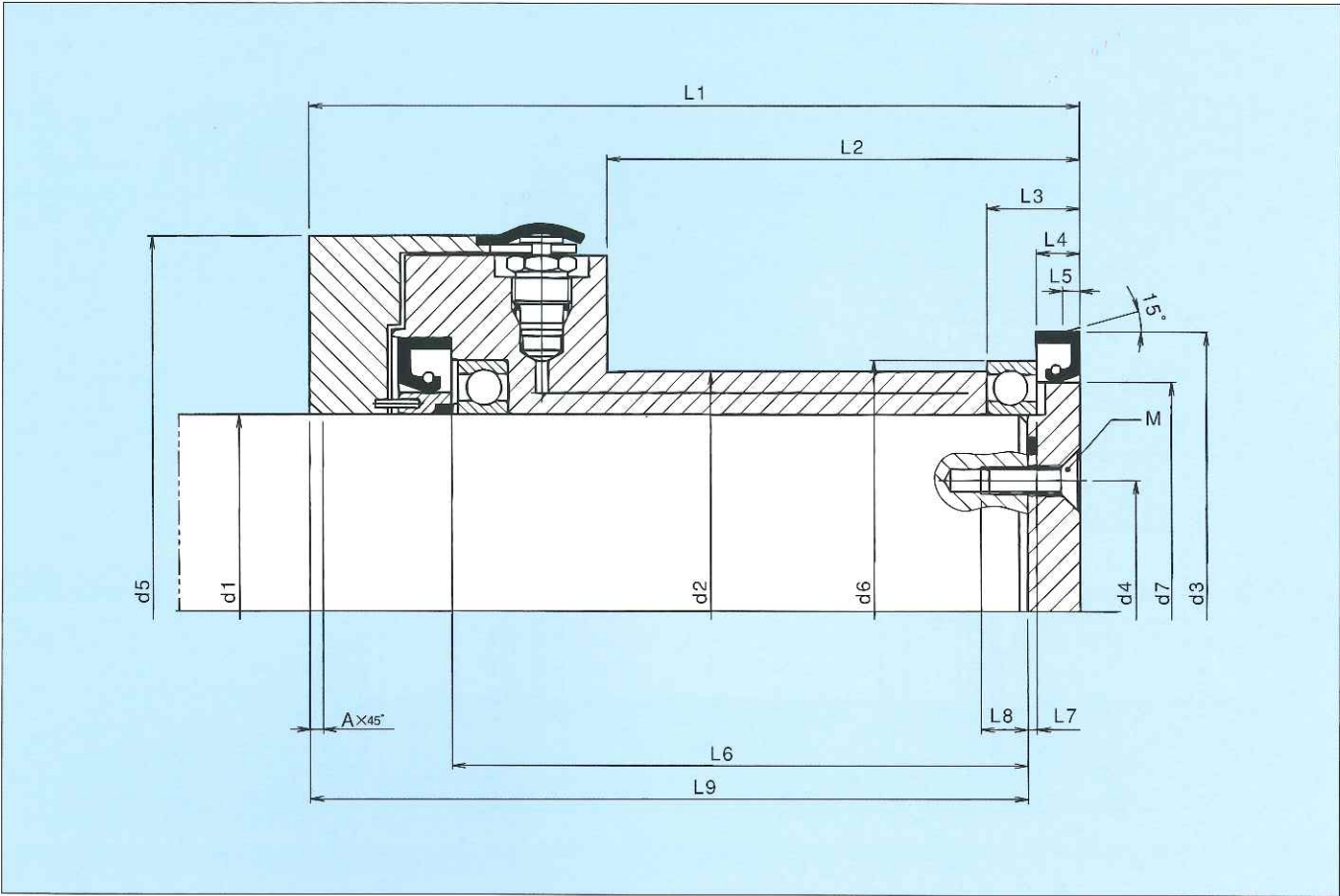
This diagram shows relationship between time and torque when load torque exceeds a set torque.

As load torque reaches a set torque, contact surfaces of the coupling slip, and hydraulic pressure is released. As a result, torque is interrupted (the time from slip occurrence to torque interruption is about 1/100 sec.).

SAFETY FIT

STB Type

No-key shaft – for torque limiter

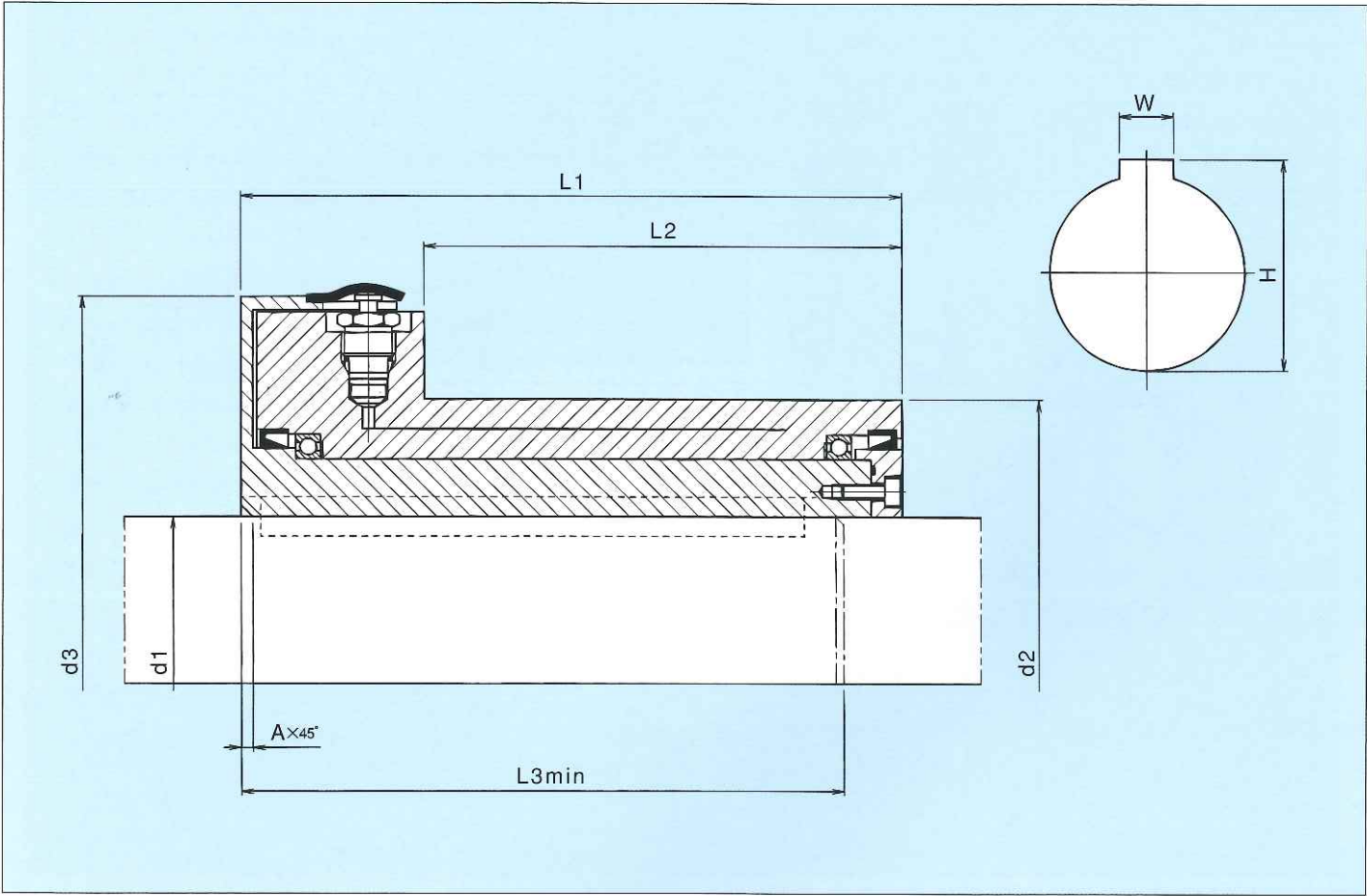


Size	Torque range, Nm	Geometries,mm																		Weight kg	Inertia moment J kgm ²
		d ₁	d ₂	d ₃	d ₄	d ₅	d ₆	d ₇	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇	L ₈	L ₉	A	M		
60	1800- 3600	60	75	90	40	136	78	70	137	83	18	8	2	106	1	13	128	1.5	M6	4.9	0.012
70	3000- 6000	70	90	100	50	148	90	80	150	92	18	8	2	115.5	1.5	13	140.5	1.5	M6	6.6	0.020
80	3900- 7800	80	100	110	50	157	100	90	166	108	18	8	2	131.5	1.5	13	156.5	1.5	M6	7.6	0.025
90	5000- 10000	90	110	125	65	168	115	100	184	123	25	12	3	145	2	18	170	1.5	M8	9.2	0.037
100	7500- 15000	100	125	140	70	183	125	110	206	133	25	12	3	156	3	18	191	1.5	M8	14	0.065
110	10000- 20000	110	140	150	80	201	140	120	208	137	28	12	3	167	3	18	193	2	M8	16	0.095
120	13000- 25000	120	150	160	90	209	150	130	237	161	29	13	3	189	3	18	221	2	M8	19	0.120
130	17000- 33000	130	160	170	100	218	165	140	250	174	31	13	3	140	3	18	234	2	M8	21	0.140
140	20000- 40000	140	170	180	105	228	175	150	261	183	31	13	3	212	3	23	245	2	M10	24	0.190
150	23000- 46000	150	180	190	115	238	190	160	275	195	33	13	3	226	3	23	259	2	M10	27	0.230
160	36000- 71000	160	200	200	120	253	200	170	300	215	33	13	3	249	3	23	284	2.5	M10	32	0.320
170	39000- 78000	170	210	215	130	258	215	180	300	213	37	15	4	247	3	23	282	2.5	M10	34	0.370
180	49000- 98000	180	225	225	135	273	225	190	300	213	37	16	4	248	3	23	281	2.5	M10	38	0.460
190	63000-126000	190	240	250	145	286	240	200	350	260	39	15	4	300	3	23	332	2.5	M10	50	0.660
200	70000-140000	200	250	250	150	296	250	220	350	260	39	15	4	300	3	23	332	2.5	M10	53	0.750
220	85000-170000	220	270	270	175	320	270	240	350	260	39	15	4	300	3	23	332	2.5	M10	57	0.930

※The contents can be changed depending on circumstances.

STBK Type

Keyed shaft – for torque limiter

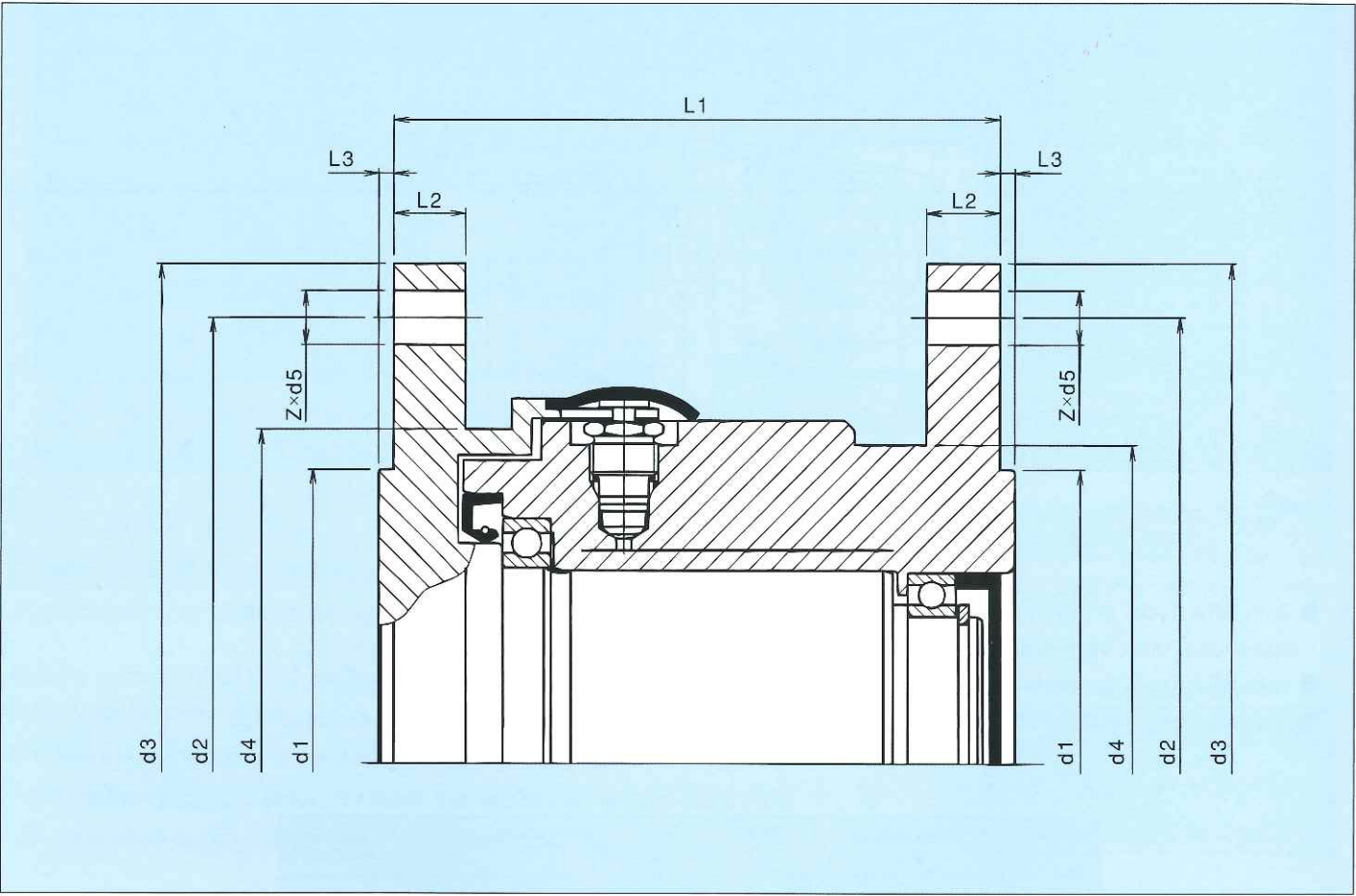


Size	Torque range, Nm	Geometries, mm							Weight kg	Inertia moment J kgm ²
		d ₁	d ₂	d ₃	L ₁	L ₂	L _{3min}	A		
50	1700- 3400	40-50	80	138	105	67	80	1.5	5.7	0.011
60	2500- 5000	50-60	95	153	110	71	82	1.5	7.5	0.018
70	3750- 7500	60-70	110	166	125	83	105	1.5	10	0.031
80	6500- 13000	70-80	125	183	140	98	120	1.5	14	0.050
90	9000- 18000	80-90	145	201	160	113	130	2	20	0.093
100	11500- 23000	90-100	160	218	175	122	140	2	26	0.139
110	17000- 34000	100-110	175	228	190	137	145	2	31	0.197
120	20500- 41000	110-120	190	243	200	146	155	2	37	0.263
130	28000- 56000	120-130	205	256	220	164	160	2	44	0.345
145	35500- 71000	130-145	220	268	230	173	170	2	51	0.460
155	41000- 82000	140-155	240	286	260	193	180	2.5	69	0.721
165	55000-110000	150-165	255	301	285	218	190	2.5	83	0.976
185	75000-150000	160-185	280	333	300	233	210	2.5	113	1.650

The width and height of keyway can be adjusted with the other shaft.

SRP Type

Flange joint – for torque limiter

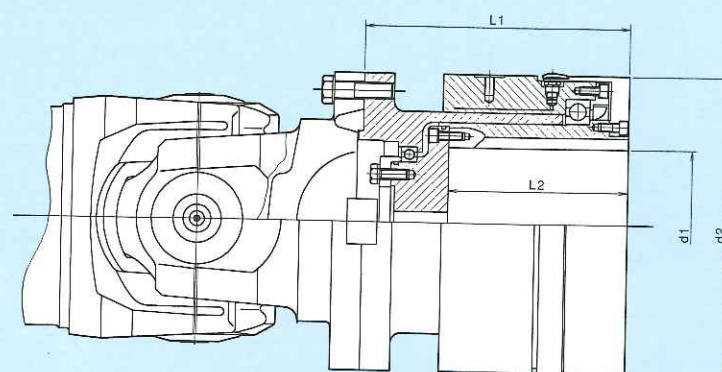


Size	Torque range, Nm	Geometries, mm									Weight kg	Inertia moment J kgm ²
		d ₁	d ₂	d ₃	d ₄	d ₅	Z	L ₁	L ₂	L ₃		
45	700- 1500	73	96	117	76	9	6	105	14	2	7	0.009
60	1600- 3200	94	122	152	96	11	8	115	19	2	11	0.025
80	2900- 5800	115	150	178	122	13	6	113	19	2	15	0.047
100	5400- 10800	140	184	213	150	17	6	135	22	2	25	0.110
110	8200- 16400	163	208	240	174	17	8	161	22	2	36	0.190
130	12600- 25200	188	242	280	200	21	8	173	28	2	54	0.393
160	20500- 41000	222	280	318	234	21	8	193	28	2	78	0.727
190	28000- 56000	245	305	347	262	21	10	199	28	3	98	1.095
203	39000- 78000	273	345	390	294	21	10	206	38	3	139	2.084
228	58000-116000	310	368	425	324	21	14	240	38	3	187	3.242
254	111000-222000	331	406	457	355	25	14	330	26	4	279	5.073
300	142000-284000	371	460	527	404	25	16	309	28	6	340	8.187
356	244000-488000	451	530	591	472	32	14	385	33	6	565	17.746
406	290000-580000	483	580	640	518	32	18	387	38	6	684	25.971

※The contents can be changed depending on circumstances.

SRA Type

Flanged Hub – for Torque Limiter



Features

- With SRA Type, entire torque is transmitted by a flanged sleeve, while pressurization unit carries only static load; thus, very heavy torque can be transmitted.
- With SRA Type, an intermediate sleeve can be provided to attach a shaft with a key slot.
- Some typical examples are incorporation into universal joints for rolling mills and into gear couplings.

Size	Release torque max. Nm	Diameter d _{max} mm	Geometries, mm			Supported universal joint size
			d ₂	L ₁	L ₂	
160	18600	110	230	245	175	P180
180	29400	125	250	260	185	P180
200	45100	135	280	305	210	P200
225	63700	155	315	325	225	P225
250	84300	175	350	340	230	P250
280	127000	195	390	375	255	P280
315	176000	220	440	405	280	P315
355	264000	250	500	440	305	P355
400	372000	280	560	480	330	P400
450	529000	315	630	515	360	P450
500	696000	350	700	540	375	P500
550	951000	385	770	590	420	P550

※The contents can be changed depending on circumstances.

Shear Tube Replacement and Pressure Setting

WARNING

- Before you begin, make sure that the motor is not powered, and that the power switch cannot be turned on.
- Do not loosen screws during use because high pressure oil is injected. Besides, be sure to release pressure before you begin.
- In case of use as a torque limiter, the shaft slips as excessive torque is applied; at the same time, the shear tube is cut off, and high pressure oil wells out. Thus, provide a protective cover so as to prevent the shear tube head and high pressure lubricating oil from spattering.

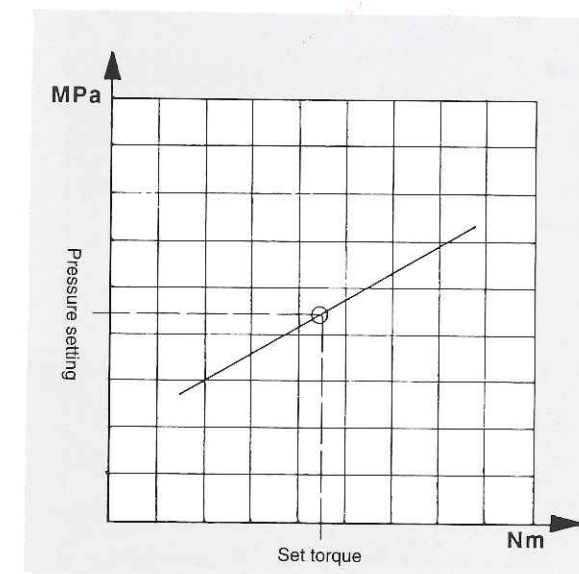


Fig. 3 Calibration chart

In order to restore SAFETY FIT, go through the steps 1 to 6. In so doing, take the following precautions.

1. Make sure that there are no foreign objects in the power transmission system.
2. Turn the coupling until you can reach the oil filler joint and the shear tube.
3. If the shear lug is got loose, be sure to fasten it.

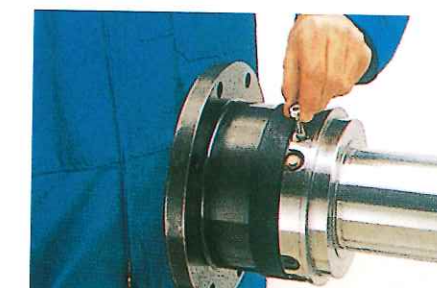
Tightening torque of shear tube	
Size	Tightening torque
L-28	35Nm
L-39	
L-63	100Nm



(Step 1) Replace the broken shear tube.



(Step 2) Tighten a new shear tube at a set torque so that the tip of shear tube is fixed on the seating surface.



(Step 3) Pressure setting: using the attached screw (M8), pull out the protective plug from the oil filler joint.



(Step 4) Connect a pump, and turn the shear tube by 1/8 revolution (a channel in the oil filler joint will open).



(Step 5) Continue injecting until the manometer shows required value. Tighten the shear tube at a set torque. Calibration chart (Fig. 12) is enclosed with every coupling.



(Step 6) After pressure inside the pump drops, disconnect the pump. Set up the protective plug. Now the coupling is available for use. (These steps take several minutes altogether.)

◆ Conversion factors for the metric system and the British Customary yard-pound system

	Metric System	Yard-Pound System
Length	1cm	0.3937in
	25.4mm	1in
	1m	3.2808ft
	0.3048m	1ft=12in
Mass	1g	0.035274oz
	1kg	2.20462ib
	28.3495g	1oz
	0.45359kg	1ib=16oz
Area	1cm ²	0.155in ²
	1m ²	10.76391ft ²
	6.4516cm ²	1in ²
	0.092903m ²	1ft ²
Volume	1cm ³	0.0610237in ³
	1m ³	35.3147ft ³
	16.3871cm ³	1in ³
	0.0283168m ³	1ft ³

◆ Conversion factors for the conventional systems and the International System (SI)

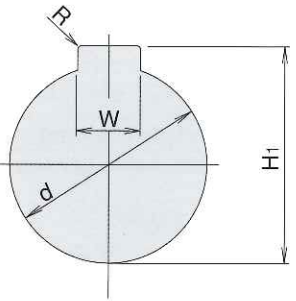
	Conventional System		SI System
	Metric	Yard-Pound	
Load	1kgf	2.20462lbf	9.80665N
	0.45359kgf	1lbf	4.44823N
	0.10197kgf	0.22481lbf	1N
Torque	1kgfm	7.23292lbf-ft	9.80665Nm
	0.13826kgfm	1lbf-ft	1.35582Nm
	0.10197kgfm	0.73756lbf-ft	1Nm
Stress	1kgf/mm ²	1422.33lbf/in ²	9.80665N/mm ²
	0.0007031kgf/mm ²	1lbf/in ²	0.006895N/mm ²
	0.10197kgf/mm ²	145.038lbf/in ²	1N/mm ²
Pressure	1kgf/cm ²	14.223lbf/in ²	0.0980665MPa
	0.070307kgf/cm ²	1lbf/in ²	0.0068943MPa
	10.1972kgf/cm ²	145.05lbf/in ²	1MPa

◆ Allowance and tolerances for linear dimensions excluding chamfers (JIS B 0405-1991)

Unit:mm

Tolerance grade		Basic size step							
Symbol	Grade	Incl & Over 0.5 To 3	Over 3 To 6	Over 6 To 30	Over 30 To 120	Over 120 To 400	Over 400 To 1000	Over 1000 To 2000	Over 2000 To 4000
		Tolerances							
f	Fine series	±0.05	±0.05	±0.1	±0.15	±0.2	±0.3	±0.5	—
m	Medium series	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2
c	Coarse series	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	±4
v	Extra Coarse series	—	±0.5	±1	±1.5	±2.5	±4	±6	±8

Keyway for parallel key (JIS B 1301, 1996, current standard)



Unit:mm

Applicable shaft diameter d	Nominal size of key W×h	Dimension of keyway					
		W		R	H ₁		
		Basic Dimension	Tolerance (Js9)		Basic Dimension	Tolerance	
Over 30 To 38	10×8	10	±0.0180	0.25~0.40	d+3.3	+0.2 0	
Over 38 To 44	12×8	12	±0.0215	0.25~0.40	d+3.3	+0.2 0	
Over 44 To 50	14×9	14	±0.0215	0.25~0.40	d+3.8	+0.2 0	
Over 50 To 55	(15×10)	15	±0.0215	0.25~0.40	d+5.3	+0.2 0	
Over 50 To 58	16×10	16	±0.0215	0.25~0.40	d+4.3	+0.2 0	
Over 58 To 65	18×11	18	±0.0215	0.25~0.40	d+4.4	+0.2 0	
Over 65 To 75	20×12	20	±0.0260	0.40~0.60	d+4.9	+0.2 0	
Over 75 To 80	22×14	22	±0.0260	0.40~0.60	d+5.4	+0.2 0	
Over 80 To 85							
Over 80 To 90	(24×16)	24	±0.0260	0.40~0.60	d+8.4	+0.2 0	
Over 85 To 95	25×14	25	±0.0260	0.40~0.60	d+5.4	+0.2 0	
Over 95 To 110	28×16	28	±0.0260	0.40~0.60	d+6.4	+0.2 0	
Over 110 To 120	32×18	32	±0.0310	0.40~0.60	d+7.4	+0.2 0	
Over 120 To 130							
Over 125 To 140	(35×22)	35	±0.0310	0.70~1.00	d+11.4	+0.3 0	
Over 130 To 150	36×20	36	±0.0310	0.70~1.00	d+8.4	+0.3 0	
Over 140 To 160	(38×24)	38	±0.0310	0.70~1.00	d+12.4	+0.3 0	
Over 150 To 170	40×22	40	±0.0310	0.70~1.00	d+9.4	+0.3 0	
Over 160 To 180	(42×26)	42	±0.0310	0.70~1.00	d+13.4	+0.3 0	
Over 170 To 180	45×25	45	±0.0310	0.70~1.00	d+10.4	+0.3 0	
Over 180 To 200							
Over 200 To 230	50×28	50	±0.0310	0.70~1.00	d+11.4	+0.3 0	
Over 230 To 250	56×32	56	±0.0370	1.20~1.60	d+12.4	+0.3 0	
Over 250 To 260							
Over 260 To 290	63×32	63	±0.0370	1.20~1.60	d+12.4	+0.3 0	
Over 290 To 315	70×36	70	±0.0370	1.20~1.60	d+14.4	+0.3 0	
Over 315 To 330							
Over 330 To 380	80×40	80	±0.0370	2.00~2.50	d+15.4	+0.3 0	
Over 380 To 400	90×45	90	±0.0435	2.00~2.50	d+17.4	+0.3 0	
Over 400 To 440							
Over 440 To 500	100×50	100	±0.0435	2.00~2.50	d+19.5	+0.3 0	

Remarks : Those of parenthesized nominal dimensions which are not specified in the International Standards shall not be used in

Inquiries Specification for Universal Joint (UJ)
For General Machinery

Date

Company Name	Phone
Department	Responsible Personnel
User Name	
Machine Name	
Quantities	Lead Time
Required documents ☐ Estimate Sheet ☐ Estimate Drawing ☐ Structural Calculation Sheet	

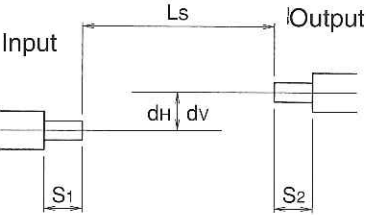
1. Loading Conditions

Motor	AC / DC	Kw /	min ⁻¹	Reduction Ratio
Required UJ Q'ty	Pcs/Motor			Direction of Rotation One-Way • Reverse

2. UJ Torque and RPM

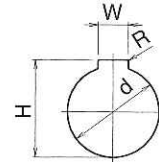
Rated Torque	N m	Rated RPM	min ⁻¹
Normal Torque	N m	Normal RPM	min ⁻¹
Maxium Torque	N m	Maximum RPM	min ⁻¹

3. Shaft Arrangement



Symbol	Ls	S1	S2	Horizontal Dimensional Difference dH	Vertical Dimensional Difference dV
Dimension					

4. Connecting Flange Hole and Keyway Dimensions



	d (Tolerance)	H (Tolerance)	W (Tolerance)	R	Hole Edge C
Input Side					
Output Side					

5. Paint ☐ Maker Standard ("Indian Red") ☐ Specific color

6. Remarks

Inquiries Specification for Universal Joint(UJ)
For Steel Mill Stands

Date

Company Name	Phone
Department	Responsible Personnel
User Name	
Quantities	Lead Time
Required documents ☐ Estimate Sheet ☐ Estimate Drawing ☐ Structural Calculation Sheet	

1. Equipment Outline

Machine Name	Application Part
Roll Diameter	Minimum Diameter mm / Maximum Diameter mm
Allowable Rotating Diameter for	mm

2. Loading Conditions

Motor	AC • DC	kW /	min ⁻¹	Reduction Ratio
Required UJ Q'ty	Pcs/Motor			Direction of Rotation One-Way Reverse
UJ RPM	Normal	min ⁻¹	Maximum	min ⁻¹

3. UJ Torque

Base Torque [Reference torque for calculations] $T_{100} = (9552 \times kW / \text{Normal RPM}) \times \text{Distribution Factor} = () \times = \text{Nm}$

Normal Torque [To consider fatigue strength] $T_n = T_{100} \times \text{Overload Allowance} = \times = \text{Nm}$

Maximum Torque [To consider rupture strength] $T_e = T_{100} \times \text{Overload Allowance} = \times = \text{Nm}$

Mean Torque [To consider bearing life limit] $T_m = T_{100} \times \text{Overload Allowance} = \times = \text{Nm}$

4. Other Requirements

Required Bearing Life Time	hours	Ambient Atmospheric Condition	Water/Water Vapor/Dust/Temperature (°C)
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5. Dimensions

UJ Required shaft Angle	deg	Shaft-end Dimension	mm
Driving Shaft Diameter / Tolerance	mm	UJ Extension	mm
Driven Shaft Diameter / Tolerance	mm	Shaft Engagement Length	mm
		Shaft Engagement Length	mm

6. Remarks

SAFETY FIT Inquiries Specification for
Torque Limiter

Date

Requester	Tel.
Department	Person in charge
Place of Use	
Machine of Use	Installation Position
Quantity	Delivery Time

1. Type of Spindle Used

☐ Universal joint ☐ Gear coupling ☐ Other ()

2. Output/Number of Revolutions

Motor	AC · DC	kW /	min ⁻¹	Reduction ratio
Number of spindles	pcs.	/	per motor	Rotation direction One-way rotation
				Forward/Reverse

3. Torque

Rated torque	Nm
Max. torque (in normal operation)	Nm
Set release torque	Nm

4. Joint

Shaft diameter / Tolerance	mm	Limiting rotation diameter	mm
Shaft length	mm	Limiting length	mm
Key presence	No · Yes (shape, size)		

5. Environment

Operating temperature max °C / min °C
Place of installation ☐ Indoor ☐ Outdoor ☐ Exposed to water ☐ Not exposed to water

5. Present State

Number of times shear pin cuts off (per year) Time from shear pin cut to stop

6. Memo

Sales Office

Head Office

3-10-10, Tsukiji, Chuo-ku, Tokyo, JAPAN
Post Code:104-8431
E-mail:rep@najico.co.jp

Universal Joint & Heat Exchanger Div.

Sales Dep. ☎+81-3-3543-9772 Fax.+81-3-3543-9779
Tokyo Sales Branch ☎+81-3-3543-9771 Fax.+81-3-3543-9789

Sapporo Sales Branch

Nishi3-19, Kita 9-Jo, Kita-Ku, Sapporo, JAPAN
Post Cord:060-0809 ☎+81-11-726-8787 Fax.+81-11-726-9428

Sendai Sales Branch

2-10-33, Honcho, Aoba-Ku, Sendai, JAPAN
Post Cord:980-0014 ☎+81-22-225-2539 Fax.+81-22-225-2540

Nagoya Sales Branch

3-21-7, Meieki, Nakamura-Ku, Nagoya, JAPAN
Post Cord:450-0002 ☎+81-52-561-1281 Fax.+81-52-561-1285

Osaka Sales Branch

4-1-14, Miyahara, Yodogawa-Ku, Osaka, JAPAN
Post Cord:532-0003 ☎+81-6-6350-7001 Fax.+81-6-6350-7002

Yonago Sales Office

2-218-1, Doushoumachi, Yonago-shi, Tottori, JAPAN
Post Cord:683-0064 ☎+81-859-38-0060 Fax.+81-859-38-0061

Okayama Sales Office

1-23-404, Shinkurashiekimae, Kurashiki-Shi, Okayama, JAPAN
Post Cord:710-0253 ☎+81-86-523-5051 Fax.+81-86-523-5052

Hiroshima Sales Branch

2-2-9, Otemchi, Naka-Ku, Hiroshima, JAPAN
Post Cord:730-0051 ☎+81-82-545-5105 Fax.+81-82-545-5721

Shikoku Sales Branch

2-4-20, Kotobukicho, Takamatsu-shi, Kagawa, JAPAN
Post Cord:760-0023 ☎+81-87-821-7904 Fax.+81-87-821-7967

Fukuoka Sales Branch

1-8-12, Hakataekiminami, Hakata-ku, Fukuoka, JAPAN
Post Cord:812-0016 ☎+81-92-441-3778 Fax.+81-92-441-3780

Beijing Representative Office

2910B, Jingguang Center, Huijialou, Chaoyang district, Beijing, CHINA
Post Cord:100020 ☎+86-10-6597-3700 Fax.+86-10-6597-3873

Shinnajicokosan Co., Ltd.

2-32-2 (Moriya Industrial Park), Midori, Moriya-city, Ibaragi, JAPAN
Post Cord:302-0106 ☎+81-297-48-7701 Fax.+81-297-48-8430

Nakamurajidosha Shokai Co., Ltd.

2-7-17, Sasaguchi, Chuo-ku, Niigata-city, Niigata, JAPAN
Post Cord:950-0911 ☎+81-25-241-4678 Fax.+81-25-241-0185

Nakamura Jico Asia Pacific Pte. Ltd.

10 Anson Road #28-12A, International Plaza, SINGAPORE
Post Cord:079903 ☎+65 6635 6307 Fax.+65 6635 6309





This mark symbolizes our business philosophy of: ①Establishment of an enterprise based on customer trust. ②Contribution to society through business activity. ③Life worth living in work through the sum of all employees. We are advancing on the basic principle of "work with your feet planted firmly on the ground" following our business philosophy of "trust, contribution, harmony".

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