

VARIABLE EFFORT SUPPORTS

The latest range of Variable Effort Supports has been designed to cater for the ever increasing space limitations on Offshore Rigs and other process plants and also to enable the units to be finished in either a galvanised or protective paint finish at minimum cost, allowing full assembly without damaging such finishes.

APPLICATION

Variable Effort Supports are used to support the weight of pipework or equipment whilst allowing a degree of movement relative to the supporting structure. Where pipes transport hot (or cold) liquids or gases they expand (or contract) due to the difference between operating and ambient temperatures. It is necessary to support the pipe in operating and ambient conditions, whilst permitting movement between the two. Variable Effort Supports may also be needed to cater for ambient temperature variation local to items of plant or long vertical pipe runs, or where pipes pass between buildings that may be subject to relative movement due to subsidence or earthquake.

LOAD RANGE

We offer a wide range of variable effort supports catering for loads from 3.43kgf to 39120kgf.

Our standard range of variable supports offers 5 travel ranges over 29 spring sizes enabling the engineer to optimise his selection of spring stiffness giving the lowest possible variability.

Our **High-load** range of variable supports caters for situations where high load carrying capacity and compact design is required. We offer 3 travel ranges (V1 to V3) over 7 spring sizes catering for loads from 6445kgf to 39120kgf.

Most of these spring sizes are available in the following configurations.

WORKING RANGES

V1	35mm	V4	210mm
V2	70mm	V5	280mm
V3	140mm		

These figures represent the total working travel available from each range however it should be noted that the allowable deviation will restrict the amount of the full travel range that can be used. The lower the allowable variability the less available travel will be useable.

SPRING STIFFNESS

The stiffness of the spring is a function of the load range and travel range with the shorter travel ranges using the stiffer springs. Spring stiffness has a direct relationship to variability, also referred to as allowable deviation. Variability is the measure of the variance in supporting effort in either the 'cold' or the 'hot' condition when compared with the 'design' load.

The ideal pipe supporting system will exert no additional force on the pipe and will therefore be made up of entirely constant effort supports. This would be a very costly and inefficient solution.

The most cost effective solution is that which utilises 100% of the available 'stress capacity' of the pipe and combines rigid hangers, variable effort supports and constant effort supports to deliver this optimum solution.

Because we offer the engineer a large number of spring sizes over a wide range of working loads it is possible to select the ideal spring rate and create the optimum pipe

supporting solution that minimises the need for constant effort supports.

The critical factor in specifying variable effort supports is the allowable variability. The engineer should work towards maximising variability within the specified limit thereby making use of the maximum stress capacity of the pipe and achieving the most cost effective hanger solution.

SUPPORT TYPES

TS1, TS2, TS3	Top Suspended
TA	Top Adjustable
ES	Extended Support
DS	Double Support
BM1, BM2, BM3, BM4	Base Mounted

RELATED SPECIFICATIONS

Our Variable Effort Supports are designed and manufactured to meet the requirements of the following specifications:

EN13480	ANSI/ASME B31.1
ANSI/ASME B31.3	ANSI/MSS SP-58
IBR-REG-371	

INSTALLATION AND ERECTION

Types TS1, TS2, TS3, TA and ES

Lift the support carefully into position and secure to the hanger rod for type TS1, to the beam attachment with a suspension bolt or clevis pin for types TS2 and TS3 or to the support beams for types TA and ES. Make the connection to the pipework via the hanger rod and pipe clip. Apply tension to the spring unit by rotating the turnbuckle (or adjusting nut for type TA). When the preset load is attained, the locking nuts above the spring plate will become free to rotate. The locking nuts beneath the spring plate are then ready to carry any hydrostatic test load. On completion of hydrostatic testing, lagging, etc. the locking nuts must be fully withdrawn from the spring plate to the unlocked position. See diagram on page 40.

Type DS

The procedure is similar to the above except that the spring canister is inverted and application of the load will release the locking nuts below the spring plate, with nuts above the spring plate carrying the hydrostatic test load, etc.

Types BM1, BM2, BM3, BM4

For these supports the load is transferred to the support by rotation of the height adjustment nut, which is situated below the load pad, rather than via a turnbuckle. Then proceed as for TS1, etc.

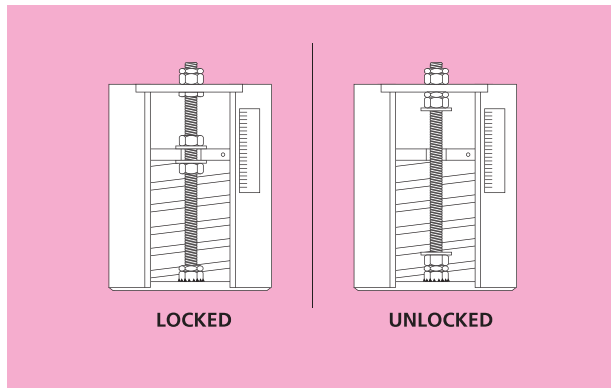
MAINTENANCE

Variable Effort Supports are designed to be maintenance free. On no account should any attempt be made to remove the spring coil from the canister, since it has been pre-compressed. Periodic inspection should be carried out at a frequency which suits the environment in which they are used. Check for visual damage, for any corrosion (especially of the spring coil and threaded rods) and to ensure that no debris has fallen into the support which could impede the movement of the spring.

A more detailed erection and maintenance procedure is available upon request.

VARIABLE EFFORT SUPPORTS

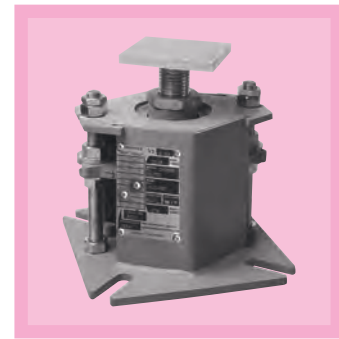
STANDARD FEATURES



1. Compactness of units. Installed heights designed to minimum.
2. Preset and multi-locking device, allowing unit to be supplied locked at its installed load and ready to accept a test load of at least twice the rated load. The infinitely adjustable multi-lock is permanently fixed to the unit, allowing re-locking at any travel position. This is of particular benefit at times of plant outages or during pipework maintenance/inspection.
3. Overtravel is provided on either side of the working range.
4. Supports are fitted with stainless steel nameplates marked with the installed and operating load, support reference mark, type and unique serial number.
5. Variable effort supports are supplied as standard with plastic coated spring coils and hot-dipped galvanised casings and threaded items.

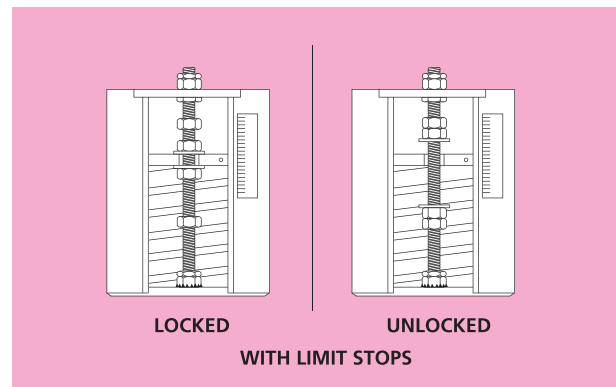


Type TS2



Type BM1

OPTIONAL FEATURES



1. Limit Stops. The preset/multilock facility may be enhanced to precisely limit spring travel. Additional nuts welded in position are used to limit movement to a specified amount.
2. The construction of our variable effort supports makes the application of special paint finishes a simple matter.
3. For low temperature applications suitable grades of carbon steel are used to suit the specified temperature range. Where necessary the material used for spring coils is also changed to an appropriate grade of steel.
4. For extreme corrosive condition extra-thick body section can be supplied.
5. For extended life in offshore or other situations subject to highly corrosive conditions, supports are available in various grades of stainless steel with the spring coil from 17/4 PH (precipitation hardened) stainless steel. Please check with our design department for dimensional information.
6. In Cryogenic applications supports are available manufactured entirely in austenitic stainless steel. Please check with our design department for dimensional information.
7. For type BM1 Supports, where lateral loading greater than 25% of the maximum operating load is envisaged, PTFE covered load pads should be specified.

VARIABLE EFFORT SUPPORTS

SELECTION

Selection of Variable Effort Supports can either be done manually from the catalogue as described below, or by using computer software that is available from our sales department.

SELECTION FROM THE CATALOGUE

Load charts on pages 43 and 54 can be opened out and used at the same time as dimensional charts for the units being selected.

Range: The choice of range V1 to V5 will depend upon the movement at the support position and the allowable change in effort.

Change in effort = movement x Spring Rate

This often expressed as a percentage of operating load.

$$\text{Variation in effort} = \frac{\text{Movement} \times \text{Spring Rate}}{\text{Operating Load}} \times 100\%$$

This variation is usually limited to 25% although greater variation is sometimes specified where a higher spring rate is justified in the pipework analysis, or lesser when supporting critical items.

For guidance only on selecting the travel range, movements of 15 mm, 30 mm, 60 mm, 90 mm and 120 mm will produce variations in effort of approximately 25% of 'mid table load' on ranges V1 to V5 respectively.

SUPPORT SIZE

Selection of support size is determined using the selection charts in N or kgf which are located on fold out page.

SELECTION PROCEDURE

1. Determine the required supporting effort and pipe movement (up or down) installed to operating. Weights of spreader beams, heavy pipe clamps, etc. should be added to the pipe load.
2. Estimate which travel range will be required. (See above).
3. Select the smallest spring size which has the operating load within the working travel.
4. Ensure the spring selected can accommodate the preset to operating travel within the working range. This is done by moving up and down the chart from the operating load by the amount of the travel. Down if the movement 'installed to operating' is up, and up if the movement 'installed to operating' is down.
5. If the spring selected can not accommodate the movement try a larger spring size or the next travel range. If the movement can not be accommodated by V5 range then a constant effort support is required.
6. Check the variation in supporting effort for the selected spring

$$\text{Variation} = \frac{\text{Movement} \times \text{Spring Rate}}{\text{Operating Load}} \times 100\%$$

If this exceeds the allowable variation then choose the next travel range and go back to 3 above. If the variation is less than half of the allowable then a smaller travel range may be acceptable. Choose a smaller travel range and go back to Step 4. If the variation exceeds the allowable for a V5 selection then a constant effort support is required.

TYPE

Determine the type of unit required, i.e. TS1, TS2, TS3, TA, ES, DS, BM1, BM2, BM3 or BM4. Selection will depend upon the location of steelwork/concrete and available space.

Once the travel range, spring size and type have been selected the descriptions can be written, i.e. V1-18BMI.

CALCULATION OF INSTALLED DIMENSIONS

The "RTO" or rod take out dimension for TS1, TS2, TS3 and DS units and "J" dimension for TA, ES and BM supports tabulated are dimensions at minimum load, i.e. at the start of the working range. In order to determine installed dimensions carry out the calculations below:

a) Installed Load =
Operating Load + (Movement x Spring Rate)
for 'installed to operating' movement up.

b) Installed Load =
Operating Load - (Movement x Spring Rate)
for 'installed to operating' movement down.

Spring Displacement at Installed Load =
 $\frac{\text{Installed Load} - \text{Minimum Load (mm)}}{\text{Spring Rate}}$

Installed Dimension =
R.T.O. + Spring Displacement at Installed Load
(TS1, TS2, TS3 and DS units).

Installed Dimension =
J - Spring Displacement at Installed Load
(TA, ES and BM units).

ORDERING

Either:

- a) Advise
- i) Number off.
 - ii) Support Description, i.e.
V2 — 12 — TS3
Travel Range Spring Size Type
 - iii) Operating Load.
 - iv) Installed to operating movement and direction.
 - v) Finish required.
 - vi) Support Mark No.
 - vii) Thread Form.

N.B. If exact load and movement are not known supports will be supplied set at mid-travel.

- or b)
- i) Number off.
 - ii) Support Type.
 - iii) Operating Load.
 - iv) Installed to operating movement.
 - v) Allowable variation. This will be taken as 25% of operating load unless otherwise stated.
 - vi) Finish.
 - vii) Support Mark No.
 - viii) Thread Form.

In this case we will determine support size to be supplied.

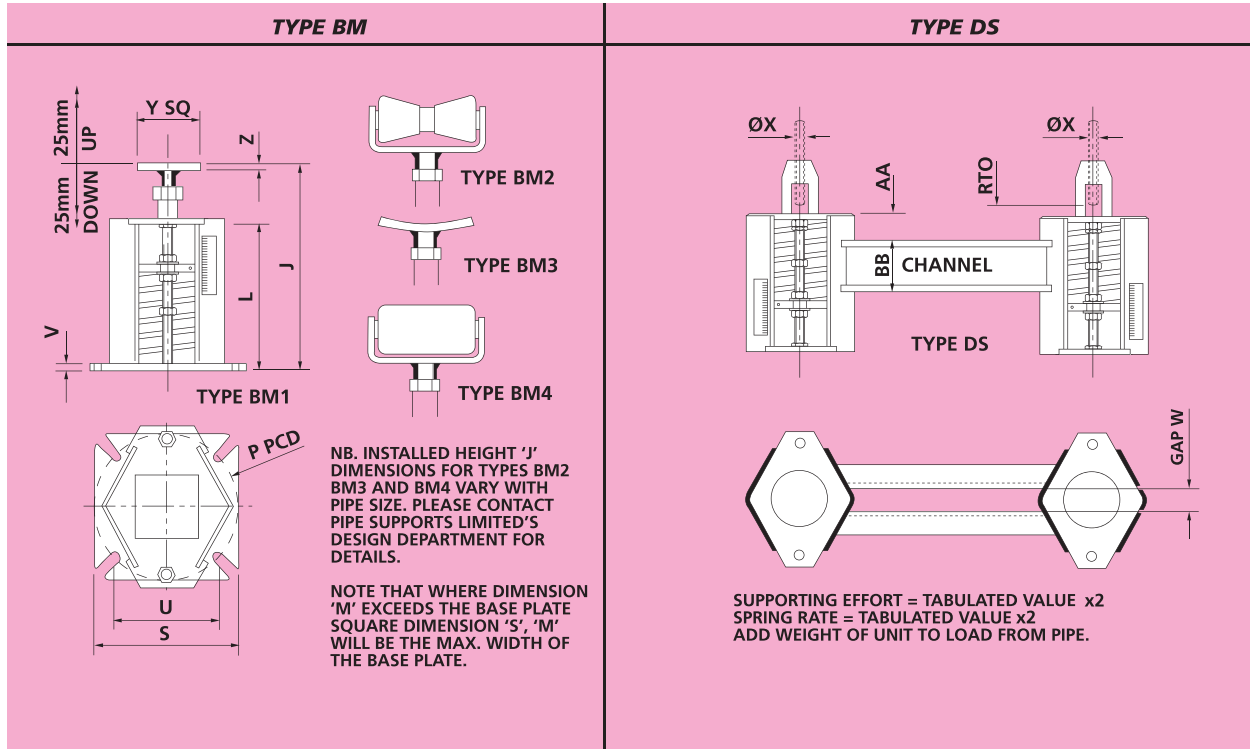
VARIABLE EFFORT SUPPORTS

VARIABLE EFFORT SUPPORT SELECTION CHART

Newtons

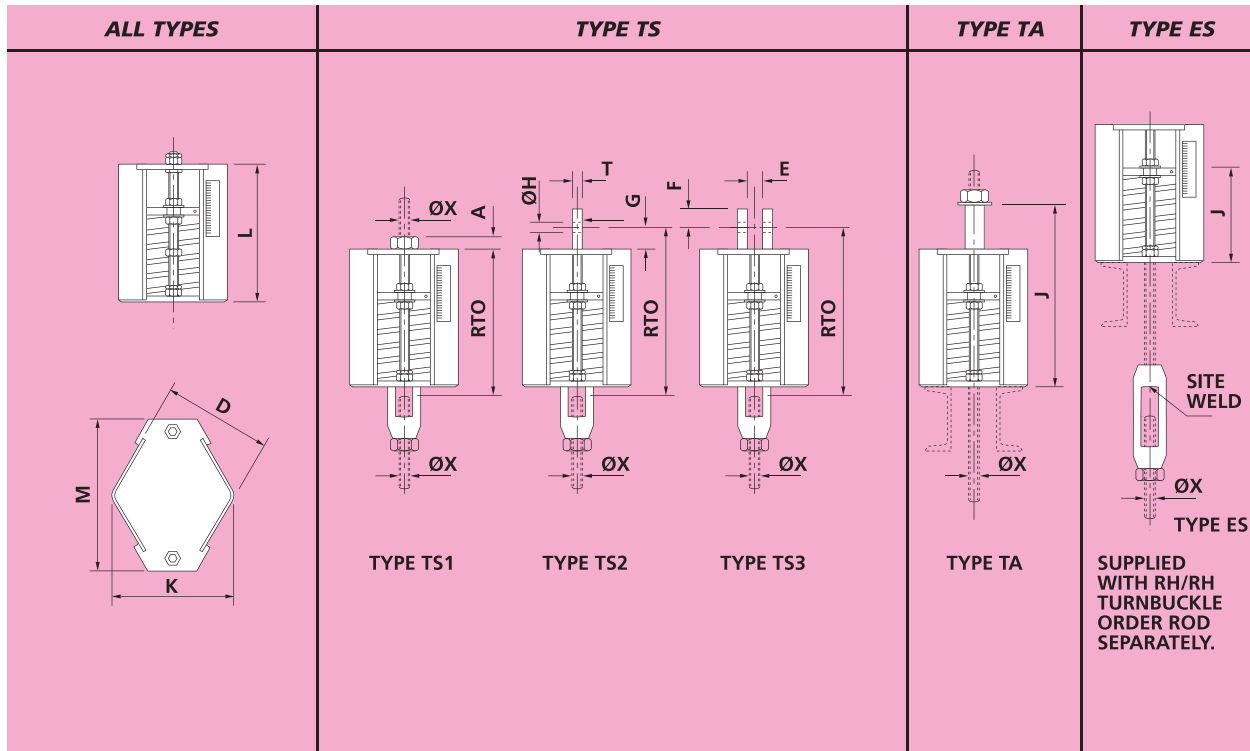
MOVEMENT mm		SPRING SIZE																															
V1	V2	V3	V4	V5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
MIN	0	0	0	0	26.7	46.7	75.5	107	125	160	178	289	353	461	608	775	1079	1412	1981	2471	3501	4511	5972	7963	10611	14328	20006	26782	35333	47023	62272	83102	111139
W	0	0	0	0	28.1	48.4	77.6	110	129	165	183	296	363	473	625	798	1108	1453	2034	2544	3591	4631	6132	8176	10894	14711	20532	27483	36281	48270	63934	85360	114064
O	0	0	0	0	29.5	50.2	79.7	112	133	170	189	303	373	486	642	821	1138	1493	2088	2617	3682	4752	6291	8389	11177	15095	21059	28183	37228	49517	65595	87619	116989
R	5	10	20	40	30.9	51.9	81.8	115	137	175	194	310	382	499	659	844	1167	1534	2141	2690	3772	4872	6451	8602	11460	15479	21586	28884	38175	50764	67257	89878	119915
K	10	20	40	80	32.3	53.7	83.9	118	141	179	200	317	392	511	676	867	1196	1575	2194	2763	3863	4992	6610	8815	11743	15863	22112	29584	39122	52010	68919	92137	122840
I	15	30	60	120	33.7	55.5	86.0	121	146	184	206	324	402	524	693	890	1226	1615	2248	2836	3953	5113	6770	9029	12026	16247	22639	30285	40069	53257	70580	94396	125765
N	20	40	80	160	35.1	57.2	88.1	124	150	189	211	331	412	536	710	912	1255	1656	2301	2909	4043	5233	6929	9242	12309	16631	23166	30895	41016	54504	72242	96655	128690
G	25	50	100	200	36.5	59.0	90.2	126	154	194	217	338	422	549	727	935	1285	1697	2354	2982	4134	5353	7089	9455	12591	17015	23692	31686	41964	55751	73904	98914	131616
A	30	60	120	240	37.9	60.7	92.3	129	158	199	222	345	431	562	744	958	1314	1737	2408	3055	4224	5474	7249	9668	12874	17399	24219	32387	42911	56996	75565	101173	134541
E	35	70	140	280	39.3	62.5	94.5	132	162	204	228	352	441	574	761	981	1344	1778	2461	3128	4315	5594	7408	9881	13157	17783	24746	33087	43858	58245	77227	103431	137466
MAX	40	80	160	320	40.7	64.2	96.6	135	167	209	234	359	451	587	778	1004	1373	1819	2514	3201	4405	5714	7568	10094	13440	18166	25272	33788	44805	59492	78889	105690	140391
					42.1	66.0	98.7	138	171	214	239	366	461	599	795	1027	1402	1859	2568	3274	4496	5834	7727	10307	13723	18550	25799	34488	45752	60739	80550	107949	143317
					43.5	67.7	101	140	175	219	245	373	471	612	812	1050	1432	1900	2621	3347	4586	5955	7887	10520	14006	18934	26326	35189	46700	61985	82212	110208	146242
					44.9	69.5	103	143	179	224	251	380	481	624	829	1073	1461	1941	2674	3420	4676	6075	8046	10733	14289	19318	26853	35889	47647	63232	83873	112467	149167
					46.3	71.3	105	146	183	228	256	387	490	637	846	1096	1491	1981	2728	3493	4767	6195	8206	10947	14572	19702	27379	36590	48594	64479	85535	114726	152092
					47.7	73.0	107	149	188	233	262	394	500	650	863	1119	1520	2022	2781	3566	4857	6316	8365	11160	14855	20086	27906	37291	49541	65726	87197	116965	155018
					49.1	74.8	109	152	192	238	267	401	510	662	880	1142	1549	2063	2834	3639	4948	6436	8525	11373	15138	20470	28433	37991	50488	66973	88858	119244	157943
					50.5	76.5	111	154	196	243	273	406	520	675	897	1165	1579	2103	2888	3711	5038	6556	8684	11586	15421	20854	28959	38692	51435	68220	90520	121502	160868
					51.9	78.3	113	157	200	248	279	415	530	687	914	1188	1608	2144	2941	3784	5128	6677	8844	11799	15704	21238	29486	39392	52383	69467	92182	123761	163793
					53.3	80.0	116	160	205	253	284	422	539	700	931	1211	1638	2185	2994	3857	5219	6797	9003	12012	15987	21622	30013	40093	53330	70714	93843	126020	166719
					54.7	81.8	118	163	209	258	290	429	549	713	948	1234	1667	2225	3048	3930	5309	6917	9163	12225	16270	22005	30539	40794	54277	71960	95505	128279	169644
					56.1	83.5	120	166	213	263	296	436	559	725	965	1257	1697	2266	3101	4003	5400	7038	9323	12438	16553	22389	31066	41494	55224	73207	97166	130538	172569
					57.5	85.3	122	168	217	268	301	443	569	738	982	1280	1726	2307	3154	4076	5490	7158	9482	12652	16836	22773	31593	42195	56171	74454	98828	132797	175494
					58.9	87.1	124	171	221	273	307	450	579	750	999	1303	1755	2347	3208	4149	5580	7278	9642	12865	17119	23157	32119	42895	57118	75701	100490	135056	178420
					60.3	88.8	126	174	226	278	312	457	588	763	1016	1326	1785	2388	3261	4222	5671	7399	9801	13078	17402	23541	32646	43596	58066	76948	102515	137315	181345
					61.7	90.6	128	177	230	282	318	465	598	775	1033	1349	1814	2429	3314	4295	5761	7519	9961	13291	17685	23925	33173	44296	59013	78195	103813	139574	184270
					63.1	92.3	130	180	234	287	324	472	608	788	1050	1372	1844	2469	3368	4368	5852	7639	10120	13504	17968	24309	33699	44997	59960	79442	105475	141832	187195
					64.5	94.1	132	182	238	292	329	479	618	801	1067	1395	1873	2510	3421	4441	5942	7759	10280	13717	18251	24693	34226	45698	60907	80689	107136	144091	190121
					65.9	95.8	134	185	242	297	335	486	628	813	1084	1418	1902	2551	3474	4514	6033	7880	10439	13930	18534	25077	34753	46398	61854	81936	108798	146350	193046
					67.3	97.6	137	188	247	302	341	493	637	826	1100	1441	1932	2591	3528	4587	6123	8000	10599	14143	18817	25460	35280	47099	62802	83182	110459	148609	195971
					68.7	99.3	139	191	251	307	346	500	647	838	1117	1464	1961	2632	3581	4660	6213	8120	10758	14356	19100	25844	35806	47799	63749	84429	112121	150868	198896
					70.1	101	141	194	255	312	352	507	657	851	1134	1487	1991	2673	3634	4733	6304	8241	10918	14570	19382	26228	36333	48500	64696	85676	113783	153127	201822
					71.5	103	143	196	259	317	357	514	667	864	1151	1510	2020	2713	3688	4806	6394	8361	11077	14783	19565	26612	36860	49200	65643	86923	115444	155386	204747
					72.9	105	145	199	263	322	363	521	677	876	1168	1532	2050	2754	3741	4879	6485	8481	11237	14996	19948	26996	37396	49901	66590	88170	117106	157645	207672
					74.3	106	147	202	268	327	369	528	686	889	1185	1555	2079	2795	3794	4952	6575	8602	11397	15209	20231	27380	37913	50602	67537	89417	118788	159903	210597
					75.7	108	149	205	272	331	374	535	696	901	1202	1578	2108	2835	3848	5025	6665	8722	11556	15422	20514	27764	38440	51302	68485	90664	120429	162162	213523
					77.1	110	151	208	276	336	380	542	706	914	1219	1601	2138	2876	3901	5098	6756	8842	11716	15635	20797	28148	38966	52003	69432	91911	122091	164421	216448
					78.5	112	153	210	280	341	385	549	716	926	1236	1624	2167	2917	3954	5170	6846	8963	11875	15848	21080	28532	39493	52703	70379	93157	123753	166680	219373
					79.9	113	155	213	285	346	391	556	726	939	1253	1647	2197	2957	4008	5243	6937	9083	12035	16061	21363	28916	40020	53404	71326	94404	125414	168939	222298
					81.3	115	158	216	289	351	397	563	735	952	1270	1670	2226	2998	4061	5316	7027	9203	12194	16274	21646	29299	40546	54104	72273	95651	127076	171198	225224
					82.7	117	160	219	293	356	402	570	745																				

RANGE V1



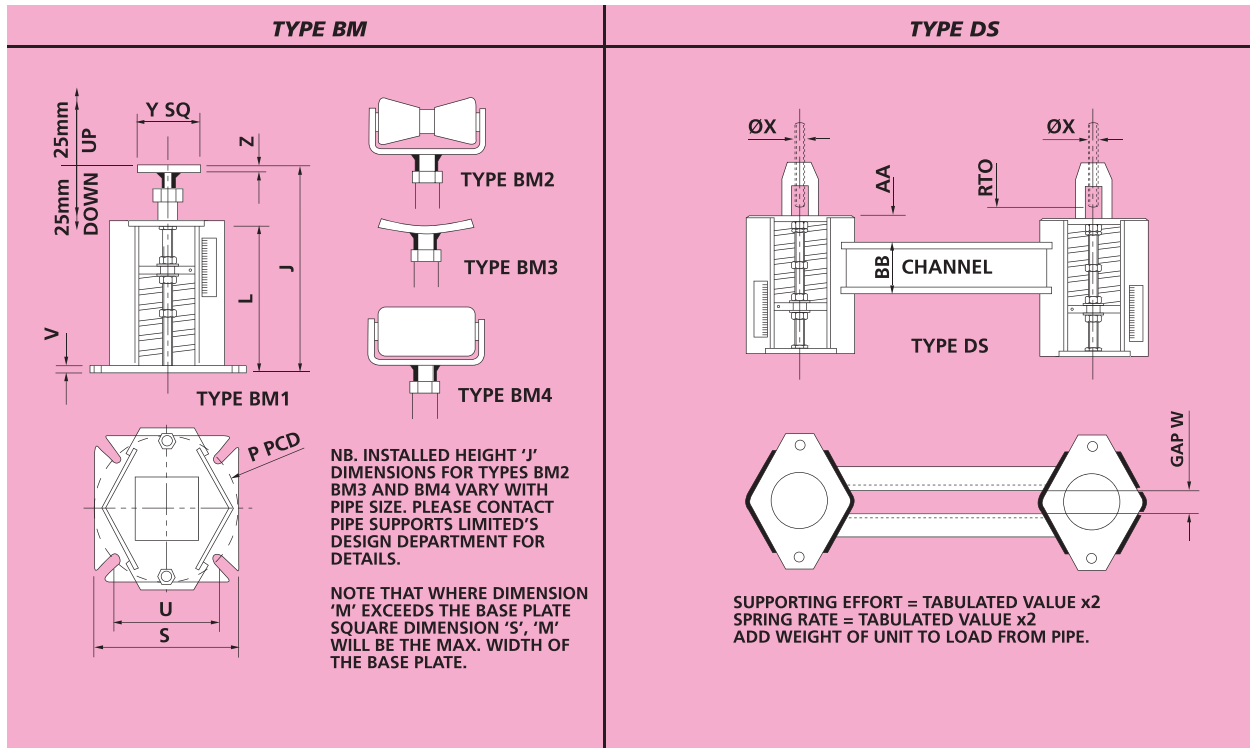
SUPPORT SIZE	J AT MIN. LOAD TYPE BM1 mm	BODY L'TH L mm	BASE PLATE SQ. S mm	BASE PLATE PCD P mm	BASE BOLT CRS. SQ. U mm	BASE BOLT SIZE V mm	BASE PLATE THK Y mm	LOAD PAD SQ. Z mm	WEIGHT kgf BM1	RTO AT MIN LOAD mm	DIM. AA mm	GAP W mm	BEAM DEPTH BB (mm)			WEIGHT kgf			
													800 MAX CENTRES	1200 MAX CENTRES	1600 MAX CENTRES	@ 800 CRS	@ 1200 CRS	@ 1600 CRS	
V1-1	184	104	150	160	113	M16	6	75	6	3.5	63	25	18	50	50	50	14	18	21
V1-2	188	108	150	160	113	M16	6	75	6	3.5	59	25	18	50	50	50	14	18	21
V1-3	193	113	150	160	113	M16	6	75	6	3.5	54	25	18	50	50	50	14	18	21
V1-4	194	114	150	160	113	M16	6	75	6	3.6	53	25	18	50	50	50	15	18	22
V1-5	193	113	150	160	113	M16	6	75	6	3.6	54	25	18	50	50	50	15	18	22
V1-6	196	116	150	160	113	M16	6	75	6	3.6	51	25	18	50	50	50	15	18	22
V1-7	197	117	150	160	113	M16	6	75	6	3.6	50	25	18	50	50	50	15	18	22
V1-8	203	123	150	160	113	M16	6	75	6	3.7	44	25	18	50	50	50	15	18	22
V1-9	206	126	150	160	113	M16	6	75	6	3.8	41	25	18	50	50	50	15	18	22
V1-10	210	127	185	177	125	M20	8	75	6	5.4	42	25	22	75	75	75	19	24	30
V1-11	214	131	185	177	125	M20	8	75	6	5.5	38	25	22	75	75	75	19	25	30
V1-12	215	132	185	177	125	M20	8	75	6	5.6	37	25	22	75	75	75	19	25	31
V1-13	241	152	200	197	139	M20	8	75	10	6.8	25	25	26	75	75	75	20	25	31
V1-14	254	165	200	197	139	M20	8	75	10	7.2	25	25	26	75	75	75	21	26	32
V1-15	276	187	200	197	139	M20	8	75	10	7.6	25	25	26	75	75	75	22	27	33
V1-16	292	204	270	240	170	M20	10	100	12	15.1	25	25	33	100	100	125	38	46	64
V1-17	266	178	270	240	170	M20	10	100	12	14.7	25	25	33	100	100	125	36	44	63
V1-18	279	191	270	240	170	M20	10	100	12	15.2	25	25	33	100	100	125	37	45	64
V1-19	289	199	270	240	170	M20	12	120	12	22.5	25	25	40	125	150	150	59	82	97
V1-20	307	217	270	240	170	M20	12	120	12	23.6	25	25	40	125	150	150	63	86	102
V1-21	330	240	270	240	170	M20	12	120	12	25.4	25	25	40	125	150	150	70	93	109
V1-22	337	246	270	268	190	M20	12	150	15	38.6	25	25	52	200	200	250	119	138	158
V1-23	361	270	270	268	190	M20	12	150	15	44	25	25	52	200	200	250	143	162	182
V1-24	401	308	270	268	190	M20	20	150	15	57	25	25	52	200	200	250	172	192	212
V1-25	422	320	400	400	283	M24	20	200	20	117	25	25	60	250	300	390	296	342	411
V1-26	446	339	400	400	283	M24	20	200	20	132	25	25	70	250	300	390	345	391	459
V1-27	473	363	400	400	283	M24	20	200	20	150	25	25	80	250	300	390	391	437	506
V1-28	536	416	400	400	283	M24	25	200	25	189	25	25	80	390	390	430	517	560	629
V1-29	626	495	400	400	283	M24	30	200	30	237	25	25	90	390	390	430	637	681	750

RANGE V2



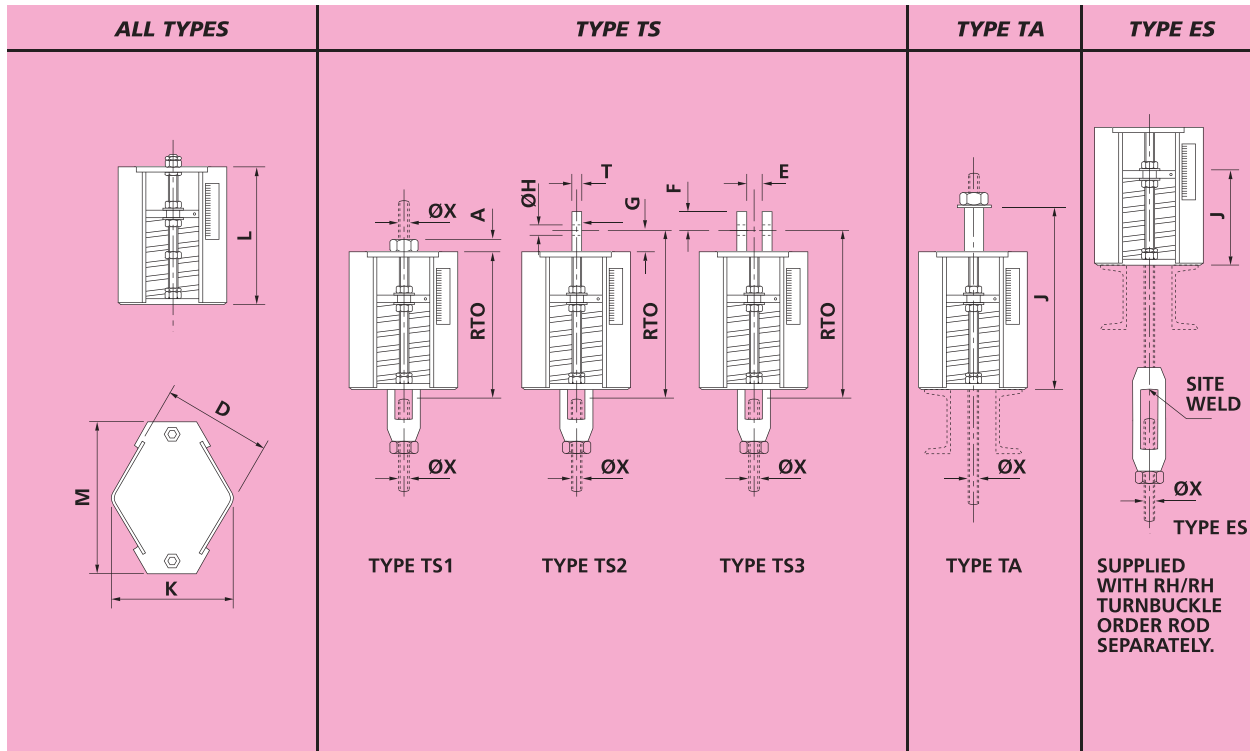
SUPPORT SIZE	ROD DIA X mm	BODY DIMENSIONS				RTO AT MIN LOAD (mm)			DEPTH OF THRD	LUG DIMENSIONS TYPES TS2 & TS3						WEIGHTS kgf			J AT MIN LOAD mm	WEIGHT kgf	J AT MIN LOAD mm	WEIGHT kgf
		D mm	K mm	M mm	L mm (not BM)	TS1	TS2	TS3		A mm	E mm	F mm	G mm	H mm	T mm	TS1	TS2	TS3				
V2-1	M12	108	122	155	169	167	199	199	12	20	20	30	14	6	4.4	4.5	4.6	249	3.6	133	3.8	
V2-2	M12	108	122	155	176	174	206	206	12	20	20	30	14	6	4.5	4.6	4.7	256	3.7	140	3.9	
V2-3	M12	108	122	155	185	183	215	215	12	20	20	30	14	6	4.7	4.8	4.9	265	3.8	148	4.1	
V2-4	M12	108	122	155	191	189	221	221	12	20	20	30	14	6	4.8	4.9	5.0	271	3.9	155	4.2	
V2-5	M12	108	122	155	187	185	217	217	12	20	20	30	14	6	4.7	4.8	4.9	267	3.9	151	4.1	
V2-6	M12	108	122	155	197	195	227	227	12	20	20	30	14	6	4.8	4.9	5.0	277	4.0	161	4.2	
V2-7	M12	108	122	155	190	188	220	220	12	20	20	30	14	6	4.8	4.9	5.0	270	4.0	154	4.2	
V2-8	M12	108	122	155	206	204	236	236	12	20	20	30	14	6	5.1	5.1	5.3	286	4.2	170	4.4	
V2-9	M12	108	122	155	208	206	238	238	12	20	20	30	14	6	5.0	5.1	5.2	288	4.2	171	4.4	
V2-10	M12	145	164	200	206	204	236	236	12	20	20	30	14	6	9.5	9.6	9.7	286	8.4	167	8.6	
V2-11	M12	145	164	200	209	207	239	239	12	20	20	30	14	6	9.7	9.8	9.9	289	8.6	171	8.8	
V2-12	M12	145	164	200	213	211	243	243	12	20	20	30	14	6	9.9	10.0	10.1	293	8.8	175	9.0	
V2-13	M12	145	164	200	222	220	258	258	12	25	30	36	18	6	10.2	10.3	10.5	302	9.1	183	9.3	
V2-14	M12	145	164	200	235	233	271	271	12	25	30	36	18	6	10.9	11.0	11.1	315	9.7	197	9.9	
V2-15	M12	145	164	200	261	259	297	297	12	25	30	36	18	6	12.2	12.4	12.5	341	11.1	223	11.3	
V2-16	M16	175	198	250	244	241	294	294	16	30	35	50	22	10	17.7	18.0	18.4	324	15.2	199	15.5	
V2-17	M16	175	198	250	264	261	314	314	16	30	35	50	22	10	18.8	19.2	19.6	344	16.3	219	16.7	
V2-18	M16	175	198	250	284	281	334	334	16	30	35	50	22	10	20.4	20.8	21.1	364	17.9	239	18.2	
V2-19	M20	220	250	320	285	281	345	345	20	35	45	60	26	10	34.0	34.6	35.2	365	28.5	232	29.0	
V2-20	M24	220	250	320	311	306	381	381	24	40	55	70	33	12	37.7	38.7	39.8	391	31.7	254	32.4	
V2-21	M30	220	250	320	348	342	428	428	30	45	55	80	40	15	45.5	46.9	48.5	428	36.1	281	37.5	
V2-22	M30	220	250	330	389	383	469	469	30	45	55	80	40	15	55.2	56.5	58.2	469	45.4	322	46.9	
V2-23	M36	220	250	330	454	447	544	544	36	60	75	90	46	15	71.2	73.1	75.5	534	58.3	376	59.6	
V2-24	M42	220	250	330	526	518	631	631	42	70	85	105	52	20	89.9	93.4	97.6	606	72.4	436	74.6	
V2-25	M48	330	376	500	467	457	587	587	48	75	100	120	60	20	165	170	176	547	139	377	143	
V2-26	M56	330	376	500	541	530	681	681	56	80	115	140	68	20	193	199	206	621	162	443	168	
V2-27	M64	330	376	520	611	598	766	766	64	90	130	155	76	25	234	243	255	691	195	507	204	
V2-28	M72	330	376	530	753	739	1108	1108	72	90	130	155	76	25	303	312	323	808	250	611	262	
V2-29	M80	330	376	540	870	854	1245	1245	80	100	150	175	85	25	382	393	407	925	309	715	328	

RANGE V2



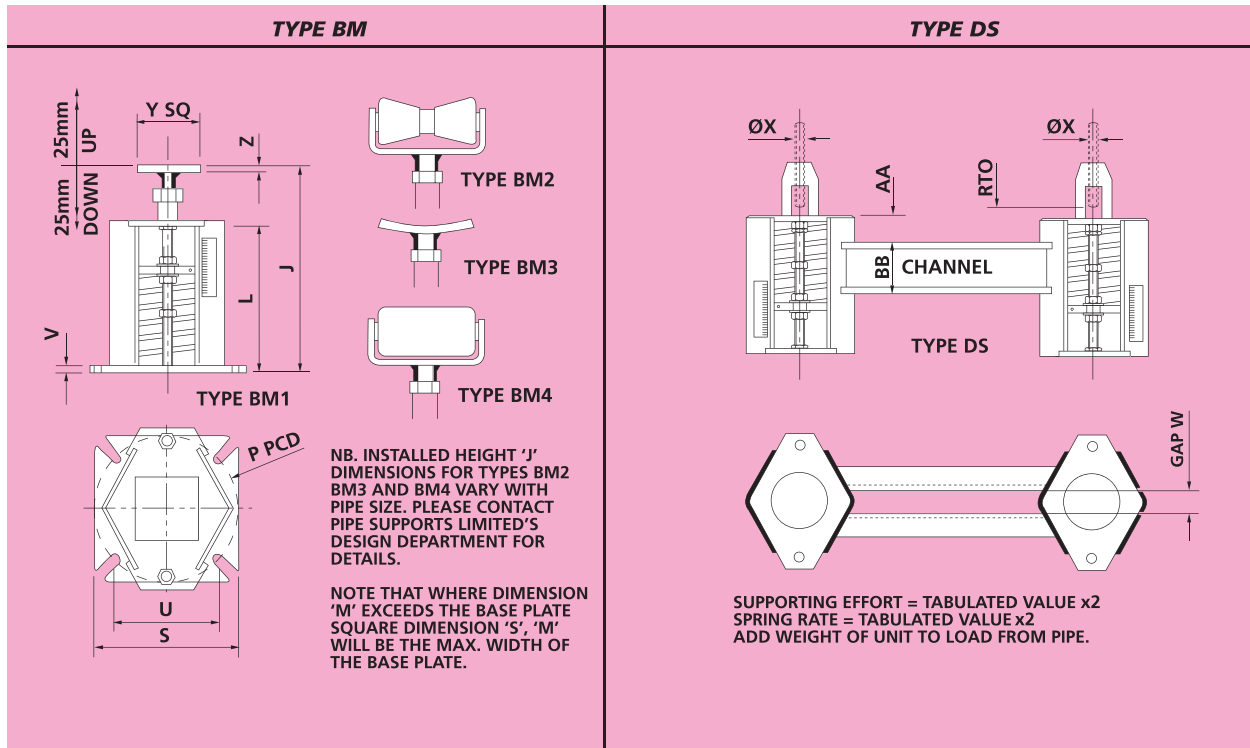
SUPPORT SIZE	J AT MIN. LOAD TYPE BM1 mm	BODY L'TH L mm	BASE PLATE SQ. S mm	BASE PLATE PCD P mm	BASE BOLT CRS. SQ. U mm	BASE BOLT SIZE V mm	BASE PLATE THK Y mm	LOAD PAD SQ. Z mm	LOAD PAD THK BM1	WEIGHT kgf	RTO AT MIN LOAD mm	DIM. AA mm	GAP W mm	BEAM DEPTH BB (mm)			WEIGHT kgf		
														800 MAX CENTRES	1200 MAX CENTRES	1600 MAX CENTRES	@ 800 CRS	@ 1200 CRS	@ 1600 CRS
V2-1	280	159	150	160	113	M16	6	75	6	3.7	25	25	18	50	50	50	15	18	22
V2-2	287	166	150	160	113	M16	6	75	6	3.7	25	25	18	50	50	50	15	19	22
V2-3	295	174	150	160	113	M16	6	75	6	3.8	25	25	18	50	50	50	16	19	23
V2-4	302	181	150	160	113	M16	6	75	6	3.9	25	25	18	50	50	50	16	19	23
V2-5	298	177	150	160	113	M16	6	75	6	3.8	25	25	18	50	50	50	16	19	23
V2-6	308	187	150	160	113	M16	6	75	6	3.9	25	25	18	50	50	50	16	19	23
V2-7	301	180	150	160	113	M16	6	75	6	3.9	25	25	18	50	50	50	16	19	23
V2-8	317	196	150	160	113	M16	6	75	6	4.1	25	25	18	50	50	50	16	20	23
V2-9	318	197	150	160	113	M16	6	75	6	4.0	25	25	18	50	50	50	16	20	23
V2-10	325	205	200	197	139	M20	10	75	6	9.6	25	25	22	75	75	75	28	34	40
V2-11	329	209	200	197	139	M20	10	75	6	9.7	25	25	22	75	75	75	29	34	40
V2-12	333	213	200	197	139	M20	10	75	6	9.9	25	25	22	75	75	75	29	35	40
V2-13	347	221	200	197	139	M20	10	75	10	10.8	25	25	26	75	75	75	30	35	41
V2-14	361	235	200	197	139	M20	10	75	10	11.3	25	25	26	75	75	75	31	37	42
V2-15	387	261	200	197	139	M20	10	75	10	12.4	25	25	26	75	75	75	34	39	45
V2-16	368	239	270	240	170	M20	12	100	12	20.0	25	25	33	100	100	125	48	56	74
V2-17	388	259	270	240	170	M20	12	100	12	20.9	25	25	33	100	100	125	50	58	76
V2-18	408	279	270	240	170	M20	12	100	12	22.2	25	25	33	100	100	125	53	61	80
V2-19	405	276	270	268	190	M20	12	120	12	31.7	25	25	40	125	150	150	84	106	122
V2-20	427	298	270	268	190	M20	12	120	12	34.2	25	25	40	125	150	150	91	113	129
V2-21	454	325	270	268	190	M20	12	120	12	37.8	25	25	40	125	150	150	107	129	145
V2-22	498	366	270	268	190	M20	12	150	15	46.8	25	25	52	200	200	250	139	158	178
V2-23	542	410	270	268	190	M20	12	150	15	55.5	25	25	52	200	200	250	171	190	210
V2-24	607	473	270	268	190	M20	20	150	15	71.4	25	25	52	200	200	250	208	228	247
V2-25	563	420	400	400	283	M24	20	200	20	141	25	25	60	250	300	390	352	398	467
V2-26	629	481	400	400	283	M24	20	200	20	158	25	25	70	250	300	390	409	455	523
V2-27	699	548	400	400	283	M24	20	200	20	192	25	25	80	250	300	390	491	537	606
V2-28	816	655	400	400	283	M24	25	200	25	248	25	25	80	390	390	430	657	700	769
V2-29	940	768	400	400	283	M24	30	200	30	312	25	25	90	390	390	430	815	859	928

RANGE V3



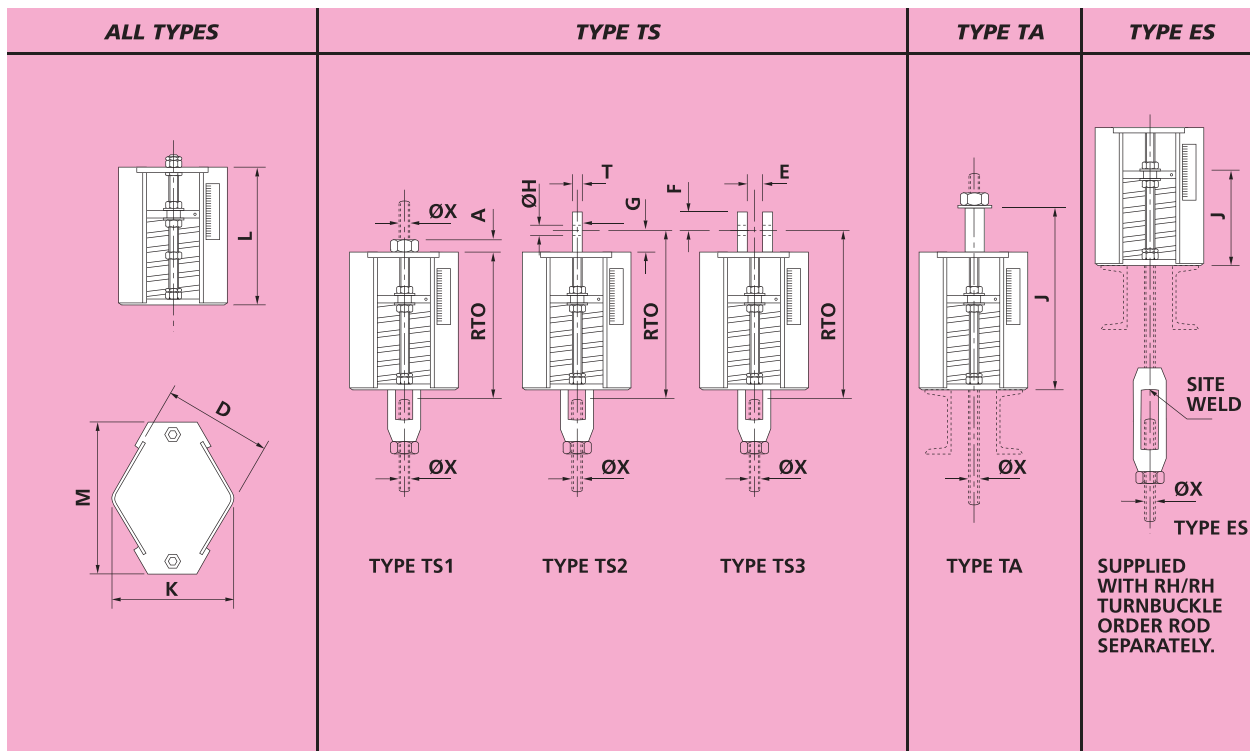
SUPPORT SIZE	ROD DIA X mm	BODY DIMENSIONS				RTO AT MIN LOAD (mm)			DEPTH OF THRD A mm	LUG DIMENSIONS TYPES TS2 & TS3						WEIGHTS kgf			J AT MIN LOAD mm	WEIGHT kgf	J AT MIN LOAD mm	WEIGHT kgf
		D mm	K mm	M mm	L mm (not BM)	TS1	TS2	TS3		E mm	F mm	G mm	H mm	T mm	TS1	TS2	TS3					
V3-1	M12	108	122	155	294	292	324	324	12	20	20	30	14	6	5.4	5.5	5.6	454	4.7	243	4.8	
V3-2	M12	108	122	155	315	313	345	345	12	20	20	30	14	6	5.8	5.8	6.0	475	5.0	264	5.1	
V3-3	M12	108	122	155	329	327	359	359	12	20	20	30	14	6	5.9	6.0	6.1	489	5.1	278	5.2	
V3-4	M12	108	122	155	330	328	360	360	12	20	20	30	14	6	6.0	6.1	6.2	490	5.2	279	5.3	
V3-5	M12	108	122	155	323	321	353	353	12	20	20	30	14	6	6.0	6.1	6.2	483	5.2	272	5.3	
V3-6	M12	108	122	155	328	326	358	358	12	20	20	30	14	6	6.0	6.1	6.2	488	5.2	277	5.3	
V3-7	M12	108	122	155	336	334	366	366	12	20	20	30	14	6	6.2	6.3	6.4	496	5.4	286	5.5	
V3-8	M12	108	122	155	356	354	386	386	12	20	20	30	14	6	6.6	6.7	6.8	516	5.7	306	5.9	
V3-9	M12	108	122	155	370	368	400	400	12	20	20	30	14	6	7.0	7.1	7.2	530	6.1	319	6.2	
V3-10	M12	145	164	200	351	349	381	381	12	20	20	30	14	6	12.0	12.0	12.2	511	10.9	299	11.0	
V3-11	M12	145	164	200	357	355	387	387	12	20	20	30	14	6	12.3	12.4	12.5	517	11.2	305	11.4	
V3-12	M12	145	164	200	364	362	394	394	12	20	20	30	14	6	12.7	12.8	12.9	524	11.6	312	11.7	
V3-13	M12	145	164	200	380	378	416	416	12	25	30	36	18	6	13.2	13.3	13.5	540	12.1	328	12.2	
V3-14	M12	145	164	200	406	404	442	442	12	25	30	36	18	6	14.4	14.5	14.7	566	13.3	353	13.4	
V3-15	M12	145	164	200	455	453	491	491	12	25	30	36	18	6	16.9	17.1	17.2	615	15.8	403	15.9	
V3-16	M16	220	250	320	374	371	424	424	16	30	35	50	22	10	30.0	30.3	30.7	534	27.0	315	27.2	
V3-17	M16	220	250	320	409	406	459	459	16	30	35	50	22	10	33.6	33.9	34.3	569	30.5	350	30.7	
V3-18	M16	220	250	320	430	427	480	480	16	30	35	50	22	10	36.0	36.4	36.7	590	32.9	371	33.1	
V3-19	M20	220	250	320	473	469	533	533	20	35	45	60	26	10	43.8	44.4	45.0	633	38.2	406	38.4	
V3-20	M24	220	250	320	519	514	589	589	24	40	55	70	33	12	50.0	51.0	52.1	679	43.8	448	44.2	
V3-21	M30	220	250	320	578	572	658	658	30	45	55	80	40	15	61.6	63.0	64.6	738	51.6	497	52.6	
V3-22	M30	220	250	330	649	643	729	729	30	45	55	80	40	15	76.1	77.5	79.1	809	65.7	568	66.7	
V3-23	M36	220	250	330	759	752	849	849	36	60	75	90	46	15	101	103	105	919	87.0	667	87.2	
V3-24	M42	220	250	330	929	921	1034	1034	42	70	85	105	52	20	136	140	144	1089	117	825	117	
V3-25	M48	330	376	500	806	796	926	926	48	75	100	120	60	20	235	240	246	966	207	702	209	
V3-26	M56	330	376	500	942	931	1082	1082	56	80	115	140	68	20	283	289	297	1102	248	770	251	
V3-27	M64	330	376	520	1074	1061	1229	1229	64	90	130	155	76	25	358	367	379	1234	311	956	318	
V3-28	M72	330	376	530	1310	1496	1665	1665	72	90	130	155	76	25	474	483	494	1445	408	1154	417	
V3-29	M80	330	376	540	1528	1712	1903	1903	80	100	150	175	85	25	609	620	635	1663	517	1359	532	

RANGE V3



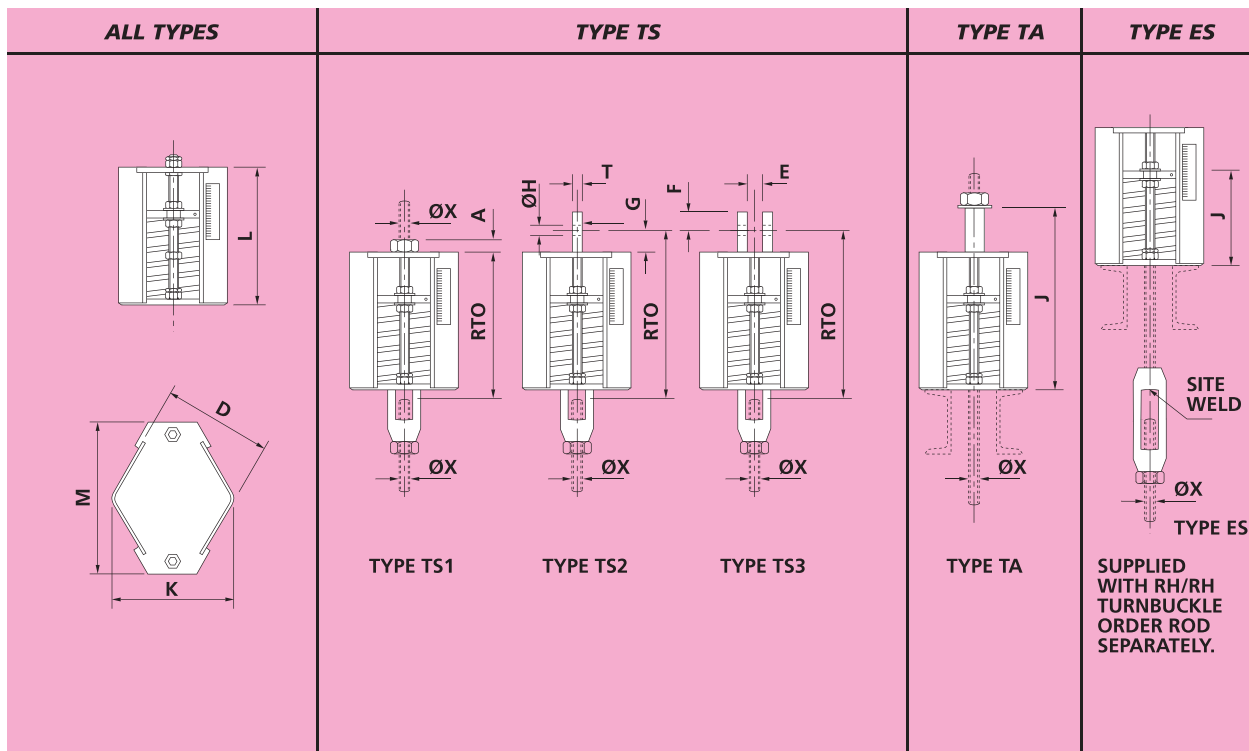
SUPPORT SIZE	J AT MIN. LOAD TYPE BM1 mm	BODY L'TH L mm	BASE PLATE SQ. S mm	BASE PLATE PCD P mm	BASE BOLT CRS. SQ. U mm	BASE BOLT SIZE V mm	BASE PLATE THK Y mm	LOAD PAD SQ. Z mm	LOAD PAD THK BM1	WEIGHT kgf	RTO AT MIN LOAD mm	DIM. AA mm	GAP W mm	BEAM DEPTH BB (mm)			WEIGHT kgf		
														800 MAX CENTRES	1200 MAX CENTRES	1600 MAX CENTRES	@ 800 CRS	@ 1200 CRS	@ 1600 CRS
V3-1	484	281	150	160	113	M16	6	75	6	4.1	25	25	18	50	50	50	17	20	24
V3-2	505	302	150	160	113	M16	6	75	6	4.3	25	25	18	50	50	50	18	21	25
V3-3	519	316	150	160	113	M16	6	75	6	4.4	25	25	18	50	50	50	18	21	25
V3-4	520	317	150	160	113	M16	6	75	6	4.4	25	25	18	50	50	50	18	22	25
V3-5	513	310	150	160	113	M16	6	75	6	4.5	25	25	18	50	50	50	18	22	25
V3-6	518	315	150	160	113	M16	6	75	6	4.5	25	25	18	50	50	50	18	22	25
V3-7	527	324	150	160	113	M16	6	75	6	4.7	25	25	18	50	50	50	19	22	26
V3-8	547	344	150	160	113	M16	6	75	6	4.9	25	25	18	50	50	50	19	23	26
V3-9	560	357	150	160	113	M16	6	75	6	5.2	25	25	18	50	50	50	20	24	27
V3-10	551	349	200	197	139	M20	10	75	6	10.9	25	25	22	75	75	75	33	39	45
V3-11	557	355	200	197	139	M20	10	75	6	11.2	25	25	22	75	75	75	34	39	45
V3-12	564	362	200	197	139	M20	10	75	6	11.5	25	25	22	75	75	75	35	40	46
V3-13	586	378	200	197	139	M20	10	75	10	12.6	25	25	26	75	75	75	36	41	47
V3-14	611	403	200	197	139	M20	10	75	10	13.6	25	25	26	75	75	75	38	44	49
V3-15	661	453	200	197	139	M20	10	75	10	15.6	25	25	26	75	75	75	43	49	54
V3-16	580	371	270	268	190	M20	12	100	12	28.4	25	25	33	100	100	125	71	79	97
V3-17	615	406	270	268	190	M20	12	100	12	31.4	25	25	33	100	100	125	79	87	105
V3-18	636	427	270	268	190	M20	12	100	12	33.5	25	25	33	100	100	125	83	91	109
V3-19	673	462	270	268	190	M20	12	120	12	39.5	25	25	40	125	150	150	103	126	141
V3-20	715	504	270	268	190	M20	12	120	12	43.9	25	25	40	125	150	150	116	138	154
V3-21	764	553	270	268	190	M20	12	120	12	50.6	25	25	40	125	150	150	139	161	177
V3-22	838	624	270	268	190	M20	12	150	15	63.7	25	25	52	200	200	250	180	200	220
V3-23	927	713	270	268	190	M20	12	150	15	79.5	25	25	52	200	200	250	230	250	269
V3-24	1090	874	270	268	190	M20	20	150	15	109	25	25	52	200	200	250	300	320	339
V3-25	982	757	400	400	283	M24	20	200	20	200	25	25	60	250	300	390	492	538	607
V3-26	1109	880	400	400	283	M24	20	200	20	232	25	25	70	250	300	390	589	635	703
V3-27	1242	1009	400	400	283	M24	20	200	20	295	25	25	80	250	300	390	739	785	854
V3-28	1453	1210	400	400	283	M24	25	200	25	390	25	25	80	390	390	430	999	1042	1111
V3-29	1678	1424	400	400	283	M24	30	200	30	501	25	25	90	390	390	430	1269	1313	1382

RANGE V4



SUPPORT SIZE	ROD DIA X mm	BODY DIMENSIONS				RTO AT MIN LOAD (mm)			DEPTH OF THRD A mm	LUG DIMENSIONS TYPES TS2 & TS3						WEIGHTS kgf			J AT MIN LOAD mm	WEIGHT kgf	J AT MIN LOAD mm	WEIGHT kgf
		D mm	K mm	M mm	L mm (not BM)	TS1	TS2	TS3		E mm	F mm	G mm	H mm	T mm	TS1	TS2	TS3					
V4-10	M12	177.6	188.9	200	523	521	553	553	12	20	20	30	14	6	16.8	16.8	17.1	763	15.3	471	15.4	
V4-11	M12	177.6	188.9	200	532	530	562	562	12	20	20	30	14	6	17.2	17.4	17.5	772	15.7	480	16.0	
V4-12	M12	177.6	188.9	200	543	541	573	573	12	20	20	30	14	6	17.8	17.9	18.1	783	16.2	491	16.4	
V4-13	M12	177.6	188.9	200	568	566	604	604	12	25	30	36	18	6	18.5	18.6	18.9	808	16.9	516	17.1	
V4-14	M12	177.6	188.9	200	607	605	643	643	12	25	30	36	18	6	20.2	20.3	20.6	847	18.6	554	18.8	
V4-15	M12	177.6	188.9	200	682	680	718	718	12	25	30	36	18	6	23.7	23.9	24.1	922	22.1	630	22.3	
V4-16	M16	246.2	263.5	320	578	575	628	628	16	30	35	50	22	10	42.0	42.4	43.0	818	37.8	517	38.1	
V4-17	M16	246.2	263.5	320	633	630	683	683	16	30	35	50	22	10	47.0	47.5	48.0	873	42.7	572	43.0	
V4-18	M16	246.2	263.5	320	675	672	725	725	16	30	35	50	22	10	50.4	51.0	51.4	915	46.1	614	46.3	
V4-19	M20	246.2	263.5	320	709	705	769	769	20	35	45	60	26	10	61.3	62.2	63.0	949	53.5	639	53.8	
V4-20	M24	246.2	263.5	320	778	773	848	848	24	40	55	70	33	12	70.0	71.4	72.9	1018	61.3	704	61.9	

RANGE V5



SUPPORT SIZE	ROD DIA X mm	BODY DIMENSIONS				RTO AT MIN LOAD (mm)			DEPTH OF THRD A mm	LUG DIMENSIONS TYPES TS2 & TS3						WEIGHTS kgf			J AT MIN LOAD mm	WEIGHT kgf	J AT MIN LOAD mm	WEIGHT kgf
		D mm	K mm	M mm	L mm (not BM)	TS1	TS2	TS3		E mm	F mm	G mm	H mm	T mm	TS1	TS2	TS3					
V5-12	M12	177.6	188.9	200	696	694	726	726	12	20	20	30	14	6	21.6	21.8	21.9	1016	19.7	644	19.9	
V5-13	M12	177.6	188.9	200	728	726	764	764	12	25	30	36	18	6	22.4	22.6	23.0	1048	20.6	676	20.7	
V5-14	M12	177.6	188.9	200	780	778	816	816	12	25	30	36	18	6	24.5	24.7	25.0	1100	22.6	727	22.8	
V5-15	M12	177.6	188.9	200	878	876	914	914	12	25	30	36	18	6	28.7	29.1	29.2	1198	26.9	826	27.0	
V5-16	M16	246.2	263.5	320	714	711	764	764	16	30	35	50	22	10	51.0	51.5	52.2	1034	45.9	653	46.2	
V5-17	M16	246.2	263.5	320	781	778	831	831	16	30	35	50	22	10	57.1	57.6	58.3	1101	51.9	720	52.2	
V5-18	M16	246.2	263.5	320	822	819	872	872	16	30	35	50	22	10	61.2	61.9	62.4	1142	55.9	761	56.3	

RANGE V5

TYPE BM

TYPE BM1
TYPE BM2
TYPE BM3
TYPE BM4

NB. INSTALLED HEIGHT 'J' DIMENSIONS FOR TYPES BM2, BM3 AND BM4 VARY WITH PIPE SIZE. PLEASE CONTACT PIPE SUPPORTS LIMITED'S DESIGN DEPARTMENT FOR DETAILS.

NOTE THAT WHERE DIMENSION 'M' EXCEEDS THE BASE PLATE SQUARE DIMENSION 'S', 'M' WILL BE THE MAX. WIDTH OF THE BASE PLATE.

TYPE DS

TYPE DS

SUPPORTING EFFORT = TABULATED VALUE x2
SPRING RATE = TABULATED VALUE x2
ADD WEIGHT OF UNIT TO LOAD FROM PIPE.

SUPPORT SIZE	J AT MIN. LOAD TYPE BM1 mm	BODY L'TH L mm	BASE PLATE SQ. S mm	BASE PLATE PCD P mm	BASE BOLT CRS. SQ. U mm	BASE BOLT SIZE V mm	LOAD PAD SQ. Y mm	LOAD PAD THK Z mm	WEIGHT TYPE BM1 kgf	RTO AT MIN LOAD mm	DIM. M mm	GAP W mm	RSC SIZE			WEIGHT kgf			
													900 MAX CENTRES	1300 MAX CENTRES	1800 MAX CENTRES	@ 900 CRS	@ 1300 CRS	@ 1800 CRS	
V5-12	1060	694	200	205.1	145	M20	10	75	6	19.6	25	25	22	76 x 38	76 x 38	76 x 38	53.1	58.6	65.5
V5-13	1098	726	200	205.1	145	M20	10	75	10	21.4	25	25	26	76 x 38	76 x 38	76 x 38	54.9	60.3	67.3
V5-14	1149	777	200	205.1	145	M20	10	75	10	23.1	25	25	26	76 x 38	76 x 38	76 x 38	59.0	64.4	71.4
V5-15	1248	876	200	205.1	145	M20	10	75	10	26.5	25	25	26	76 x 38	76 x 38	76 x 38	67.6	73.1	80.0
V5-16	1082	709	270	280	198	M20	12	100	12	48.3	25	25	33	76 x 38	102 x 51	102 x 51	110.8	124.5	135.5
V5-17	1149	776	270	280	198	M20	12	100	12	53.4	25	25	33	76 x 38	102 x 51	102 x 51	122.9	136.7	147.7
V5-18	1190	817	270	280	198	M20	12	100	12	57.0	25	25	33	76 x 38	102 x 51	102 x 51	131.3	145.2	156.4

VARIABLE EFFORT SUPPORT LOAD SELECTION CHART

kgf

MOVEMENT mm	SPRING SIZE																																	
	V1	V2	V3	V4	V5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
MIN	0	0	0	0	0	2.72	4.76	7.7	10.9	12.7	16.3	18.1	29.5	36.0	47.0	62.0	79.0	110	144	202	252	357	460	609	812	1111	1500	2094	2802	3700	4922	6519	8704	11633
W	0	0	0	0	0	2.86	4.94	7.91	11.2	13.1	16.8	18.7	30.2	37.0	48.3	63.7	81.3	113	148	207	259	366	472	625	834	1111	1500	2094	2802	3700	4922	6519	8704	11633
	5	10	20	30	40	3.01	5.12	8.13	11.5	13.6	17.3	19.2	30.9	38.0	49.6	65.5	83.7	116	152	213	267	375	485	642	855	1140	1539	2147	2874	3796	5049	6689	8935	11930
O	5	10	20	30	40	3.15	5.30	8.34	11.8	14.0	17.8	19.8	31.6	39.0	50.8	67.2	86.0	119	156	218	274	385	497	658	877	1169	1578	2201	2945	3893	5176	6858	9165	12228
	10	20	30	40	50	3.29	5.48	8.56	12.0	14.4	18.3	20.4	32.4	40.0	52.1	68.9	88.4	122	161	224	282	394	509	674	899	1197	1618	2255	3017	3989	5304	7028	9395	12526
R	10	20	30	40	50	3.43	5.66	8.77	12.3	14.8	18.8	21.0	33.1	41.0	53.4	70.7	90.7	125	165	229	289	403	521	690	921	1226	1657	2309	3088	4086	5431	7197	9626	12824
	15	30	40	60	80	3.58	5.83	8.99	12.6	15.3	19.3	21.5	33.8	42.0	54.7	72.4	93.0	128	169	235	297	412	534	707	942	1255	1696	2362	3160	4183	5558	7367	9856	13123
K	15	30	40	60	80	3.72	6.01	9.20	12.9	15.7	19.8	22.1	34.5	43.0	56.0	74.1	95.4	131	173	240	304	422	546	723	964	1284	1735	2416	3231	4279	5665	7536	10086	13421
	20	40	60	80	100	3.86	6.19	9.42	13.2	16.1	20.3	22.7	35.2	44.0	57.3	75.9	97.7	134	177	246	312	431	558	739	986	1313	1774	2470	3303	4376	5812	7706	10317	13719
I	20	40	60	80	100	4.01	6.37	9.63	13.5	16.6	20.8	23.3	35.9	45.0	58.5	77.8	100	137	181	251	319	440	570	755	1008	1342	1813	2523	3374	4472	5939	7875	10547	14018
	25	50	70	90	120	4.15	6.55	9.85	13.8	17.0	21.3	23.8	36.6	46.0	59.8	79.3	102	140	185	256	326	449	583	772	1029	1371	1852	2577	3445	4569	6066	8044	10777	14316
N	25	50	70	90	120	4.29	6.73	10.1	14.0	17.4	21.8	24.4	37.4	47.0	61.1	81.0	105	143	190	262	334	458	595	788	1051	1399	1892	2631	3517	4665	6194	8214	11008	14614
	30	60	80	100	140	4.44	6.91	10.3	14.3	17.9	22.3	25.0	38.1	48.0	62.4	82.8	107	146	194	267	341	468	607	804	1073	1428	1931	2684	3588	4762	6321	8383	11238	14913
G	30	60	80	100	140	4.58	7.09	10.5	14.6	18.3	22.8	25.6	38.8	49.0	63.7	84.5	109	149	198	273	349	477	619	820	1095	1457	1970	2738	3660	4859	6448	8553	11468	15211
	35	70	90	120	160	4.72	7.27	10.7	14.9	18.7	23.3	26.1	39.5	50.0	65.0	86.2	112	152	202	278	356	486	632	837	1116	1486	2009	2792	3731	4955	6575	8722	11699	15509
A	35	70	90	120	160	4.86	7.45	10.9	15.2	19.1	23.8	26.7	40.2	51.0	66.2	88.0	114	155	206	284	364	495	644	853	1138	1515	2048	2846	3803	5052	6702	8892	11929	15807
	40	80	100	140	180	5.01	7.62	11.1	15.5	19.6	24.3	27.3	40.9	52.0	67.5	89.7	116	158	210	289	371	505	656	869	1160	1544	2087	2899	3874	5148	6829	9061	12159	16106
E	40	80	100	140	180	5.15	7.80	11.3	15.8	20.0	24.8	27.8	41.6	53.0	68.8	91.4	119	161	214	294	378	514	669	886	1181	1573	2126	2953	3945	5245	6956	9230	12390	16404
	45	90	110	150	200	5.29	7.98	11.6	16.0	20.4	25.3	28.4	42.4	54.0	70.1	93.2	121	164	219	300	386	523	681	902	1203	1601	2166	3007	4017	5342	7084	9400	12620	16702
R	45	90	110	150	200	5.44	8.16	11.8	16.3	20.9	25.8	29.0	43.1	55.0	71.4	94.9	123	167	223	305	393	532	693	916	1225	1630	2205	3060	4098	5438	7211	9569	12850	17001
	50	100	120	160	210	5.58	8.34	12.0	16.6	21.3	26.3	29.6	43.8	56.0	72.7	96.6	126	170	227	311	401	541	705	934	1247	1659	2244	3114	4160	5535	7338	9739	13081	17299
W	50	100	120	160	210	5.72	8.52	12.2	16.9	21.7	26.8	30.1	44.5	57.0	73.9	98.4	128	173	231	316	408	551	718	951	1268	1688	2283	3168	4231	5631	7465	9908	13311	17597
	55	110	130	170	220	5.86	8.70	12.4	17.2	22.1	27.3	30.7	45.2	58.0	75.2	100	131	176	235	322	416	560	730	967	1290	1717	2322	3222	4303	5728	7592	10078	13542	17895
O	55	110	130	170	220	6.01	8.88	12.6	17.5	22.6	27.8	31.3	45.9	59.0	76.5	102	133	179	239	327	423	569	742	983	1312	1746	2361	3275	4374	5824	7719	10247	13772	18194
	60	120	140	180	240	6.15	9.06	12.9	17.7	23.0	28.3	31.9	46.7	60.0	77.8	104	135	182	244	333	431	578	754	999	1334	1774	2401	3329	4446	5921	7847	10417	14002	18492
R	60	120	140	180	240	6.29	9.24	13.1	18.0	23.4	28.8	32.4	47.4	61.0	79.1	105	138	185	248	338	438	587	767	1016	1355	1803	2440	3383	4517	6018	7974	10586	14233	18790
	65	130	150	190	250	6.44	9.41	13.3	18.3	23.9	29.3	33.0	48.1	62.0	80.4	107	140	188	252	343	445	597	779	1032	1377	1832	2479	3436	4588	6114	8101	10755	14463	19089
K	65	130	150	190	250	6.58	9.59	13.5	18.6	24.3	29.8	33.6	48.8	63.0	81.6	109	142	191	256	349	453	606	791	1048	1399	1861	2518	3490	4660	6211	8228	10925	14693	19387
	70	140	160	200	260	6.72	9.77	13.7	18.9	24.7	30.3	34.1	49.5	64.0	82.9	110	145	194	260	354	460	615	804	1065	1420	1890	2557	3544	4731	6307	8355	11094	14924	19685
I	70	140	160	200	260	6.86	9.95	13.9	19.2	25.1	30.8	34.7	50.2	65.0	84.2	112	147	197	264	360	468	624	816	1081	1442	1919	2596	3598	4803	6404	8482	11254	15154	19983
	75	150	170	210	270	7.01	10.1	14.1	19.5	25.6	31.3	35.3	50.9	66.0	85.5	114	149	200	268	365	475	634	828	1097	1464	1948	2635	3651	4873	6501	8609	11433	15384	20282
N	75	150	170	210	270	7.15	10.3	14.4	19.7	26.0	31.8	35.9	51.7	67.0	86.8	116	152	203	273	371	483	643	840	1113	1486	1976	2675	3705	4946	6597	8737	11603	15615	20580
	80																																	

SELECTION CHART FOR HIGH LOAD VARIABLE EFFORT SUPPORTS LOADS IN N

MOVEMENT mm	SPRING SIZE									
	V1	V2	V3	H1	H2	H3	H4	H5	H6	H7
MIN	0	0	0	55741	74276	100293	120033	140039	160692	187474
				57233	76256	102980	123194	143726	164895	192378
				58725	78237	105667	126354	147413	169099	197282
				60216	80218	108354	129514	151099	173302	202186
				61708	82198	111042	132674	154786	177506	207090
				63200	84179	113729	135834	158473	181709	211994
				64692	86160	116416	138994	162160	185913	216898
W	5	10	20	66184	88140	119103	142154	165847	190116	221802
				67675	90121	121791	145314	169534	194319	226706
				69167	92102	124478	148475	173220	198523	231610
				70659	94083	127165	151635	176907	202726	236514
				72151	96063	129852	154795	180594	206930	241418
				73643	98044	132540	157955	184281	211133	246322
				75134	100025	135227	161115	187968	215337	251226
O	10	20	40	76626	102005	137914	164275	191654	219540	256130
				78118	103986	140602	167435	195341	223744	261034
				79610	105967	143289	170596	199028	227947	265938
				81102	107948	145976	173756	202715	232151	270842
				82594	109928	148663	176916	206402	236354	275746
				84085	111909	151351	180076	210089	240558	280651
				85577	113890	154038	183236	213775	244761	285555
K	15	30	60	87069	115870	156725	186396	217462	248965	290459
				88561	117851	159412	189556	221149	253168	295363
				90053	119832	162100	192716	224836	257371	300267
				91544	121812	164787	195877	228523	261575	305171
				93036	123793	167474	199037	232210	265778	310075
				94528	125774	170161	202197	235896	269982	314979
				96020	127755	172849	205357	239583	274185	319883
I	20	40	80	97512	129735	175536	208517	243270	278389	324787
				99003	131716	178223	211677	246957	282592	329691
				100495	133697	180910	214837	250644	286796	334595
				101987	135677	183598	217998	254330	290999	339499
				103479	137658	186285	221158	258017	295203	344403
				104971	139639	188972	224318	261704	299406	349307
				106462	141620	191659	227478	265391	303610	354211
N	25	50	100	107954	143600	194347	230638	269078	307813	359115
				109446	145581	197034	233798	272765	312017	364019
				110938	147562	199721	236958	276451	316220	368923
				112430	149542	202409	240118	280138	320423	373827
				113921	151523	205096	243279	283825	324627	378731
				115413	153504	207783	246439	287512	328830	383635
				116905	155484	210470	249599	291199	333034	388539
A	30	60	120	118397	157465	213158	252759	294885	337237	393444
				119889	159446	215845	255919	298572	341441	398348
				121380	161427	218532	259079	302259	345644	403252
				122872	163407	221219	262239	305946	349848	408156
				124364	165388	223906	265400	309633	354051	413060
				125856	167369	226593	268561	313320	358254	417964
				127348	169350	229280	271722	317007	362457	422868
G	35	70	140	128840	171330	231969	274883	320694	366260	427772
				130332	173311	234656	278044	324381	370463	432676
				131824	175292	237343	281205	328068	374666	437580
				133316	177273	240030	284366	331755	378869	442484
				134808	179254	242717	287527	335442	383072	447388
				136300	181235	245404	290688	339129	387275	452292
				137792	183216	248091	293849	342816	391478	457196
E	40	80	160	139284	185196	250879	297010	346506	395681	462100
				140776	187177	253566	300171	350193	399884	467004
				142268	189158	256253	303332	353880	404087	471908
				143760	191139	258940	306493	357573	408290	476812
				145252	193120	261627	309654	361260	412493	481716
				146744	195101	264314	312815	364953	416696	486620
				148236	197082	267001	315976	368640	420899	491524
MAX	40	80	160	149728	199063	270519	322136	372421	425102	496428
				151220	201044	273206	325297	376108	429305	501332
				152712	203025	275893	328458	379792	433508	506236
				154204	205006	278580	331619	383485	437711	511140
				155696	206987	281267	334780	387172	441914	516044
				157188	208968	283954	337941	390859	446117	520948
				158680	210949	286641	341102	394546	450320	525852

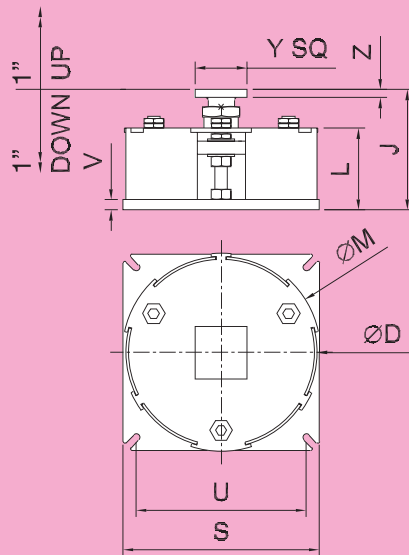
SPRING RATE N/mm	H1 H2 H3 H4 H5 H6 H7							
	V1	1492	1981	2802	3160	3687	4203	4904
	V2	745.9	990	1401	1580	1843	2102	2452
V3	373	495.2	700.6	790	922	1051	1226	

SELECTION CHART FOR HIGH LOAD VARIABLE EFFORT SUPPORTS LOADS IN kgf

MOVEMENT mm	SPRING SIZE									
	V1	V2	V3	H1	H2	H3	H4	H5	H6	H7
MIN	0	0	0	5684	7574	10227	12240	14280	16386	19117
				5836	7776	10501	12562	14656	16815	19617
				5988	7978	10775	12884	15032	17243	20117
				6140	8180	11049	13207	15408	17672	20617
				6292	8382	11323	13529	15784	18101	21117
				6445	8584	11597	13851	16160	18529	21617
				6597	8786	11871	14173	16536	18958	22117
W	5	10	20	6749	8988	12145	14496	16912	19386	22618
				6901	9190	12419	14818	17288	19815	23118
				7053	9392	12693	15140	17664	20244	23618
				7205	9594	12967	15462	18040	20672	24118
				7357	9796	13241	15785	18415	21101	24618
				7509	9998	13515	16107	18791	21530	25118
				7662	10200	13789	16429	19167	21958	25618
O	10	20	40	7814	10402	14063	16751	19543	22387	26118
				7966	10604	14337	17074	19919	22816	26618
				8118	10806	14611	17396	20295	23244	27118
				8270	11008	14885	17718	20671	23673	27618
				8422	11210	15159	18040	21047	24101	28118
				8574	11412	15433	18363	21423	24530	28618
				8726	11614	15707	18685	21799	24959	29118
K	15	30	60	8879	11815	15982	19007	22175	25387	29619
				9031	12017	16256	19329	22551	25816	30119
				9183	12219	16530	19652	22927	26245	30619
				9335	12421	16804	19974	23303	26673	31119
				9487	12623	17078	20296	23679	27102	31619
				9639	12825	17352	20618	24055	27530	32119
				9791	13027	17626	20941	24431	27959	32619
I	20	40	80	9943	13229	17900	21263	24807	28388	33119
				10095	13431	18174	21585	25183	28816	33619
				10248	13633	18448	21907	25559	29245	34119
				10400	13835	18722	22230	25934	29674	34619
				10552	14037	18996	22552	26310	30102	35119
				10704	14239	19270	22874	26686	30531	35619
				10856	14441	19544	23196	27062	30960	36119
N	25	50	100	11008	14643	19818	23519	27438	31388	36620
				11160	14845	20092	23841	27814	31817	37120
				11313	15047	20366	24163	28190	32245	37620
				11465	15249	20640	24485	28566	32674	38120
				11617	15451	20914	24808	28942	33103	38620
				11769	15653	21188	25130	29318	33531	39120
				11921	15855	21462	25452	29694	33960	39620
A	30	60	120	12073	16057	21736	25774	30070	34389	40120
				12225	16259	22010	26096	30446	34817	40620
				12377	16461	22284	26419	30822	35246	41120
				12529	16663	22558	26741	31198	35675	41620
				12681	16865	22832	27063	31574	36104	42120
				12833	17067	23106	27385	31950	36533	42620
				12985	17269	23380	27707	32326	36962	43120
G	35	70	140	13135	17471	23654	28029	32692	37391	43620
				13287	17673	23928	28351	33068	37819	44120
				13439	17875	24202	28673	33444	38248	44620
				13591	18077	24476	28995	33820	38677	45120
				13743	18279	24750	29317	34196	39106	45620
				13						

HIGH LOAD VARIABLES

TYPE BM1



All TYPES			TYPE BM1								
SUPPORT SIZE	BODY DIMENSIONS		J AT MIN. LOAD TYPE BM1	BODY L'TH	BASE PLATE SQ.	BASE BOLT CRS. SQ.	BASE BOLT SIZE	BASE PLATE THK	LOAD PAD SQ.	LOAD PAD THK	WEIGHT
	Ø D	Ø M									
V1-H1	630	657	408	276	650	550	M24	35	200	25	326.0
V1-H2	630	657	449	313	650	550	M24	40	200	25	383.3
V1-H3	730	757	460	313	750	650	M24	40	200	30	519.0
V1-H4	730	757	508	361	750	650	M30	50	200	30	600.8
V1-H5	730	757	558	371	750	650	M30	50	200	30	646.8
V1-H6	730	757	595	396	750	650	M30	50	200	40	672.0
V1-H7	780	807	608	409	800	700	M30	60	200	40	818.1
V2-H1	730	757	526	354	750	650	M24	35	200	25	458.9
V2-H2	730	757	574	398	750	650	M24	40	200	25	545.8
V2-H3	730	757	622	435	750	650	M24	40	200	30	586.9
V2-H4	730	757	690	503	750	650	M30	50	200	30	681.9
V2-H5	730	757	740	513	750	650	M30	50	200	30	737.5
V2-H6	730	757	802	563	750	650	M30	50	200	40	772.9
V2-H7	780	807	815	576	800	700	M30	60	200	40	933.6
V3-H1	730	757	809	557	750	650	M24	35	200	25	543.6
V3-H2	730	757	886	630	750	650	M24	40	200	25	658.1
V3-H3	730	757	964	697	750	650	M24	40	200	30	729.9
V3-H4	730	757	1077	810	750	650	M30	50	200	30	853.4
V3-H5	730	757	1127	820	750	650	M30	50	200	30	929.0
V3-H6	730	757	1242	923	750	650	M30	50	200	40	996.7
V3-H7	780	807	1255	936	800	700	M30	60	200	40	1190.2

SWAY BRACES

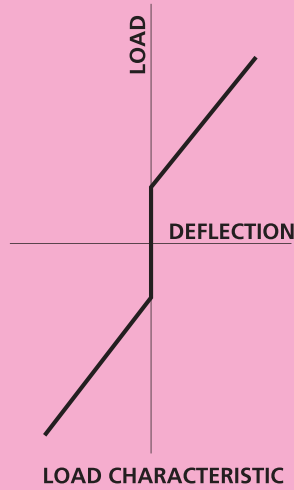


Fig. 1

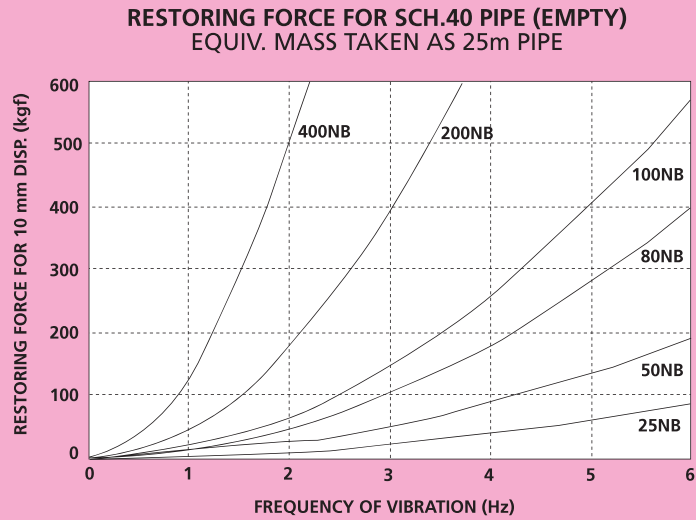


Fig. 2

DESCRIPTION

Sway Braces are essentially a double-acting spring, housed in a canister. Unlike variable effort supports, Sway Braces are not intended to carry the weight of pipework; their purpose is to limit undesirable movement.

Sway Braces act like a rigid strut until a small preload is reached, whereafter the restraining force increases in proportion to the applied deflection. Fig. 1

Undesirable movement can occur due to many phenomena, such as wind loading, sympathetic vibration, rapid valve closure, relief valves opening, two phase flow or earthquake. It may be necessary to limit this type of deflection to prevent the generation of unacceptable stresses and equipment loadings.

The Sway Brace is a cost-effective means of limiting pipework deflection. It should be noted however that it does provide some resistance to the thermal movement of the pipework and care should be taken when specifying to ensure that this is acceptable. Installation of Sway Braces will have the effect of raising the fundamental frequency of vibration of a pipework system; this is likely to reduce undesirable deflections.

Sway Braces are often used to solve unforeseen problems of resonant vibration.

For situations where the resistance to thermal movement provided by Sway Braces is unacceptable, you are referred to Pipe Supports Group's range of hydraulic snubbers and dampers.

THE PIPE SUPPORTS RANGE OF STANDARD SWAY BRACES

Bergen Pipe Supports offer a range of eight Sway Braces, all of which limit movement to a maximum of 70mm in either direction. Preloads range from 14 kgf to 1040 kgf and corresponding maximum loads from 85 to 6170 kgf.

SELECTION

Care should be taken when selecting to ensure the Sway Brace provides sufficient force to limit the deflection caused by the dynamic occurrence, but not so much as to unduly restrain the thermal movement of the piping. Ideally selections should be checked by analysis.

The following notes are intended only as a guide:

1. Calculate the load imposed upon the pipework by the Sway Brace if the pipework expands in its normal (unrestrained) manner.

$$P = L_p + K x$$

Where L_p is the preload (kgf)

K is the spring rate (kgf/mm)

x is the deflection at the attachment position (mm) in the axis of the brace

2. Check whether this is acceptable; as a guide, consider what change in effort would be acceptable at a spring support location on the pipework: this may be 25% of the load at a support location.

3. Estimate the force required to restrain the pipework. If the pipework is vibrating with frequency f Hz at a maximum displacement (half amplitude) of x mm then, in simple harmonic motion, the **restoring force** exerted by the pipework at maximum displacement (kgf)

$$= \frac{4\pi^2 f^2 m x}{1000 \text{ g}}$$

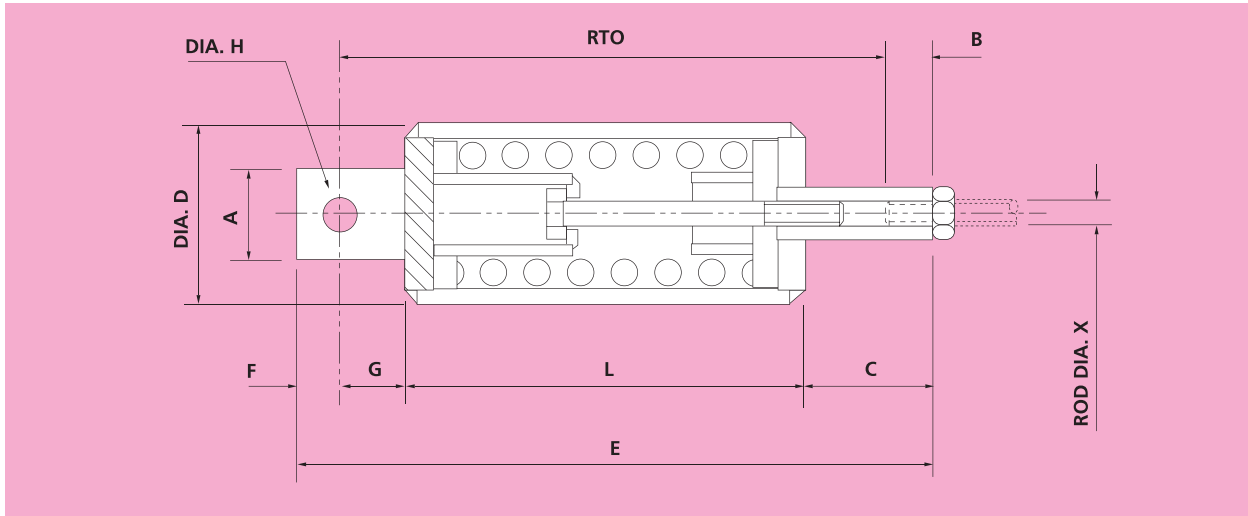
Where m is the equivalent mass of the pipework in kg.

It is likely that a Sway Brace having a preload greater than this value will fully restrain the pipe at the support location, while a Sway Brace for which this value is greater than the preload, but less than the max. load will have a significant effect.

Given a pipe which is vibrating at a known frequency with a known maximum displacement, the restoring force can be estimated if an assessment of the equivalent mass of the pipe can be made. Unfortunately, it is not very easy to do this with such accuracy without performing a dynamic analysis of the pipework. The equivalent mass will depend upon the length of pipework between anchors, the route of the pipework and the mode of vibration. Obviously any additional masses such as valves or flanged connections will also have an effect.

Figure 2 shows restoring forces for a 10mm deflection of empty unlagged schedule 40 pipe, for which the equivalent mass is arbitrarily taken as 25m of pipe.

SWAY BRACES



SIZE	SB1	SB2	SB3	SB4	SB5	SB6	SB7	SB8
PRELOAD kgf	14	45	140	300	400	535	770	1040
MAX LOAD kgf	85	260	800	1860	2470	3340	4620	6170
RATE kgf/mm	1.0	3.0	9.2	21.73	28.83	38.15	53.70	71.40
PRELOAD N	137	441	1370	2940	3920	5250	7550	10200
MAX. LOAD N	834	2550	7850	18240	24220	32750	45310	60510
RATE N/mm	9.8	29.4	90.4	213	283	384	527	701
RTOmm	308	305	311	359	395	406	447	495
ROD SIZE X	M20	M24	M24	M30	M36	M36	M42	M48
Amm	80	80	80	100	100	100	110	130
Bmm	25	30	30	38	45	45	53	60
Cmm	138	138	136	146	148	143	160	190
DIA. D mm	102	102	152	168	168	219	219	219
Emm	378	380	386	462	505	516	575	640
Fmm	19	19	19	26	35	35	42	42
Gmm	28	28	28	48	57	57	63	63
DIA.Hmm	19	19	19	26	35	35	42	42
Lmm	193	195	203	242	265	281	310	345
WEIGHT kgf	6.8	7.6	16	27	31	51	60	73

STANDARD DESIGN FEATURES

1. Rugged construction.
2. Compact design.
3. Spring preloaded.
4. 70 mm of travel in both directions.
5. Supplied with plastic coated spring coils, galvanised threaded items and painted casings.

NON STANDARD DESIGN FEATURES

1. Sway Braces are available in all the corrosion-resistant materials and finishes which are applicable to our range of variable effort supports.
2. We can build customized sway braces using any of our variable effort support springs.

ORDERING INFORMATION

1. Size
2. Finish if other than Bergen Pipe Supports standard.
3. Thread form if other than isometric coarse.
4. Mark No. (if known).

INSTALLATION AND ERECTION

1. It is recommended that Sway Braces are installed in conjunction with a tubular strut, since they work both in tension and compression.
2. The unit should be installed so that it does not apply undue force in the installed (hot condition). The imposed loads will then apply in the cold condition.

MAINTENANCE

Periodic inspection should be made at intervals to suit the operating environment. Check for visual damage, corrosion and wear.

VARIABLE EFFORT SUPPORT

