

CONSTANT EFFORT SUPPORTS

Our current range of Constant Effort Supports is the latest step in a continuous development programme which began in 1950 with the 'Con-Ten' support.

The range has been designed taking into account all the knowledge gained since these early days. This know-how has determined the optimum geometrical arrangement to ensure that, theoretically, the deviation of supporting effort is kept to a minimum. Fewer friction points ensure this applies in practice as well as theory. The single most critical factor affecting constancy is the spring, and we at Pipe Supports have made great efforts to design a range of springs that will deliver the performance our customers demand. In addition, the range has been designed to cater for the ever-increasing space limitations on offshore rigs, power stations and other process plants.

Other criteria that have been carefully considered, both during the conceptual and practical design stages, are the effects of ageing on the spring, the environment that hangers have to work in, the particular needs of the sophisticated pipework company in their requirement for 'balancing' lines during erection, and the capability to provide simple site adjustment to overcome changes or problems that occur late in the contract period.

Our range of Constant Effort Supports is the result, which we are proud to present in this catalogue.

APPLICATION

Constant Effort Supports are used to support pipework or equipment with an essentially constant supporting effort during what may be large vertical movement. Where the change in supporting effort which occurs when using variable effort supports is unacceptable, or where the amount of travel provided by variable effort supports is insufficient, constant effort supports should be specified. High temperature steam lines in power stations and flow lines on oil production platforms are examples of situations where large relative movement between piping and the

supporting structure make the use of Constant Effort Supports essential.

RANGE

Our standard range of Constant Effort Supports caters for loads up to above 50 tonnes with movement provided up to 750 mm.

FRAME SIZE AND SPRING SIZE

The support designation gives the support frame size and spring size:

C5-17

FRAME SIZE C5

SPRING SIZE 17

Many dimensions are common for a given frame size.

SUPPORT TYPES

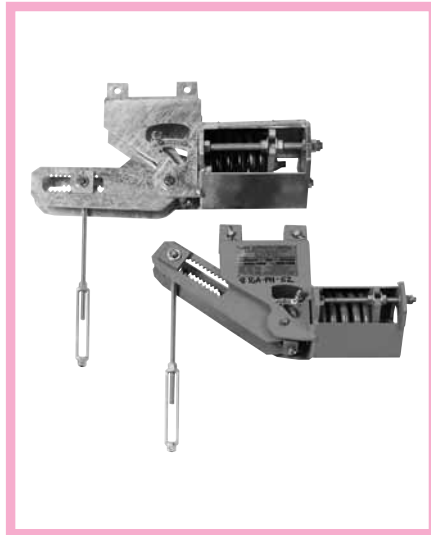
We offer eleven standard support types:

- HS** Horizontal type – single point suspension
- HD** Horizontal type – double point suspension
- VS** Vertical type – single point suspension
- VD** Vertical type – double point suspension
- VIS** Vertical inverted type – single point suspension
- VID** Vertical inverted type – double point suspension
- HBM** Horizontal base mounted
- HBMCS** Horizontal base mounted compression seat
- VBM** Vertical base mounted
- VBMCS** Vertical base mounted compression seat
- VIBM** Vertical inverted base mounted

Details of Vertical inverted tandem type (type VIT) are available on request.

SUSPENSION STYLES

For the suspended types, five styles of top suspension are available, namely TS1, TS2, TS3, TS4 and TS5.



Constant Effort Supports Type HD

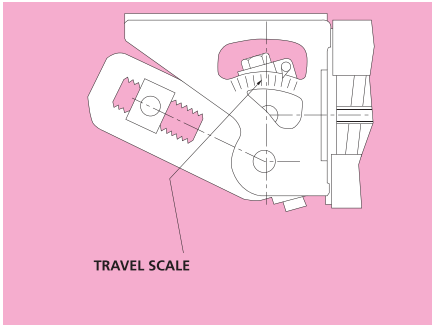


Type VBM

CONSTANT EFFORT SUPPORTS

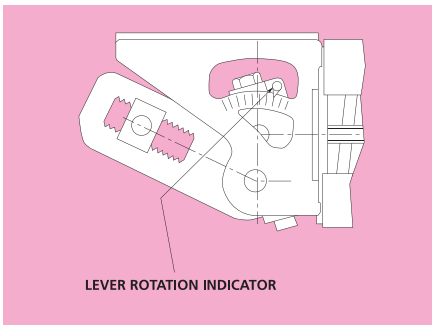
STANDARD FEATURES

- 1. Compactness of units.** Installed heights and overall sizes designed to the minimum.
- 2. Travel Indicator.** Enables the behaviour of the pipework to be monitored, indicating that pipework movement is as designed and calling attention to any system irregularities.

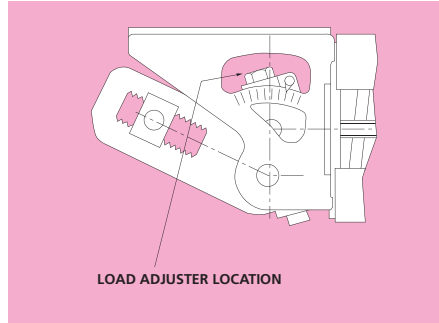


- 3. Lever Rotation Indicator.** The support frames incorporate a window. The position of the lever rotation indicator within the window provides a visual indication of the position of the lever, and therefore confirmation that the support is taking load correctly. If the lever rotation indicator is away from the extremities of the window, the support is taking load. If the indicator is at the back of the window, the support may be off load; if it is at the front, the support may be overloaded. If the indicator is at either extremity, adjustment of the support travel position and/or load adjustment is required.

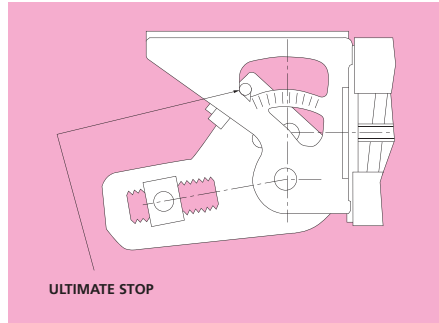
The lever rotation indicator provides quick visual confirmation that the support is "on load"; this assessment can be made from a considerable distance.



- 4. Load Adjustment Facility.** A minimum of +/-20% site load adjustment is available without altering the travel provided. The load adjuster is conveniently situated for site use. In cases where greater load adjustment is required this can be supplied, by prior agreement.



- 5. Ultimate Stop.** The construction of the main frame is such that in the case of overload the lever arm will be arrested prior to the spring becoming solid.

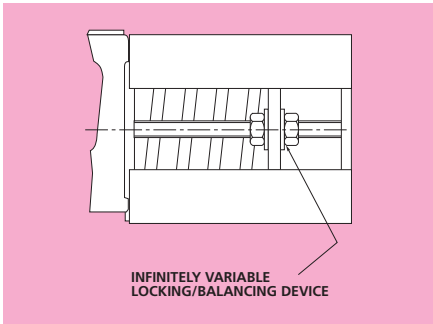


- 6. Infinitely Variable Locking/Balancing Device.** Every unit is sent to site locked in the D.T.S. (Despatched to Site) position shown on the general arrangement drawing for the contract. The locking mechanism comprises two locking rods which run the full length of the spring housing. The hanger is locked and becomes a rigid support by restraining the spring compression plate as shown in the illustration following. The locking device being constructed from two threaded members operates in an infinitely variable number of positions and is securely attached to the support for future re-use, regardless of pipework position.

For details on how to use the locking/balancing device see section headed Installation and Erection.

CONSTANT EFFORT SUPPORTS

STANDARD FEATURES



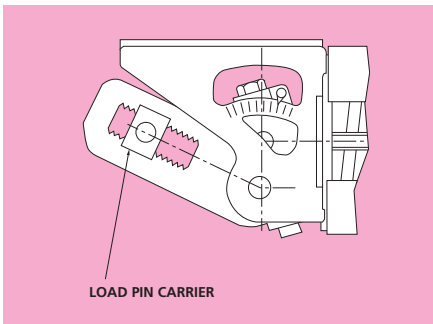
7. **Variable Position Load Pin Carrier.** The position of the load pin is determined and set during manufacture to achieve the design load and travel requested.

For supports other than those with very small movement provided, a variable position load pin carrier is fitted; this provides potential for additional load adjustment. By moving the carrier closer to the fulcrum, the supporting effort will be increased and the travel provided decreased. By moving the carrier in the opposite direction, the supporting effort is decreased, and the travel provided increased. This provides maximum flexibility in situations where changes to the required supporting effort can occur.

Once the carrier is repositioned, there is still the $\pm 20\%$ load adjustment available.

Variable position load pin carriers are fitted to supports whose total movements provided are greater than the following values:

- C1: 120 mm, C2: 120 mm,
C3: 120 mm, C4: 160 mm, C5: 100 mm, C6: 130 mm,
C7: 180 mm.

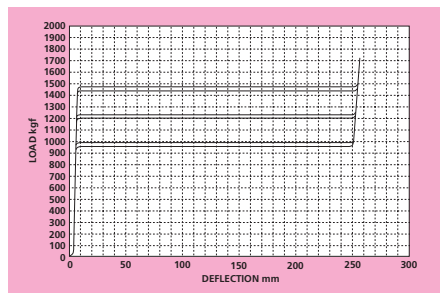


8. **Bearings.** The bearings used are PTFE dry bearings and are enclosed to stop the ingress of dirt and dust. No maintenance or lubrication is required.
9. **Name Plate.** Each support is supplied with a deeply engraved nameplate giving the following data:



The serial number allocated to each support is unique and will allow traceability of the support details for many years. As a double safeguard against loss or overpainting of nameplate, etc., each support is steel stamped with the customer's reference mark.

10. **Testing.** Every unit is tested in our calibrated test rigs to prove mechanical performance. Deviation is recorded and graphical reports are available if requested. Our standard range of constants deliver supporting effort to within $\pm 5\%$ of the specified design load. Our standard documentation includes a certificate of works test for mechanical performance and a certificate of conformity for materials and manufacture.



11. **High Performance Supports.** We offer supports that will operate with minimal friction and hysteresis. These supports are available by special request and will deliver supporting effort to within $\pm 2\%$ of the specified design load. Over an adjusted range of $\pm 10\%$ of the design load the supports remain within $\pm 2\%$ of the adjusted load. These supports have precision load adjustment scales and utilise fine pitched threads for the load adjustment mechanism allowing for very accurate adjustment of the support in situ.
12. **Corrosion Protection.** All springs are plastic coated to give maximum corrosion protection. Threaded parts are supplied hot-dipped galvanised while carbon steel parts are painted with one coat of high-build acrylic semi-gloss paint. Other options are available by request.

CONSTANT EFFORT SUPPORTS

INSTALLATION AND ERECTION

Types HS, HD, VS, VD, HBM, VBM, VIS, VID & VIBM:

1. Make fast upper and lower suspension connections ensuring the hanger rod is directly over the required point of attachment remembering that the lower suspension rod should not be more than 5 deg. from the vertical in any condition.
2. All supports are sent to site locked in the D.T.S. (Despatched to site) position shown on the contract drawing. To ensure the support is taking load correctly, adjust the turnbuckle until the pipework is at the correct elevation.

If the supporting system is in balance, the locking nuts holding the spring compression plate will be easily moved and should be parked at opposite extremities of the locking rods (away from the moving spring plate). If the locking nut nearest to the lever arm will not rotate, then the support is overloaded and positive adjustment on the load adjuster is required until the nut just becomes free; the support is then in balance.

If the nuts furthest from the lever arm will not rotate, the support is providing too much supporting effort, and negative load adjustment is required until these nuts just become free.

3. When the system is subject to cold pull, the support is delivered locked in the D.T.S. position. Prior to cold pull, the support must be unlocked to allow the support to travel and 'assist' with the cold pull.

On completion of the cold pull, the indicator reading should be that shown as P.T.E. (Prior to Thermal Expansion) on the contract drawing. It is also possible to achieve the cold pull movement by means of the support turnbuckle with the support remaining locked, in this instance D.T.S. = P.T.E.

4. If the pipework is subject to lagging, hydrostatic testing or acid cleaning after installation of the supports, the supports should remain locked until these operations are complete.
5. IT IS IMPERATIVE THAT A FINAL CHECK OF ALL SUPPORTS IS CARRIED OUT TO ENSURE THAT THEY ARE ALL UNLOCKED PRIOR TO THERMAL EXPANSION TAKING PLACE, AND TO ENSURE THAT THEY ARE SET IN THEIR CORRECT P.T.E. POSITIONS.
6. Supports must not be used for purposes other than that for which they have been designed. They must not be used for rigging and erection purposes. They should be handled as pieces of semi-machinery and stored indoors in a dry environment.

Types HBMCs & VBMCs

1. The same procedures as above apply except that the transference of the load to the support is done by means of the adjuster nut which is situated below the load pad instead of by means of the turnbuckle.

MAINTENANCE

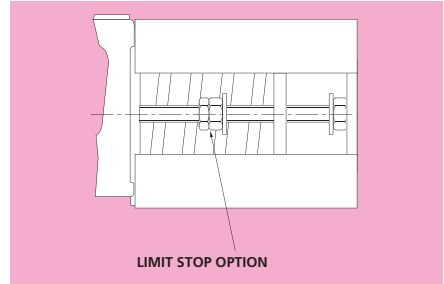
It is recommended that supports are inspected every six months for the following:

1. That no debris or tools are impairing the correct operation of the support.
2. That position of the travel indicator is as anticipated in the design. If this is not the case, the pipework engineer should be notified.

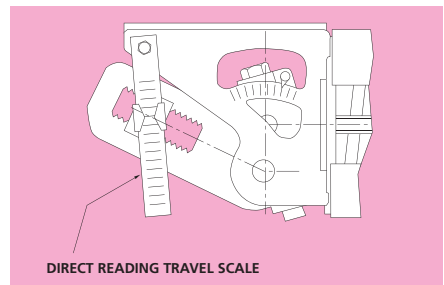
A more detailed erection and maintenance procedure is available on request.

OPTIONAL FEATURES

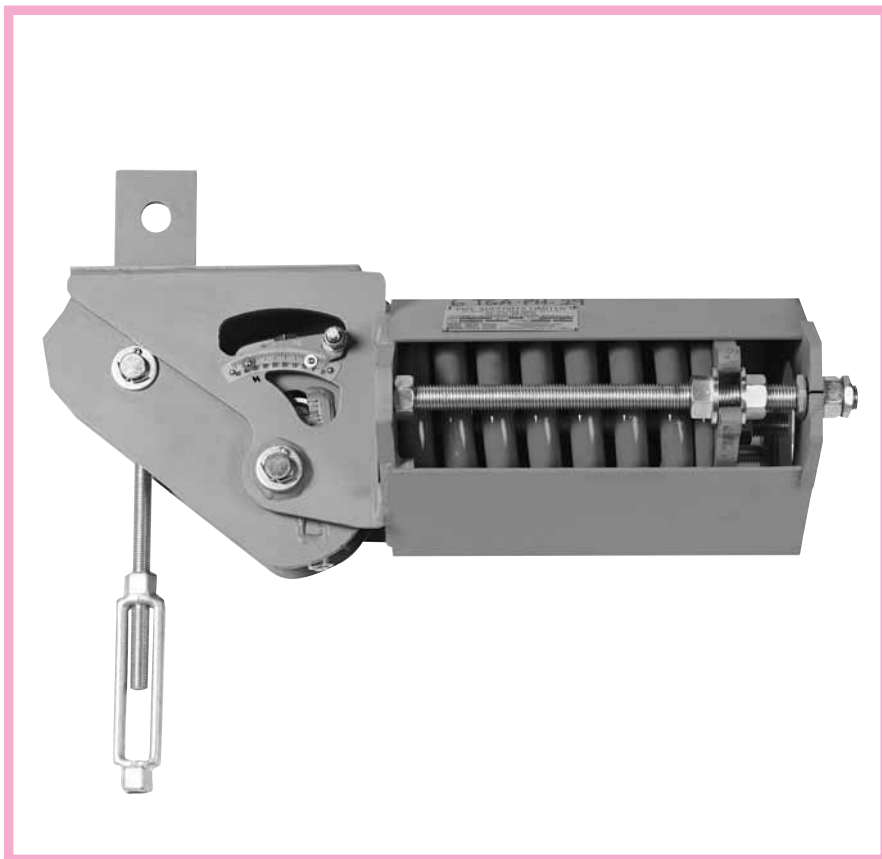
1. Limit Stops. The infinitely variable locking/balancing device may be enhanced to precisely limit spring travel. Additional nuts welded in position are used to limit movement to a specified amount.



2. The construction of Constant 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 conditions, extra-thick body section can be supplied.
5. Fully galvanised supports are available where required. Due to the construction of the units, no welding takes place after galvanising.
6. 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.
7. In Cryogenic applications supports are available manufactured entirely in austenitic stainless steel.
Please check with our design department for dimensional information.
8. For types HBMC and VBMC, where lateral loading greater than 25% of the maximum operating load is envisaged, PTFE covered load pads should be specified.
9. Direct Reading Travel Indicator. For precise setting of the support position, a direct reading indicator, giving the travel position in mm is available upon request.

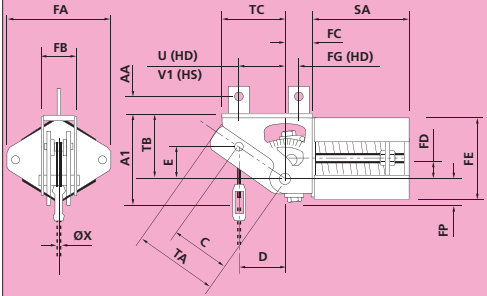


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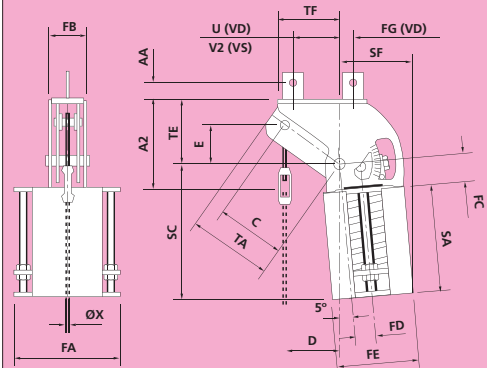


CONSTANT EFFORT SUPPORTS: SUSPENDED TYPES

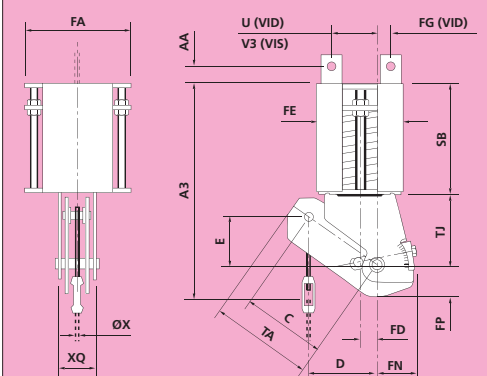
TYPES HD & HS



TYPES VD & VS

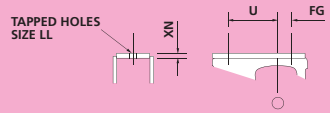


TYPES VID & VIS



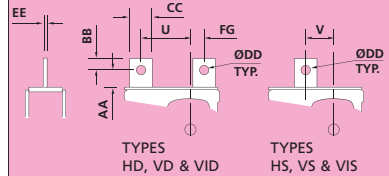
ALTERNATIVE TOP SUSPENSION STYLES

STYLE TS1 (TYPES HD & VD)



TYPES HD & VD

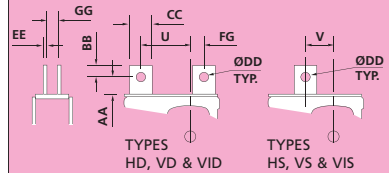
STYLE TS2 (ALL TYPES)



TYPES HD, VD & VID

TYPES HS, VS & VIS

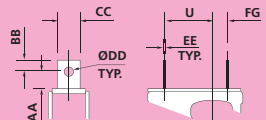
STYLE TS3 (ALL TYPES)



TYPES HD, VD & VID

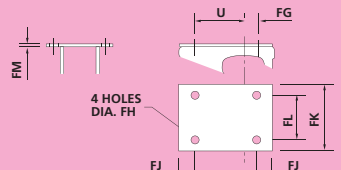
TYPES HS, VS & VIS

STYLE TS4 (TYPES HD, VD & VID)



TYPES HD, VD & VID

STYLE TS5 (TYPES HD & VD)



TYPES HD & VD

C1: DIMENSIONS FOR SIZES C1-1 TO C1-4

MOVEMENT DEPENDENT DIMENSIONS				
MOVEMENT PROVIDED mm		40-120	130-210	220-300
TRAVEL RANGE DEPENDENT DIMENSIONS	U	105	105	205
	TA	205	325	446
	TB	135	200	270
	TC	130	130	230
	TD	60	80	100
	TE	135	205	270
	TF	150	215	275
	TG	65	90	110
	TH	65	90	110
	TJ	100	100	128

TOP SUSPENSION DETAILS	
DD	14
AA	30
BB	20
CC	50
EE	6
GG	20
LL	M12

FIXED DIMENSIONS					
FA	155	FQ	75	XE	14
FB	85	FR	180	XF	190
FC	45	FS	180	XG	105
FD	25	FT	105	XH	55
FE	122	FU	35	XJ	150
FF	6	FV	140	XK	200
FG	35	FW	14	XL	14
FH	14	FX	60	XM	75
FJ	20	FY	80	XN	10
FK	180	FZ	180	XP	100
FL	140	XA	245	XQ	104
FM	6	XB	105	XR	100
FN	75	XC	100		
FP	40	XD	140		

SPRING SIZE DEPENDENT DIMENSIONS					
	T C	2 C	3 C	4 C	
SA	132	150	162	184	
SB	142	160	172	194	
SC	180	200	210	235	
SD	195	215	225	250	
SE	195	215	225	250	
SF	105	105	105	110	

WEIGHTS (kgf)				
	T C	2 C	3 C	4 C
HS/HD	9	10	10	11
VS/VD	11	11	12	12
VIS/VID	11	11	11	12
HBMCS	11	11	12	12
HBM	9	9	10	10
VBM	10	10	10	11
VBMCS	13	13	13	14
VIBM	10	10	11	11

SINGLE POINT SUSPENSION DIMENSION 'V'							
MOVEMENT PROVIDED mm	ALL SIZES			T C	2 C	3 C	T C
	V1	V3	V2	V2	V2	V2	V2
40	41	45					
50	50	55					
60	59	65	58	61	63	65	
70	68	74	66	70	73	75	
80	76	82	74	78	82	85	
90	83	91	81	86	90	94	
100	91	99	88	94	99	103	
110	98	107	94	102	107	112	
120	106	114	100	109	115	121	
130			106	116	122	129	
140			112	122	130	138	
150			117	129	137	146	
160			123	135	144	153	
170			128	141	151	161	
180			132	147	157	169	
190			137	153	164	176	
200			142	158	170	183	
210			146	164	176	190	
220			150	169	182	197	
230			154	174	188	204	
240			158	179	194	210	
250			162	183	199	217	
260			166	188	205	223	
270			170	193	210	229	
280			173	197	215	235	
290			177	201	220	241	
300			180	206	225	247	

TYPES HS AND VIS ARE NOT USED ABOVE 120mm TRAVEL

INSTALLED HEIGHT DIMENSIONS **J4** AND **J7** ALLOW ± 25 mm ADJUSTMENT.

TAKE-OUT DIMENSIONS **A1**, **A2**, **A3**, **J5**, **J6** AND **J8** ALLOW ± 75 mm ADJUSTMENT AND ASSUME USE OF A STANDARD F228A EYEBOLT.

WHERE SEVERE HEADROOM LIMITATIONS EXIST, DIMENSIONS **A1**, **A2** AND **A3** CAN BE REDUCED AND DIMENSIONS **J5**, **J6** AND **J8** INCREASED AS FOLLOWS BY USE OF A SHORTENED EYEBOLT:

ØX	M12
CHANGE mm	160

NOTE DIA. **X** IS THREADED ISO METRIC COARSE RIGHT HAND AS STANDARD.

NOTE THAT DIMENSIONS **A1**, **A2**, **A3**, **J4**, **J5**, **J6**, **J7** AND **J8** ARE GIVEN AT ZERO ROTATION, THAT IS WITH THE LEVER IN THE UPPERMOST POSITION.

N.B. DIMENSION **TA** IS THE MINIMUM FORWARD CLEARANCE REQUIRED.

C1: DIMENSIONS FOR SIZES C1-1 TO C1-4

MOVEMENT PROVIDED mm	ALL SIZES										C1-1			C1-2			C1-3			C1-4						
	ALL										VIS VID	VBM	VBMCs	VIS VID	VBM	VBMCs	VIS VID	VBM	VBMCs	VIS VID	VBM	VBMCs				
	C mm	D mm	E mm	A1 mm	HS HD	VS VD	HEMCs	HBM	VBM		OX mm	A3 mm	J6 mm	J7 mm	OX mm	A3 mm	J6 mm	J7 mm	OX mm	A3 mm	J6 mm	J7 mm	OX mm	A3 mm	J6 mm	J7 mm
	AT ZERO ROTATION										AT 0° ROTATION			AT 0° ROTATION			AT 0° ROTATION			AT 0° ROTATION						
40	54	44	31	479		307	-279	-279		M12	586		422	M12	604		442	M12	616		452	M12	638		477	
50	67	55	38	472		314	-272	-272		M12	579		429	M12	597		449	M12	609		459	M12	631		484	
60	80	66	46	464	464	322	-264	-264		M12	571	-134	437	M12	589	-114	457	M12	601	-104	467	M12	623	-79	492	
70	94	77	54	456	456	330	-256	-256		M12	563	-126	445	M12	581	-106	465	M12	593	-96	475	M12	615	-71	500	
80	107	88	61	449	449	337	-249	-249		M12	556	-119	452	M12	574	-99	472	M12	586	-89	482	M12	608	-64	507	
90	120	99	69	441	441	345	-241	-241		M12	548	-111	460	M12	566	-91	480	M12	578	-81	490	M12	600	-56	515	
100	134	110	77	433	433	353	-233	-233		M12	540	-103	468	M12	558	-83	488	M12	570	-73	498	M12	592	-48	523	
110	147	121	84	426	426	360	-226	-226		M12	533	-96	475	M12	551	-76	495	M12	563	-66	505	M12	585	-41	530	
120	161	132	92	418	418	368	-218	-218		M12	525	-88	483	M12	543	-68	503	M12	555	-58	513	M12	577	-33	538	
130	174	143	100	475	480	396	-185	-185		M12	517	-80	491	M12	535	-60	511	M12	547	-50	521	M12	569	-25	546	
140	187	153	107	468	473	403	-178	-178		M12	510	-73	498	M12	528	-53	518	M12	540	-43	528	M12	562	-18	553	
150	201	164	115	460	465	411	-170	-170		M12	502	-65	506	M12	520	-45	526	M12	532	-35	536	M12	554	-10	561	
160	214	175	123	452	457	419	-162	-162		M12	494	-57	514	M12	512	-37	534	M12	524	-27	544	M12	546	-2	569	
170	228	186	130	445	450	426	-155	-155		M12	487	-50	521	M12	505	-30	541	M12	517	-20	551	M12	539	5	576	
180	241	197	138	437	442	434	-147	-147		M12	479	-42	529	M12	497	-22	549	M12	509	-12	559	M12	531	13	584	
190	254	208	146	429	434	442	-139	-139		M12	471	-34	537	M12	489	-14	557	M12	501	-4	567	M12	523	21	592	
200	268	219	154	421	426	450	-131	-131		M12	463	-26	545	M12	481	-6	565	M12	493	4	575	M12	515	29	600	
210	281	230	161	414	419	457	-124	-124		M12	456	-19	552	M12	474	1	572	M12	486	11	582	M12	508	36	607	
220	294	241	169	476	476	485	-96	-96		M12	476	-11	560	M12	494	9	580	M12	506	19	590	M12	528	44	615	
230	308	252	177	468	468	493	-88	-88		M12	468	-3	568	M12	486	17	588	M12	498	27	598	M12	520	52	623	
240	321	263	184	461	461	500	-81	-81		M12	461	4	575	M12	479	24	595	M12	491	34	605	M12	513	59	630	
250	335	274	192	453	453	508	-73	-73		M12	453	12	583	M12	471	32	603	M12	483	42	613	M12	505	67	638	
260	348	285	200	445	445	516	-65	-65		M12	445	20	591	M12	463	40	611	M12	475	50	621	M12	497	75	646	
270	361	296	207	438	438	523	-58	-58		M12	438	27	598	M12	456	47	618	M12	468	57	628	M12	490	82	653	
280	375	307	215	430	430	531	-50	-50		M12	430	35	606	M12	448	55	626	M12	460	65	636	M12	482	90	661	
290	388	318	223	422	422	539	-42	-42		M12	422	43	614	M12	440	63	634	M12	452	73	644	M12	474	98	669	
300	401	329	230	415	415	546	-35	-35		M12	415	50	621	M12	433	70	641	M12	445	80	651	M12	467	105	676	

C2: DIMENSIONS FOR SIZES C2-5 TO C2-7

MOVEMENT DEPENDENT DIMENSIONS					
TRAVEL RANGE DEPENDENT DIMENSIONS	MOVEMENT PROVIDED mm	40-120		130-210	
		220-300	310-400		
U	105	105	270	270	
TA	209	329	450	583	
TB	140	205	275	350	
TC	130	130	295	295	
TD	70	85	105	120	
TE	140	215	275	350	
TF	155	235	305	370	
TG	80	95	115	135	
TH	80	95	115	135	
TJ	120	120	120	168	

TOP SUSPENSION DETAILS	
DD	14
AA	30
BB	20
CC	50
EE	6
GG	20
LL	M12

FIXED DIMENSIONS			
FA	200	FQ	75
FB	85	FR	180
FC	55	FS	180
FD	25	FT	105
FE	164	FU	35
FF	6	FV	140
FG	35	FW	14
FH	14	FX	70
FJ	20	FY	90
FK	180	FZ	180
FL	140	XA	265
FM	6	XB	105
FN	80	XC	120
FP	50	XD	140
		XE	14
		XF	190
		XG	105
		XH	55
		XJ	150
		XK	200
		XL	14
		XM	80
		XN	10
		XP	110
		XQ	104
		XR	120

SPRING SIZE DEPENDENT DIMENSIONS			
	C2-5	C2-6	C2-7
SA	197	172	184
SB	207	182	194
SC	260	235	245
SD	275	250	260
SE	275	250	260
SF	130	130	130

WEIGHTS (kgf)			
	C2-5	C2-6	C2-7
HS/HD	16	16	16
VS/VD	18	18	18
VIS/VID	19	19	19
HBMCS	18	18	18
HBM	16	16	16
VBM	17	17	17
VBMCS	20	20	20
VIBM	19	19	19

SINGLE POINT SUSPENSION DIMENSION 'V'					
MOVEMENT PROVIDED mm	ALL SIZES		C2-5	C2-6	C2-7
	V1	V3	V2	V2	V2
40	42	47			
50	52	58			
60	61	69			
70	71	78			
80	79	88	82	87	88
90	88	98	91	96	99
100	97	107	100	106	109
110	106	116	108	115	118
120	114	125	116	124	128
130			124	133	138
140			131	142	147
150			139	151	156
160			146	159	165
170			153	167	174
180			160	175	182
190			167	183	191
200			173	191	199
210			180	199	208
220			186	206	216
230			192	214	224
240			198	221	232
250			203	228	240
260			209	235	247
270			215	242	255
280			220	249	262
290			225	255	270
300			230	262	277
310			235	268	284
320			240	274	291
330			245	281	298
340			250	287	305
350			255	293	311
360			259	298	318
370			264	304	324
380			268	310	331
390			272	316	337
400			277	321	343

TYPES HS AND VS ARE NOT USED ABOVE 120mm TRAVEL

INSTALLED HEIGHT DIMENSIONS **J4** AND **J7** ALLOW ± 25 mm ADJUSTMENT.

TAKE-OUT DIMENSIONS **A1**, **A2**, **A3**, **J5**, **J6** AND **J8** ALLOW ± 75 mm ADJUSTMENT AND ASSUME USE OF A STANDARD F228A EYEBOLT.

WHERE SEVERE HEADROOM LIMITATIONS EXIST, DIMENSIONS **A1**, **A2** AND **A3** CAN BE REDUCED AND DIMENSIONS **J5**, **J6** AND **J8** INCREASED AS FOLLOWS BY USE OF A SHORTENED EYEBOLT:

ØX	M12
CHANGE mm	160

NOTE DIA. **X** IS THREADED ISO METRIC COARSE RIGHT HAND AS STANDARD.

NOTE THAT DIMENSIONS **A1**, **A2**, **A3**, **J4**, **J5**, **J6**, **J7** AND **J8** ARE GIVEN AT ZERO ROTATION, THAT IS WITH THE LEVER IN THE UPPERMOST POSITION.

N.B. DIMENSION **TA** IS THE MINIMUM FORWARD CLEARANCE REQUIRED.

C2: DIMENSIONS FOR SIZES C2-5 TO C2-7

MOVEMENT PROVIDED mm	ALL SIZES										C2-5			C2-6			C2-7									
	ALL									HS HD	VS VD	HEMCS	HBM	VBM	OX mm	VIS VID	VBM	VEMCS	OX mm	VIS VID	VBM	VEMCS	OX mm	VIS VID	VBM	VEMCS
	C mm	D mm	E mm	A1 mm	A2 mm	J4 mm	J5 mm	J8 mm	A3 mm																	
	AT ZERO ROTATION										AT 0° ROTATION			AT 0° ROTATION			AT 0° ROTATION									
40	54	44	31	484		333	-264	-264	M12	671		518	M12	646		493	M12	658		503						
50	67	55	38	477		340	-257	-257	M12	664		525	M12	639		500	M12	651		510						
60	80	66	46	469		348	-249	-249	M12	656		533	M12	631		508	M12	643		518						
70	94	77	54	461		356	-241	-241	M12	648		541	M12	623		516	M12	635		526						
80	107	88	61	454	454	363	-234	-234	M12	641	-39	548	M12	616	-64	523	M12	628	-54	533						
90	120	99	69	446	446	371	-226	-226	M12	633	-31	556	M12	608	-56	531	M12	620	-46	541						
100	134	110	77	438	438	379	-218	-218	M12	625	-23	564	M12	600	-48	539	M12	612	-38	549						
110	147	121	84	431	431	386	-211	-211	M12	618	-16	571	M12	593	-41	546	M12	605	-31	556						
120	161	132	92	423	423	394	-203	-203	M12	610	-8	579	M12	585	-33	554	M12	597	-23	564						
130	174	143	100	480	490	411	-180	-180	M12	602	0	581	M12	577	-25	556	M12	589	-15	566						
140	187	153	107	473	483	418	-173	-173	M12	595	7	588	M12	570	-18	563	M12	582	-8	573						
150	201	164	115	465	475	426	-165	-165	M12	587	15	596	M12	562	-10	571	M12	574	0	581						
160	214	175	123	457	467	434	-157	-157	M12	579	23	604	M12	554	-2	579	M12	566	8	589						
170	228	186	130	450	460	441	-150	-150	M12	572	30	611	M12	547	5	586	M12	559	15	596						
180	241	197	138	442	452	449	-142	-142	M12	564	38	619	M12	539	13	594	M12	551	23	604						
190	254	208	146	434	444	457	-134	-134	M12	556	46	627	M12	531	21	602	M12	543	31	612						
200	268	219	154	426	436	465	-126	-126	M12	548	54	635	M12	523	29	610	M12	535	39	620						
210	281	230	161	419	429	472	-119	-119	M12	541	61	642	M12	516	36	617	M12	528	46	627						
220	294	241	169	481	481	480	-91	-91	M12	533	69	650	M12	508	44	625	M12	520	54	635						
230	308	252	177	473	473	508	-83	-83	M12	525	77	658	M12	500	52	633	M12	512	62	643						
240	321	263	184	466	466	515	-76	-76	M12	518	84	665	M12	493	59	640	M12	505	69	650						
250	335	274	192	458	458	523	-68	-68	M12	510	92	673	M12	485	67	648	M12	497	77	658						
260	348	285	200	450	450	531	-60	-60	M12	502	100	681	M12	477	75	656	M12	489	85	666						
270	361	296	207	443	443	538	-53	-53	M12	495	107	688	M12	470	82	663	M12	482	92	673						
280	375	307	215	435	435	546	-45	-45	M12	487	115	696	M12	462	90	671	M12	474	100	681						
290	388	318	223	427	427	554	-37	-37	M12	479	123	704	M12	454	98	679	M12	466	108	689						
300	401	329	230	420	420	561	-30	-30	M12	472	130	711	M12	447	105	686	M12	459	115	696						
310	415	340	238	487	487	584	-2	-2	M12	512	138	719	M12	487	113	694	M12	499	123	704						
320	428	351	246	479	479	592	6	6	M12	504	146	727	M12	479	121	702	M12	491	131	712						
330	442	362	253	472	472	599	13	13	M12	497	153	734	M12	472	128	709	M12	484	138	719						
340	455	373	261	464	464	607	21	21	M12	489	161	742	M12	464	136	717	M12	476	146	727						
350	468	384	269	456	456	615	29	29	M12	481	169	750	M12	456	144	725	M12	468	154	735						
360	482	395	276	449	449	622	36	36	M12	474	176	757	M12	449	151	732	M12	461	161	742						
370	495	406	284	441	441	630	44	44	M12	466	184	765	M12	441	159	740	M12	453	169	750						
380	509	417	292	433	433	638	52	52	M12	458	192	773	M12	433	167	748	M12	445	177	758						
390	522	428	299	426	426	645	59	59	M12	451	199	780	M12	426	174	755	M12	438	184	765						
400	535	439	307	418	418	653	67	67	M12	443	207	788	M12	418	182	763	M12	430	192	773						

C3: DIMENSIONS FOR SIZES C3-8 TO C3-10

MOVEMENT DEPENDENT DIMENSIONS							
MOVEMENT PROVIDED mm	40-120	130-210	220-300	310-400	410-500		
TRAVEL RANGE DEPENDENT DIMENSIONS	U	120	120	270	270	270	
	TA	213	306	454	587	721	
	TB	155	195	280	355	430	
	TC	145	145	295	295	295	
	TD	80	90	110	125	145	
	TE	155	195	280	355	430	
	TF	155	225	315	390	455	
	TG	90	100	120	140	165	
	TH	90	100	120	140	165	
	TJ	155	155	155	155	207	
TOP-SUSPENSION DETAILS	C3-8	DD	14	14	14	14	14
		AA	30	30	30	30	30
		BB	20	20	20	20	20
		CC	50	50	50	50	50
		EE	6	6	6	6	6
		GG	20	20	20	20	20
	LL	M12	M12	M12	M12	M12	
	C3-9	DD	18	14	14	14	14
		AA	36	30	30	30	30
		BB	30	20	20	20	20
		CC	50	50	50	50	50
		EE	6	6	6	6	6
GG		25	20	20	20	20	
LL	M16	M12	M12	M12	M12		
C3-10	DD	18	14	14	14	14	
	AA	36	30	30	30	30	
	BB	30	20	20	20	20	
	CC	50	50	50	50	50	
	EE	6	6	6	6	6	
	GG	25	20	20	20	20	
LL	M16	M12	M12	M12	M12		

FIXED DIMENSIONS					
FA	250	FQ	75	XE	14
FB	89	FR	180	XF	220
FC	65	FS	195	XG	120
FD	50	FT	120	XH	90
FE	198	FU	35	XJ	180
FF	8	FV	140	XK	250
FG	35	FW	14	XL	14
FH	14	FX	85	XM	115
FJ	20	FY	120	XN	12
FK	180	FZ	220	XP	145
FL	140	XA	330	XQ	118
FM	8	XB	120	XR	155
FN	115	XC	170		
FP	60	XD	180		

SPRING SIZE DEPENDENT DIMENSIONS			
	φ C3	φ C3	φ C3-10
SA	211	233	253
SB	223	245	265
SC	280	305	325
SD	300	325	345
SE	300	325	345
SF	175	175	180

WEIGHTS (kgf)			
	φ C3	φ C3	φ C3-10
HS/HD	24	25	26
VS/VD	25	27	28
VIS/VID	27	28	30
HBMCS	27	28	30
HBM	23	24	26
VBM	24	25	27
VBMCS	29	30	32
VIBM	28	29	31

SINGLE POINT SUSPENSION DIMENSION 'V'						
MOVEMENT PROVIDED mm	ALL SIZES		φ C3	φ C3	φ C3-10	φ C3-10
	V1	V3	V2	V2	V2	V2
40	43	48				
50	53	60				
60	63	71				
70	73	81	75	77	78	
80	83	92	85	87	89	
90	92	102	94	98	99	
100	101	112	103	107	110	
110	110	123	112	117	120	
120	119	132	121	127	130	
130			130	136	139	
140			139	145	149	
150			147	155	159	
160			155	163	168	
170			163	172	177	
180			171	181	187	
190			179	190	196	
200			186	198	204	
210			193	206	213	
220			201	214	222	
230			208	222	231	
240			215	230	239	
250			222	238	247	
260			228	246	256	
270			235	253	264	
280			242	261	272	
290			248	268	280	
300			254	275	287	
310			260	282	295	
320			266	290	303	
330			272	296	310	
340			278	303	318	
350			284	310	325	
360			290	317	333	
370			295	323	340	
380			301	330	347	
390			306	336	354	
400			311	343	361	
410			317	349	368	
420			322	355	375	
430			327	361	381	
440			332	367	388	
450			337	373	395	
460			342	379	401	
470			346	385	407	
480			351	390	414	
490			356	396	420	
500			360	401	426	

TYPES HS AND VIS ARE NOT USED ABOVE 10mm TRAVEL

INSTALLED HEIGHT DIMENSIONS **J4** AND **J7** ALLOW ±25mm ADJUSTMENT.

TAKE-OUT DIMENSIONS **A1**, **A2**, **A3**, **J5**, **J6** AND **J8** ALLOW ±75mm ADJUSTMENT AND ASSUME USE OF A STANDARD F228A EYEBOLT.

WHERE SEVERE HEADROOM LIMITATIONS EXIST, DIMENSIONS **A1**, **A2** AND **A3** CAN BE REDUCED AND DIMENSIONS **J5**, **J6** AND **J8** INCREASED AS FOLLOWS BY USE OF A SHORTENED EYEBOLT:

ØX	M12	M16
CHANGE mm	160	160

NOTE DIA. **X** IS THREADED ISO METRIC COARSE RIGHT HAND AS STANDARD.

NOTE THAT DIMENSIONS **A1**, **A2**, **A3**, **J4**, **J5**, **J6**, **J7** AND **J8** ARE GIVEN AT ZERO ROTATION, THAT IS WITH THE LEVER IN THE UPPERMOST POSITION.

N.B. DIMENSION **TA** IS THE MINIMUM FORWARD CLEARANCE REQUIRED.

C3: DIMENSIONS FOR SIZES C3-8 TO C3-10

MOVEMENT PROVIDED mm	ALL SIZES										C3-8			C3-9			C3-10			
	ALL								OX mm	VIS VID mm	VBM J6 mm	VBMS J7 mm	OX mm	VIS VID mm	VBM J6 mm	VBMS J7 mm	OX mm	VIS VID mm	VBM J6 mm	VBMS J7 mm
	C mm	D mm	E mm	A1 mm	A2 mm	J4 mm	J5 mm	J8 mm												
	AT ZERO ROTATION										AT 0° ROTATION			AT 0° ROTATION			AT 0° ROTATION			
40	54	44	31	499		387	-254	-254	M12	722		582	M16	744		607	M16	764		627
50	67	55	38	492		394	-247	-247	M12	715		589	M12	737		614	M16	757		634
60	80	66	46	484		402	-239	-239	M12	707		597	M12	729		622	M16	749		642
70	94	77	54	476	476	410	-231	-231	M12	699	-21	605	M12	721	4	630	M12	741	24	650
80	107	88	61	469	469	417	-224	-224	M12	692	-14	612	M12	714	11	637	M12	734	31	657
90	120	99	69	461	461	425	-216	-216	M12	684	-6	620	M12	706	19	645	M12	726	39	665
100	134	110	77	453	453	433	-208	-208	M12	676	2	628	M12	698	27	653	M12	718	47	673
110	147	121	84	446	446	440	-201	-201	M12	669	9	635	M12	691	34	660	M12	711	54	680
120	161	132	92	438	438	448	-193	-193	M12	661	17	643	M12	683	42	668	M12	703	62	688
130	174	143	100	470	470	462	-175	-175	M12	653	25	647	M12	675	50	672	M12	695	70	692
140	187	153	107	463	463	469	-168	-168	M12	646	32	654	M12	668	57	679	M12	688	77	699
150	201	164	115	455	455	477	-160	-160	M12	638	40	662	M12	660	65	687	M12	680	85	707
160	214	175	123	447	447	485	-152	-152	M12	630	48	670	M12	652	73	695	M12	672	93	715
170	228	186	130	440	440	492	-145	-145	M12	623	55	677	M12	645	80	702	M12	665	100	722
180	241	197	138	432	432	500	-137	-137	M12	615	63	685	M12	637	88	710	M12	657	108	730
190	254	208	146	424	424	508	-129	-129	M12	607	71	693	M12	629	96	718	M12	649	116	738
200	268	219	154	501	501	530	-101	-101	M12	599	79	695	M12	621	104	720	M12	641	124	740
210	281	230	161	494	494	537	-94	-94	M12	592	86	702	M12	614	111	727	M12	634	131	747
220	294	241	169	486	486	545	-86	-86	M12	584	94	710	M12	606	119	735	M12	626	139	755
230	308	252	177	478	478	553	-78	-78	M12	576	102	718	M12	598	127	743	M12	618	147	763
240	321	263	184	471	471	560	-71	-71	M12	569	109	725	M12	591	134	750	M12	611	154	770
250	335	274	192	463	463	568	-63	-63	M12	561	117	733	M12	583	142	758	M12	603	162	778
260	348	285	200	455	455	576	-55	-55	M12	553	125	741	M12	575	150	766	M12	595	170	786
270	361	296	207	448	448	583	-48	-48	M12	546	132	748	M12	568	157	773	M12	588	177	793
280	375	307	215	440	440	591	-40	-40	M12	538	140	756	M12	560	165	781	M12	580	185	801
290	388	318	223	432	432	599	-32	-32	M12	530	148	764	M12	552	173	789	M12	572	193	809
300	401	329	230	425	425	606	-25	-25	M12	523	155	771	M12	545	180	796	M12	565	200	816
310	415	340	238	492	492	629	3	3	M12	515	163	779	M12	537	188	804	M12	557	208	824
320	428	351	246	484	484	637	11	11	M12	507	171	787	M12	529	196	812	M12	549	216	832
330	442	362	253	477	477	644	18	18	M12	500	178	794	M12	522	203	819	M12	542	223	839
340	455	373	261	469	469	652	26	26	M12	492	186	802	M12	514	211	827	M12	534	231	847
350	468	384	269	461	461	660	34	34	M12	484	194	810	M12	506	219	835	M12	526	239	855
360	482	395	276	454	454	667	41	41	M12	477	201	817	M12	499	226	842	M12	519	246	862
370	495	406	284	446	446	675	49	49	M12	469	209	825	M12	491	234	850	M12	511	254	870
380	509	417	292	438	438	683	57	57	M12	461	217	833	M12	483	242	858	M12	503	262	878
390	522	428	299	431	431	690	64	64	M12	454	224	840	M12	476	249	865	M12	496	269	885
400	535	439	307	423	423	698	72	72	M12	446	232	848	M12	468	257	873	M12	488	277	893
410	549	449	315	490	490	726	105	105	M12	490	240	856	M12	512	265	881	M12	532	285	901
420	562	460	322	483	483	733	112	112	M12	483	247	863	M12	505	272	888	M12	525	292	908
430	575	471	330	475	475	741	120	120	M12	475	255	871	M12	497	280	896	M12	517	300	916
440	589	482	338	467	467	749	128	128	M12	467	263	879	M12	489	288	904	M12	509	308	924
450	602	493	345	460	460	756	135	135	M12	460	270	886	M12	482	295	911	M12	502	315	931
460	616	504	353	452	452	764	143	143	M12	452	278	894	M12	474	303	919	M12	494	323	939
470	629	515	361	444	444	772	151	151	M12	444	286	902	M12	466	311	927	M12	486	331	947
480	642	526	368	437	437	779	158	158	M12	437	293	909	M12	459	318	934	M12	479	338	954
490	656	537	376	429	429	787	166	166	M12	429	301	917	M12	451	326	942	M12	471	346	962
500	669	548	384	421	421	795	174	174	M12	421	309	925	M12	443	334	950	M12	463	354	970

C4: DIMENSIONS FOR SIZES C4-11 TO C4-15

MOVEMENT DEPENDENT DIMENSIONS		MOVEMENT PROVIDED mm							
		40-80	90-160	170-220	230-300	310-400	410-500	510-600	
TRAVEL RANGE DEPENDENT DIMENSIONS	U	155	155	155	155	345	345	345	
	TA	188	291	368	470	599	727	855	
	TB	200	200	235	295	365	435	510	
	TC	205	205	205	205	370	370	370	
	TD	115	115	115	130	145	165	180	
	TE		200	255	315	375	435	510	
	TF		230	280	345	425	505	580	
	TG	130	130	130	145	160	180	195	
	TH	130	130	130	145	160	180	195	
	TJ	195	195	195	195	195	195	226	
	TOP SUSPENSION DETAILS	C4-11	DD	22	14	14	14	14	14
			AA	50	30	30	30	30	30
			BB	35	20	20	20	20	20
			CC	60	50	50	50	50	50
			EE	10	6	6	6	6	6
GG		30	20	20	20	20	20		
LL		M20	M12	M12	M12	M12	M12		
C4-12		DD	22	18	14	14	14	14	
		AA	50	36	30	30	30	30	
		BB	35	30	20	20	20	20	
		CC	60	50	50	50	50	50	
		EE	10	6	6	6	6	6	
GG		30	25	20	20	20	20		
LL		M20	M16	M12	M12	M12	M12		
C4-13		DD	26	18	18	14	14	14	
	AA	60	36	36	36	30	30		
	BB	45	30	30	30	20	20		
	CC	80	50	50	50	50	50		
	EE	10	6	6	6	6	6		
GG	35	25	25	25	20	20			
LL	M24	M16	M16	M12	M12	M12			
C4-14	DD	26	22	18	14	14	14		
	AA	60	50	36	36	30	30		
	BB	45	35	30	30	20	20		
	CC	80	60	50	50	50	50		
	EE	10	10	6	6	6	6		
GG	35	30	25	25	20	20			
LL	M24	M20	M16	M16	M12	M12			
C4-15	DD	33	26	22	22	18	18		
	AA	70	60	50	50	36	36		
	BB	55	45	35	35	30	30		
	CC	100	80	60	60	50	50		
	EE	12	10	10	10	6	6		
GG	40	35	30	30	25	25			
LL	M30	M24	M20	M20	M16	M16			

FIXED DIMENSIONS					
FA	330	FQ	100	XE	18
FB	115	FR	225	XF	270
FC	95	FS	240	XG	155
FD	51	FT	155	XH	110
FE	250	FU	35	XJ	220
FF	10	FV	175	XK	315
FG	35	FW	18	XL	18
FH	18	FX	105	XM	155
FJ	25	FY	160	XN	20
FK	225	FZ	300	XP	190
FL	175	XA	415	XQ	148
FM	10	XB	155	XR	195
FN	155	XC	210		
FP	90	XD	250		

SPRING SIZE DEPENDENT DIMENSIONS					
	C4-11	C4-12	C4-13	C4-14	C4-15
SA	264	286	312	351	400
SB	284	306	332	371	420
SC	365	390	415	455	505
SD	385	410	435	475	525
SE	385	410	435	475	525
SF	210	210	215	215	220

WEIGHTS (kgf)					
	C4-11	C4-12	C4-13	C4-14	C4-15
HS/HD	55	55	60	65	75
VS/VD	60	60	65	70	80
VIS/VID	60	65	70	75	80
HBMCS	60	65	70	75	80
HBM	50	55	60	65	70
VBM	55	55	60	65	75
VBMCS	65	70	75	80	85
VIBM	60	65	70	75	80

SINGLE POINT SUSPENSION DIMENSION 'V'							
MOVEMENT PROVIDED FROM	ALL SIZES		C4-11	C4-12	C4-13	C4-14	C4-15
	V1	V3	V2	V2	V2	V2	V2
40	43	48					
50	53	60					
60	63	71					
70	73	82					
80	82	93					
90	92	104	95				
100	101	114	104	107	110	112	113
110	111	124	113	117	120	122	124
120	120	135	122	126	130	133	135
130	129	145	131	136	139	143	145
140	138	155	140	145	149	153	156
150	147	165	148	154	159	163	166
160	155	174	156	163	168	173	176
170			164	172	177	182	187
180			172	180	187	192	197
190			180	189	196	202	207
200			188	197	205	211	217
210			195	206	213	221	226
220			203	214	222	230	236
230			210	222	231	239	246
240			217	230	239	248	255
250			224	237	248	257	265
260			231	245	256	266	274
270			238	252	264	275	284
280			245	260	272	283	293
290			251	267	280	292	302
300			258	274	288	300	311
310			264	282	296	309	320
320			270	289	304	317	329
330			276	295	311	325	338
340			282	302	319	334	347
350			288	309	326	342	355
360			294	316	333	350	364
370			300	322	341	358	373
380			305	329	348	366	381
390			311	335	355	373	389
400			316	341	362	381	398
410			322	348	369	389	406
420			327	354	376	396	414
430			332	360	382	404	422
440			337	366	389	411	431
450			343	372	396	418	439
460			348	377	402	426	447
470			353	383	409	433	454
480			357	389	415	440	462
490			362	394	422	447	470
500			367	400	428	454	478
510			372	406	434	461	485
520			376	411	440	468	493
530			381	416	446	475	501
540			385	422	452	482	508
550			390	427	458	488	516
560			394	432	464	495	523
570			399	437	470	502	530
580			403	442	476	508	537
590			407	447	482	515	545
600			411	452	487	521	552

TYPES HS AND VS ARE NOT USED ABOVE 160mm TRAVEL

INSTALLED HEIGHT DIMENSIONS **J4** AND **J7** ALLOW ±25mm ADJUSTMENT.

TAKE-OUT DIMENSIONS **A1**, **A2**, **A3**, **J5**, **J6** AND **J8** ALLOW ±75mm ADJUSTMENT AND ASSUME USE OF A STANDARD F228A EYEBOLT.

WHERE SEVERE HEADROOM LIMITATIONS EXIST, DIMENSIONS **A1**, **A2** AND **A3** CAN BE REDUCED AND DIMENSIONS **J5**, **J6** AND **J8** INCREASED AS FOLLOWS BY USE OF A SHORTENED EYEBOLT:

ØX	M12	M16	M20	M24	M30
CHANGE mm	160	160	140	140	120

NOTE DIA. **X** IS THREADED ISO METRIC COARSE RIGHT HAND AS STANDARD.

NOTE THAT DIMENSIONS **A1**, **A2**, **A3**, **J4**, **J5**, **J6**, **J7** AND **J8** ARE GIVEN AT ZERO ROTATION, THAT IS WITH THE LEVER IN THE UPPERMOST POSITION.

N.B. DIMENSION **TA** IS THE MINIMUM FORWARD CLEARANCE REQUIRED.

C7: DIMENSIONS FOR SIZES C7-24 TO C7-27

MOVEMENT DEPENDENT DIMENSIONS						
MOVEMENT PROVIDED mm	90-180	190-340	350-440	450-540	550-640	650-750
U	355	355	395	395	525	525
TA	445	630	745	860	975	1102
TB	510	510	540	540	600	665
TC	475	475	475	475	600	600
TD	270	270	270	270	270	280
TE	510	510	540	600	640	695
TF	475	475	525	600	685	770
TG	290	290	290	290	290	300
TH	290	290	290	290	290	300
TJ	460	460	460	460	460	460
DD	60	46	40	40	40	40
AA	120	90	80	80	80	80
BB	100	75	55	55	55	55
CC	180	130	110	110	110	110
EE	20	15	15	15	15	15
GG	75	60	45	45	45	45
LL	M56	M42	M36	M36	M36	M36
DD	68	52	40	40	40	40
AA	140	105	80	80	80	80
BB	115	85	55	55	55	55
CC	200	150	110	110	110	110
EE	20	20	15	15	15	15
GG	80	70	45	45	45	45
LL	M64	M48	M36	M36	M36	M36
DD	68	60	46	46	40	40
AA	140	120	90	90	80	80
BB	115	100	75	75	55	55
CC	200	180	130	130	110	110
EE	20	20	15	15	15	15
GG	80	75	60	60	45	45
LL	M64	M56	M42	M42	M36	M36
DD	76	60	52	46	46	46
AA	155	120	105	90	90	90
BB	130	100	85	75	75	75
CC	220	180	150	130	130	130
EE	25	20	20	15	15	15
GG	90	75	70	60	60	60
LL	M72	M56	M48	M42	M42	M42

FIXED DIMENSIONS					
FA	655	FQ	150	XE	40
FB	228	FR	480	XF	570
FC	240	FS	585	XG	355
FD	179	FT	355	XH	320
FE	526	FU	100	XJ	440
FF	25	FV	350	XK	805
FG	100	FW	40	XL	40
FH	40	FX	280	XM	400
FJ	65	FY	375	XN	50
FK	480	FZ	630	XP	500
FL	350	XA	1020	XQ	302
FM	30	XB	355	XR	460
FN	400	XC	535		
FP	230	XD	500		

SPRING SIZE DEPENDENT DIMENSIONS				
	C7-24	C7-25	C7-26	C7-27
SA	868	868	868	868
SB	918	918	918	918
SC	1115	1115	1115	1115
SD	1150	1150	1150	1150
SE	1150	1150	1150	1150
SF	540	540	540	540

WEIGHTS (kgf)				
	C7-24	C7-25	C7-26	C7-27
HS/HD	580	620	670	720
VS/VD	610	660	710	760
VIS/VID	630	680	730	780
HBMCS	630	670	720	770
HBM	560	610	650	710
VBMS	590	640	690	740
VBMCS	670	720	770	820
VIBM	610	650	700	750

SINGLE POINT SUSPENSION DIMENSION 'V'							
MOVEMENT PROVIDED mm	ALL SIZES		C7-24	C7-25	C7-26	C7-27	
	V1	V3	V2	V2	V2	V2	
90	91	112					
100	101	120					
110	111	133					
120	120	144					
130	130	156					
140	139	167	149				
150	149	178	158	162	165	166	
160	157	189	168	172	175	177	
170	167	200	178	182	185	187	
180	176	211	187	192	196	198	
190	185	222	197	202	206	208	
200	194	232	206	212	216	218	
210	203	243	216	222	226	229	
220	212	254	225	232	236	239	
230	220	264	234	241	246	249	
240	229	275	243	251	256	259	
250	238	285	252	260	266	269	
260	246	295	261	270	275	279	
270	255	305	270	279	285	289	
280	263	315	279	288	295	299	
290	272	325	287	297	304	308	
300	280	335	296	307	314	318	
310	288	345	304	316	323	328	
320	297	355	313	325	331	337	
330	305	364	321	334	342	347	
340	313	374	330	342	351	356	
350			338	351	360	366	
360			346	360	369	375	
370			354	369	378	384	
380			362	377	387	394	
390			370	386	396	403	
400			378	394	405	412	
410			386	403	414	421	
420			394	411	423	430	
430			401	419	431	439	
440			409	428	440	448	
450			416	436	449	457	
460			424	444	457	466	
470			431	452	466	475	
480			439	460	474	483	
490			446	468	483	492	
500			454	476	491	501	
510			461	484	499	509	
520			468	492	508	518	
530			475	500	516	527	
540			482	507	524	535	
550			489	515	532	543	
560			496	523	540	552	
570			503	530	548	560	
580			510	538	556	569	
590			517	545	564	577	
600			523	553	572	585	
610			530	560	580	593	
620			537	567	588	601	
630			543	575	596	609	
640			550	582	603	617	
650			556	589	611	625	
660			563	596	619	633	
670			569	603	626	641	
680			576	610	634	649	
690			582	617	641	657	
700			588	624	649	665	
710			594	631	656	673	
720			601	638	663	680	
730			607	645	671	688	
740			613	652	678	696	
750			619	658	685	703	

TYPES HS AND VIS ARE NOT USED ABOVE 340mm TRAVEL

INSTALLED HEIGHT DIMENSIONS **J4** AND **J7** ALLOW ± 25 mm ADJUSTMENT.

TAKE-OUT DIMENSIONS **A1**, **A2**, **A3**, **J5**, **J6** AND **J8** ALLOW ± 75 mm ADJUSTMENT AND ASSUME USE OF A STANDARD F228A EYEBOLT.

WHERE SEVERE HEADROOM LIMITATIONS EXIST, DIMENSIONS **A1**, **A2** AND **A3** CAN BE REDUCED AND DIMENSIONS **J5**, **J6** AND **J8** INCREASED AS FOLLOWS BY USE OF A SHORTENED EYEBOLT:

ØX	M20	M24	M30	M36	M42	M48	M56	M64	M72
CHANGE mm	140	140	120	100	80	NIL	NIL	NIL	NIL

NOTE DIA. **X** IS THREADED ISO METRIC COARSE RIGHT HAND AS STANDARD.

NOTE THAT DIMENSIONS **A1**, **A2**, **A3**, **J4**, **J5**, **J6**, **J7** AND **J8** ARE GIVEN AT ZERO ROTATION, THAT IS WITH THE LEVER IN THE UPPERMOST POSITION.

N.B. DIMENSION **TA** IS THE MINIMUM FORWARD CLEARANCE REQUIRED.

C7: DIMENSIONS FOR SIZES C7-28 AND C7-29

MOVEMENT DEPENDENT DIMENSIONS								
MOVEMENT PROVIDED mm	90-180	190-340	350-440	450-540	550-640	650-750		
TRAVEL RANGE DEPENDENT DIMENSIONS	U	355	355	385	385	525	525	
	TA	445	630	745	860	975	1102	
	TB	510	510	540	540	600	665	
	TC	475	475	475	475	600	600	
	TD	270	270	270	270	270	280	
	TE	510	510	570	600	655	700	
	TF	475	475	545	630	700	790	
	TG	290	290	290	290	290	300	
	TH	290	290	290	290	290	300	
	TJ	460	460	460	460	460	460	
TOP SUSPENSION DETAILS	C7-28	DD	76	68	52	52	46	46
		AA	155	140	105	105	90	90
		BB	130	115	85	85	75	75
		CC	220	200	150	150	130	130
		EE	25	20	20	20	15	15
	C7-29	GG	90	80	70	70	60	60
		LL	M72	M64	M48	M48	M42	M42
		DD	85	68	60	60	52	52
		AA	175	140	120	120	105	105
		BB	150	115	100	100	85	85
CC	240	200	180	180	150	150		
EE	25	20	20	20	20	20		
GG	100	80	75	75	70	70		
LL	M80	M64	M56	M56	M48	M48		

FIXED DIMENSIONS					
FA	710	FQ	150	XE	46
FB	228	FR	480	XF	570
FC	240	FS	585	XG	355
FD	179	FT	355	XH	320
FE	572	FU	100	XJ	440
FF	25	FV	350	XK	805
FG	100	FW	46	XL	40
FH	46	FX	280	XM	415
FJ	65	FY	375	XN	60
FK	480	FZ	680	XP	500
FL	350	XA	1060	XQ	302
FM	30	XB	355	XR	460
FN	415	XC	575		
FP	230	XD	550		

SPRING SIZE DEPENDENT DIMENSIONS		
	C7-28	C7-29
SA	999	999
SB	1059	1059
SC	1245	1245
SD	1280	1280
SE	1280	1280
SF	575	575

WEIGHTS (kgf)		
	C7-28	C7-29
HS/HD	930	1000
VS/VD	970	1040
VIS/VID	990	1060
HBMS	1000	1070
HBM	910	980
VBMS	960	1030
VBMS	1050	1120
VIBM	960	1030

SINGLE POINT SUSPENSION DIMENSION 'V'				
MOVEMENT PROVIDED mm	ALL SIZES		C7-28	C7-29
	V1	V3		
120	123	145		
130	132	157		
140	142	168		
150	152	180		
160	162	191		
170	171	203		
180	181	214	196	
190	190	225	207	209
200	199	236	217	219
210	209	247	227	229
220	218	258	237	240
230	227	269	247	250
240	237	279	256	260
250	246	290	267	270
260	255	301	277	280
270	263	311	286	290
280	272	322	296	300
290	281	332	306	310
300	290	343	315	320
310	299	353	323	329
320	308	364	334	339
330	317	374	344	349
340	325	384	353	358
350			362	368
360			371	377
370			381	387
380			390	396
390			399	405
400			408	415
410			417	424
420			426	433
430			435	442
440			443	451
450			452	460
460			461	469
470			469	478
480			478	487
490			487	496
500			495	505
510			504	514
520			512	522
530			520	531
540			529	540
550			537	548
560			545	557
570			553	567
580			562	574
590			570	582
600			578	590
610			586	599
620			594	607
630			602	615
640			609	623
650			617	632
660			625	640
670			633	648
680			640	656
690			648	664
700			656	672
710			663	680
720			671	688
730			678	695
740			686	703
750			693	711

TYPES HS AND VIS ARE NOT USED ABOVE 340mm TRAVEL

INSTALLED HEIGHT DIMENSIONS **J4** AND **J7** ALLOW ± 25 mm ADJUSTMENT.

TAKE-OUT DIMENSIONS **A1**, **A2**, **A3**, **J5**, **J6** AND **J8** ALLOW ± 75 mm ADJUSTMENT AND ASSUME USE OF A STANDARD F228A EYEBOLT.

WHERE SEVERE HEADROOM LIMITATIONS EXIST, DIMENSIONS **A1**, **A2** AND **A3** CAN BE REDUCED AND DIMENSIONS **J5**, **J6** AND **J8** INCREASED AS FOLLOWS BY USE OF A SHORTENED EYEBOLT:

ØX	M36	M42	M48	M56	M64	M72	M80
CHANGE mm	100	80	NIL	NIL	NIL	NIL	NIL

NOTE DIA. **X** IS THREADED ISO METRIC COARSE RIGHT HAND AS STANDARD.

NOTE THAT DIMENSIONS **A1**, **A2**, **A3**, **J4**, **J5**, **J6**, **J7** AND **J8** ARE GIVEN AT ZERO ROTATION, THAT IS WITH THE LEVER IN THE UPPERMOST POSITION.

N.B. DIMENSION **TA** IS THE MINIMUM FORWARD CLEARANCE REQUIRED.

C8: DIMENSIONS FOR SIZE C8-30

MOVEMENT DEPENDENT DIMENSIONS							
MOVEMENT PROVIDED mm		150-190	200-340	350-440	450-540	550-640	650-750
TRAVEL RANGE DEPENDENT DIMENSIONS	U	300	400	400	500	500	600
	TA	470	600	720	850	970	1110
	TB	650	650	650	650	650	705
	TC	440	520	520	615	615	690
	TE	—	650	650	650	675	705
	TF	—	540	540	620	700	775
	TG	320	320	320	320	320	320
TOP SUSPENSION DETAILS	DD	95	76	68	60	60	52
	AA	200	155	140	120	120	105
	BB	170	130	115	100	100	85
	CC	260	220	200	180	180	150
	EE	30	25	20	20	20	20
	GG	120	90	80	75	75	70

FIXED DIMENSIONS			
FA	812	FR	565
FB	332	FS	660
FC	330	FT	400
FD	179	FU	150
FE	657	FV	455
FF	25	FW	40
FG	150	SA	1200
FP	280	SC	1540

WEIGHTS (kgf)	
	C8-30
HS/HD	1570
VS/VD	1660
HBM	1540

C8-30 SUPPORTS ARE AVAILABLE IN THE FOLLOWING TYPES

TYPE HBM

TYPE HS, STYLE TS2 AND TS3

TYPE HD, STYLE TS2, TS3 AND TS4

TYPE VS, STYLE TS2 AND TS3

TYPE VD, STYLE TS2, TS3 AND TS4

TAKE-OUT DIMENSIONS **A1**, **A2** AND **J5** ALLOW ± 75 mm ADJUSTMENT

NOTE DIA. **X** IS THREADED ISO METRIC COARSE RIGHT HAND AS STANDARD.

NOTE THAT DIMENSIONS **A1**, **A2** AND **J5** ARE GIVEN AT ZERO ROTATION, THAT IS WITH THE LEVER IN THE UPPERMOST POSITION.

MOVEMENT PROVIDED mm	GX mm	ALL			HS HD	HS	VS VD	VS	HBM
		C mm	D mm	E mm	A1 mm	V1 mm	A2 mm	V2 mm	J5 mm
AT ZERO ROTATION									
150	M90	201	164	115	1210	141			-240
160	M80	214	175	123	1102	150			-132
170	M80	228	186	130	1095	159			-125
180	M80	241	197	138	1087	168			-117
190	M80	254	208	146	1079	177			-109
200	M72	268	219	154	991	186	991	215	-21
210	M72	281	230	161	984	194	984	224	-14
220	M72	294	241	169	976	203	976	234	-6
230	M72	308	252	177	968	211	968	244	2
240	M72	321	263	184	961	220	961	254	9
250	M72	335	274	192	953	228	953	264	17
260	M64	348	285	200	895	237	895	273	75
270	M64	361	296	207	888	245	888	283	82
280	M64	375	307	215	880	253	880	293	90
290	M64	388	318	223	872	261	872	302	98
300	M64	401	329	230	865	270	865	312	105
310	M64	415	340	238	857	278	857	321	113
320	M64	428	351	246	849	286	849	330	121
330	M64	442	362	253	842	294	842	339	128
340	M56	455	373	261	819	302	819	349	151
350	M56	468	384	269	811	310	811	358	159
360	M56	482	395	276	804	318	804	367	166
370	M56	495	406	284	796	325	796	376	174
380	M56	509	417	292	788	333	788	385	182
390	M56	522	428	299	781	341	781	394	189
400	M56	535	439	307	773	348	773	403	197
410	M56	549	449	315	765	356	765	411	205
420	M56	562	460	322	758	364	758	420	212
430	M56	575	471	330	750	371	750	429	220
440	M56	589	482	338	742	379	742	437	228
450	M56	602	493	345	735	386	735	446	235
460	M56	616	504	353	727	394	727	455	243
470	M48	629	515	361	704	401	704	463	266
480	M48	642	526	368	697	408	697	471	273
490	M48	656	537	376	689	415	689	480	281
500	M48	669	548	384	681	423	681	488	289
510	M48	683	559	391	674	430	674	496	296
520	M48	696	570	399	666	437	666	505	304
530	M48	709	581	407	658	444	658	513	312
540	M48	723	592	415	650	451	650	521	320
550	M48	736	603	422	643	458	643	529	327
560	M48	749	614	430	635	465	635	537	335
570	M48	763	625	438	627	472	627	545	343
580	M48	776	636	445	620	479	620	553	350
590	M48	790	647	453	612	486	612	561	358
600	M48	803	658	461	604	493	604	569	366
610	M42	816	669	468	557	499	557	577	413
620	M42	830	680	476	549	506	549	584	421
630	M42	843	691	484	541	513	541	592	429
640	M42	857	702	491	534	520	534	600	436
650	M42	870	713	499	526	526	526	608	444
660	M42	883	724	507	518	533	518	615	452
670	M42	897	734	514	510	539	510	623	459
680	M42	910	745	522	502	546	502	630	467
690	M42	923	756	530	494	552	494	638	475
700	M42	937	767	537	486	559	486	645	482
710	M42	950	778	545	478	565	478	653	490
720	M42	964	789	553	470	571	470	660	498
730	M42	977	800	560	462	578	462	667	505
740	M42	990	811	568	454	584	454	674	513
750	M42	1004	822	576	446	590	446	682	521

C8: DIMENSIONS FOR SIZE C8-31

MOVEMENT DEPENDENT DIMENSIONS							
MOVEMENT PROVIDED mm		160-190	200-340	350-440	450-540	550-640	650-750
TRAVEL RANGE DIMENSIONS	U	300	400	400	500	500	800
	TA	470	600	720	850	970	1110
	TB	850	850	850	850	850	705
	TC	440	520	520	615	615	690
	TE	—	650	650	650	675	705
	TF	—	540	540	620	700	775
	TG	320	320	320	320	320	320
TOP SUSPENSION DETAILS	DD	95	85	68	68	68	60
	AA	200	175	140	140	140	120
	BB	170	150	115	115	115	100
	CC	260	240	200	200	200	180
	EE	30	25	20	20	20	20
	GG	120	100	80	80	80	75

FIXED DIMENSIONS			
FA	876	FR	565
FB	332	FS	660
FC	330	FT	400
FD	179	FU	150
FE	733	FV	455
FF	25	FW	40
FG	150	SA	1250
FP	280	SC	1590

WEIGHTS (kgf)	
	C8-31
HS/HD	1950
VS/VD	2040
HBM	1920

C8-31 SUPPORTS ARE AVAILABLE IN THE FOLLOWING TYPES

TYPE HBM

TYPE HS, STYLE TS2 AND TS3

TYPE HD, STYLE TS2, TS3 AND TS4

TYPE VS, STYLE TS2 AND TS3

TYPE VD, STYLE TS2, TS3 AND TS4

TAKE-OUT DIMENSIONS **A1**, **A2** AND **J5** ALLOW ± 75 mm ADJUSTMENT

NOTE DIA. **X** IS THREADED ISO METRIC COARSE RIGHT HAND AS STANDARD.

NOTE THAT DIMENSIONS **A1**, **A2** AND **J5** ARE GIVEN AT ZERO ROTATION, THAT IS WITH THE LEVER IN THE UPPERMOST POSITION.

MOVEMENT PROVIDED mm	OX mm	ALL			HS HD	HS	VS VD	VS	HBM
		C mm	D mm	E mm	A1 mm	V1 mm	A2 mm	V2 mm	J5 mm
		AT ZERO ROTATION							
160	M90	214	175	123	1202	148			-232
170	M90	228	186	130	1195	157			-225
180	M90	241	197	138	1187	166			-217
190	M90	254	208	146	1179	174			-209
200	M80	268	219	154	1071	183			-101
210	M80	281	230	161	1064	191			-94
220	M80	294	241	169	1056	200			-86
230	M80	308	252	177	1048	208			-78
240	M80	321	263	184	1041	216	1041	254	-71
250	M72	335	274	192	953	225	953	263	17
260	M72	348	285	200	945	233	945	273	25
270	M72	361	296	207	938	241	938	283	32
280	M72	375	307	215	930	249	930	292	40
290	M72	388	318	223	922	257	922	302	48
300	M72	401	329	230	915	266	915	311	55
310	M72	415	340	238	907	274	907	320	63
320	M64	428	351	246	849	281	849	330	121
330	M64	442	362	253	842	289	842	339	128
340	M64	455	373	261	834	297	834	348	136
350	M64	468	384	269	826	305	826	357	144
360	M64	482	395	276	819	313	819	366	151
370	M64	495	406	284	811	321	811	375	159
380	M64	509	417	292	803	328	803	384	167
390	M64	522	428	299	796	336	796	393	174
400	M64	535	439	307	788	343	788	402	182
410	M64	549	449	315	780	351	780	411	190
420	M64	562	460	322	773	358	773	419	197
430	M56	575	471	330	750	366	750	428	220
440	M56	589	482	338	742	373	742	437	228
450	M56	602	493	345	735	380	735	445	235
460	M56	616	504	353	727	388	727	454	243
470	M56	629	515	361	719	395	719	462	251
480	M56	642	526	368	712	402	712	471	258
490	M56	656	537	376	704	409	704	479	266
500	M56	669	548	384	696	416	696	488	274
510	M56	683	559	391	689	424	689	496	281
520	M56	696	570	399	681	431	681	504	289
530	M56	709	581	407	673	438	673	512	297
540	M56	723	592	415	665	445	665	520	305
550	M56	736	603	422	658	451	658	529	312
560	M56	749	614	430	650	458	675	537	320
570	M56	763	625	438	642	465	667	545	328
580	M56	776	636	445	635	472	660	553	335
590	M48	790	647	453	612	479	637	560	358
600	M48	803	658	461	604	485	629	568	366
610	M48	816	669	468	597	492	622	576	373
620	M48	830	680	476	589	499	614	584	381
630	M48	843	691	484	581	505	606	592	389
640	M48	857	702	491	574	512	599	599	396
650	M48	870	713	499	621	519	621	607	404
660	M48	883	724	507	613	525	613	615	412
670	M48	897	734	514	606	531	606	622	419
680	M48	910	745	522	598	538	598	630	427
690	M48	923	756	530	590	544	590	637	435
700	M48	937	767	537	583	551	583	645	442
710	M48	950	778	545	575	557	575	652	450
720	M48	964	789	553	567	563	567	659	458
730	M48	977	800	560	560	569	560	667	465
740	M48	990	811	568	552	576	552	674	473
750	M48	1004	822	576	544	582	544	681	481

