



3.6 - Suspended sets

Increased activities of the bulk handling industry world wide necessitate conveying even greater quantities of bulk and large lump materials. This demand has accelerated the development of realistic solutions for belt conveyor that couple robust strength with working flexibility, resulting in even higher belt speeds.

In particular, research into solutions for the most critical area of the conveyor, that of the loading zone, has resulted in the RULMECA development of the suspended "garland" troughing sets.

These suspended sets are quickly and simply installed, and allow maintenance to be performed on them without shutting down the plant.

For these reasons, the "garland" suspended system has been the subject of substantial research and development, resulting in their increasing use in the most diverse applications.



3 Troughing sets

3.6.1 - Characteristics and advantages

The “garland” consists of a series of load carrying rollers, attached together by chain links.

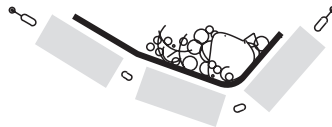
This arrangement gives to the troughing set the characteristics of mobility and flexibility resulting in a perfect central belt trough.

The “garland” is suspended from rigid supports or occasionally spring loaded which adds further flexibility to the structure.

The principal advantage obtained using these types of suspended sets is their possibility to “flex” in the direction of the conveyor or indeed in a transverse sense.

This movement helps to dissipate some of the kinetic energy derived from the friction contained in the conveyed material itself.

In this way forces and stresses are absorbed and limited with the consequent reduction in damage to the belt and to the rollers themselves.



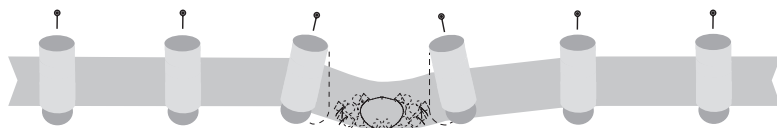
With respect to other lighter types of suspended sets (made from steel cable rotating in only two bearings), the RULMECA “garland” troughing set has spindles with two bearings in each roller (therefore up

to 10 bearings for a set of 5 rollers) which combines to give constructive strength with the easiest fluency of rotation.



In comparison with the fixed troughing sets the “garland” systems have other notable superior features to recommend them:

- Improved absorption of dynamic stresses, above all, in the case of conveying large lump size material, which in turn results in a longer life for the rubber belt and the rollers.
- Improved belt centralising, in that any tracking off is absorbed by the articulation of the suspended set which realigns the belt.
- Improved load containment towards the centre of the belt.
- Improved load capacity, given the same belt width, due to the great increase in obtainable loading without material spillage.
- Maximum working speeds are higher.
- Less maintenance down time.
- Lower structural conveyor weight and installation costs.



3.6.2 - Applications and configurations

The suspended “garland” systems are particularly suitable for the high speed conveying of large lump size material or very sharp or angular material and to absorb loading from excessive heights.

In these cases, the characteristic of flexibility of the suspended troughing set avoids over dimensioning that is necessary in the cases where a fixed troughing set of traditional design would be employed.

The Rulmeca suspended set utilises, as standard, rollers from the series PSV, TOP, PL and PLF, whose characteristics have previously been described in the respective chapters.

The “garland” may comprise 2, 3 or 5 plain rollers for the load carrying sets Fig. 6; a pair of plain rollers or with rings, for the return sets Fig. 7; and from 3, 5 (or more as required) rollers with shock absorbing rings for the impact troughing sets Fig. 8.

In the latter case, if the average weight of material lump or the fall height is not excessive, it is possible to use plain rollers without shock absorbing rings.

“Garland” with 5 rollers in the loading zone

The major forces on the rollers and belt occur, as has been noted, in the loading zone.



It is here that the suspended system clearly exhibits its advantages over the fixed system. Studying the dynamic forces involved in this section one is able to demonstrate that, thanks to the ability to absorb impact, a system of 5 rollers as a “garland” increases

the load capacity 2 or 4 times with respect to traditional fixed troughing sets.

Other configurations as required may be taken into consideration on request.

Fig. 6 - Suspended set for carrying belt

Fig. 7 - Suspended set for return belt

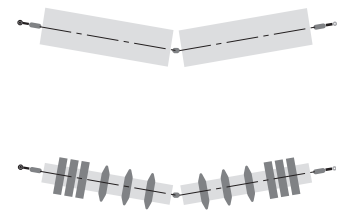
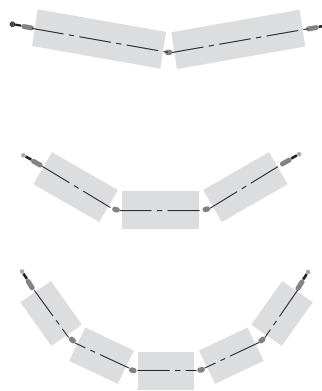
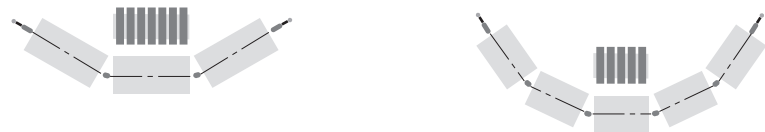
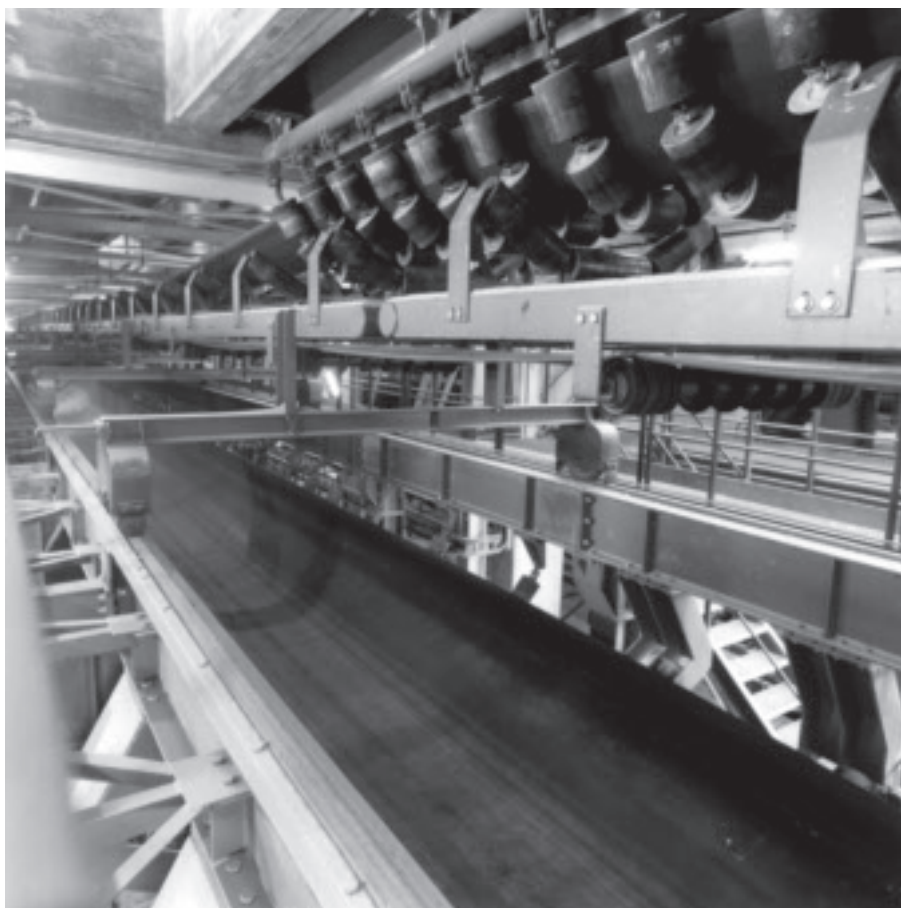


Fig. 8 - Suspended set for impact troughing set with three or five plain rollers or with shock absorbing rings








3 Troughing sets



3.6.3 - Programme

Garland type	arrangements	description
GS 2		for upper and return set with two rollers
GS 3		for upper and impact set with three rollers
GS 5		for upper and impact set with five rollers
Suspension brackets and connections		for upper and return sets



3 Troughing sets "garland" series GS2



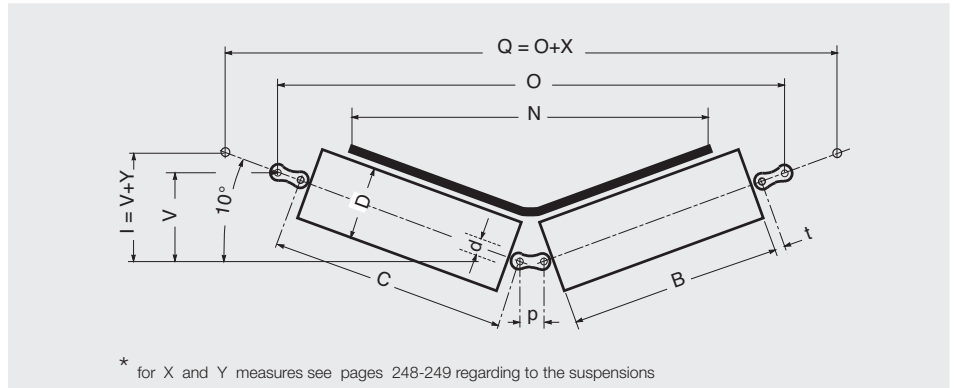
The diameters and types of rollers in the table are those advised for suspended sets with two rollers, for different widths of belt. The diameter of the roller is chosen from those possible for the type of roller considered (see chapter 2 rollers) and must be suitable for the speed and load capacity of the belt (see chapter 2 para. 2.3 selection method).

Rollers that may be utilised to comprise the "garland" GS2 must be from the series PSV, TOP, PL, PLF, and where needed, with return rings (see chapter 2, rollers with rings).

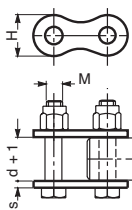
belt width mm	roller D mm	B	C	A	type	bearing			spindle		type of suspensions
						V	O	d	p		
500	63-89 108-133	315	343	363	PSV/1-FHD	6204	64	751	20	25.40	A-C-F
		315	347	371	PSV/2-FHD	6205	66	778	25	31.75	A-C-F
		315	347	371	PSV/3-FHD	6305	66	778	25	31.75	A-C-F
650	63-89 108-133	380	408	428	PSV/1-FHD	6204	75	879	20	25.40	A-C-F
		380	412	436	PSV/2-FHD	6205	77	906	25	31.75	A-C-F
		380	412	436	PSV/3-FHD	6305	77	906	25	31.75	A-C-F
		380	420	452	PSV/4-FHD	6206	80	940	30	38.10	B-C-F
800	63-89-108 133-159	465	493	513	PSV/1-FHD	6204	90	1046	20	25.40	A-C-F
		465	497	521	PSV/2-FHD	6205	92	1073	25	31.75	A-C-F
		465	497	521	PSV/3-FHD	6305	92	1073	25	31.75	A-C-F
		465	505	537	PSV/4-FHD	6206	94	1108	30	38.10	B-C-F
1000	63-89-108 133-159	600	628	648	PSV/1-FHD	6204	113	1312	20	25.40	A-C-F
		600	632	656	PSV/2-FHD	6205	115	1339	25	31.75	A-C-F
		600	632	656	PSV/3-FHD	6305	115	1339	25	31.75	A-C-F
		600	640	672	PSV/4-FHD	6206	118	1374	30	38.10	B-C-F
1200	89-108 133-159	700	728	748	PSV/1-FHD	6204	131	1509	20	25.40	A-C-F
		700	732	756	PSV/2-FHD	6205	133	1536	25	31.75	A-C-F
		700	732	756	PSV/3-FHD	6305	133	1536	25	31.75	A-C-F
		700	740	772	PSV/4-FHD	6206	135	1571	30	38.10	B-C-F
		700	744	776	PSV/7-FHD	6308	137	1597	40	44.45	B-C-F
1400	89-108 133-159-194	800	828	848	PSV/1-FHD	6204	148	1706	20	25.40	A-C-F
		800	832	856	PSV/2-FHD	6205	150	1733	25	31.75	A-C-F
		800	832	856	PSV/3-FHD	6305	150	1733	25	31.75	A-C-F
		800	840	872	PSV/4-FHD	6206	152	1768	30	38.10	B-C-F
		800	844	876	PSV/7-FHD	6308	154	1794	40	44.45	B-C-F

Example of ordering
standard design
GS2,1000/PSV/1-FHD,20K,89N,C=628

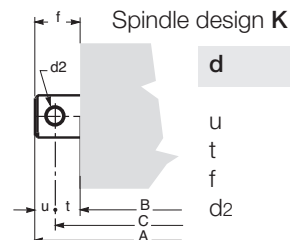
specify type of suspensions
(see page 248-249 for available types)



belt width mm	roller D mm	B	C	A	type	bearing	V	O	spindle		type of suspensions
									d	p	
1600	89-108 133-159-194	900	932	956	PSV/2-FHD	6205	167	1930	25	31.75	A-C-F
		900	932	956	PSV/3-FHD	6305	167	1930	25	31.75	A-C-F
		900	940	972	PSV/4-FHD	6206	170	1965	30	38.10	B-C-F
		900	944	976	PSV/7-FHD	6308	172	1991	40	44.45	B-C-F
1800	108-133 159-194	1000	1032	1056	PSV/2-FHD	6205	185	2127	25	31.75	A-C-F
		1000	1032	1056	PSV/3-FHD	6305	185	2127	25	31.75	A-C-F
		1000	1040	1072	PSV/4-FHD	6206	187	2162	30	38.10	B-C-F
		1000	1044	1076	PSV/7-FHD	6308	189	2188	40	44.45	B-C-F
2000	133 159-194	1100	1132	1156	PSV/2-FHD	6205	202	2324	25	31.75	A-C-F
		1100	1132	1156	PSV/3-FHD	6305	202	2324	25	31.75	A-C-F
		1100	1140	1172	PSV/4-FHD	6206	205	2359	30	38.10	B-C-F
		1100	1144	1176	PSV/7-FHD	6308	206	2385	40	44.45	B-C-F
2200	133 159-194	1250	1282	1306	PSV/3-FHD	6305	228	2619	25	31.75	A-C-F
		1250	1290	1322	PSV/5-FHD	6306	231	2654	30	38.10	B-C-F
		1250	1294	1326	PSV/7-FHD	6308	232	2681	40	44.45	B-C-F
2400	133 159-194	1400	1432	1456	PSV/3-FHD	6305	254	2915	25	31.75	A-C-F
		1400	1440	1472	PSV/5-FHD	6306	257	2949	30	38.10	B-C-F
		1400	1444	1476	PSV/7-FHD	6308	258	2976	40	44.45	B-C-F
2600	159 194	1500	1544	1576	PSV/7-FHD	6308	276	3173	40	44.45	B-C-F



d	20	25	30	40
s	3	4	5	6
H	21	24	30	36
M	8	10	14	16



d	20	25	30	40
u	10	12	16	16
t	14	16	20	22
f	24	28	36	38
d2	8,3	10,3	14,5	16,5



3 Troughing sets "garland" series GS3

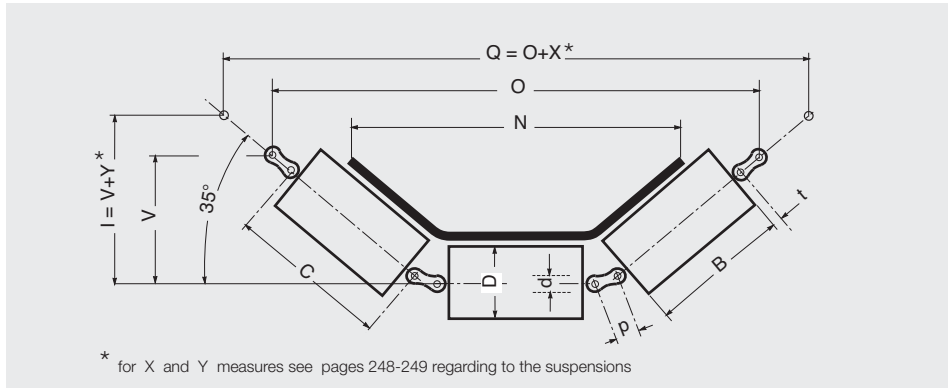


The diameters and types of rollers in the table are those advised for suspended sets with three rollers, for different widths of belt. The diameter of the roller is chosen from those possible for the type of roller considered (see chapter 2 rollers) and must be suitable for the speed and load capacity of the belt (see chapter 2 para. 2.3 selection method). Rollers that may be utilised to comprise the "garland" GS3 must be from the series PSV, TOP, PL, PLF, exceptionally, and only where absolutely necessary, with impact rings (see chapter 2, impact rollers).

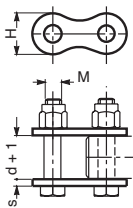
belt width mm	roller							spindle		type of suspensions	
	D mm	B	C	A	type	bearing	V	O	d		p
500	63-89 108-133	200	228	248	PSV/1-FHD	6204	153	692	20	25.40	A-C
		200	232	256	PSV/2-FHD	6205	161	725	25	31.75	A-C
		200	232	256	PSV/3-FHD	6305	161	725	25	31.75	A-C
		200	240	272	PSV/4-FHD	6206	171	768	30	38.10	B-C-E
650	63-89 108-133	250	278	298	PSV/1-FHD	6204	182	824	20	25.40	A-C
		250	282	306	PSV/2-FHD	6205	190	857	25	31.75	A-C
		250	282	306	PSV/3-FHD	6305	190	857	25	31.75	A-C
		250	290	322	PSV/4-FHD	6206	200	900	30	38.10	B-C-E
800	63-89 108-133-159	315	343	363	PSV/1-FHD	6204	219	995	20	25.40	A-C
		315	347	371	PSV/2-FHD	6205	227	1028	25	31.75	A-C
		315	347	371	PSV/3-FHD	6305	227	1028	25	31.75	A-C
		315	355	387	PSV/4-FHD	6206	237	1072	30	38.10	B-C-E
1000	63-89 108-133-159	380	408	428	PSV/1-FHD	6204	256	1166	20	25.40	A-C
		380	412	436	PSV/2-FHD	6205	264	1200	25	31.75	A-C
		380	412	436	PSV/3-FHD	6305	264	1200	25	31.75	A-C
		380	420	452	PSV/4-FHD	6206	274	1243	30	38.10	B-C-E
1200	89-108 133-159	465	493	513	PSV/1-FHD	6204	305	1391	20	25.40	A-C
		465	497	521	PSV/2-FHD	6205	313	1424	25	31.75	A-C
		465	497	521	PSV/3-FHD	6305	313	1424	25	31.75	A-C
		465	505	537	PSV/4-FHD	6206	323	1467	30	38.10	B-C-E
		465	509	541	PSV/7-FHD	6308	331	1501	40	44.45	B-C-E
1400	89-108 133-159-194	530	558	578	PSV/1-FHD	6204	342	1562	20	25.40	A-C
		530	562	586	PSV/2-FHD	6205	350	1595	25	31.75	A-C
		530	562	586	PSV/3-FHD	6305	350	1595	25	31.75	A-C
		530	570	602	PSV/4-FHD	6206	360	1639	30	38.10	B-C-E
		530	574	606	PSV/7-FHD	6308	368	1672	40	44.45	B-C-E

Example of ordering
standard design
GS3,1200/PSV/4-FHD,30K,133N,C=505

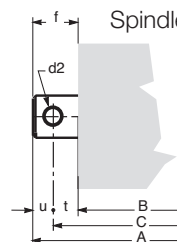
specify type of suspensions
(see page 248-249 for available types)



belt width mm	roller D mm	B	C	A	type	bearing	V	O	spindle		type of suspensions
									d	p	
1600	89-108 133-159-194	600	632	656	PSV/2-FHD	6205	390	1780	25	31.75	A-C
		600	632	656	PSV/3-FHD	6305	390	1780	25	31.75	A-C
		600	640	672	PSV/4-FHD	6206	400	1824	30	38.10	B-C-E
		600	644	676	PSV/7-FHD	6308	408	1857	40	44.45	B-C-E
1800	108-133 159-194	670	702	726	PSV/2-FHD	6205	430	1965	25	31.75	A-C
		670	702	726	PSV/3-FHD	6305	430	1965	25	31.75	A-C
		670	710	742	PSV/4-FHD	6206	441	2008	30	38.10	B-C-E
		670	710	742	PSV/5-FHD	6306	441	2008	30	38.10	B-C-E
		670	714	746	PSV/7-FHD	6308	448	2041	40	44.45	B-C-E
2000	133 159-194	750	790	822	PSV/4-FHD	6206	486	2219	30	38.10	B-C-E
		750	790	822	PSV/5-FHD	6306	486	2219	30	38.10	B-C-E
		750	794	826	PSV/7-FHD	6308	494	2252	40	44.45	B-C-E
2200	133 159-194	800	840	872	PSV/4-FHD	6206	515	2351	30	38.10	B-C-E
		800	840	872	PSV/5-FHD	6306	515	2351	30	38.10	B-C-E
		800	844	876	PSV/7-FHD	6308	523	2384	40	44.45	B-C-E
2400	133 159-194	900	940	972	PSV/4-FHD	6206	572	2615	30	38.10	B-C-E
		900	940	972	PSV/5-FHD	6306	572	2615	30	38.10	B-C-E
		900	944	976	PSV/7-FHD	6308	580	2648	40	44.45	B-C-E
2600	159 194	950	944	1026	PSV/7-FHD	6308	609	2780	40	44.45	B-C-E



d	20	25	30	40
s	3	4	5	6
H	21	24	30	36
M	8	10	14	16



d	20	25	30	40
u	10	12	16	16
t	14	16	20	22
f	24	28	36	38
d2	8,3	10,3	14,5	16,5



3 Troughing sets "garland" series GS5



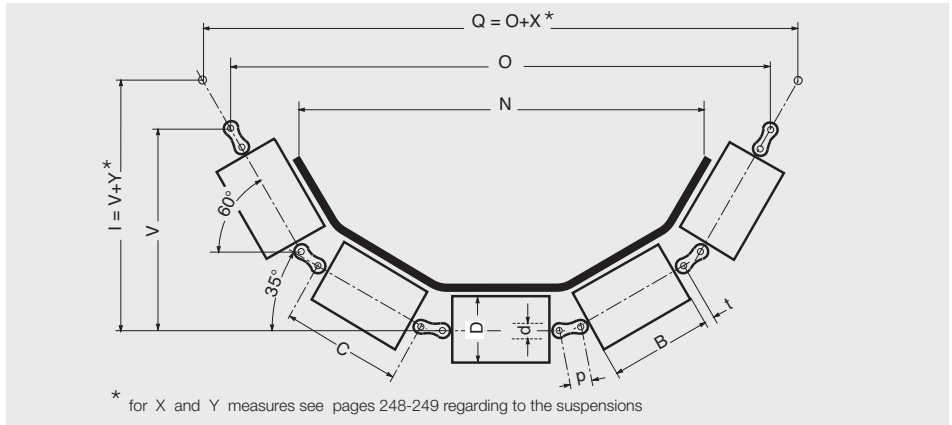
The diameters and types of rollers in the table are those advised for suspended sets with five rollers, for different widths of belt. The diameter of the roller is chosen from those possible for the type of roller considered (see chapter 2 rollers) and must be suitable for the speed and load capacity of the belt (see chapter 2 para. 2.3 selection method).

Rollers that may be utilised to comprise the "garland" GS5 must be from the series PSV, TOP, PL, PLF, exceptionally, and only where absolutely necessary, with impact rings (see chapter 2, impact rollers).

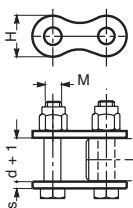
belt width mm	roller D mm	roller							spindle		type of suspensions
		B	C	A	type	bearing	V	O	d	p	
800	89-108 108-133	165	193	213	PSV/1-FHD	6204	326	810	20	25.40	A-C
		165	197	221	PSV/2-FHD	6205	344	852	25	31.75	A-C
		165	197	221	PSV/3-FHD	6305	344	852	25	31.75	A-C
		165	205	237	PSV/4-FHD	6206	368	908	30	38.10	B-C-E
1000	89-108 108-133	205	233	253	PSV/1-FHD	6204	384	956	20	25.40	A-C
		205	237	261	PSV/2-FHD	6205	402	997	25	31.75	A-C
		205	237	261	PSV/3-FHD	6305	402	997	25	31.75	A-C
		205	245	277	PSV/4-FHD	6206	425	1054	30	38.10	B-C-E
1200	89-108 133-159	250	278	298	PSV/1-FHD	6204	449	1120	20	25.40	A-C
		250	282	306	PSV/2-FHD	6205	466	1161	25	31.75	A-C
		250	282	306	PSV/3-FHD	6305	466	1161	25	31.75	A-C
		250	290	322	PSV/4-FHD	6206	490	1217	30	38.10	B-C-E
		250	294	326	PSV/7-FHD	6308	508	1259	40	44.45	B-C-E
1400	89-108 133-159-194	290	318	338	PSV/1-FHD	6204	506	1265	20	25.40	A-C
		290	322	346	PSV/2-FHD	6205	524	1307	25	31.75	A-C
		290	322	346	PSV/3-FHD	6305	524	1307	25	31.75	A-C
		290	330	362	PSV/4-FHD	6206	548	1363	30	38.10	B-C-E
		290	334	366	PSV/7-FHD	6308	565	1404	40	44.45	B-C-E
1600	89-108 133-159-194	340	372	396	PSV/2-FHD	6205	596	1489	25	31.75	A-C
		340	372	396	PSV/3-FHD	6305	596	1489	25	31.75	A-C
		340	380	412	PSV/4-FHD	6206	620	1545	30	38.10	B-C-E
		340	384	416	PSV/7-FHD	6308	637	1586	40	44.45	B-C-E

Example of ordering
standard design
GS5,1600/PSV/7-FHD,40K,159N,C=384

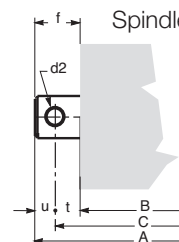
specify type of suspensions
(see page 248-249 for available types)



belt width mm	roller D mm	B	C	A	type	bearing	V	O	spindle		type of suspensions
									d	p	
1800	108-133 159-194	380	412	436	PSV/2-FHD	6205	654	1634	25	31.75	A-C
		380	412	436	PSV/3-FHD	6305	654	1634	25	31.75	A-C
		380	420	452	PSV/4-FHD	6206	677	1690	30	38.10	B-C-E
		380	420	452	PSV/5-FHD	6306	677	1690	30	38.10	B-C-E
		380	424	456	PSV/7-FHD	6308	695	1732	40	44.45	B-C-E
2000	133 159-194	420	460	492	PSV/4-FHD	6206	735	1836	30	38.10	B-C-E
		420	460	492	PSV/5-FHD	6306	735	1836	30	38.10	B-C-E
		420	464	496	PSV/7-FHD	6308	753	1877	40	44.45	B-C-E
2200	133 159-194	460	500	532	PSV/4-FHD	6206	792	1981	30	38.10	B-C-E
		460	500	532	PSV/5-FHD	6306	792	1981	30	38.10	B-C-E
		460	504	536	PSV/7-FHD	6308	810	2023	40	44.45	B-C-E
2400	133 159-194	500	540	572	PSV/4-FHD	6206	850	2127	30	38.10	B-C-E
		500	540	572	PSV/5-FHD	6306	850	2127	30	38.10	B-C-E
		500	544	576	PSV/7-FHD	6308	868	2169	40	44.45	B-C-E
2600	159 194	540	584	616	PSV/7-FHD	6308	925	2314	40	44.45	B-C-E



d	20	25	30	40
s	3	4	5	6
H	21	24	30	36
M	8	10	14	16



Spindle design K				
d	20	25	30	40
u	10	12	16	16
t	14	16	20	22
f	24	28	36	38
d2	8,3	10,3	14,5	16,5

3 Troughing sets suspensions for "garland"

3.6.4 - Suspensions

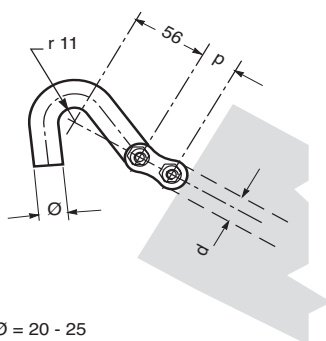
The connecting links and the suspensions are important components that assure ample movement possibilities and at the same time grant a rapid, straight forward installation and maintenance.

Different types of suspension satisfy different working conditions. The following indicate just some of the most common in use.



Hook type A

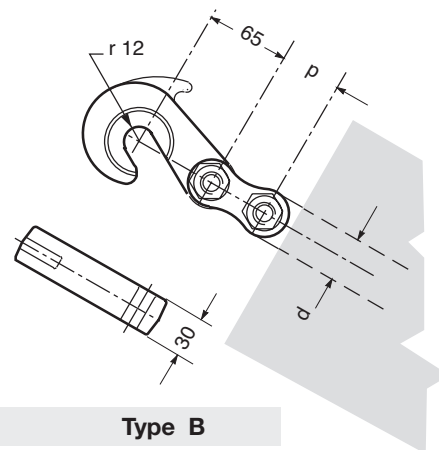
For upper and return sets with roller spindle $d = 20$ and 25 mm.



$\text{Ø} = 20 - 25$

Hook type B

For upper and return impact sets with roller spindle $d = 30$ and 40 mm for heavy loads.

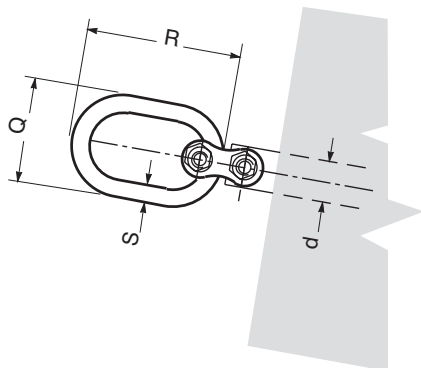


	Type A		Type B	
*	X	Y	X	Y
10°	105	19	122	22
35°	86	36	100	42
60°	56	48	65	56

* The measures X and Y are used to determine the fixation distance Q - see GS2-GS3-GS5 garlands drawings at previous pages.

Hook type C

Upper and return sets for light loads.



d	Q	R	S
20	40	85	10
25/30	52	108	13
40	64	132	16

*	d	X	Y
10°	20	96	17
	25/30	122	22
	40	154	28
35°	20	78	33
	25/30	100	42
	40	126	53
60°	20	51	44
	25/30	65	56
	40	82	71

Important note: all types of supports that are designed to fit to the belt conveyor structure and those, in particular that hook up to the suspensions, must have an equal inclination to the side rollers angle and allow complete freedom of movement of the suspensions and of the rollers in both longitudinal and vertical senses.

Hook type E

This is a system for rapid "unhooking" of an upper troughing set. To be used when the conveyor cannot be stopped. This system allows sets to be removed from below the belt and allows substitution, during normal maintenance breaks.

Fig. 1 shows the application of a system using a retaining pin, in the case of an overloaded conveyor.

Fig. 2 without pin.

d	S	p
30	20	38,10
40	20	44,45



*	X	Y
10°	346	63
35°	282	118
60°	184	159

* The measures X and Y are used to determine the fixation distance Q - see GS2-GS3-GS5 garlands drawings at previous pages.

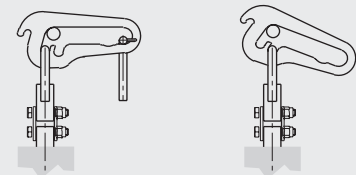
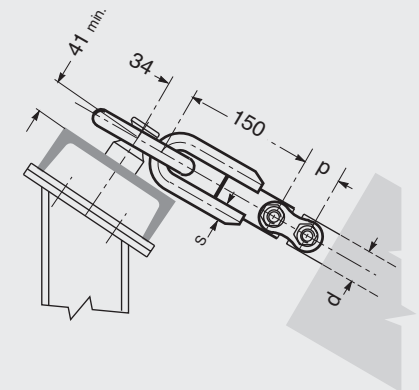


Fig. 1

Fig. 2



Hook type F

To support the return belt and where it is necessary to change the angle of the rollers, the chain may be slotted into the fork as the links permit.



d	S	P	Q	R
20	10	35	34	55
25/30	13	45	44	71
40	16	56	54	88

* Measures X and Y to be calculated according to the chain fixation point.



3 Troughing sets

