

METAL COMPENSATORS

Metal compensators

Used to compensate for pipe expansions, as vibration dampers, as installation compensators for non-flooding pipes or to facilitate installation of pipe fittings.

The core piece of the compensators is the parallel corrugated, twist-free metal bellows, mainly made of stainless and acid-resistant steel alloys.

Materials

The standard versions of the steel bellows compensators consist of a stainless steel bellows made of materials 304ss – 316ss and 321ss with connecting parts made of carbon steel.

The compensators can also be manufactured from other stainless alloys and, for higher temperatures, from highly heat-resistant alloys 1.4828, Inconel, Hastelloy and the like.

Area of application of compensators

All compensators, which have neither an inner guide tube nor an outer protection tube, can absorb axial, angular and lateral movements as well as vibrations. Therefore, these types have a very versatile application and can be used for practically all cases.

Temperature

The permissible temperature of the standard versions with connecting parts made of carbon steel is up to +400 °C.

At higher temperatures, the connecting parts must also be made of alloyed steel.

Pressure and strain absorption

The values for pressure and deflection given in the tables apply at normal temperature. The values are reduced at higher temperatures.

It should also be noted that the test pressure must not exceed 1.5 times the nominal pressure at normal temperature. With angular and lateral loading, the permissible pressures are also reduced by approx. 30 %.

The total permissible axial deflection of a compensator consists of a plus deflection and a minus deflection, whereby plus deflection and minus deflection each amount to 50 % of the total deflection.

The values given in the tables for the different types of loading (axial and lateral) always apply when the expansion joint is subjected to only one type of loading. However, if the compensator is subjected to several load types, the values given must be reduced accordingly.

Fixed point forces

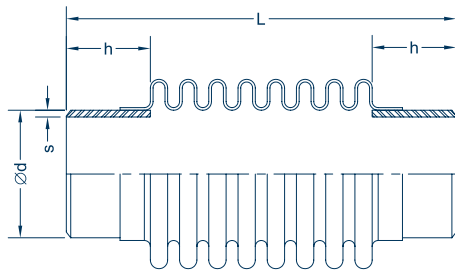
The fixed point forces are composed of the internal resistance of the expansion joint and the resulting force from the effective surface of the expansion joint and the operating pressure of the pipeline.

Installation of the compensator

If the compensator is used for axial expansion absorption, the installation length depends on the prevailing installation temperature as well as the minimum temperature occurring later in operation and the actual movement occurring.

METAL COMPENSATORS

WELD END TYPE - PN6



Standard Bellows Material
**304ss - 316ss,
 321ss**
 Design Pressure
6 barg

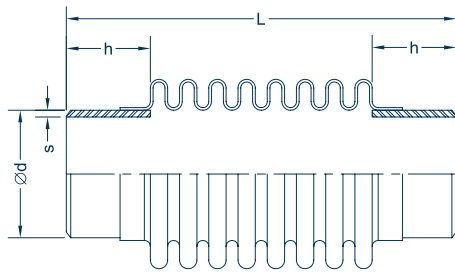
Weld end Material
Carbon Steel
 Design Temperature
400 °C



Nominal Diameter (DN)		Movements (mm)		Length (L)	Spring Rates (N/mm)		d	h	s	Effective Area (cm ²)
		Compression	Lateral (+/-)	(mm)	Axial	Lateral	(mm)	(mm)	(mm)	
25	1"	30	6	180	62	31	33,7	50	3	18
32	1¼"	30	6	180	62	31	42,4	50	3	18
40	1½"	30	7	185	54	31	48,3	50	3	23
50	2"	30	6	170	32	43	60,3	50	4	37
		45	10	225	50	26				
65	2½"	30	6	175	34	60	76,1	50	4	58
		60	11	230	53	32				
80	3"	30	3	160	41	145	88,9	50	4	80
		60	12	260	66	37				
100	4"	30	3	190	71	301	114,3	60	5	129
		60	9	260	72	82				
125	5"	30	3	190	84	511	139,7	60	5	185
		60	8	265	78	121				
150	6"	30	2	235	105	814	165	80	5	268
		60	7	285	63	187				
200	8"	30	2	250	146	1279	219,1	80	5	451
		60	7	310	91	310				
250	10"	30	2	290	154	2049	273	100	6	682
		60	7	365	86	369				
300	12"	75	8	385	77	267	323,9	100	6	945
		30	2	320	355	4380				
350	14"	60	6	400	197	800	355,6	100	6	1127
		75	9	450	162	428				
400	16"	30	2	310	386	5669	406,4	100	7	1479
		60	6	400	214	1036				
450	18"	75	8	450	175	554	457	100	8	1839
		30	2	320	250	4046				
500	20"	60	5	370	178	1520	508	100	8	2264
		75	8	420	139	728				
600	24"	30	2	320	307	6177	610	100	8	3227
		60	4	390	331	5003				
700	28"	75	6	420	265	2379	711	100	8	4372
		30	2	340	419	14565				
800	32"	60	5	425	262	3797	813	100	8	5705
		75	5	440	262	3363				
900	36"	30	1	320	755	45102	914	100	8	7201
		60	3	380	503	14411				
1000	40"	75	3	410	431	9278	1016	100	8	8885
		30	1	335	1194	70128				
		60	3	405	796	22008				
		75	4	450	682	13061				
		30	1	340	1037	70455				
		60	2	380	829	35891				
		75	4	450	592	13993				

METAL COMPENSATORS

WELD END TYPE - PN10



Standard Bellows Material
**304ss - 316ss,
 321ss**
 Design Pressure
10 barg

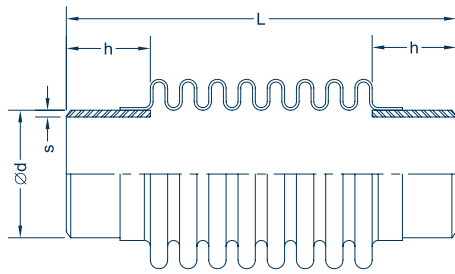
Weld end Material
Carbon Steel
 Design Temperature
400 °C



Nominal Diameter (DN)		Movements (mm)		Length (L) (mm)	Spring Rates (N/mm)		d (mm)	h (mm)	s (mm)	Effective Area (cm ²)
		Compression	Lateral (+/-)		Axial	Lateral				
25	1"	30	6	180	62	31	33,7	50	3	18
32	1¼"	30	6	180	62	31	42,4	50	3	18
40	1½"	30	7	225	93	30	48,3	50	3	23
50	2"	30	5	185	62	57	60,3	50	4	38
		45	8	215	106	55				
65	2½"	30	4	185	68	95	76,1	50	4	58
		45	6	215	98	77				
		60	10	240	105	56				
80	3"	30	4	185	66	124	88,9	50	4	80
		45	6	215	90	95				
		60	10	235	90	70				
100	4"	30	3	200	113	333	114,3	60	5	129
		45	5	230	88	159				
		60	7	265	109	118				
125	5"	30	2	200	134	641	139,7	60	5	187
		45	4	230	104	274				
		60	7	265	107	169				
150	6"	30	3	245	152	936	165	80	5	268
		45	4	270	118	448				
		60	6	315	127	245				
200	8"	30	3	265	211	1422	219,1	80	5	460
		45	5	305	158	584				
		60	7	330	140	385				
250	10"	30	2	310	292	2687	273	100	6	683
		45	5	360	195	888				
		60	7	395	159	499				
300	12"	30	2	310	355	4380	323,9	100	6	945
		45	3	360	254	1567				
		60	6	395	197	840				
350	14"	30	2	320	582	8653	355,6	100	6	1141
		45	4	370	364	2417				
		60	5	405	323	1509				
400	16"	30	2	320	474	7707	406	100	7	1483
		45	3	360	339	3242				
		60	5	400	296	1867				
450	18"	30	1	330	587	11842	457	100	8	1841
		45	3	375	714	7176				
		60	4	420	555	3626				
500	20"	30	2	340	758	14195	508	100	8	2268
		45	3	385	649	8039				
		60	4	430	505	3733				

METAL COMPENSATORS

WELD END TYPE - PN16



Standard Bellows Material
**304ss - 316ss,
 321ss**
 Design Pressure
16 barg

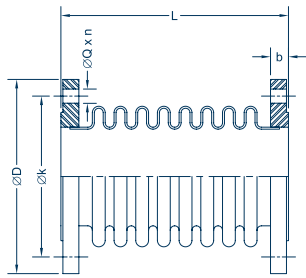
Weld end Material
Carbon Steel
 Design Temperature
400 °C



Nominal Diameter (DN)		Movements (mm)		Length (L) (mm)	Spring Rates (N/mm)		d (mm)	h (mm)	s (mm)	Effective Area (cm ²)
		Compression	Lateral (+/-)		Axial	Lateral				
50	2"	30	4	185	117	109	60,3	50	4	38
		45	4	215	126	64				
65	2½"	30	3	185	128	179	76,1	50	4	58
		45	7	215	124	97				
		60	8	240	182	99				
80	3"	30	3	185	124	231	88,9	50	4	80
		45	7	215	123	129				
		60	9	245	166	121				
100	4"	30	3	200	145	484	114,3	60	5	129
		45	4	230	146	266				
		60	8	265	161	173				
125	5"	30	3	200	168	808	139,7	60	5	186
		45	5	230	126	333				
		60	7	265	171	267				
150	6"	30	2	245	350	2166	165	80	5	268
		45	4	270	171	648				
		60	7	315	191	379				
200	8"	30	2	265	513	3132	219,1	80	5	456
		45	4	305	338	1242				
		60	5	340	300	817				
250	10"	30	2	310	559	5149	273	100	6	684
		45	4	360	372	1517				
		60	5	395	335	1051				
300	12"	30	2	335	675	5823	323,9	100	6	964
		45	6	430	405	1282				
		60	10	510	347	616				
350	14"	30	1	335	739	7601	355,6	100	6	1155
		45	4	410	850	3840				
		60	7	480	638	1661				
400	16"	30	1	320	1545	25149	406,4	100	7	1486
		45	4	430	858	4157				
		60	6	490	702	2184				
450	18"	30	3	350	869	11727	457	100	8	1856
		45	6	430	579	3504				
		60	11	530	434	1316				
500	20"	30	2	330	1048	22570	508	100	8	2274
		45	3	390	749	7967				
		60	6	440	582	3981				

METAL COMPENSATORS

FIXED FLANGED TYPE - PN6



Standard Bellows Material
**304ss - 316ss,
 321ss**
 Design Pressure
6 barg

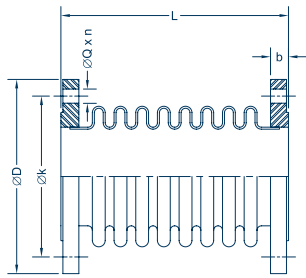
Weld end Material
Carbon Steel
 Design Temperature
400 °C



Nominal Diameter (DN)		Movements (mm)		Length (L)	Spring Rates (N/mm)		d	h	s	n	Q	Effective Area (cm ²)	
		Compression	Lateral (+/-)	(mm)	Axial	Lateral	(mm)	(mm)	(mm)		(mm)		
25	1"	30	6	120	62	31	100	75	14	4	11	18	
32	1¼"	30	6	120	62	31	120	90	14	4	14	18	
40	1½"	30	7	125	54	31	130	100	14	4	14	23	
50	2"	30	6	110	32	43	140	110	14	4	14	37	
		45	10	155	50	26							
65	2½"	30	6	120	34	60	160	130	14	4	14	58	
		60	11	170	53	32							
80	3"	30	3	105	41	145	190	150	16	4	18	80	
		60	12	205	66	37							
100	4"	30	3	115	71	301	210	170	16	4	18	129	
		60	9	185	72	82							
125	5"	30	3	120	84	511	240	200	18	8	18	185	
		60	8	200	78	121							
150	6"	30	2	120	105	814	265	225	18	8	18	268	
		60	7	175	63	187							
200	8"	30	2	145	146	1279	320	280	20	8	18	451	
		60	7	200	91	310							
250	10"	30	2	145	154	2049	375	335	22	12	18	682	
		60	7	220	86	369							
300	12"	75	8	240	77	267	440	395	22	12	22	945	
		30	2	170	355	4380							
350	14"	60	6	260	197	800	490	445	22	12	22	1127	
		75	9	310	162	428							
400	16"	30	2	165	386	5669	540	495	22	16	22	1479	
		60	6	260	214	1036							
450	18"	75	8	310	175	554	595	550	24	16	22	1839	
		30	2	180	250	4046							
500	20"	60	5	230	178	1520	645	600	24	20	22	2264	
		75	8	280	139	728							
600	24"	30	2	180	307	6177	755	705	24	20	26	3227	
		60	4	240	331	5003							
700	28"	75	6	310	265	2379	860	810	24	24	26	4372	
		30	2	190	419	14565							
800	32"	60	5	270	262	3797	975	920	24	24	30	5705	
		75	5	310	262	3363							
900	36"	30	1	170	755	45102	1075	1020	26	24	30	7201	
		60	3	230	503	14411							
1000	40"	75	3	280	431	9278	1175	1120	26	28	30	8885	
		30	1	190	1194	70128							
		60	3	255	796	22008							
		75	4	330	682	13061							
		30	1	165	1037	70455							
		60	2	205	829	35891							
		75	4	330	592	13993							

METAL COMPENSATORS

FIXED FLANGED TYPE - PN10



Standard Bellows Material
**304ss - 316ss,
321ss**

Design Pressure
10 barg

Weld end Material
Carbon Steel

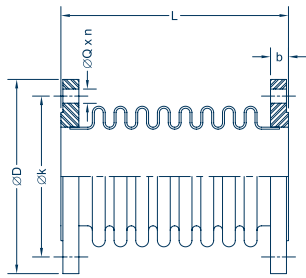
Design Temperature
400 °C



Nominal Diameter (DN)		Movements (mm)		Length (L) (mm)	Spring Rates (N/mm)		d (mm)	h (mm)	s (mm)	n	Q (mm)	Effective Area (cm ²)
		Compression	Lateral (+/-)		Axial	Lateral						
25	1"	30	6	125	62	31	115	85	16	4	14	18
32	1¼"	30	6	125	62	31	140	100	16	4	18	18
40	1½"	30	7	155	93	30	150	110	16	4	18	23
50	2"	30	5	130	62	57	165	125	18	4	18	38
		45	8	155	106	55						
65	2½"	30	4	130	68	95	185	145	18	4	18	58
		45	6	160	98	77						
		60	10	185	105	56						
80	3"	30	4	130	66	124	200	160	20	8	18	80
		45	6	165	90	95						
		60	10	185	90	70						
100	4"	30	3	135	113	333	220	180	20	8	18	129
		45	5	165	88	159						
		60	7	205	109	118						
125	5"	30	2	140	134	641	250	210	22	8	18	187
		45	4	170	104	274						
		60	7	210	107	169						
150	6"	30	3	145	152	936	285	240	22	8	22	268
		45	4	170	118	448						
		60	6	210	127	245						
200	8"	30	3	175	211	1422	340	295	24	8	22	460
		45	5	210	158	584						
		60	7	230	140	385						
250	10"	30	2	180	292	2687	395	350	26	12	22	683
		45	5	235	195	888						
		60	7	275	159	499						
300	12"	30	2	165	355	4380	445	400	26	12	22	945
		45	3	205	254	1567						
		60	6	245	197	840						
350	14"	30	2	170	582	8653	505	460	26	16	22	1141
		45	4	215	364	2417						
		60	5	255	323	1509						
400	16"	30	2	170	474	7707	565	515	26	16	26	1483
		45	3	210	339	3242						
		60	5	255	296	1867						
450	18"	30	1	185	587	11842	615	565	28	20	26	1841
		45	3	230	714	7176						
		60	4	270	555	3626						
500	20"	30	2	195	758	14195	670	620	28	20	26	2268
		45	3	235	649	8039						
		60	4	285	505	3733						

METAL COMPENSATORS

FIXED FLANGED TYPE - PN16



Standard Bellows Material
**304ss - 316ss,
 321ss**
 Design Pressure
16 barg

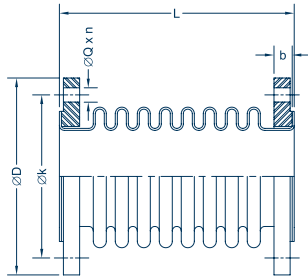
Weld end Material
Carbon Steel
 Design Temperature
400 °C



Nominal Diameter (DN)		Movements (mm)		Length (L) (mm)	Spring Rates (N/mm)		d (mm)	h (mm)	s (mm)	n	Q (mm)	Effective Area (cm ²)
		Compression	Lateral (+/-)		Axial	Lateral						
50	2"	30	4	120	117	109	165	125	18	4	18	38
		45	4	150	126	64						
65	2½"	30	3	120	128	179	185	145	18	4	18	58
		45	7	150	124	97						
		60	8	180	182	99						
80	3"	30	3	120	124	231	200	160	20	8	18	80
		45	7	150	123	129						
		60	9	180	166	121						
100	4"	30	3	120	145	484	220	180	20	8	18	129
		45	4	150	146	266						
		60	8	185	161	173						
125	5"	30	3	125	168	808	250	210	22	8	18	186
		45	5	155	126	333						
		60	7	190	171	267						
150	6"	30	2	130	350	2166	285	240	22	8	22	268
		45	4	155	171	648						
		60	7	200	191	379						
200	8"	30	2	150	513	3132	340	295	24	12	22	456
		45	4	190	338	1242						
		60	5	230	300	817						
250	10"	30	2	165	559	5149	405	355	26	12	26	684
		45	4	205	372	1517						
		60	5	245	335	1051						
300	12"	30	2	200	675	5823	460	410	28	12	26	964
		45	6	300	405	1282						
		60	10	380	347	616						
350	14"	30	1	210	739	7601	520	470	30	16	26	1155
		45	4	290	850	3840						
		60	7	370	638	1661						
400	16"	30	1	210	1545	25149	580	525	32	16	30	1486
		45	4	310	858	4157						
		60	6	365	702	2184						
450	18"	30	3	240	869	11727	640	585	32	20	30	1856
		45	6	320	579	3504						
		60	11	405	434	1316						
500	20"	30	2	215	1048	22570	715	650	34	20	33	2274
		45	3	270	749	7967						
		60	6	330	582	3981						

METAL COMPENSATORS

FLOATING FLANGED TYPE - PN6



Standard Bellows Material
**304ss - 316ss,
 321ss**
 Design Pressure
6 barg

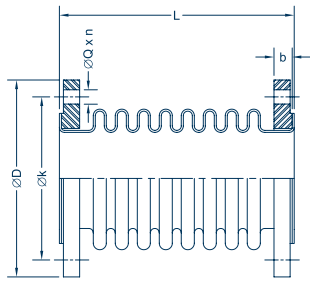
Weld end Material
Carbon Steel
 Design Temperature
400 °C



Nominal Diameter (DN)		Movements (mm)		Length (L) (mm)	Spring Rates (N/mm)		d (mm)	h (mm)	s (mm)	n	Q (mm)	Effective Area (cm ²)
		Compression	Lateral (+/-)		Axial	Lateral						
25	1"	30	6	120	62	31	100	75	14	4	11	18
32	1¼"	30	6	120	62	31	120	90	14	4	14	18
40	1½"	30	7	125	54	31	130	100	14	4	14	23
50	2"	30	6	110	32	43	140	110	14	4	14	37
		45	10	155	50	26						
65	2½"	30	6	120	34	60	160	130	14	4	14	58
		60	11	170	53	32						
80	3"	30	3	105	41	145	190	150	16	4	18	80
		60	12	205	66	37						
100	4"	30	3	115	71	301	210	170	16	4	18	129
		60	9	185	72	82						
125	5"	30	3	120	84	511	240	200	18	8	18	185
		60	8	200	78	121						
150	6"	30	2	120	105	814	265	225	18	8	18	268
		60	7	175	63	187						
200	8"	30	2	145	146	1279	320	280	20	8	18	451
		60	7	200	91	310						
250	10"	30	2	145	154	2049	375	335	22	12	18	682
		60	7	220	86	369						
		75	8	240	77	267						
300	12"	30	2	170	355	4380	440	395	22	12	22	945
		60	6	260	197	800						
		75	9	310	162	428						
350	14"	30	2	165	386	5669	490	445	22	12	22	1127
		60	6	260	214	1036						
		75	8	310	175	554						
400	16"	30	2	180	250	4046	540	495	22	16	22	1479
		60	5	230	178	1520						
		75	8	280	139	728						
450	18"	30	2	180	307	6177	595	550	24	16	22	1839
		60	4	230	219	2321						
		75	6	280	170	1111						
500	20"	30	2	180	279	6909	645	600	24	20	22	2264
		60	4	230	199	2596						
		75	6	280	155	1243						
600	24"	30	2	170	530	18745	755	705	24	20	26	3227
		60	4	240	331	5003						
		75	6	310	265	2379						
700	28"	30	2	190	419	14565	860	810	24	24	26	4372
		60	5	270	262	3797						
		75	5	310	262	3363						
800	32"	30	1	170	755	45102	975	920	24	24	30	5705
		60	3	230	503	14411						
		75	3	280	431	9278						
900	36"	30	1	190	1194	70128	1075	1020	26	24	30	7201
		60	3	255	796	22008						
		75	4	330	682	13061						
1000	40"	30	1	165	1037	70455	1175	1120	26	28	30	8885
		60	2	235	829	35891						
		75	4	330	592	13993						

METAL COMPENSATORS

FLOATING FLANGED TYPE - PN10



Standard Bellows Material
**304ss - 316ss,
 321ss**
 Design Pressure
10 barg

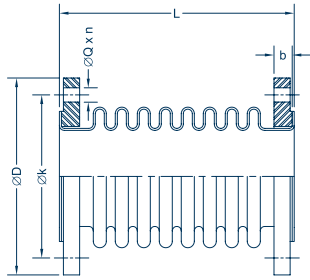
Weld end Material
Carbon Steel
 Design Temperature
400 °C



Nominal Diameter (DN)	Movements (mm)		Length (L) (mm)	Spring Rates (N/mm)		d (mm)	h (mm)	s (mm)	n	Q (mm)	Effective Area (cm ²)	
	Compression	Lateral (+/-)		Axial	Lateral							
25	1"	30	6	125	62	31	115	85	16	4	14	18
32	1¼"	30	6	125	62	31	140	100	18	4	18	18
40	1½"	30	7	155	93	30	150	110	18	4	18	23
50	2"	30	5	130	62	57	165	125	20	4	18	38
		45	8	155	106	55						
65	2½"	30	4	130	68	95	185	145	20	8	18	58
		45	6	160	98	77						
		60	10	185	105	56						
80	3"	30	4	130	66	124	200	160	20	8	18	80
		45	6	165	90	95						
		60	10	185	90	70						
100	4"	30	3	135	113	333	220	180	22	8	18	129
		45	5	165	88	159						
		60	7	205	109	118						
125	5"	30	2	140	134	641	250	210	22	8	18	187
		45	4	170	104	274						
		60	7	210	107	169						
150	6"	30	3	145	152	936	285	240	24	8	22	268
		45	4	170	118	448						
		60	6	210	127	245						
200	8"	30	3	175	211	1422	340	295	24	8	22	460
		45	5	210	158	584						
		60	7	230	140	385						
250	10"	30	2	180	292	2687	395	350	26	12	22	683
		45	5	235	195	888						
		60	7	275	159	499						
300	12"	30	2	165	355	4380	445	400	26	12	22	945
		45	3	205	254	1567						
		60	6	245	197	840						
350	14"	30	2	170	582	8653	505	460	26	16	22	1141
		45	4	215	364	2417						
		60	5	255	323	1509						
400	16"	30	2	170	474	7707	565	515	26	16	26	1483
		45	3	210	339	3242						
		60	5	255	296	1867						
450	18"	30	1	185	587	11842	615	565	28	20	26	1841
		45	3	230	714	7176						
		60	4	270	555	3626						
500	20"	30	2	195	758	14195	670	620	28	20	26	2268
		45	3	235	649	8039						
		60	4	285	505	3733						

METAL COMPENSATORS

FLOATING FLANGED TYPE - PN16



Standard Bellows Material
**304ss - 316ss,
 321ss**
 Design Pressure
16 barg

Weld end Material
Carbon Steel
 Design Temperature
400 °C



Nominal Diameter (DN)		Movements (mm)		Length (L) (mm)	Spring Rates (N/mm)		d (mm)	h (mm)	s (mm)	n	Q (mm)	Effective Area (cm ²)
		Compression	Lateral (+/-)		Axial	Lateral						
50	2"	30	4	120	117	109	165	125	18	4	4	38
		45	4	150	126	64						
65	2½"	30	3	120	128	179	185	145	18	4	4	58
		45	7	150	124	97						
		60	8	180	182	99						
80	3"	30	3	120	124	231	200	160	20	8	8	80
		45	7	150	123	129						
		60	9	180	166	121						
100	4"	30	3	120	145	484	220	180	20	8	8	129
		45	4	150	146	266						
		60	8	185	161	173						
125	5"	30	3	125	168	808	250	210	22	8	8	186
		45	5	155	126	333						
		60	7	190	171	267						
150	6"	30	2	130	350	2166	285	240	22	8	8	268
		45	4	155	171	648						
		60	7	200	191	379						
200	8"	30	2	150	513	3132	340	295	24	12	12	456
		45	4	190	338	1242						
		60	5	230	300	817						
250	10"	30	2	165	559	5149	405	355	26	12	12	684
		45	4	205	372	1517						
		60	5	245	335	1051						
300	12"	30	2	200	675	5823	460	410	28	12	12	964
		45	6	300	405	1282						
		60	10	380	347	616						
350	14"	30	1	210	739	7601	520	470	30	16	16	1155
		45	4	290	850	3840						
		60	7	370	638	1661						
400	16"	30	1	210	1545	25149	580	525	32	16	16	1486
		45	4	310	858	4157						
		60	6	365	702	2184						
450	18"	30	3	240	869	11727	640	585	32	20	20	1856
		45	6	320	579	3504						
		60	11	405	434	1316						
500	20"	30	2	215	1048	22570	715	650	34	20	20	2274
		45	3	270	749	7967						
		60	6	330	582	3981						