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compensatori di dilatazione
expansion joints

metallici
gomma
tessili
teflon

metal
rubber
fabric
teflon

tubi flessibili
flexible hoses

metallici
gomma
teflon

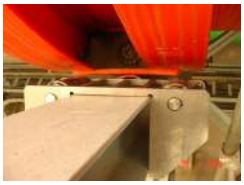
metal
rubber
teflon

supporti elastici e tiranti puntoni
spring supports and rigid struct

carico variabile
carico costante

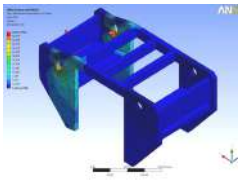
variable load
constant load

supporti
pipe supports



supporti a rullo
pattini di
scorrimento

roll supports
slide bearings



certificazioni
certifications

compensatori di dilatazioni metallici

metal expansion joints

compensatore di dilatazione laterale DN 5000
lateral expansion joint ND 5000

compensatori di dilatazione laterali DN 3400
lateral expansion joints ND 3400

compensatori di dilatazione cardanici DN 4600
gimbal expansion joints ND 4600

compensatore di dilatazione bilanciato DN 2400
balanced expansion joints ND 2400

compensatori di dilatazione rettangolari
rectangular expansion joints

sistema di fresh air con compensatori di dilatazione tessili
fresh air system with fabric expansion joints









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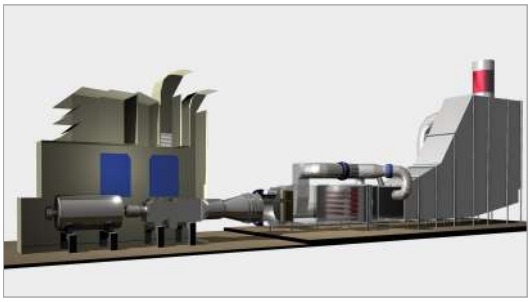
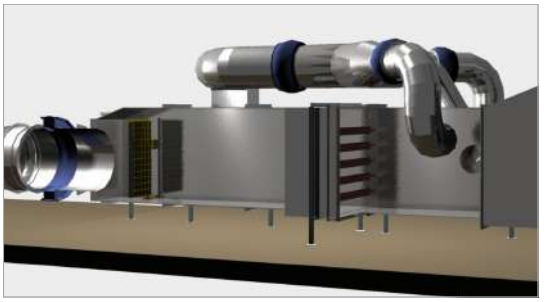
progetto e installazioni di compensatori angolari e laterali su tubazioni scarico turbine a vapore
design and installation of hinged and lateral expansion joints on piping discharge steam turbine

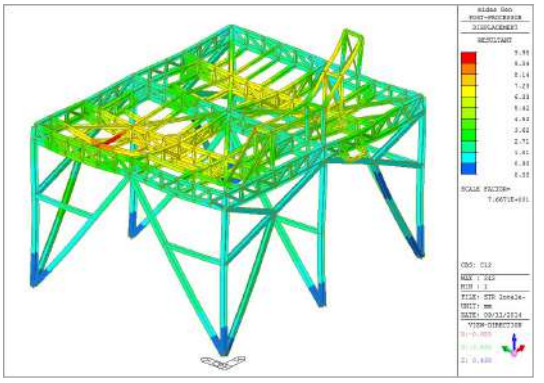





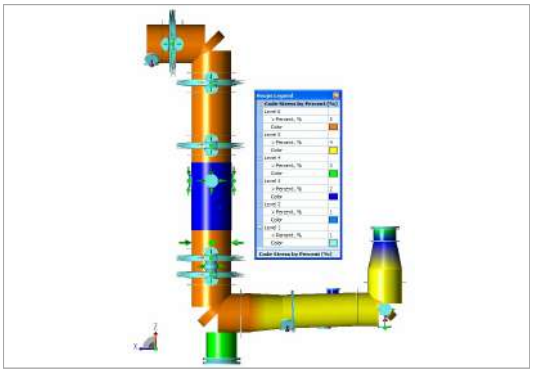
progetto e installazione di compensatori in fibre tessili
design and installation of fabric expansion joints

piping engineering division

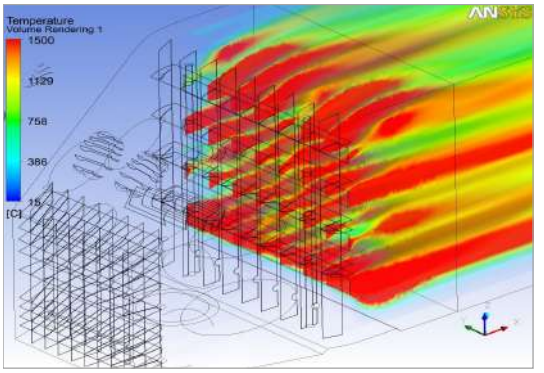
progettazione 3D tubazione DN 1800 scarico turbina vapore
3D design piping ND 1800 discharge steam turbine



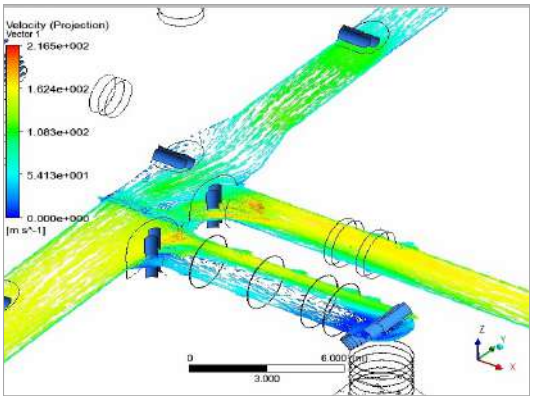
disegni e calcoli con metodo FEM di strutture metalliche
drawings and calculations with FEM method of metallic structures



stress analysis tubazione DN 1800 scarico turbina vapore
stress analysis piping ND 1800 discharge steam turbine



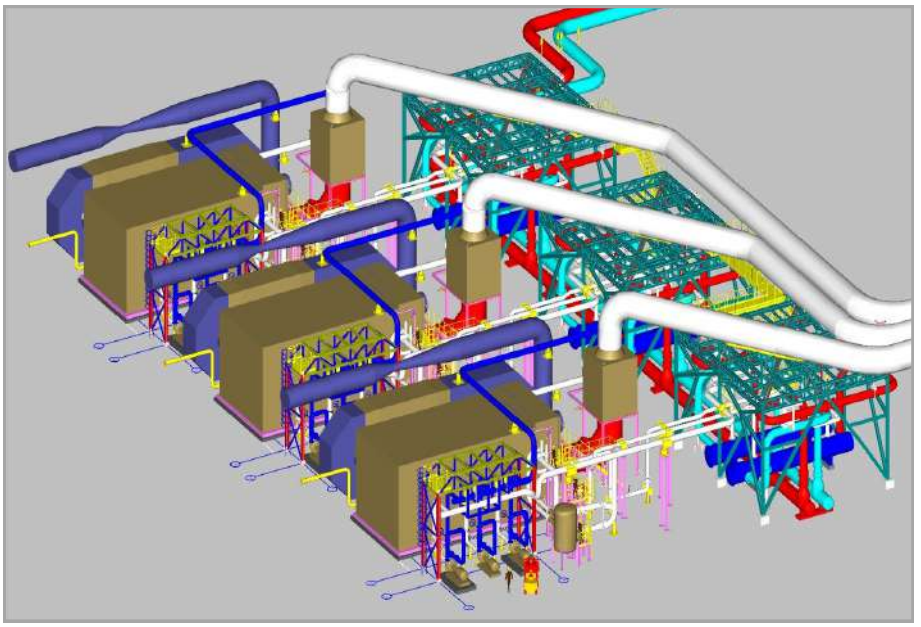
analisi termo fluido dinamiche condotto scarico turbina a gas
thermal fluid dynamics analysis of duct discharge gas turbine

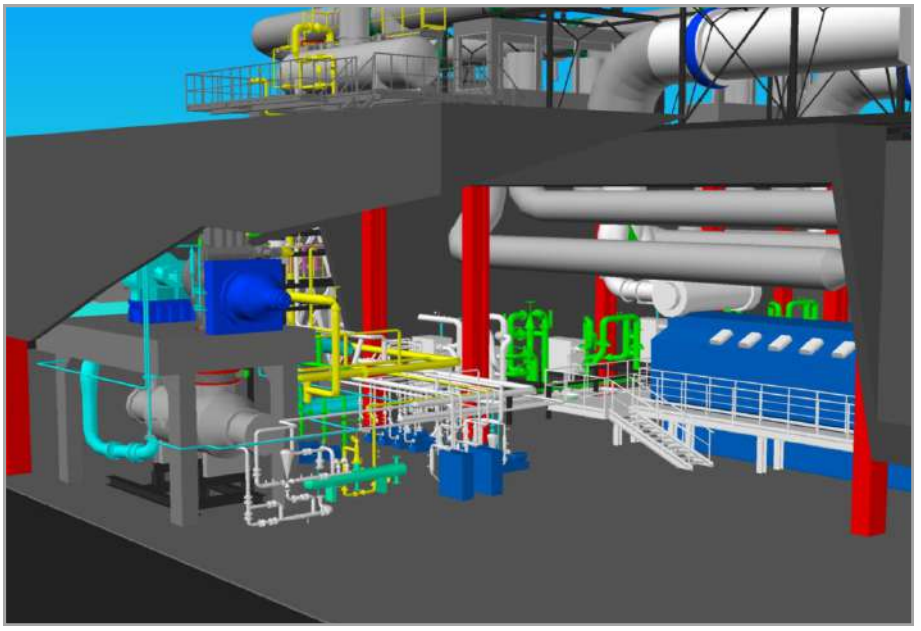


verifiche fluido dinamiche tubazione scarico turbina a vapore
fluid dynamics simulation of discharge piping steam turbine

assistenza in cantiere
assistance on site

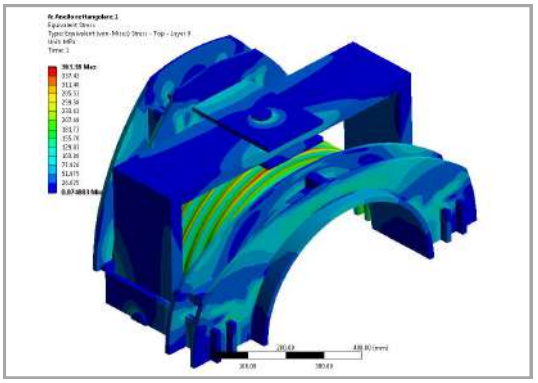
piping engineering division



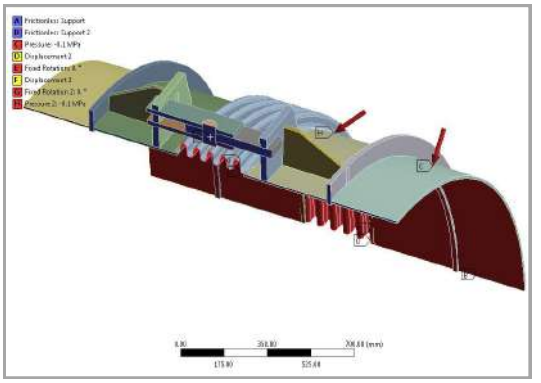


modello 3D
3D model

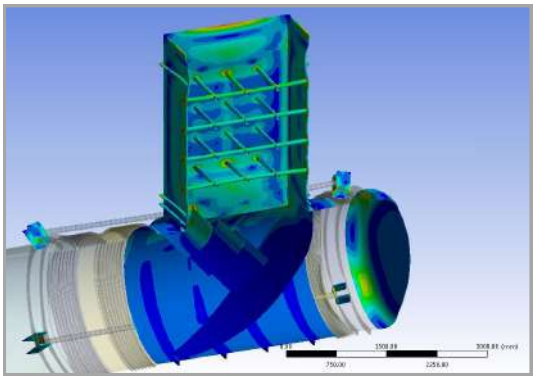
piping engineering division



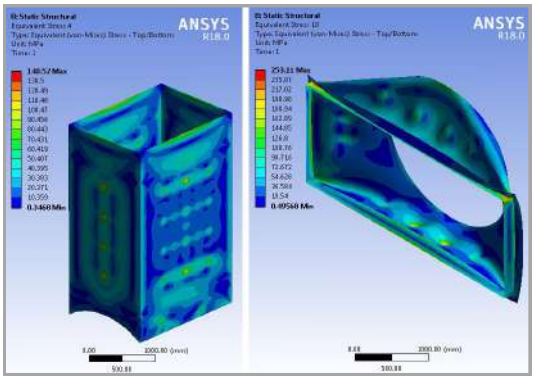
analisi FEM di un compensatore cardanico DN 600
FEM analysis of gimbal expansion joint ND 600



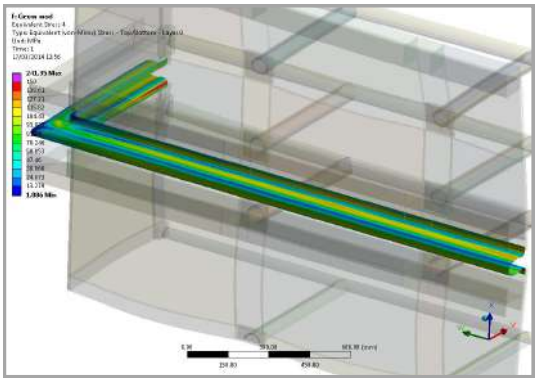
analisi FEM di un compensatore angolare DN 2100
FEM analysis of hinged expansion joint ND 2100



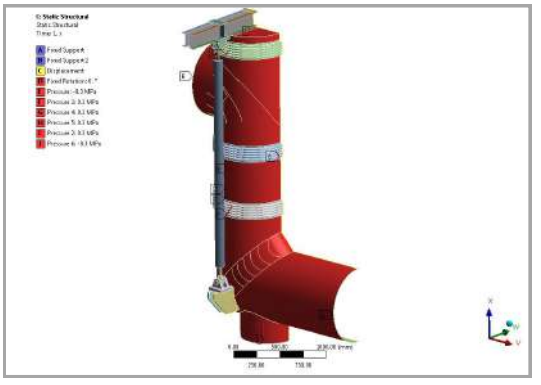
analisi FEM di un compensatore bilanciato DN 2400
FEM analysis of balanced expansion joint ND 2400



analisi FEM di uno scarico turbina a sezione rettangolare
FEM analysis of discarge turbine rectangular section



analisi FEM compensature a sezione rettangolare
FEM analysis of rectangular expansion joint



analisi FEM di un compensatore bilanciato DN 800
FEM analysis of balanced expansion joint ND 800

STEEL PIPES DIMENSIONS ACCORDING TO ASA B.36.10—B.36.19—BS.1600 (Dimensions in mm)

ND Nom. Diam	Øe inches	Øe mm	SCHED. 5S (1)		SCHED. 10S (1)		SCHED.10		SCHED.20		SCHED.30		STANDARD		SCHED. 40		SCHED. 60		EXTRA STRONG (XS)		SCHED. 80		SCHED. 100		SCHED. 120		SCHED. 140		SCHED. 160		DUBLE EXTRA STRONG (XXS)	
			THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M	THK	Kg/M
6	1/8"	10,24			1,24	0,28							1,73	0,36	1,73	0,36			2,41	0,46	2,41	0,46										
8	1/4"	13,72			1,65	0,49							2,24	0,63	2,24	0,63			3,02	0,80	3,02	0,80										
10	3/8"	17,15			1,65	0,62							2,31	0,85	2,31	0,85			3,20	1,10	3,20	1,10										
15	1/2"	21,34	1,65	0,8	2,11	1,00							2,77	1,26	2,77	1,26			3,73	1,62	3,73	1,62							4,78	1,95	7,47	2,54
20	3/4"	26,67	1,65	1,03	2,11	1,28							2,87	1,68	2,87	1,68			3,91	2,19	3,91	2,19							5,56	2,89	7,82	3,63
25	1"	33,40	1,65	1,29	2,77	2,08							3,38	2,50	3,38	2,50			4,55	3,23	4,55	3,23							6,35	4,23	9,09	5,45
32	1¼"	42,16	1,65	1,65	2,77	2,69							3,56	3,38	3,56	3,38			4,85	4,46	4,85	4,46							6,35	5,60	9,70	7,75
40	1½"	48,26	1,65	1,90	2,77	3,11							3,68	4,05	3,68	4,05			5,08	5,40	5,08	5,40							7,14	7,23	10,16	9,54
50	2"	60,30	1,65	2,40	2,77	3,93							3,91	5,43	3,91	5,43			5,54	7,47	5,54	7,47							8,74	11,10	11,07	13,44
65	2½"	73,03	2,11	3,69	3,05	5,25							5,16	8,62	5,16	8,62			7,01	11,40	7,01	11,40							9,52	14,90	14,02	20,39
80	3"	88,90	2,11	4,51	3,05	6,44							5,49	11,28	5,49	11,28			7,62	15,25	7,62	15,25							11,13	21,30	15,24	27,65
90	3½"	101,6	2,11	5,18	3,05	7,39							5,74	13,56	5,74	13,56			8,08	18,62	8,08	18,62										
100	4"	114,3	2,11	5,83	3,05	8,35							6,02	16,06	6,02	16,06			8,56	22,29	8,56	22,29			11,13	28,25			13,49	33,51	17,12	40,99
125	5"	141,3	2,77	9,46	3,40	11,56							6,55	21,76	6,55	21,76			9,52	30,92	9,52	30,92			12,70	40,24			15,88	49,05	19,05	57,37
150	6"	168,3	2,77	11,31	3,40	13,82							7,11	28,23	7,11	28,23			10,97	42,52	10,97	42,52			14,27	54,20			18,26	67,47	21,95	79,11
200	8"	219,1	2,77	14,77	3,76	19,94			6,35	32,28	7,04	36,76	8,18	42,49	8,18	42,49	10,31	53,07	12,70	64,57	12,70	64,57	15,09	75,79	18,26	90,32	20,62	100,9	23,01	111,2	22,22	107,8
250	10"	273,0	3,40	22,60	4,19	27,75			6,35	41,73	7,80	50,96	9,27	60,24	9,27	60,24	12,70	81,46	12,70	81,46	15,09	95,84	18,26	114,6	21,44	132,9	25,40	155,0	28,58	172,1	25,40	154,9
300	12"	323,9	3,96	31,22	4,57	35,96			6,35	49,68	8,38	65,14	9,52	73,76	10,31	79,71	14,27	109,0	12,70	97,36	17,48	131,8	21,44	159,7	25,40	186,7	28,58	207,9	33,32	238,6	25,40	186,7
350	14"O.D.	335,6	3,96	34,33	4,78	41,26	6,35	54,63	7,92	67,98	9,52	81,21	9,52	81,21	11,12	94,31	15,09	126,5	12,70	107,3	19,05	157,9	23,83	194,6	27,79	224,4	31,75	253,3	35,70	281,5		
400	16"O.D.	406,4	4,19	41,51	4,78	47,24	6,35	62,58	7,92	77,92	9,52	93,13	9,52	93,13	12,70	123,2	16,66	160,0	12,70	123,2	21,44	203,2	26,19	245,3	30,96	286,3	36,53	332,7	40,49	364,9		
450	18"O.D.	457,2	4,19	47,76	4,78	53,21	6,35	70,53	7,92	87,85	11,12	122,1	9,52	105,1	14,27	155,9	19,05	205,6	12,70	139,1	23,83	254,2	29,36	309,6	34,92	363,3	39,67	408,2	45,24	459,2		
500	20"O.D.	508,0	4,78	59,19	5,54	68,53	6,35	78,47	9,52	117,0	12,70	155,0	9,52	116,9	15,09	183,1	20,62	247,8	12,70	155,0	26,19	310,9	32,54	381,2	38,10	441,1	44,45	507,6	50,01	564,2		
550	22"O.D.	558,8	4,78	65,17	5,54	75,45	6,35	86,42	9,52	128,9	12,70	170,9	9,52	128,9			22,22	293,8	12,70	170,9	28,58	373,2	34,92	450,7	41,28	526,2	47,62	599,8	53,98	671,3		
600	24"O.D.	609,6	5,54	82,38	6,35	94,35	6,35	94,37	9,52	140,8	14,27	209,5	9,52	140,8	17,48	254,7	24,61	354,6	12,70	186,7	30,96	441,3	38,89	546,8	46,02	639,2	52,37	719,2	59,64	806,7		
650	26"O.D.	660,4					7,92	127,6	12,70	202,6			9,52	152,7					12,70	202,6												
700	28"O.D.	711,2					7,92	137,5	12,70	218,5	15,87	271,9	9,52	164,6					12,70	218,5												
750	30"O.D.	762,0	6,35	118,2	7,92	147,2	7,92	147,4	12,70	234,4	15,87	291,8	9,52	176,6					12,70	234,4												
800	32"O.D.	812,8					7,92	15,74	12,70	250,3	15,87	311,7	9,52	188,5	17,48	342,2			12,70	250,3												
850	34"O.D.	863,6					7,92	167,3	12,70	266,2	15,87	331,5	9,52	200,4	17,48	364,0			12,70	266,2												
900	36"O.D.	914,4					7,92	177,3	12,70	282,1	15,87	351,4	9,52	212,3	19,05	420,2			12,70	282,1												
1000	40"O.D.	1066,8											9,52	248,0					12,70	329,9												

TOLERANCES ACCORDING TO ASTM A312 / A530

Diameter range	from 1/8" to 1½" _ from 10,2 to 48,26 mm	da 2" a 4" _ da 60, 33 a 114,40 mm	from 5" to 8"_ from 141,3 to 219,08 mm	from 10" to 18" _ from 273,05 to 457,2 mm	over 18" _ over 457,2 mm
Diameter tolerances	+ 0,40 mm _ -0,79 mm	+ 0,79 mm _ - 0,79 mm	+ 1,59 mm _ - 0,79 mm	+ 2,38 mm _ - 0,79 mm	+ 0,32 mm _ - 0,79 mm
Thickness tolerances	- 12,5% + not specified, the extra tolerance is not limited				

Table 9 — Material selection for the manufacturing of flanges

Group	Forgings			Flat products			Castings			Bars[1]		
	Material name	Standard	Material number	Material name	Standard	Material number	Material name	Standard	Material number	Material name	Standard	Material number
2E0	—	—	—	—	—	—	GP240GR	EN 10213-2	1.0621	—	—	—
3E0	—	—	—	P235GH	EN 10028-2	1.0345	GP240GH	EN 10213-2	1.0619	P235GH	EN 10273	1.0345
3E0	—	—	—	—	—	—	—	—	—	P250GH	EN 10273	1.0460
3E0	P245GH	EN 10222-2	1.0352	P265GH	EN 10028-2	1.0425	GP280GH	EN 10213-2	1.0625	P265GH	EN 10273	1.0425
3E1	P280GH	EN 10222-2	1.0426	P295GH	EN 10028-2	1.0481	—	—	—	P295GH	EN 10273	1.0481
4E0	16Mo3	EN 10222-2	1.5415	16Mo3	EN 10028-2	1.5415	G20Mo5	EN 10213-2	1.5419	16Mo3	EN 10273	1.5415
5E0	13CrMo4-5	EN 10222-2	1.7335	13CrMo4-5	EN 10028-2	1.7335	G17CrMo5-5	EN 10213-2	1.7357	13CrMo4-5	EN 10273	1.7335
6E0	11CrMo9-10	EN 10222-2	1.7383	12CrMo9-10	EN 10028-2	1.7375	G17CrMo9-10	EN 10213-2	1.7379	11CrMo9-10	EN 10273	1.7383
	-	-	-	10CrMo9-10	EN 10028-2	1.7380	—			10CrMo9-10	EN 10273	1.7380
6E1	X16CrMo5-1 +NT	EN 10222-2	1.7366	—	—	—	GX15CrMo5	EN 10213-2	1.7365	—	—	—
7E0	—	—	—	P275NL1	EN 10028-3	1.0488	G17Mn5	EN 10213-3	1.1131	—	—	—
	—	—	—	P275NL2	EN 10028-3	1.1104	G20Mn5	EN 10213-3	1.6220	—	—	—
7E1	—	—	—	P355NL1	EN 10028-3	1.0566	—	—	—	—	—	—
	—	—	—	P355NL2	EN 10028-3	1.1106	—	—	—	—	—	—
7E2	15NiMn6	EN 10222-3	1.6228	15NiMn6	EN 10028-4	1.6228	G9Ni10	EN 10213-3	1.5636	—	—	—
	—	—	—	11MnNi5-3	EN 10028-4	1.6212	—	—	—	—	—	—
	13MnNi6-3	EN 10222-3	1.6217	13MnNi6-3	EN 10028-4	1.6217	—	—	—	—	—	—
	—	—	—				—	—	—	—	—	—
7E3	12Ni14	EN 10222-3	1.5637	12Ni14	EN 10028-4	1.5637	G9Ni14	EN 10213-3	1.5638	—	—	—
	X12Ni5	EN 10222-3	1.5680	X12N5	EN 10028-4	1.5680	—	—	—	—	—	—
	X8Ni9	EN 10222-3	1.5662	X8Ni9	EN 10028-4	1.5662	—	—	—	—	—	—
8E0	—	—	—	—	—	—	—	—	—	—	—	—
8E2	P285NH	EN 10222-4	1.0477	P275NH	EN 10028-3	1.0487	—	—	—	P275NH	EN 10273	1.0487
	P285QH	EN 10222-4	1.0478	—	—	—				—	—	—
8E3	P355NH	EN 10222-4	1.0565	P355N	EN 10028-3	1.0562	—	—	—	P355NH	EN 10273	1.0565
	P355QH1	EN 10222-4	1.0571	P355NH	EN 10028-3	1.0565				P355QH	EN 10273	1.8867
9E0	X20CrMoV11-1	EN 10222-2	1.4922	—	—	—	GX23CrMoV12-1	EN 10213-2	1.4931	—	—	—
9E1	X10CrMoVNb9-1	EN 10222-2	1.4903	X10CrMoVNb9-1	EN 10028-2	1.4903	—	—	—	—	—	—
10E0	X2CrNi18-9	EN 10222-5	1.4307	X2CrNi18-9	EN 10028-7	1.4307	GX2CrNi19-11	EN 10213-4	1.4309	X2CrNi18-9	EN 10272	1.4307
	—	—	—	X2CrNi19-11	EN 10028-7	1.4306	—	—	—	X2CrNi19-11	EN 10272	1.4306
10E0	—	—	—	X1CrNi25-21	EN 10028-7	1.4335	—	—	—	—	—	—
10E1	X2CrNiN18-10	EN 10222-5	1.4311	X2CrNiN18-10	EN 10028-7	1.4311	—	—	—	X2CrNiN18-10	EN 10272	1.4311
11E0	X5CrNi18-10	EN 10222-5	1.4301	X5CrNi18-10	EN 10028-7	1.4301	GX5CrNi19-10	EN 10213-4	1.4308	X5CrNi18-10	EN 10272	1.4301
	X6CrNi18-10	EN 10222-5	1.4948	X6CrNi18-10	EN 10028-7	1.4948	—	—	—	—	—	—

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Table 9 (*continued*)

Group	Forgings			Flat products			Castings			Bars		
	Material name	Standard	Material number	Material name	Standard	Material number	Material name	Standard	Material number	Material name	Standard	Material number
12E0	X6CrNiTi18-10	EN 10222-5	1.4541	X6CrNiTi18-10	EN 10028-7	1.4541	—	—	—	X6CrNiTi18-10	EN 10272	1.4541
	X6CrNiNb18-10	EN 10222-5	1.4550	X6CrNiNb18-10	EN 10028-7	1.4550	GX5CrNiNb19-11	EN 10213-4	1.4552	X6CrNiNb18-10	EN 10272	1.4550
	X6CrNiTiB18-10	EN 10222-5	1.4941	X6CrNiTiB18-10	EN 10028-7	1.4941	—	—	—	—	—	—
13E0	X2CrNiMo17-12-2	EN 10222-5	1.4404	X2CrNiMo17-12-2	EN 10028-7	1.4404	GX2CrNiMo19-11-2	EN 10213-4	1.4409	X2CrNiMo17-12-2	EN 10272	1.4404
	X2CrNiMo17-12-3	EN 10222-5	1.4432	X2CrNiMo17-12-3	EN 10028-7	1.4432	—	—	—	X2CrNiMo17-12-3	EN 10272	1.4432
	X2CrNiMo18-14-3	EN 10222-5	1.4435	X2CrNiMo18-14-3	EN 10028-7	1.4435	—	—	—	X2CrNiMo18-14-3	EN 10272	1.4435
	X1NiCrMoCu25-20-5	EN 10222-5	1.4539	X1NiCrMoCu25-20-5	EN 10028-7	1.4539	GX2NiCrMo28-20-2	EN 10213-4	1.4458	X1NiCrMoCu25-20-5	EN 10272	1.4539
	—	—	—	X1NiCrMoCu31-27-4	EN 10028-7	1.4563	—	—	—	X1NiCrMoCu31-27-4	EN 10272	1.4563
13E1	X2CrNiMoN17-11-2	EN 10222-5	1.4406	X2CrNiMoN17-11-2	EN 10028-7	1.4406	—	—	—	X2CrNiMoN17-11-2	EN 10028-7	1.4406
13E1	X2CrNiMoN17-13-3	EN 10222-5	1.4429	X2CrNiMoN17-13-3	EN 10028-7	1.4429	—	—	—	X2CrNiMoN17-13-3	EN 10028-7	1.4429
13E1	—	—	—	X2CrNiMoN17-13-5	EN 10028-7	1.4439	—	—	—	X2CrNiMoN17-13-5	EN 10028-7	1.4439
13E1	—	—	—	X1NiCrMoCuN25-20-7	EN 10028-7	1.4529	—	—	—	X1NiCrMoCuN25-20-7	EN 10028-7	1.4529
13E1	—	—	—	X1CrNiMoCuN20-18-7	EN 10028-7	1.4547	—	—	—	X1CrNiMoCuN20-18-7	EN 10272	1.4547
14E0	X5CrNiMo17-12-2	EN 10222-5	1.4401	X5CrNiMo17-12-2	EN 10028-7	1.4401	GX5CrNiMo19-11-2	EN 10213-4	1.4408	X5CrNiMo17-12-2	EN 10272	1.4401
14E0	X3CrNiMo17-13-3	EN 10222-5	1.4436	X3CrNiMo17-13-3	EN 10028-7	1.4436	—	—	—	X3CrNiMo17-13-3	EN 10272	1.4436
15E0	X6CrNiMoTi17-12-2	EN 10222-5	1.4571	X6CrNiMoTi17-12-2	EN 10028-7	1.4571	—	—	—	X6CrNiMoTi17-12-2	EN 10272	1.4571
	—	—	—	X6CrNiMoNb17-12-2	EN 10028-7	1.4580	GX5CrNiMoNb19-11-2	EN 10213-4	1.4581	X6CrNiMoNb17-12-2	EN 10272	1.4580
16E0	—	—	—	—	—	—	GX2CrNiMoCuN25-6-3-3	EN 10213-4	1.4517	—	—	—
	—	—	—	X2CrNiN23-4	EN 10028-7	1.4362	—	—	—	X2CrNiN23-4	EN 10272	1.4362
	X2CrNiMoN22-5-3	EN 10222-5	1.4462	X2CrNiMoN22-5-3	EN 10028-7	1.4462	GX2CrNiMoN22-5-3	EN 10213-4	1.4470	X2CrNiMoN22-5-3	EN 10272	1.4462
	X2CrNiMoN25-7-4	EN 10222-5	1.4410	X2CrNiMoN25-7-4	EN 10028-7	1.4410	—	—	—	X2CrNiMoN25-7-4	EN 10272	1.4410
	—	—	—	—	—	—	GX2CrNiMoN26-7-4	EN 10213-4	1.4469	—	—	—

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Table 9 (*continued*)

Group	Seamless tubes			Welded tubes		
	Material name	Standard	Material number	Material name	Standard	Material number
2E0	—	—	—	—	—	—
3E0	P195GH	EN 10216-2	1.0348	P195GH	EN 10217-2	1.0348
	P235GH	EN 10216-2	1.0345	P235GH	EN 10217-2	1.0345
3E1	P265GH	EN 10216-2	1.0425	P265GH	EN 10217-2	1.0425
4E0	16Mo3	EN 10216-2	1.5415	16Mo3	EN 10217-2	1.5415
5E0	13CrMo4-5	EN 10216-2	1.7335	—	—	—
6E0	10CrMo9-10	EN 10216-2	1.7380	—	—	—
6E0	11CrMo9-10	EN 10216-2	1.7383	—	—	—
6E1	X11CrMo5-1+NT1	EN 10216-2	1.7362+NT1	—	—	—
7E0	P275NL1	EN 10216-3	1.0488	P275NL1	EN 10217-3	1.0488
	P275NL2	EN 10216-3	1.1104	P275NL2	EN 10217-3	1.1104
7E1	P355NL1	EN 10216-3	1.0566	P355NL1	EN 10217-3	1.0566
	P355NL2	EN 10216-3	1.1106	P355NL2	EN 10217-3	1.1106
7E2	12Ni14	EN 10216-4	1.5637	—	—	—
	X10Ni9	EN 10216-4	1.5682	—	—	—
7E3	13MnNi6-3	EN 10216-4	1.6217	—	—	—
8E0	P275NL1	EN 10216-3	1.0488	P275NL1	EN 10217-3	1.0488
8E0	P275NL2	EN 10216-3	1.1104	P275NL2	EN 10217-3	1.1104
8E2	—	—	—	—	—	—
8E3	P355NH	EN 10216-3	1.0565	P355NH	EN 10217-3	1.0565
9E0	X20CrMoV11-1	EN 10216-2	1.4922	—	—	—
9E1	X10CrMoVNb9-1	EN 10216-2	1.4903	—	—	—
10E0	X2CrNi18-9	EN 10216-5	1.4307	X2CrNi18-9	EN 10217-7	1.4307
	X2CrNi19-11	EN 10216-5	1.4306	X2CrNi19-11	EN 10217-7	1.4306
	X1CrNi25-21	EN 10216-5	1.4335	—	—	—
10E1	X2CrNiN18-10	EN 10216-5	1.4311	X2CrNiN18-10	EN 10217-7	1.4311
11E0	X5CrNi18-10	EN 10216-5	1.4301	X5CrNi18-10	EN 10217-7	1.4301
11E0	X6CrNi18-10	EN 10216-5	1.4948	—	—	—
12E0	X6CrNiTi18-10	EN 10216-5	1.4541	X6CrNiTi18-10	EN 10217-7	1.4541
	X6CrNiNb18-10	EN 10216-5	1.4550	X6CrNiNb18-10	EN 10217-7	1.4550
	X7CrNiTi18-10	EN 10216-5	1.4940	—	—	—
	X7CrNiTiB18-10	EN 10216-5	1.4941	—	—	—
	X7CrNiNb18-10	EN 10216-5	1.4912	—	—	—
	X8CrNiNb16-13	EN 10216-5	1.4961	—	—	—

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Table 9 (*concluded*)

Group	Seamless tubes			Welded tubes		
	Material name	Standard	Material number	Material name	Standard	Material number
13E0	X2CrNiMo17-12-2	EN 10216-5	1.4404	X2CrNiMo17-12-2	EN 10217-7	1.4404
	—	—	—	X2CrNiMo17-12-3	EN 10217-7	1.4432
	X2CrNiMo18-14-3	EN 10216-5	1.4435	X2CrNiMo18-14-3	EN 10217-7	1.4435
	X1NiCrMoCu25-20-5	EN 10216-5	1.4539	X1NiCrMoCu25-20-5	EN 10217-7	1.4539
	X1NiCrMoCu31-27-4	EN 10216-5	1.4563	X1NiCrMoCu31-27-4	EN 10217-7	1.4563
	—	—	—	X2CrNiMoN18-15-4	EN 10217-7	1.4438
	X6CrNiMo17-13-2	EN 10216-5	1.4918	—	—	—
13E1	X2CrNiMoN17-13-3	EN 10216-5	1.4429	X2CrNiMoN17-13-3	EN 10217-7	1.4429
	X2CrNiMoN17-13-5	EN 10216-5	1.4439	X2CrNiMoN17-13-5	EN 10217-7	1.4439
	X1CrNiMoN25-22-2	EN 10216-5	1.4466	—	—	—
	X1CrNiMoCuN20-18-7	EN 10216-5	1.4547	X1CrNiMoCuN20-18-7	EN 10217-7	1.4547
	X1NiCrMoCuN25-20-7	EN 10216-5	1.4529	X1NiCrMoCuN25-20-7	EN 10217-7	1.4529
14E0	X5CrNiMo17-12-2	EN 10216-5	1.4401	X5CrNiMo17-12-2	EN 10217-7	1.4401
	X3CrNiMo17-13-3	EN 10216-5	1.4436	X3CrNiMo17-13-3	EN 10217-7	1.4436
15E0	X6CrNiMoTi17-12-2	EN 10216-5	1.4571	X6CrNiMoTi17-12-2	EN 10217-7	1.4571
	X6CrNiMoNb17-12-2	EN 10216-5	1.4580	—	—	—
16E0	X2CrNiMoS18-5-3	EN 10216-5	1.4424	—	—	—
	X2CrNiMoN22-5-3	EN 10216-5	1.4462	X2CrNiMoN22-5-3	EN 10217-7	1.4462
	X2CrNiN23-4	EN 10216-5	1.4362	X2CrNiN23-4	EN 10217-7	1.4362
	X2CrNiMoN25-7-4	EN 10216-5	1.4410	X2CrNiMoN25-7-4	EN 10217-7	1.4410
	X2CrNiMoCuN25-6-3	EN 10216-5	1.4507	—	—	—
	X2CrNiMoCuWN25-7-4	EN 10216-5	1.4501	X2CrNiMoCuWN25-7-4	EN 10217-7	1.4501

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P/T-RATING FOR A SELECTION OF EN MATERIALS

EN 1092-1:2007 (E)

Table G.2.1-2 — PN 6

PN	Group	ν_R (mm)	max. allowable temperature TS °C																						
			RT	100	150	200	250	300	350	400	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
			max. allowable pressure PS bar																						
6	3E0	≤ 50	6,0	5,5	5,2	5	4,5	4,1	3,8	3,5	1,9														
	3E0	50 < ν_R ≤ 150	6,0	5,1	5	4,6	4,2	3,8	3,6	3,4	1,9														
	3E1	≤ 50	6,0	6,0	6,0	6,0	5,8	5,2	4,8	4,4	2,4														
	3E1	50< ν_R ≤ 150	6,0	6,0	5,7	5,4	5,0	4,6	4,2	3,8	2,4														
	4E0	≤ 60	6,0	6,0	6,0	6,0	5,8	5,1	4,8	4,4	4,1	3,8	3,5	3,2	2,9	2,6	2,1	1,6	1,3						
	4E0	60 < ν_R ≤ 90	6,0	6,0	6,0	6,0	5,5	4,8	4,5	4,1	3,8	3,6	3,3	3,1	2,8	2,6	2,1	1,6	1,3						
	4E0	90 < ν_R ≤ 150	6,0	6,0	6,0	5,5	5,1	4,5	4,2	3,8	3,5	3,3	3,1	3,0	2,8	2,6	2,1	1,6	1,3						
	5E0	≤ 60	6,0	6,0	6,0	6,0	6,0	6,0	5,7	5,4	5,0	4,8	4,5	4,3	4,0	3,9	3,3	2,6	2,2	1,7	1,4	1,1	0,9		
	5E0	60 < ν_R ≤ 90	6,0	6,0	6,0	6,0	6,0	5,8	5,4	5,0	4,7	4,5	4,3	4,1	3,9	3,9	3,3	2,6	2,2	1,7	1,4	1,1	0,9		
	5E0	90 < ν_R ≤ 150	6,0	6,0	6,0	6,0	6,0	5,5	5,0	4,7	4,4	4,2	4,1	4,0	3,9	3,9	3,3	2,6	2,2	1,7	1,4	1,1	0,9		
	6E0	≤ 150	6,0	6,0	6,0	6,0	6,0	6,0	5,8	5,5	5,2	5,0	4,7	4,4	4,1	3,8	3,3	2,9	2,5	2,2	1,9	1,6	1,4	1,2	1,0	0,9
	6E1	≤ 150	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	5,0	4,1	3,2	2,7	2,3	2,0	1,6	1,4	1,2	1,0			
	8E2	35 < ν_R ≤ 70	6,0	6,0	6,0	5,6	5,1	4,4	3,9	3,3																
	8E2	70 < ν_R ≤ 100	6,0	6,0	5,6	5,2	4,7	3,9	3,3	2,8																
	8E2	100 < ν_R ≤ 150	6,0	5,8	5,3	4,7	4,2	3,3	2,8	2,2																
	8E3	50 < ν_R ≤ 100	6,0	6,0	6,0	6,0	6,0	5,8	5,4	4,7																
	8E3	100 < ν_R ≤ 150	6,0	6,0	6,0	6,0	6,0	5,6	5,0	4,2																
	9E0	≤ 150	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	5,3	4,7	4,2	3,6	3,1	2,7	2,3	1,9	1,6
	9E1	≤ 130	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	6,0	5,7	5,2	4,7	4,2	3,8	3,4	3,0	2,6

Maximum allowable pressures at temperatures for which 100.000 h creep have been considered, are indicated in the gray cells.

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P/T-RATING FOR A SELECTION OF EN MATERIALS

EN 1092-1:2007 (E)
Table G.2.1-3 — PN 10

PN	Group	ν_R (mm)	max. allowable temperature TS °C																							
			RT	100	150	200	250	300	350	400	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
			max. allowable pressure PS bar																							
10	3E0	≤ 50	10,0	9,2	8,8	8,3	7,6	6,9	6,4	5,9	3,2															
	3E0	50 < ν_R ≤ 150	10,0	8,5	8,3	7,7	7,0	6,4	6,0	5,7	3,2															
	3E1	≤ 50	10,0	10,0	10,0	10,0	9,7	8,8	8,0	7,3	4,0															
	3E1	50< ν_R ≤ 150	10,0	10,0	9,5	9,0	8,3	7,6	7,0	6,4	4,0															
	4E0	≤ 60	10,0	10,0	10,0	10,0	9,7	8,5	8,0	7,4	6,9	6,4	5,9	5,4	4,9	4,4	3,5	2,8	2,2							
	4E0	60 < ν_R ≤ 90	10,0	10,0	10,0	10,0	9,2	8,0	7,6	6,9	6,4	6,0	5,6	5,2	4,8	4,4	3,5	2,8	2,2							
	4E0	90 < ν_R ≤ 150	10,0	10,0	10,0	9,2	8,5	7,6	7,0	6,3	5,9	5,6	5,3	5,0	4,7	4,4	3,5	2,8	2,2							
	5E0	≤ 60	10,0	10,0	10,0	10,0	10,0	10,0	9,5	9,0	8,4	8,0	7,6	7,2	6,8	6,5	5,5	4,4	3,7	2,9	2,3	1,9	1,5			
	5E0	60 < ν_R ≤ 90	10,0	10,0	10,0	10,0	10,0	9,7	9,0	8,3	7,8	7,5	7,2	6,9	6,6	6,5	5,5	4,4	3,7	2,9	2,3	1,9	1,5			
	5E0	90 < ν_R ≤ 150	10,0	10,0	10,0	10,0	10,0	9,1	8,4	7,9	7,3	7,1	6,9	6,7	6,5	6,5	5,5	4,4	3,7	2,9	2,3	1,9	1,5			
	6E0	≤ 150	10,0	10,0	10,0	10,0	10,0	10,0	9,7	9,2	8,8	8,3	7,8	7,3	6,9	6,4	5,6	4,9	4,2	3,7	3,2	2,7	2,4	2,0	1,8	1,6
	6E1	≤ 150	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	8,4	6,9	5,3	4,5	3,8	3,3	2,8	2,3	2,0	1,7			
	8E2	35 < ν_R ≤ 70	10,0	10,0	10,0	9,3	8,6	7,4	6,5	5,6																
	8E2	70 < ν_R ≤ 100	10,0	10,0	9,4	8,6	7,9	6,5	5,6	4,6																
	8E2	100 < ν_R ≤ 150	10,0	9,7	8,8	7,9	7,0	5,6	4,6	3,7																
	8E3	50 < ν_R ≤ 100	10,0	10,0	10,0	10,0	10,0	9,8	9,0	7,9																
	8E3	100 < ν_R ≤ 150	10,0	10,0	10,0	10,0	10,0	9,3	8,4	7,0																
	9E0	≤ 150	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	8,9	7,9	7,0	6,0	5,2	4,5	3,8	3,2	2,8
	9E1	≤ 130	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	9,5	8,7	7,9	7,1	6,3	5,7	5,0	4,4

Maximum allowable pressures at temperatures for which 100.000 h creep have been considered, are indicated in the gray cells.

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P/T-RATING FOR A SELECTION OF EN MATERIALS

EN 1092-1:2007 (E)
Table G.2.1-4 — PN 16

PN	Group	ν_R (mm)	max. allowable temperature TS °C																							
			RT	100	150	200	250	300	350	400	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
			max. allowable pressure PS bar																							
16	3E0	≤ 50	16,0	14,8	14	13,3	12,1	11	10,2	9,5	5,2															
	3E0	50 < ν_R ≤ 150	16,0	13,7	13,3	12,4	11,3	10,2	9,6	9,1	5,2															
	3E1	≤ 50	16,0	16,0	16	16	15,6	14	12,9	11,8	6,4															
	3E1	50< ν_R ≤ 150	16,0	16,0	15,2	14,5	13,3	12,2	11,3	10,2	6,4															
	4E0	≤ 60	16,0	16,0	16,0	16,0	15,6	13,7	12,9	11,9	11,0	10,2	9,4	8,6	7,8	7,0	5,6	4,4	3,5							
	4E0	60 < ν_R ≤ 90	16,0	16,0	16,0	16,0	14,8	12,9	12,1	11,1	10,2	9,6	9,0	8,3	7,7	7,0	5,6	4,4	3,5							
	4E0	90 < ν_R ≤ 150	16,0	16,0	16,0	14,8	13,7	12,1	11,2	10,1	9,4	8,9	8,5	8,0	7,5	7,0	5,6	4,4	3,5							
	5E0	≤ 60	16,0	16,0	16,0	16,0	16,0	16,0	15,2	14,4	13,4	12,8	12,1	11,5	10,8	10,4	8,8	7,1	5,9	4,6	3,7	3,0	2,5			
	5E0	60 < ν_R ≤ 90	16,0	16,0	16,0	16,0	16,0	15,6	14,4	13,4	12,5	12	11,5	11	10,5	10,4	8,8	7,1	5,9	4,6	3,7	3,0	2,5			
	5E0	90 < ν_R ≤ 150	16,0	16,0	16,0	16,0	16,0	14,7	13,5	12,7	11,8	11,4	11,1	10,7	10,4	10,4	8,8	7,1	5,9	4,6	3,7	3,0	2,5			
	6E0	≤ 150	16,0	16,0	16,0	16,0	16,0	16,0	15,6	14,8	14,0	13,3	12,5	11,8	11,0	10,2	8,9	7,8	6,8	5,9	5,1	4,4	3,8	3,3	2,8	2,5
	6E1	≤ 150	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	13,5	11,0	8,6	7,3	6,1	5,3	4,4	3,8	3,2	2,8			
	8E2	35 < ν_R ≤ 70	16,0	16,0	16,0	15,0	13,7	11,9	10,4	8,9																
	8E2	70 < ν_R ≤ 100	16,0	16,0	15,0	13,8	12,7	10,4	8,9	7,4																
	8E2	100 < ν_R ≤ 150	16,0	15,6	14,1	12,7	11,2	8,9	7,4	5,9																
	8E3	50 < ν_R ≤ 100	16,0	16,0	16,0	16,0	16,0	15,6	14,4	12,7																
	8E3	100 < ν_R ≤ 150	16,0	16,0	16,0	16,0	16,0	14,9	13,4	11,2																
	9E0	≤ 150	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	14,3	12,7	11,2	9,7	8,4	7,2	6,1	5,2	4,4
	9E1	≤ 130	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	16,0	15,3	13,9	12,6	11,4	10,2	9,1	8,0	7,1

Maximum allowable pressures at temperatures for which 100.000 h creep have been considered, are indicated in the gray cells.

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P/T-RATING FOR A SELECTION OF EN MATERIALS

EN 1092-1:2007 (E)
Table G.2.1-5 — PN 25

PN	Group	ν_R (mm)	max. allowable temperature TS °C																						
			RT	100	150	200	250	300	350	400	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
			max. allowable pressure PS bar																						
25	3E0	≤ 50	25,0	23,2	22,0	20,8	19,0	17,2	16,0	14,8	8,2														
	3E0	50 < ν_R ≤ 150	25,0	21,4	20,8	19,4	17,7	16,0	15,1	14,2	8,2														
	3E1	≤ 50	25,0	25,0	25,0	25,0	24,4	22,0	20,2	18,4	10,1														
	3E1	50< ν_R ≤ 150	25,0	25,0	23,8	22,7	20,8	19,1	17,7	16,0	10,1														
	4E0	≤ 60	25,0	25,0	25,0	25,0	24,4	21,4	20,2	18,6	17,2	16,0	14,7	13,5	12,3	11,0	8,8	7,0	5,5						
	4E0	60 < ν_R ≤ 90	25,0	25,0	25,0	25,0	23,2	20,2	19,0	17,3	16,0	15,0	14,0	13,0	12,0	11,0	8,8	7,0	5,5						
	4E0	90 < ν_R ≤ 150	25,0	25,0	25,0	23,2	21,4	19,0	17,5	15,8	14,7	14,0	13,2	12,5	11,8	11,0	8,8	7,0	5,5						
	5E0	≤ 60	25,0	25,0	25,0	25,0	25,0	25,0	23,8	22,5	21,0	20,0	19,0	18,0	17,0	16,3	13,8	11,1	9,2	7,2	5,8	4,7	3,9		
	5E0	60 < ν_R ≤ 90	25,0	25,0	25,0	25,0	25,0	24,4	22,5	20,9	19,6	18,8	18,0	17,2	16,5	16,3	13,8	11,1	9,2	7,2	5,8	4,7	3,9		
	5E0	90 < ν_R ≤ 150	25,0	25,0	25,0	25,0	25,0	22,9	21,1	19,8	18,4	17,9	17,3	16,8	16,2	16,3	13,8	11,1	9,2	7,2	5,8	4,7	3,9		
	6E0	≤ 150	25,0	25,0	25,0	25,0	25,0	25,0	24,4	23,2	22,0	20,8	19,6	18,4	17,2	16,0	14,0	12,2	10,7	9,2	8,0	6,9	6,0	5,2	4,5	4,0
	6E1	≤ 150	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	21,2	17,3	13,4	11,4	9,6	8,3	7,0	5,9	5,1	4,4		
	8E2	35 < ν_R ≤ 70	25,0	25,0	25,0	23,4	21,5	18,6	16,3	14,0															
	8E2	70 < ν_R ≤ 100	25,0	25,0	23,5	21,6	19,8	16,3	14,0	11,6															
	8E2	100 < ν_R ≤ 150	25,0	24,4	22,1	19,8	17,5	14,0	11,6	9,2															
	8E3	50 < ν_R ≤ 100	25,0	25,0	25,0	25,0	25,0	24,5	22,6	19,8															
	8E3	100 < ν_R ≤ 150	25,0	25,0	25,0	25,0	25,0	23,3	21,0	17,5															
	9E0	≤ 150	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	22,3	19,8	17,5	15,2	13,2	11,3	9,6	8,2	7,0
	9E1	≤ 130	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	23,9	21,7	19,7	17,8	15,9	14,2	12,6	11,1

Maximum allowable pressures at temperatures for which 100.000 h creep have been considered, are indicated in the gray cells.

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EN 1092-1:2007 (E)

Table G.2.1-6 — PN 40

PN	Group	ν_R (mm)	max. allowable temperature TS °C																							
			RT	100	150	200	250	300	350	400	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
			max. allowable pressure PS bar																							
40	3E0	≤ 50	40,0	37,1	35,2	33,3	30,4	27,6	25,7	23,8	13,1															
	3E0	50 < ν_R ≤ 150	40,0	34,2	33,3	31,0	28,3	25,7	24,1	22,8	13,1															
	3E1	≤ 50	40,0	40,0	40,0	40,0	39,0	35,2	32,3	29,5	16,1															
	3E1	50< ν_R ≤ 150	40,0	40,0	38,0	36,3	33,3	30,6	28,3	25,7	16,1															
	4E0	≤ 60	40,0	40,0	40,0	40,0	39,0	34,2	32,3	29,9	27,6	25,6	23,6	21,6	19,7	17,7	14,0	11,2	8,9							
	4E0	60 < ν_R ≤ 90	40,0	40,0	40,0	40,0	37,1	32,3	30,4	27,8	25,7	24,1	22,5	20,9	19,3	17,7	14,0	11,2	8,9							
	4E0	90 < ν_R ≤ 150	40,0	40,0	40,0	37,1	34,2	30,4	28,0	25,3	23,6	22,4	21,2	20,0	18,9	17,7	14,0	11,2	8,9							
	5E0	≤ 60	40,0	40,0	40,0	40,0	40,0	40,0	38,0	36,0	33,7	32,0	30,4	28,8	27,2	26,0	22,0	17,9	14,8	11,6	9,3	7,6	6,2			
	5E0	60 < ν_R ≤ 90	40,0	40,0	40,0	40,0	40,0	39,0	36,0	33,5	31,4	30,1	28,9	27,6	26,4	26,0	22,0	17,9	14,8	11,6	9,3	7,6	6,2			
	5E0	90 < ν_R ≤ 150	40,0	40,0	40,0	40,0	40,0	36,7	33,9	31,8	29,5	28,6	27,7	26,8	26,0	26,0	22,0	17,9	14,8	11,6	9,3	7,6	6,2			
	6E0	≤ 150	40,0	40,0	40,0	40,0	40,0	40,0	39,0	37,1	35,2	33,3	31,4	29,5	27,6	25,7	22,4	19,6	17,1	14,8	12,9	11,0	9,7	8,3	7,2	6,4
	6E1	≤ 150	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	33,9	27,7	21,5	18,2	15,4	13,3	11,2	9,5	8,1	7,0			
	8E2	35 < ν_R ≤ 70	40,0	40,0	40,0	37,5	34,4	29,9	26,0	22,4																
	8E2	70 < ν_R ≤ 100	40,0	40,0	37,7	34,6	31,8	26,0	22,4	18,6																
	8E2	100 < ν_R ≤ 150	40,0	39,0	35,4	31,8	28,0	22,4	18,6	14,8																
	8E3	50 < ν_R ≤ 100	40,0	40,0	40,0	40,0	40,0	39,2	36,1	31,8																
	8E3	100 < ν_R ≤ 150	40,0	40,0	40,0	40,0	40,0	37,3	33,7	28,0																
	9E0	≤ 150	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	35,8	31,8	28,0	24,3	21,1	18,0	15,4	13,1	11,2
	9E1	≤ 130	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	40,0	38,2	34,8	31,6	28,5	25,5	22,8	20,1	17,9

Maximum allowable pressures at temperatures for which 100.000 h creep have been considered, are indicated in the gray cells.

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P/T-RATING FOR A SELECTION OF EN MATERIALS

EN 1092-1:2007 (E)

Table G.2.1-7 — PN 63

PN	Group	ν_R (mm)	max. allowable temperature TS °C																						
			RT	100	150	200	250	300	350	400	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
			max. allowable pressure PS bar																						
63	3E0	≤ 50	63,0	58,5	55,5	52,5	48,0	43,5	40,5	37,5	20,7														
	3E0	50 < ν_R ≤ 150	63,0	54,0	52,5	48,9	44,7	40,5	38,1	36,0	20,7														
	3E1	≤ 50	63,0	63,0	63,0	63,0	61,5	55,5	51,0	46,5	25,5														
	3E1	50< ν_R ≤ 150	63,0	63,0	60,0	57,3	52,5	48,3	44,7	40,5	25,5														
	4E0	≤ 60	63,0	63,0	63,0	63,0	61,5	54,0	51,0	47,1	43,5	40,3	37,2	34,1	31,0	27,9	22,2	17,7	14,1						
	4E0	60 < ν_R ≤ 90	63,0	63,0	63,0	63,0	58,5	51,0	48,0	43,8	40,5	37,9	35,4	32,9	30,4	27,9	22,2	17,7	14,1						
	4E0	90 < ν_R ≤ 150	63,0	63,0	63,0	58,5	54,0	48,0	44,1	39,9	37,2	35,3	33,4	31,6	29,7	27,9	22,2	17,7	14,1						
	5E0	≤ 60	63,0	63,0	63,0	63,0	63,0	63,0	60,0	56,7	53,1	50,5	47,9	45,4	42,8	41,1	34,8	28,2	23,4	18,3	14,7	12,0	9,9		
	5E0	60 < ν_R ≤ 90	63,0	63,0	63,0	63,0	63,0	61,5	56,7	52,8	49,5	47,5	45,5	43,5	41,5	41,1	34,8	28,2	23,4	18,3	14,7	12,0	9,9		
	5E0	90 < ν_R ≤ 150	63,0	63,0	63,0	63,0	63,0	57,9	53,4	50,1	46,5	45,1	43,7	42,3	40,9	41,1	34,8	28,2	23,4	18,3	14,7	12,0	9,9		
	6E0	≤ 150	63,0	63,0	63,0	63,0	63,0	63,0	61,5	58,5	55,5	52,5	49,5	46,5	43,5	40,5	35,4	30,9	27,0	23,4	20,4	17,4	15,3	13,2	11,4	10,2
	6E1	≤ 150	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	53,4	43,6	33,9	28,8	24,3	21,0	17,7	15,0	12,9	11,1		
	8E2	35 < ν_R ≤ 70	63,0	63,0	63,0	59,1	54,3	47,1	41,1	35,4															
	8E2	70 < ν_R ≤ 100	63,0	63,0	59,4	54,6	50,1	41,1	35,4	29,4															
	8E2	100 < ν_R ≤ 150	63,0	61,5	55,8	50,1	44,1	35,4	29,4	23,4															
	8E3	50 < ν_R ≤ 100	63,0	63,0	63,0	63,0	63,0	61,8	57,0	50,1															
	8E3	100 < ν_R ≤ 150	63,0	63,0	63,0	63,0	63,0	58,8	53,1	44,1															
	9E0	≤ 150	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	56,4	50,1	44,1	38,4	33,3	28,5	24,3	20,7	17,7
	9E1	≤ 130	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	63,0	60,3	54,9	49,8	45,0	40,2	36,0	31,8	28,2

Maximum allowable pressures at temperatures for which 100.000 h creep have been considered, are indicated in the gray cells.

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P/T-RATING FOR A SELECTION OF EN MATERIALS

EN 1092-1:2007 (E)
Table G.2.1-8 — PN 100

PN	Group	ν_R (mm)	max. allowable temperature TS °C																							
			RT	100	150	200	250	300	350	400	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
			max. allowable pressure PS bar																							
100	3E0	≤ 50	100,0	92,8	88,0	83,3	76,1	69,0	64,2	59,5	32,8															
	3E0	50 < ν_R ≤ 150	100,0	85,7	83,3	77,6	70,9	64,2	60,4	57,1	32,8															
	3E1	≤ 50	100,0	100,0	100,0	100,0	97,6	88,0	80,9	73,8	40,4															
	3E1	50< ν_R ≤ 150	100,0	100,0	95,2	90,9	83,3	76,6	70,9	64,2	40,4															
	4E0	≤ 60	100,0	100,0	100,0	100,0	97,6	85,7	80,9	74,7	69,0	64,0	59,1	54,2	49,2	44,2	35,2	28,0	22,3							
	4E0	60 < ν_R ≤ 90	100,0	100,0	100,0	100,0	92,8	80,9	76,1	69,5	64,2	60,2	56,2	52,2	48,2	44,2	35,2	28,0	22,3							
	4E0	90 < ν_R ≤ 150	100,0	100,0	100,0	92,8	85,7	76,1	70,0	63,3	59,0	56,0	53,1	50,2	47,2	44,2	35,2	28,0	22,3							
	5E0	≤ 60	100,0	100,0	100,0	100,0	100,0	100,0	95,2	90,0	84,2	80,2	76,1	72,0	68,0	65,2	55,2	44,7	37,1	29,0	23,3	19,0	15,7			
	5E0	60 < ν_R ≤ 90	100,0	100,0	100,0	100,0	100,0	97,6	90,0	83,8	78,5	75,4	72,2	69,1	66,0	65,2	55,2	44,7	37,1	29,0	23,3	19,0	15,7			
	5E0	90 < ν_R ≤ 150	100,0	100,0	100,0	100,0	100,0	91,9	84,7	79,5	73,8	71,6	69,4	67,2	65,0	65,2	55,2	44,7	37,1	29,0	23,3	19,0	15,7			
	6E0	≤ 150	100,0	100,0	100,0	100,0	100,0	100,0	97,6	92,8	88,0	83,3	78,5	73,8	69,0	64,2	56,1	49,0	42,8	37,1	32,3	27,6	24,2	20,9	18,0	16,1
	6E1	≤ 150	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	84,8	69,3	53,8	45,7	38,5	33,3	28,0	23,8	20,4	17,6			
	8E2	35 < ν_R ≤ 70	100,0	100,0	100,0	93,8	86,1	74,7	65,2	56,1																
	8E2	70 < ν_R ≤ 100	100,0	100,0	94,2	86,6	79,5	65,2	56,1	46,6																
	8E2	100 < ν_R ≤ 150	100,0	97,6	88,5	79,5	70,0	56,1	46,6	37,1																
	8E3	50 < ν_R ≤ 100	100,0	100,0	100,0	100,0	100,0	98,0	90,4	79,5																
	8E3	100 < ν_R ≤ 150	100,0	100,0	100,0	100,0	100,0	93,3	84,2	70,0																
	9E0	≤ 150	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	89,5	79,5	70,0	60,9	52,8	45,2	38,5	32,8	28,0
	9E1	≤ 130	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	95,7	87,1	79,0	71,4	63,8	57,1	50,4	44,7

Maximum allowable pressures at temperatures for which 100.000 h creep have been considered, are indicated in the gray cells.

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P/T-RATING FOR A SELECTION OF EN MATERIALS

EN 1092-1:2007 (E)
Table G.2.1-9 — PN 160

PN	Group	ν_R (mm)	max. allowable temperature TS °C																						
			RT	100	150	200	250	300	350	400	450	460	470	480	490	500	510	520	530	540	550	560	570	580	590	600
			max. allowable pressure PS bar																						
160	3E0	≤ 50	160,0	148,5	140,9	133,3	121,9	110,4	102,8	95,2	52,5														
	3E0	50 < ν_R ≤ 150	160,0	137,1	133,3	124,1	113,5	102,8	96,7	91,4	52,5														
	3E1	≤ 50	160,0	160,0	160,0	160,0	156,1	140,9	129,5	118,0	64,7														
	3E1	50< ν_R ≤ 150	160,0	160,0	152,3	145,5	133,3	122,6	113,5	102,8	64,7														
	4E0	≤ 60	160,0	160,0	160,0	160,0	156,1	137,1	129,5	119,6	110,4	102,5	94,6	86,7	78,8	70,8	56,3	44,9	35,8						
	4E0	60 < ν_R ≤ 90	160,0	160,0	160,0	160,0	148,5	129,5	121,9	111,2	102,8	96,4	90,0	83,6	77,2	70,8	56,3	44,9	35,8						
	4E0	90 < ν_R ≤ 150	160,0	160,0	160,0	148,5	137,1	121,9	112,0	101,3	94,4	89,7	85,0	80,3	75,6	70,8	56,3	44,9	35,8						
	5E0	≤ 60	160,0	160,0	160,0	160,0	160,0	160,0	152,3	144,0	134,8	128,3	121,8	115,3	108,8	104,3	88,3	71,6	59,4	46,4	37,3	30,4	25,1		
	5E0	60 < ν_R ≤ 90	160,0	160,0	160,0	160,0	160,0	156,1	144,0	134,0	125,7	120,6	115,6	110,6	105,6	104,3	88,3	71,6	59,4	46,4	37,3	30,4	25,1		
	5E0	90 < ν_R ≤ 150	160,0	160,0	160,0	160,0	160,0	147,0	135,6	127,2	118,0	114,6	111,0	107,5	104,0	104,3	88,3	71,6	59,4	46,4	37,3	30,4	25,1		
	6E0	≤ 150	160,0	160,0	160,0	160,0	160,0	160,0	156,1	148,5	140,9	133,3	125,7	118,0	110,4	102,8	89,9	78,4	68,5	59,4	51,8	44,1	38,8	33,5	28,9	25,9
	6E1	≤ 150	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	135,7	110,9	86,0	73,1	61,7	53,3	44,9	38,0	32,7	28,1		
	8E2	35 < ν_R ≤ 70	160,0	160,0	160,0	150,0	137,9	119,6	104,3	89,9															
	8E2	70 < ν_R ≤ 100	160,0	160,0	150,8	138,6	127,2	104,3	89,9	74,6															
	8E2	100 < ν_R ≤ 150	160,0	156,1	141,7	127,2	112,0	89,9	74,6	59,4															
	8E3	50 < ν_R ≤ 100	160,0	160,0	160,0	160,0	160,0	156,9	144,7	127,2															
	8E3	100 < ν_R ≤ 150	160,0	160,0	160,0	160,0	160,0	149,3	134,8	112,0															
	9E0	≤ 150	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	143,2	127,2	112,0	97,5	84,5	72,3	61,7	52,5	44,9
	9E1	≤ 130	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	160,0	153,1	139,4	126,4	114,2	102,0	91,4	80,7	71,6

Maximum allowable pressures at temperatures for which 100.000 h creep have been considered, are indicated in the gray cells.

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Table 2-1.1 Pressure–Temperature Ratings for Group 1.1 Materials

Nominal Designation	Forgings	Castings	Plates
C–Si	A 105 (1)	A 216 Gr. WCB (1)	A 515 Gr. 70 (1)
C–Mn–Si	A 350 Gr. LF2 (1)	...	A 516 Gr. 70 (1), (2)
C–Mn–Si–V	A 350 Gr. LF6 Cl 1 (3)	...	A 537 Cl. 1 (4)
3½Ni	A 350 Gr. LF3	...	...

	Working Pressure by Classes, bar						
	Class						
Temp., °C	150	300	400	600	900	1500	2500
–29 to 38	19.6	51.1	68.1	102.1	153.2	255.3	425.5
50	19.2	50.1	66.8	100.2	150.4	250.6	417.7
100	17.7	46.6	62.1	93.2	139.8	233.0	388.3
150	15.8	45.1	60.1	90.2	135.2	225.4	375.6
200	13.8	43.8	58.4	87.6	131.4	219.0	365.0
250	12.1	41.9	55.9	83.9	125.8	209.7	349.5
300	10.2	39.8	53.1	79.6	119.5	199.1	331.8
325	9.3	38.7	51.6	77.4	116.1	193.6	322.6
350	8.4	37.6	50.1	75.1	112.7	187.8	313.0
375	7.4	36.4	48.5	72.7	109.1	181.8	303.1
400	6.5	34.7	46.3	69.4	104.2	173.6	289.3
425	5.5	28.8	38.4	57.5	86.3	143.8	239.7
450	4.6	23.0	30.7	46.0	69.0	115.0	191.7
475	3.7	17.4	23.2	34.9	52.3	87.2	145.3
500	2.8	11.8	15.7	23.5	35.3	58.8	97.9
538	1.4	5.9	7.9	11.8	17.7	29.5	49.2

NOTES:
(1) Upon prolonged exposure to temperatures above 425°C, the carbide phase of steel may be converted to graphite. Permissible but not recommended for prolonged use above 425°C.
(2) Not to be used over 455°C.
(3) Not to be used over 260°C.
(4) Not to be used over 370°C.

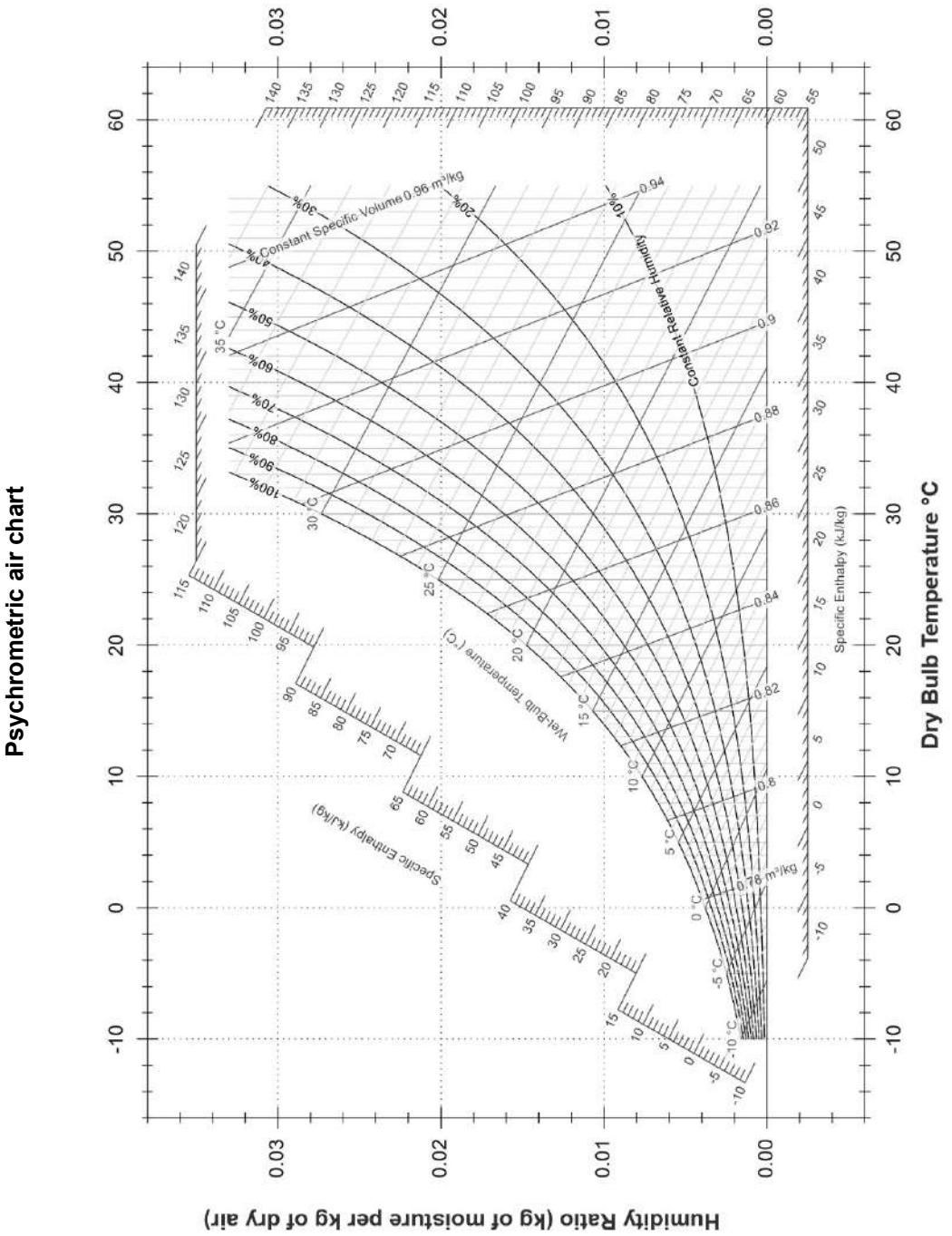
Table 2-1.9 Pressure–Temperature Ratings for Group 1.9 Materials

Nominal Designation	Forgings	Castings	Plates
1¼Cr–½Mo	...	A 217 Gr. WC6 (1)–(3)	...
1¼Cr–½Mo–Si	A 182 Gr. F11 Cl. 2 (1), (4)	...	A 387 Gr. 11 Cl. 2 (4)

Working Pressures by Classes, bar							
	Class						
Temp., °C	150	300	400	600	900	1500	2500
–29 to 38	19.8	51.7	68.9	103.4	155.1	258.6	430.9
50	19.5	51.7	68.9	103.4	155.1	258.6	430.9
100	17.7	51.5	68.6	103.0	154.4	257.4	429.0
150	15.8	49.7	66.3	99.5	149.2	248.7	414.5
200	13.8	48.0	63.9	95.9	143.9	239.8	399.6
250	12.1	46.3	61.7	92.7	139.0	231.8	386.2
300	10.2	42.9	57.0	85.7	128.6	214.4	357.1
325	9.3	41.4	55.0	82.6	124.0	206.6	344.3
350	8.4	40.3	53.6	80.4	120.7	201.1	335.3
375	7.4	38.9	51.6	77.6	116.5	194.1	323.2
400	6.5	36.5	48.9	73.3	109.8	183.1	304.9
425	5.5	35.2	46.5	70.0	105.1	175.1	291.6
450	4.6	33.7	45.1	67.7	101.4	169.0	281.8
475	3.7	31.7	42.3	63.4	95.1	158.2	263.9
500	2.8	25.7	34.3	51.5	77.2	128.6	214.4
538	1.4	14.9	19.9	29.8	44.7	74.5	124.1
550	...	12.7	16.9	25.4	38.1	63.5	105.9
575	...	8.8	11.7	17.6	26.4	44.0	73.4
600	...	6.1	8.1	12.2	18.3	30.5	50.9
625	...	4.3	5.7	8.5	12.8	21.3	35.5
650	...	2.8	3.8	5.7	8.5	14.2	23.6

NOTES:
(1) Use normalized and tempered material only.
(2) Not to be used over 590°C.
(3) The deliberate addition of any element not listed in ASTM A 217, Table 1 is prohibited, except that Ca and Mg may be added for deoxidation.
(4) Permissible but not recommended for prolonged use above 590°C.

Psychrometric air chart



PHYSICAL PROPERTIES OF WATER VAPOR

PRESSURE				TEMPERATURE		SPECIFIC VOLUME	WATER SENSITIVE HEAT		LATENT HEAT		TOTAL HEAT	
RELATED		ABSOLUTE										
bar	kg/cm²	bar	kg/cm²	K	°C	m³/kg	kJ/kg	kcal/kg	kJ/kg	kcal/kg	kJ/kg	kcal/kg
		0,050	0,051	306,0	32,9	28,192	137,8	32,9	2423,7	579,2	2561,5	612,2
		0,100	0,102	318,9	45,8	16,474	191,8	45,8	2392,8	571,9	2584,6	617,7
		0,150	0,153	327,1	54,0	10,022	225,9	54,0	2373,1	567,2	2599,1	621,2
		0,200	0,204	333,2	60,0	7,649	251,4	60,1	2358,3	563,6	2609,7	623,7
		0,250	0,255	338,1	65,0	6,204	271,9	65,0	2346,3	560,7	2618,2	625,7
		0,300	0,306	342,2	69,1	5,229	289,2	69,1	2336,1	558,3	2625,3	627,4
		0,350	0,357	345,8	72,7	4,530	304,3	72,7	2327,2	556,2	2631,5	628,9
		0,400	0,408	349,0	75,9	3,993	317,6	75,9	2319,2	554,3	2636,8	630,2
		0,450	0,459	351,8	78,7	3,580	329,7	78,8	2312,0	552,6	2641,7	631,3
		0,500	0,510	354,5	81,3	3,240	340,5	81,4	2305,4	551,0	2645,9	632,4
		0,600	0,611	359,1	85,9	2,732	359,8	86,0	2293,6	548,2	2653,5	634,2
		0,700	0,713	363,1	89,9	2,365	376,7	90,0	2283,3	545,6	2660,0	635,7
		0,800	0,815	366,6	93,5	2,087	391,6	93,6	2274,1	543,5	2665,8	637,1
		0,900	0,917	359,8	86,7	1,869	405,1	96,8	2265,7	541,5	2670,9	638,3
		1,000	1,019	372,8	99,6	1,964	417,4	99,8	2258,0	539,6	2675,5	639,4
0	0	1,013	1,032	373,1	100,0	1,673	419,0	100,1	2257,0	539,4	2676,0	639,6
0,05	0,051	1,063	1,083	374,5	101,4	1,601	424,9	101,5	2253,3	538,4	2678,2	640,0
0,10	0,102	1,113	1,134	375,8	102,6	1,533	430,2	102,8	2250,2	537,7	2680,4	640,6
0,15	0,153	1,163	1,185	378,2	105,1	1,471	435,6	104,1	2246,7	536,9	2682,3	641,1
0,20	0,204	1,213	1,236	379,4	106,2	1,414	440,8	105,3	2243,4	536,2	2684,2	641,5
0,30	0,306	1,313	1,338	380,5	107,4	1,312	450,4	107,6	2237,2	534,7	2687,6	642,3
0,40	0,408	1,413	1,440	382,7	109,5	1,225	459,7	109,8	2231,3	533,3	2691,0	643,1
0,50	0,510	1,513	1,542	384,7	111,6	1,149	468,3	111,9	2225,6	531,9	2693,9	643,8
0,60	0,611	1,613	1,644	386,7	113,5	1,038	476,4	113,8	2220,4	530,6	2696,8	644,5
0,70	0,713	1,713	1,746	388,5	115,4	1,024	484,1	115,7	2215,4	529,5	2699,5	644,9
0,80	0,815	1,813	1,848	390,3	117,1	0,971	491,6	117,5	2210,5	528,3	2702,1	645,4
0,90	0,917	1,913	1,950	391,9	118,8	0,923	498,9	119,2	2205,6	527,1	2704,5	645,9
1,00	1,019	2,013	2,052	393,6	120,4	0,881	505,6	120,8	2201,1	526,0	2706,7	646,4
1,10	1,121	2,113	2,154	395,1	121,9	0,841	512,2	122,4	2197,0	525,1	2709,2	647,0
1,20	1,223	2,213	2,256	396,6	123,4	0,806	518,7	124,0	2192,8	524,1	2711,5	647,5
1,30	1,325	2,313	2,358	398,0	124,9	0,773	524,7	125,4	2188,7	523,1	2713,3	648,0
1,40	1,427	2,413	2,460	399,4	126,3	0,743	530,5	126,8	2184,8	522,2	2715,3	648,5
1,50	1,529	2,513	2,562	400,8	127,6	0,714	536,1	128,1	2181,0	521,2	2717,1	648,8
1,60	1,631	2,613	2,663	402,0	128,9	0,689	544,6	130,1	2177,3	520,4	2718,9	649,3
1,70	1,733	2,713	2,765	403,3	130,1	0,665	547,1	130,7	2173,7	519,5	2720,8	649,6
1,80	1,835	2,813	2,867	404,5	131,4	0,643	552,3	132,0	2170,1	518,6	2722,4	650,0
1,90	1,937	2,913	2,969	405,7	132,5	0,622	557,3	133,2	2166,7	517,8	2724,0	650,3
2,00	2,039	3,013	3,071	406,8	133,7	0,603	562,2	134,4	2163,3	517,0	2725,5	650,7
2,20	2,242	3,213	3,275	409,0	135,9	0,568	571,7	136,6	2156,9	515,5	2728,6	652,1

PHYSICAL PROPERTIES OF WATER VAPOR

PRESSURE				TEMPERATURE		SPECIFIC VOLUME	WATER SENSITIVE HEAT		LATENT HEAT		TOTAL HEAT	
RELATED		ABSOLUTE										
bar	kg/cm²	bar	kg/cm²	K	°C	m³/kg	kJ/kg	kcal/kg	kJ/kg	kcal/kg	kJ/kg	kcal/kg
2,40	2,446	3,413	3,479	411,1	138,0	0,536	580,7	138,8	2150,7	514,0	2731,4	652,8
2,60	2,650	3,613	3,683	413,1	140,0	0,509	589,2	140,8	2144,7	512,6	2733,9	653,4
2,80	2,854	3,813	3,887	415,1	141,9	0,483	597,4	142,8	2139,0	511,2	2736,4	654,0
3,00	3,058	4,013	4,091	416,9	143,7	0,461	605,3	144,7	2133,4	509,9	2738,7	654,6
3,20	3,262	4,213	4,294	418,6	145,4	0,440	612,9	146,5	2128,1	508,6	2741,0	655,1
3,40	3,466	4,413	4,498	420,3	147,2	0,422	620,0	148,2	2122,9	507,4	2742,9	655,6
3,60	3,670	4,613	4,702	422,0	148,8	0,405	627,1	149,9	2117,8	506,1	2744,9	656,0
3,80	3,873	4,813	4,906	423,6	150,4	0,389	634,0	151,5	2112,9	505,0	2746,9	656,5
4,00	4,077	5,013	5,110	425,1	152,0	0,374	640,7	153,1	2108,1	503,8	2748,8	656,9
4,20	4,281	5,213	5,314	426,5	153,4	0,361	647,1	154,6	2103,5	502,7	2750,6	657,4
4,40	4,485	5,413	5,518	428,0	154,8	0,348	653,3	156,1	2098,9	501,6	2752,2	657,8
4,60	4,689	5,613	5,722	429,4	156,2	0,336	659,3	157,6	2094,5	500,6	2753,8	658,1
4,80	4,893	5,813	5,926	430,8	157,6	0,325	665,2	159,0	2090,2	499,5	2755,4	658,5
5,00	5,097	6,013	6,129	432,1	158,9	0,315	670,9	160,3	2086,0	498,5	2756,9	658,9
5,50	5,607	6,513	6,639	435,2	162,1	0,292	684,6	163,6	2075,7	496,1	2760,3	659,7
6,00	6,116	7,013	7,149	438,2	165,0	0,272	697,5	166,7	2066,0	493,8	2763,5	660,5
6,50	6,626	7,513	7,659	441,0	167,8	0,255	709,7	169,6	2056,8	491,6	2766,5	661,2
7,00	7,136	8,013	8,168	443,6	170,5	0,240	721,4	172,4	2047,7	489,4	2769,1	661,8
7,50	7,645	8,513	8,678	446,2	173,0	0,227	732,5	175,1	2039,2	487,4	2771,7	662,5
8,00	8,155	9,013	9,188	448,6	175,4	0,215	743,1	177,6	2030,9	485,4	2774,0	663,0
8,50	8,665	9,513	9,697	450,9	177,7	0,204	753,3	180,0	2022,9	483,5	2776,2	663,5
9,00	9,174	10,013	10,207	453,1	180,0	0,194	763,0	182,3	2015,1	481,6	2778,1	663,9
9,50	9,684	10,513	10,717	455,2	182,1	0,185	772,5	184,6	2007,5	479,8	2780,0	664,4
10,00	10,194	11,013	11,226	457,2	184,1	0,177	781,6	186,8	2000,1	478,0	2781,7	664,8
11,00	11,213	12,013	12,246	461,1	188,0	0,163	798,8	190,9	1986,0	474,6	2784,8	665,6
12,00	12,232	13,013	13,265	464,8	191,7	0,151	815,1	194,8	1972,5	471,4	2787,6	666,2
13,00	13,252	14,013	14,284	468,2	195,1	0,141	830,4	198,5	1959,6	468,3	2790,0	666,8
14,00	14,271	15,013	15,304	471,5	198,3	0,132	845,1	202,0	1947,1	465,3	2792,2	667,3
15,00	15,291	16,013	16,323	474,6	201,4	0,124	859,0	205,3	1935,0	462,5	2794,0	667,8
16,00	16,310	17,013	17,343	477,5	204,4	0,117	872,3	208,5	1923,4	459,7	2795,7	668,2
17,00	17,329	18,013	18,362	480,3	207,2	0,110	885,0	211,5	1912,1	457,0	2797,1	668,5
18,00	18,349	19,013	19,381	483,0	209,9	0,105	897,2	214,4	1901,3	454,4	2798,5	668,8
19,00	19,368	20,013	20,401	485,6	212,5	0,100	909,9	217,2	1890,5	451,8	2799,5	669,5
20,00	20,387	21,013	21,420	488,1	215,0	0,095	920,3	220,0	1880,2	449,4	2800,5	669,4
21,00	21,407	22,013	22,439	490,5	217,3	0,090	931,3	222,6	1870,1	447,0	2801,4	669,6
22,00	22,426	23,013	23,459	492,8	219,6	0,087	941,9	225,1	1860,1	444,6	2802,0	669,7
23,00	23,445	24,013	24,478	495,0	221,8	0,083	952,2	227,6	1850,4	442,2	2802,6	669,8
24,00	24,465	25,013	25,497	497,2	224,0	0,080	962,2	230,0	1840,9	440,0	2803,1	670,0
25,00	25,484	26,013	26,517	499,3	226,1	0,077	972,1	232,3	1831,4	437,7	2803,5	670,0

ENTHALPY OF THE SUPERHEATED WATER VAPOR

RELATED PRESSURE		TEMPERATURE											
		150°C	423,15 K	200°C	473,15 K	250°C	523,15 K	300°C	573,15 K	350°C	623,15 K	150°C	673,15 K
bar	Kg/cm²	kJ/kg	kcal/kg	kJ/kg	kcal/kg	kJ/kg	kcal/kg	kJ/kg	kcal/kg	kJ/kg	kcal/kg	kJ/kg	kcal/kg
1	1,019	2769,5	661,5	2869,1	685,3	2969,3	709,1	3068,0	732,8	3169,3	757,0	3271,9	781,5
2	2,039	2761,5	659,6	2864,9	684,3	2965,5	708,2	3065,5	732,2	3167,2	756,5	3270,2	781,1
3	3,058	2752,3	657,4	2806,3	683,2	2962,2	707,4	3063,0	731,6	3165,5	756,1	3268,1	780,6
4	4,077			2855,7	682,1	2958,8	706,6	3060,5	731,0	3163,0	755,5	3266,4	780,2
5	5,097			2850,7	680,9	2955,9	705,9	3058,0	730,4	3160,9	755,0	3265,2	779,9
6	6,116			2845,7	679,7	2952,5	705,1	3055,5	729,8	3158,0	754,5	3263,5	779,5
7	7,136			2840,2	678,4	2949,2	704,3	3053,0	729,2	3157,2	754,1	3261,8	779,1
8	8,155			2835,2	677,2	2945,4	703,4	3050,4	728,6	3155,5	753,7	3260,2	778,7
9	9,174			2829,4	675,8	2942,1	702,6	3047,9	728,0	3153,4	753,2	3258,9	778,4
10	10,194			2823,5	674,4	2938,7	701,8	3045,4	727,4	3151,3	752,7	3257,2	778,0
12	12,232			2809,7	671,1	2931,6	700,1	3039,5	726,0	3147,5	751,8	3254,3	777,3
14	14,271			2797,5	668,2	2923,1	698,2	3034,9	724,9	3143,4	750,8	3251,0	776,5
16	16,310					2915,2	696,3	3029,5	723,6	3139,2	749,8	3247,2	775,6
18	18,349					2908,1	694,6	3024,0	722,3	3150,0	748,8	3243,8	774,8
20	20,387					2899,7	692,6	3018,6	721,0	3130,8	747,8	3240,5	774,0
25	25,484					2877,1	687,2	3004,4	717,6	3120,3	745,3	3232,5	772,1
30	30,581					2852,4	681,3	2989,3	714,0	3109,4	742,7	3223,7	770,0
35	35,678					2823,9	674,5	2973,0	710,1	3098,6	740,1	3215,4	768,0
40	40,775							2956,6	706,2	3087,3	737,4	3207,0	766,0
45	45,872							2939,0	702,0	3075,5	734,6	3198,6	764,0
50	50,968							2921,5	697,8	3063,0	731,6	3189,4	761,8

SPECIFIC HEAT OF SUPERHEATED WATER STEAM

RELATED PRESSURE		200°C	473,15 K	250°C	523,15 K	300°C	573,15 K	350°C	623,15 K	400°C	673,15 K
bar	kg/cm²	kJ/kg K	kcal/kg°C	kJ/kg K	kcal/kg°C	kJ/kg K	kcal/kg°C	kJ/kg K	kcal/kg°C	kJ/kg K	kcal/kg°C
1	1,019	2,001	0,478	2,001	0,478	2,010	0,480	2,031	0,485	2,060	0,492
2	2,039	2,039	0,487	2,014	0,481	2,018	0,482	2,039	0,487	2,068	0,494
3	3,058	2,072	0,495	2,030	0,485	2,031	0,485	2,051	0,490	2,072	0,495
4	4,077	2,110	0,504	2,047	0,489	2,043	0,488	2,060	0,492	2,081	0,497
5	5,097	2,156	0,515	2,068	0,494	2,051	0,490	2,069	0,494	2,089	0,499
6	6,116	2,206	0,527	2,085	0,498	2,064	0,493	2,077	0,496	2,098	0,501
7	7,136	2,252	0,538	2,114	0,505	2,081	0,497	2,085	0,498	2,106	0,503
8	8,155	2,311	0,552	2,135	0,510	2,098	0,501	2,098	0,501	2,114	0,505
9	9,174	2,386	0,570	2,169	0,518	2,114	0,505	2,110	0,504	2,123	0,507
10	10,194	2,457	0,587	2,198	0,525	2,135	0,510	2,123	0,507	2,127	0,508
12	12,232	2,642	0,631	2,265	0,541	2,177	0,520	2,148	0,513	2,144	0,512
14	14,271	2,889	0,690	2,349	0,561	2,219	0,530	2169	0,518	2,160	0,516
16	16,310			2,436	0,582	2,257	0,539	2,194	0,524	2,173	0,519
18	18,349			2,537	0,606	2,298	0,549	2,219	0,530	2,190	0,523
20	20,387			2,646	0,632	2,336	0,558	2,240	0,535	2,206	0,527
25	25,484			2,930	0,700	2,428	0,580	2,298	0,549	2,248	0,537
30	30,581			3,232	0,772	2,533	0,605	2,357	0,563	2,290	0,547
35	35,678			3,550	0,848	2,646	0,632	2,416	0,577	2,332	0,557
40	40,775					2,780	0,664	2,478	0,592	2,370	0,566
45	45,872					2,922	0,698	2,537	0,606	2,407	0,575
50	50,968					3,077	0,735	2,596	0,620	2,449	0,585

SPECIFIC VOLUME OF SUPERHEATED WATER VAPOUR (m³/kg)

ABSOLUTE PRESSURE bar	100°C	150°C	200°C	250°C	300°C	350°C	400°C	450°C	500°C
1	1,697	1,936	2,173	2,406	2,639	2,871	3,103	3,335	3,566
2	-	0,9604	1,081	1,199	1,316	1,434	1,550	1,666	1,782
3	-	0,6345	0,7177	0,7968	0,8758	0,9541	1,032	1,109	1,187
4	-	0,4715	0,5347	0,5956	0,6554	0,7145	0,7732	0,8316	0,8898
5	-	-	0,4254	0,4749	0,5231	0,5707	0,6179	0,6647	0,7115
6	-	-	0,3526	0,3944	0,4350	0,4749	0,5143	0,5535	0,5925
7	-	-	0,3005	0,3369	0,3720	0,4064	0,4403	0,4740	0,5075
8	-	-	0,2615	0,2938	0,3248	0,3550	0,3849	0,4144	0,4438
9	-	-	0,2309	0,2602	0,2880	0,3151	0,3417	0,3680	0,3943
10	-	-	0,2065	0,2333	0,2586	0,2831	0,3072	0,3310	0,3546
12	-	-	0,1699	0,1931	0,2145	0,2352	0,2555	0,2754	0,2952
14	-	-	0,1436	0,1642	0,1830	0,2009	0,2184	0,2357	0,2527
16	-	-	-	0,1426	0,1593	0,1752	0,1907	0,2058	0,2209
18	-	-	-	0,1257	0,1410	0,1553	0,1691	0,1827	0,1961
20	-	-	-	0,1122	0,1262	0,1394	0,1519	0,1641	0,1763
25	-	-	-	0,0876	0,0997	0,1105	0,1208	0,1308	0,1405
30	-	-	-	0,0711	0,0820	0,0913	0,1005	0,1085	0,1168
35	-	-	-	0,05909	0,06919	0,07758	0,08529	0,09265	0,09976
40	-	-	-	0,04986	0,05957	0,06726	0,07416	0,08704	0,08704
50	-	-	-	-	0,04595	0,05275	0,05860	0,06402	0,06920

SIZING OF CONDENSATE TRANSPORT LINES

Approximate pressure drop in mbar per metre of pipe - Capacity in kg/h

DN	0,3 mbar/m	0,5 mbar/m	0,6 mbar/m	0,8 mbar/m	1 mbar/m	1,4 mbar/m
15	95	130	140	**160**	180	220
20	220	290	320	**370**	420	500
25	410	540	600	**690**	790	940
32	890	1180	1300	**1500**	1700	2040
40	1360	1790	2000	**2290**	2590	3100
50	2630	3450	3810	**4390**	4990	6000
65	5350	6950	7730	**8900**	10150	12100
80	8320	10900	12000	**13800**	15650	18700
100	17000	22200	24500	**28200**	31900	38000
125	32600	42600	47000	**54100**	61200	73000
150	62700	81800	90300	**104000**	117600	140000

ANSI STEAM PIPE SIZING SCHEDULE 80
(CAPACITY IN KG/H)

Pressure bar	Speed m/s	Nominal diameter (mm)													
		15	20	25	32	40	50	65	80	100	125	150	200	250	300
0,4	15	7	14	24	37	52	99	145	213	394	648	917	1606	2590	3678
	25	10	25	40	62	92	162	265	384	675	972	1457	2806	4101	5936
	40	17	35	64	102	142	265	403	576	1037	1670	2303	4318	6909	9500
0,7	15	7	16	25	40	59	109	166	250	431	680	1006	1708	2791	3852
	25	12	25	45	72	100	182	287	430	716	1145	1575	2816	4629	6204
	40	18	37	68	106	167	298	428	630	1108	1712	2417	4532	7251	10323
1,0	15	8	17	29	43	65	112	182	260	470	694	1020	1864	2814	4045
	25	12	26	48	72	100	193	300	445	730	1160	1660	3099	4869	6751
	40	19	39	71	112	172	311	465	640	1150	1800	2500	4815	7333	10370
2,0	15	12	25	45	70	100	182	280	410	715	1125	1580	2814	4545	6277
	25	19	43	70	112	162	295	428	656	1215	1755	2520	4815	7425	10575
	40	30	64	115	178	275	475	745	1010	1895	2925	4175	7678	11997	16796
3,0	15	16	37	60	93	127	245	385	535	925	1505	2040	3983	6217	8743
	25	26	56	100	152	225	425	632	910	1580	2480	3440	6779	10269	14316
	40	41	87	157	250	357	595	1025	1460	2540	4050	5940	10476	16470	22950
4,0	15	19	42	70	108	156	281	432	635	1166	1685	2460	4618	7121	10358
	25	30	63	115	180	270	450	742	1080	1980	2925	4225	7866	12225	17304
	40	49	116	197	295	456	796	1247	1825	3120	4940	7050	12661	19663	27816
5,0	15	22	49	87	128	187	352	526	770	1295	2105	2835	5548	8586	11947
	25	36	81	135	211	308	548	885	1265	2110	3540	5150	8865	14268	20051
	40	59	131	225	338	495	855	1350	1890	3510	5400	7870	13761	23205	32244
6,0	15	26	59	105	153	225	425	632	925	1555	2525	3400	6654	10297	14328
	25	43	97	162	253	370	658	1065	1520	2530	4250	6175	10629	17108	24042
	40	71	157	270	405	595	1025	1620	2270	4210	6475	9445	16515	27849	38697
7,0	15	29	63	110	165	260	445	705	952	1815	2765	3990	7390	12015	16096
	25	49	114	190	288	450	785	1205	1750	3025	4815	6900	12288	19377	27080
	40	76	177	303	455	690	1210	1865	2520	4585	7560	10880	19141	30978	43470
8,0	15	32	70	126	190	285	475	800	1125	1990	3025	4540	8042	12625	17728
	25	54	122	205	320	465	810	1260	1870	3240	5220	7120	13140	21600	33210
	40	84	192	327	510	730	1370	2065	3120	5135	8395	12470	21247	33669	46858
10,0	15	41	95	155	250	372	626	1012	1465	2495	3995	5860	9994	16172	22713
	25	66	145	257	405	562	990	1530	2205	3825	6295	8995	15966	25860	35890
	40	104	216	408	615	910	1635	2545	3600	6230	9880	14390	26621	41011	57560
14,0	15	50	121	205	310	465	810	1270	1870	3220	5215	7390	12921	20538	29016
	25	85	195	331	520	740	1375	2080	3120	5200	8500	12560	21720	34139	47218
	40	126	305	555	825	1210	2195	3425	4735	8510	13050	18630	35548	54883	46534

INITIAL HEATING CONDENSATION IN PIPE FOR STEAM TRANSPORT

Kg of condensed saturated steam per 10 m of pipe

Start-up time not exceeding 20 minutes

Relative pressure bar	DN25 1"	DN32 1.¼"	DN40 1.½"	DN50 2"	DN65 2½"	DN80 3"	DN100 4"	DN125 5"	DN150 6"	DN200 8"	DN250 10"	DN300 12"	DN350 14"	DN400 16"	DN450 18"	DN500 20"	DN600 24"
0,1	0,53	0,74	0,89	1,18	1,55	2,18	3,51	4,41	6,35	9,53	13,77	16,83	18,87	24,48	30,60	36,72	45,70
0,5	0,61	0,82	0,97	1,36	2,20	2,79	3,98	4,97	7,02	10,51	14,79	18,67	21,93	28,46	35,19	42,02	58,65
1,0	0,67	0,92	1,09	1,46	2,39	3,06	4,43	5,54	7,69	11,53	16,63	20,40	23,36	30,50	38,35	45,39	63,04
1,5	0,73	0,99	1,17	1,57	2,55	3,30	4,75	6,04	8,16	13,06	17,95	21,83	26,21	34,27	43,45	50,90	70,99
2,0	0,79	1,05	1,23	1,65	2,61	3,50	5,08	6,58	8,67	13,26	18,56	22,95	28,05	36,72	46,51	55,49	76,19
3,0	0,87	1,15	1,38	1,76	2,90	3,88	5,51	7,07	9,49	14,79	21,11	25,30	30,60	40,39	50,90	58,70	83,44
4,0	0,93	1,25	1,50	1,94	3,03	4,08	5,94	7,93	10,20	15,61	22,13	27,23	34,73	44,88	56,71	65,40	92,92
5,0	0,99	1,35	1,60	2,04	3,33	4,42	6,34	8,16	10,81	16,63	23,46	28,97	37,13	48,14	61,20	71,81	100,37
7,0	1,07	1,48	1,76	2,28	3,63	4,83	6,80	9,18	12,04	18,16	26,01	31,62	39,78	52,02	65,69	77,32	107,71
10,0	1,21	1,68	1,98	2,48	4,08	5,44	7,65	10,20	13,36	20,09	28,75	34,68	44,37	58,55	73,85	86,90	121,38
12,0	1,28	1,73	2,06	2,62	4,31	5,78	7,96	10,61	14,08	21,22	30,40	37,13	47,33	62,22	78,13	91,80	128,01
14,0	1,35	1,84	2,17	2,78	4,59	5,99	8,51	11,42	14,79	22,24	31,72	39,07	49,57	64,26	81,80	96,39	134,23
16,0	1,40	1,93	2,30	2,92	4,69	6,19	8,82	12,04	15,50	23,26	33,15	40,80	51,41	66,71	85,27	100,88	137,70
18,0	1,47	3,03	2,33	3,06	4,74	6,46	9,18	12,36	16,12	24,07	34,37	41,82	53,55	69,97	88,23	103,94	144,80
21,0	1,73	3,06	2,96	4,51	6,87	9,53	13,42	18,36	25,61	38,95	57,80	79,52	95,36	122,40	153,31	187,58	285,60
28,0	2,57	3,88	4,49	4,92	7,64	10,20	14,93	20,40	28,49	43,26	64,26	88,49	105,88	136,17	174,22	208,69	295,80
35,0	3,60	4,59	5,48	5,71	8,30	11,14	16,24	22,44	30,98	47,03	69,83	96,04	115,16	148,10	185,44	226,64	321,81
42,0	4,08	5,51	5,68	6,12	9,34	12,04	17,57	24,38	33,50	50,90	75,40	103,94	124,44	160,14	200,63	244,70	348,02

STEADY CONDENSING IN PIPES FOR STEAM TRANSPORT

Kg/h saturated steam condensed for 10 m of insulated pipe (with average efficiency)

In quiet air 10° C

Relative pressure bar	DN25 1"	DN32 1.¼"	DN40 1.½"	DN50 2"	DN65 2½"	DN80 3"	DN100 4"	DN125 5"	DN150 6"	DN200 8"	DN250 10"	DN300 12"	DN350 14"	DN400 16"	DN450 18"	DN500 20"	DN600 24"
0,1	0,51	0,61	0,71	0,81	0,91	1,22	1,53	1,63	2,14	2,75	3,37	4,08	4,89	5,71	6,32	7,34	7,85
0,5	0,61	0,71	0,81	0,96	1,12	1,42	1,73	1,83	2,55	3,26	3,98	4,89	5,30	6,69	7,14	8,06	8,67
1,0	0,71	0,81	0,96	1,12	1,32	1,63	2,04	2,55	2,85	3,72	4,59	5,61	6,22	7,14	7,65	8,77	10,00
1,5	0,84	0,91	1,02	1,22	1,53	1,83	2,24	2,85	3,16	4,08	5,10	6,22	7,24	7,75	8,67	9,89	12,90
2,0	0,91	1,02	1,12	1,32	1,63	1,93	2,44	3,16	3,46	4,49	5,51	6,73	7,96	8,98	9,69	10,71	13,36
3,0	0,96	1,12	1,32	1,53	1,83	2,24	2,85	3,87	4,08	5,10	6,33	7,65	9,59	10,51	10,81	12,04	14,28
4,0	1,02	1,22	1,42	1,73	2,04	2,55	3,16	4,59	4,48	5,71	7,04	8,47	10,20	11,73	12,65	14,08	16,93
5,0	1,22	1,32	1,63	1,93	2,24	2,65	3,46	4,79	4,99	6,22	7,65	9,18	11,22	13,36	13,87	15,81	19,48
7,0	1,32	1,53	1,83	2,14	2,55	3,16	3,97	5,40	5,71	7,24	8,87	10,51	12,64	14,48	15,81	17,65	21,22
10,0	1,53	1,83	2,04	2,55	3,06	3,67	4,69	5,61	6,73	8,47	10,51	12,75	13,97	16,62	17,85	19,79	23,46
12,0	1,73	2,04	2,34	2,75	3,36	3,97	5,10	6,12	7,34	9,28	11,73	13,87	15,91	18,36	19,69	22,24	26,62
14,0	1,83	2,24	2,55	3,06	3,57	4,28	5,50	6,63	7,99	9,99	12,75	14,99	16,52	19,69	20,40	23,26	29,27
16,0	1,93	2,34	2,75	3,26	3,87	4,59	5,91	7,44	8,46	11,02	13,46	16,22	17,54	20,71	22,34	24,58	29,38
18,0	2,14	2,55	2,85	3,46	4,18	4,89	6,22	8,16	8,97	12,04	13,97	16,83	19,07	21,93	23,66	26,52	32,03
21,0	2,34	3,06	3,36	3,67	4,59	5,61	6,93	8,67	10,20	13,36	16,12	19,07	21,01	23,87	25,81	29,27	34,99
28,0	2,55	3,67	4,28	4,48	5,30	6,32	8,16	9,99	11,93	14,99	18,67	22,44	24,58	28,05	30,70	34,17	40,80
35,0	3,67	4,08	4,89	5,1	6,22	7,34	9,28	11,52	13,77	17,14	21,22	25,50	28,05	32,33	35,09	39,17	46,21
42,0	4,08	4,89	5,20	5,71	6,93	8,16	10,20	12,75	15,30	20,19	24,17	28,76	31,62	36,31	39,47	43,86	52,33

For average efficiency, it has been considered the one that reduces heat losses to 25% compared to bare pipes (generally the insulation, more or less effective, reduces dispersion from 10 to 33%)

Dilatazioni lineari per le tubazioni *(ASME BPVC.II.D.M.2017)*

Linear piping expansions (ASME BPVC.II.D.M.2017)

Temperatura *Temperature* °C	Temperatura *Temperature* °F	Coefficienti per Acciaio al Carbonio e Bassi Legati *Coefficents for Carbon and Low Alloy* mm/m	Coefficienti per Acciaio Austenitico *Coefficents for Austenitic Stainless Steel* mm/m	Coefficienti per N06600 *Coefficents for N06600* mm/m	Coefficienti per N06625 *Coefficents for N06625* mm/m	Coefficienti per N08800, N08801, N08810 e N08811 *Coefficents for N08800, N08801, N08810 e N08811* mm/m
20	68	0	0	0	0	0
50	122	0.4	0.5	0.4	0.4	0.4
75	167	0.7	0.9	0.7	0.7	0.8
100	212	1.0	1.3	1.0	1.0	1.2
125	257	1.3	1.7	1.4	1.4	1.6
150	302	1.6	2.2	1.7	1.7	2.0
175	347	2.0	2.6	2.1	2.0	2.4
200	392	2.3	3.1	2.4	2.4	2.8
225	437	2.6	3.5	2.8	2.7	3.3
250	482	3.0	4.0	3.2	3.0	3.7
275	527	3.4	4.5	3.5	3.4	4.1
300	572	3.7	4.9	3.9	3.7	4.5
325	617	4.1	5.4	4.3	4.1	5.0
350	662	4.5	5.9	4.7	4.4	5.4
375	707	4.9	6.4	5.1	4.8	5.8
400	752	5.3	6.9	5.5	5.1	6.3
425	797	5.7	7.4	5.9	5.5	6.7
450	842	6.1	7.9	6.3	5.9	7.2
475	887	6.5	8.3	6.7	6.3	7.6
500	932	6.9	8.9	7.1	6.7	8.1
525	977	7.3	9.4	7.5	7.1	8.5
550	1022	7.7	9.9	7.9	7.5	9.0
575	1067	8.2	10.4	8.4	8.0	9.5
600	1112	8.6	10.9	8.8	8.4	9.9
625	1157	9.0	11.4	9.3	8.8	10.4
650	1202	9.4	12.0	9.7	9.3	10.9
675	1247	9.9	12.5	10.2	9.8	11.4
700	1292	10.3	13.1	10.7	10.2	11.9
725	1337	10.7	13.6	11.1	10.7	12.4
750	1382	11.1	14.1	11.6	11.2	12.9
775	1427	11.6	14.7	12.1	11.6	13.4
800	1472	12.0	15.2	12.6	12.1	14.0
825	1517	12.5	15.6	13.1	12.6	14.5

Distanze consigliate dei supporti (ASME B31.1 2016)

Suggested steel pipe support spacing (ASME B31.1 2016)

Dim. Nominale Tubo *Nominal Pipe Size* NPS	Diametro Nominale *Nominal Diameter* DN	Distanza Massima Consigliata *Suggested Maximum Span*			
		Servizio Acqua *Water Service*		Servizio Vapore, Gas o Aria *Steam, Gas or Air Service*	
		ft	m	ft	m
1	25	7	2.1	9	2.7
2	50	10	3.0	13	4.0
3	80	12	3.7	15	4.6
4	100	14	4.3	17	5.2
6	150	17	5.2	21	6.4
8	200	19	5.8	24	7.3
12	300	23	7.0	30	9.1
16	400	27	8.2	35	10.7
20	500	30	9.1	39	11.9
24	600	32	9.8	42	12.8

Tabelle di conversione unità di misura

Measure unit conversion tables

Da *From*	A *To*	Moltiplicare per *Multiply by*
at	atm	0,967841105
at	bar	0,980665
at	hbar	0,00980665
at	kg/cm^2	1
at	kg/mm^2	0,01
at	kpsi	0,014223343
at	mbar	980,665
at	mm d'acqua	10000
at	N/mm^2	0,0980665
at	Pa	98066,5
at	psi	14,22334331
at	torr	735,5612727
atm	at	1,033227453
atm	bar	1,01325
atm	hbar	0,0101325
atm	kg/cm^2	1,033227453
atm	kg/mm^2	0,010332275
atm	kpsi	0,014695949
atm	mbar	1013,25
atm	mm d'acqua	10332,27453
atm	mm Hg	760,0021002
atm	MPa	0,101325
atm	N/mm^2	0,101325
atm	N/m^2	101325
atm	Pa	101325
atm	psi	14,69594878
atm	torr	760,0021002
bar	at	1,019716213
bar	atm	0,986923267
bar	hbar	0,01
bar	kg/cm^2	1,019716213
bar	kg/dm^2	101,9716213
bar	kg/mm^2	0,010197162
bar	kg/m^2	10197,16213
bar	kpsi	0,014503774
bar	mbar	1000
bar	mm d'acqua	10197,16213
bar	mm Hg	750,0637554
bar	MPa	0,1
bar	N/cm^2	10
bar	N/dm^2	1000
bar	N/mm^2	0,1
bar	N/m^2	100000
bar	Pa	100000
bar	psf	2088,543423
bar	psi	14,50377377
bar	torr	750,0637554
bar	kPa	100
Btu [IT]	cal	251,9957611
Btu [IT]	J	1055,055853
Btu [IT]	kcal	0,251995761
BTU[IT]/lb	kcal/kg	0,555555556
cal	Btu [IT]	0,003968321
cal	J	4,1868
cal	kcal	0,001
cal	kW-h	0,000001163
cal	W-h	0,001163

Da *From*	A *To*	Moltiplicare per *Multiply by*
cm	dm	0,1
cm	ft	0,032808399
cm	in	0,393700787
cm	m	0,01
cm	mm	10
cm/cm	in/in	1
cm/cm	mm/mm	1
cm/s	m/s	0,01
cm/s	dm/s	0,1
cm/s	ft/s	0,032808399
cm/s	in/s	0,393700787
cm/s	km/h	0,036
cm/s	mm/s	10
cm/s^2	g	980,665
cm/s^2	mm/s^2	10
cm^2	dm^2	0,01
cm^2	ft^2	0,001076391
cm^2	in^2	0,15500031
cm^2	mm^2	100
cm^2	nr	0,0001
cm^2/s	ft^2/h	3,87500775
cm^2/s	ft^2/s	0,001076391
cm^2/s	in^2/s	0,15500031
cm^2/s	mm^2/s	100
cm^2/s	m^2/s	0,0001
cm^2/s	mm^2/s	10
cm^3	dm^3	0,001
cm^3	ft^3	3,53E-05
cm^3	m^3	0,061023744
cm^3	m^3	0,000001
cm^3	mm^3	1000
CV	kg-m/s	75
CV	kW	0,73549875
CV	W	735,49875
daN	9	1019,716213
daN	kg	1,019716213
daN	kN	0,01
daN	lb	2,248089431
daN	N	10
deg	rad	0,017453293
deg	mrad	17,45329255
dm	cm	10
dm	ft	0,32808399
dm	in	3,937007874
dm	m	0,1
dm	mm	100
dm/s	cm/s	10
dm/s	m/s	0,1
dm/s	ft/s	0,32808399
dm/s	in/s	3,937007874
dm/s	km/h	0,36
dm/s	mm/s	100
dm/s^2	mm/s^2	100
dm^2	cm^2	100
dm^2	ft^2	0,107639104
dm^2	in^2	15,500031
dm^2	mm^2	10000

Da *From*	A *To*	Moltiplicare per *Multiply by*
dm^2	m^2	0,01
dm^2/s	mm^2/s	100
dm^3	cm^3	1000
dm^3	ft^3	0,035314667
dm^3	in^3	61,02374409
dm^3	m^3	0,001
dm^3	mm^3	1000000
Frequenza	Hz	1
ft	cm	30,48
ft	dm	3,048
ft	in	12
ft	m	0,3048
ft	mm	304,8
ft/s	cm/s	30,48
ft/s	dm/s	3,048
ft/s	m/s	0,3048
ft/s	in/s	12
ft/s	km/h	1,09728
ft/s	mm/s	304,8
ft/s^2	mm/s^2	304,8
ft/s^2	g	32,17404856
ft-lb/BTU	kgm/kcal	0,54864
ft^2	cm^2	929,0304
ft^2	dm^2	9,290304
ft^2	in^2	144
ft^2	mm^2	92903,04
ft^2	m^2	0,09290304
ft^2/h	cm^2/s	0,258064
ft^2/h	ft^2/s	0,000277778
ft^2/h	in^2/s	0,04
ft^2/h	mm^2/s	25,8064
ft^2/h	m^2/s	2,58064E-05
ft^2/s	cm7s	929,0304
ft^2/s	ft^2/h	3600
ft^2/s	in^2/s	144
ft^2/s	mm^2/s	92903,04
ft^2/s	m^2/s	0,09290304
ft^3	cm^3	28316,84659
ft^3	dm^3	28,31684659
ft^3	m^3	0,028316847
g	daN	0,000980665
g	kg	0,001
g	ft/s^2	0,03108095
g	cm/s^2	0,001019716
g	m/s^2	0,101971621
g/cm^3	kg/cm^3	0,001
g/cm^3	kg/m^3	1000
g/cm^3	kg/dm^3	1
g/cm^3	kg/mm^3	0,000001
g/cm^3	lb/in^3	0,036127292
g/cm^3	lb/ft^3	62,42796058
h	s	3600
hbar	at	101,9716213
hbar	atm	98,69232667
hbar	bar	100
hbar	kg/cm^2	101,9716213
hbar	kg/mm^2	1,019716213

Tabelle di conversione unità di misura

Measure unit conversion tables

Da *From*	A *To*	Moltiplicare per *Multiply by*
hbar	kpsi	1,450377377
hbar	mbar	100000
hbar	mm d'acqua	1019716.213
hbar	MPa	10
hbar	N/mm^2	10
hbar	Pa	10000000
hbar	psi	1450.377377
hbar	ton	75006.37554
hbar	kPa	10000
Hz	Frequenza	1
in	cm	2,54
in	dm	0.254
in	ft	0.083333333
in	m	0.0254
in	mm	25.4
in/(100 ft)	in/in	0.000833333
in/(100 ft)	mm/mm	0,000833333
in/(100 ft)	mm/m	0.833333333
in/(in/"F)	mm/(mm/°C)	1.8
in/in	cm/cm	1
in/in	mm/mm	1
in/in	in/(100 ft)	1200
in/in	mm/m	1000
in/s	cm/s	2,54
in/s	dm/s	0.254
in/s	m/s	0.0254
in/s	ft/s	0.083333333
in/s	km/h	0.09144
in/s	mm/s	25.4
in/s^2	mm/s^2	25.4
in^2	cm^2	6,4516
in^2	dm^2	0,064516
in^2	ft^2	0,006944444
in^2	mm^2	645,16
in^2/s	cm^2/s	6,4516
in^2/s	ft^2/h	25
in^2/s	ft^2/s	0.006944444
in^2	cm^3	16.387064
in^3	dm^3	0,016387064
in^3	m^3	1.63871E-05
in^3	mm^3	16387,064
in^3/lb	m^3/kg	3.61273E-05
J	Btu [IT]	0.000947817
J	cal	0.238845897
J	kcal	0.000238846
J	kW-h	2.778E-07
J	N-m	1
J	W-h	0,000277778
kcal	Btu [IT]	3.968320719
kcal	cal	1000
kcal	J	4186.8
kcal/kg	BTU[IT]/lb	1.8
kg	daN	0,980665
kg	kN	0,00980665
kg	lb	2.204622622
kg	N	9,80665
kg	g	1000

Da *From*	A *To*	Moltiplicare per *Multiply by*
kg/cm	kg/mm	0 1
kg/cm	lb/in	5,59974146
kg/cm	N/mm	0,980665
kg/cm^2	at	1
kg/cm^2	atm	0.967841105
kg/cm^2	bar	0.980665
kg/cm^2	hbar	0.00980665
kg/cm^2	kg/dm^2	100
kg/cm^2	kg/mm^2	0.01
kg/cm^2	kg/m^2	10000
kg/cm^2	kPa	98,0665
kg/cm^2	kpsi	0,014223343
kg/cm^2	mbar	980.665
kg/cm^2	mm d'acqua	10000
kg/cm^2	mm Hg	735,5612727
kg/cm^2	MPa	0.0980665
kg/cm^2	N/cm^2	9.80665
kg/cm^2	N/dm'	980,665
kg/cm^2	N/mm^2	0.0980665
kg/cm^2	N/m^2	98066.5
kg/cm^2	Pa	98066.5
kg/cm^2	psf	2048.161436
kg/cm^2	psi	14,22334331
kg/cm^2	torr	735,5612727
kg/cm^2	kg/m^3	1000000
kg/cm^2	g/cm^3	1000
kg/cm^2	kg/dm^3	1000
kg/cm^2	kg/mm'	0.001
kg/cm^2	lb/in^3	36.127292
kg/cm^2	lb/ff	62427.96058
kg/dm^2	bar	0,00980665
kg/dm^2	kg/cm^2	0.01
kg/dm^2	kg/mm^2	0,0001
kg/dm^2	kg/m^2	100
kg/dm^2	MPa	0.000980665
kg/dm^2	N/cm^2	0.0980665
kg/dm^2	N/dm^2	9.80665
kg/dm^2	N/mm^2	0.000980665
kg/dm^2	N/m^2	980,665
kg/dm^3	kg/m^3	1000
kg/dm^3	kg/cm^3	0.001
kg/dm^3	kg/mm^3	0.000001
kg/dm^3	g/cm^3	1
kg/dm^3	lb/in^3	0.036127292
kg/dm^3	lb/ft^3	62,42796058
kg/dm^3	T/mm^3	0,000000001
kg/h	kg/min	0,016666667
kg/h	kg/s	0,000277778
kg/m	lb/ft	0.671968975
kg/m	kg/mm	0.001
kg/m^2	bar	9.80665E-05
kg/m^2	kg/cm^2	0,0001
kg/m^2	kg/dm^2	0.01
kg/m^2	kg/mm^2	0,000001
kg/m^2	MPa	9.807E-07
kg/m^3	lb/ft^3	0.062427961
kg/m^3	kg/dm^3	0.001

Da *From*	A *To*	Moltiplicare per *Multiply by*
kg/m^3	kg/cm^3	0.000001
kg/m^3	kg/mm^3	0.000000001
kg/m^3	g/cm^3	0,001
kg/m^3	lb/in^3	3.61273E-05
kg/min	kg/h	60
kg/mm	kg/cm	10
kg/mm	N/mm	9.80665
kg/mm	lb/in	55.9974146
kg/mm	N/cm	98,0665
kg/mm^2	at	100
kg/mm^2	atm	96.78411054
kg/mm^2	bar	98,0665
kg/mm^2	hbar	0.980665
kg/mm^2	kg/cm^2	100
kg/mm^2	kg/dm^2	10000
kg/mm^2	kg/m^2	1000000
kg/mm^2	kPa	9806.65
kg/mm^2	kpsi	1,422334331
kg/mm^2	MPa	9,80665
kg/mm^2	N/cm^2	980,665
kg/mm^2	N/dm^2	98066.5
kg/mm^2	N/mm^2	9.80665
kg/mm^2	N/m^2	9806650
kg/mm^2	Pa	9806650
kg/mm^2	psi	1422,334331
kg/mm^2	psf	204816.1436
kg/mm^2	lb/ft^2	204816.1436
kg/mm^2	lb/in^2	1422.334331
kg/mm^3	lb/in^3	36127.292
kg/mm^3	kg/m^3	1000000000
kg/mm^3	kg/dm^3	1000000
kg/mm^3	kg/cm^3	1000
kg/mm^3	g/cm^3	1000000
kg/mm^3	lb/ft^3	62427960.58
kg/s	kg/h	3600
kg/s	lb/s	2.204622622
kg m	lb-ft	7.233013851
kg m	lb-in	86,79616621
kg m	N-m	9,80665
kg-m/deg	lb in/deg	86.79616621
kg-m/deg	N-m/deg	9,80665
kgm/kcal	ft lb/BTU	1.82268883
kg-m/s	CV	0.013333333
kg-m/s^2	N	1
km/h	cm/s	27.77777778
km/h	dm/s	2,777777778
km/h	m/s	0,277777778
km/h	ft/s	0,911344415
km/h	in/s	10.93613298
km/h	mm/s	277,7777778
kN	daN	100
kN		101,9716213
kN-m	kN-mm	1000
kN-m	N-mm	1
kN-m/deg	kN-m/rad	57.29577951
kN-m/rad	kN-m/deg	0.017453293
kN-m/rad	kN-mm/deg	17.4532925

Tabelle di conversione unità di misura

Measure unit conversion tables

Da *From*	A *To*	Moltiplicare per *Multiply by*
kN m/rad	N-mm/deg	0.017453293
kN-mm	kN-m	0,001
kN-mm/deg	kN m/rad	0.05729578
kPa	kg/cm^2	0.010197162
kPa	kg/mm^2	0,000101972
kPa	kpsi	0.000145038
kPa	MPa	0,001
kPa	N/cm^2	0,1
kPa	N/dm^2	10
kPa	N/mm^2	0,001
kPa	N/m^2	1000
kPa	Pa	1000
kPa	psi	0.145037738
kPa	bar	0,01
kPa	hbar	0,0001
kPa	mbar	100
kpsi	at	70.30695796
kpsi	atm	68,04596391
kpsi	bar	68,94757293
kpsi	hbar	0.689475729
kpsi	kg/cm^2	70.30695796
kpsi	kg/mm^2	0,70306958
kpsi	kPa	6894.757293
kpsi	MPa	6.894757293
kpsi	Pa	6894757.293
kpsi	psi	1000
kpsi	N/mm^2	6.894757293
kW	CV	1,359621617
kW-h	cal	859845.2279
kWh	J	3600000
kWh	W-h	1000
lb	daN	0,444822162
lb	kg	0.45359237
lb	N	4.448221615
lb/ft	kg/m	1.488163944
lbffi^2	kg/mm^2	4.88243E-06
lb/ft^3	kg/m^3	16,01846337
lb/ft^3	kg/mm^3	1.60185E-08
lb/ft^3	kg/cm^3	1.60185E-05
lb/ft^3	kg/dm^3	0.016018463
lb/ft^3	g/cm^3	0.016018463
lb/ft^3	lb/in^3	0,000578704
lb/in	kg/cm	0.178579673
lb/in	N/mm	0.175126835
lb/in	kg/mm	0.017857967
lb/in	N/cm	1.751268352
lb/in^2	N/dm^2	68,94757293
lb/in^2	N/cm^2	0.689475729
lb/in^2	N/mm^2	0,006894757
lb/in^2	kg/mm^2	0,00070307
lb/in^3	kg/mm^3	2.76799E-05
lb/in^3	kg/m^3	27679,90471
lb/irf^3	kg/cm^3	0,027679905
lb/in^3	kg/dm^3	27.67990471
lb/in^3	g/cm^3	27,67990471
lb/irf^3	lb/ft^3	1728
lb/s	kg/s	0.45359237
lb-ft	kg m	0,138254954

Da *From*	A *To*	Moltiplicare per *Multiply by*
lb-ft	N-m	1,355817948
lb-in	kg m	0,011521246
lb-in	N-m	0,112984829
lb-in/deg	kg-m/deg	0.011521246
lb in/deg	N-m/deg	0,112984829
m	erri	100
m	dm	10
m	ft	3,280839895
m	in	39.37007874
m	mm	1000
m/s	cm/s	100
m/s	dm/s	10
m/s	ft/s	3.280839895
m/s	in/s	39.37007874
m/s	km/h	3.6
m/s	mm/s	1000
m/s^2	g	9.80665
m/s^2	mm/s^2	1000
m^2	cm^2	10000
m^2	dm^2	100
m^2	ft^2	10.76391042
m^2/s	cm^2/s	10000
m^2/s	ft^2/h	38750.0775
m^2/s	ft^2/s	10.76391042
m^2/s	mm^2/s	1000
m^3	cm^3	1000000
m^3	dm^3	1000
m^3	ft^3	35.31466672
m^3	in^3	61023,74409
m^3/kg	ln^3/lb	27679,90823
mbar	at	0.001019716
mbar	atm	0,000986923
mbar	bar	0.001
mbar	hbar	0.00001
mbar	kg/cm^2	0,001019716
mbar	mm d'acqua	10.19716213
mbar	mm Hg	0.750063755
mbar	MPa	0.0001
mbar	N/m^2	100
mbar	Pa	100
mbar	psi	0.014503774
mbar	torr	0,750063755
mbar	kPa	0.01
mm	cm	0.1
mm	dm	0.01
mm	fi	0,00328084
mm	in	0.039370079
mm	m	0.001
mm d'acqua	at	0.0001
mm d'acqua	atm	9.67841E-05
mm d'acqua	bar	9.80665E-05
mm d'acqua	hbar	9.807E-07
mm d'acqua	kg/cm^2	0.0001
mm d'acqua	mbar	0.0980665
mm d'acqua	mm Hg	0,073556127
mm d'acqua	MPa	9.8067E-06
mm d'acqua	N/m^2	9,80665
mm d'acqua	Pa	9.80665

Da *From*	A *To*	Moltiplicare per *Multiply by*
mm d'acqua	psi	0,001422334
mm d'acqua	torr	0,073556127
mm Hg	atm	0.001315786
mm Hg	bar	0.00133322
mm Hg	kg/cm^2	0,001359506
mm Hg	mbar	1.33322
mm Hg	mm d'acqua	13,59506049
mm Hg	MPa	0,000133322
mm Hg	N/m^2	133,322
mm Hg	Pa	133,322
mm Hg	psi	0,019336721
mm Hg	torr	1
mm/(mm/°C)	in/(in/°F)	0.555555556
mm/m	in/(100-ft)	1.2
mm/m	mm/mm	0.001
mm/m	in/in	0.001
mm/mm	cm/cm	1
mm/mm	in/in	1
mm/mm	in/(100 ft)	1200
mm/mm	mm/m	1000
mm/s	cm/s	0.1
mm/s	dm/s	0.01
mm/s	ft/s	0.00328084
mm/s	in/s	0.039370079
mm/s	m/s	0.001
mm/s	km/h	0.0036
mm/s^2	ft/s^2	0.00328084
mm/s^2	cm/s^2	0.1
mm/s^2	dm/s^2	0.01
mm/s^2	m/s^2	0.001
mm/s^2	in/s^2	0.039370078
mm^2	cm^2	0.01
mm^2	dm^2	0.0001
mm^2	fi^2	1.07639E-05
mm^2	in^2	0,001550003
mm^2/s	cm^2/s	0.01
mm^2/s	ft^2/h	0.038750078
mm^2/s	ft^2/s	1.07639E-05
mm^2/s	cm^2/s	0.1
mm^2/s	dm^2/s	0.01
mm^2/s	m^2/s	0.001
mm^3	cm^3	0.001
mm^3	dm^2	0,000001
mm^3	in^2	6.10237E-05
MPa	atm	9,869232667
MPa	bar	10
MPa	hbar	0.1
MPa	kg/cm^2	10.19716213
MPa	kg/dm^2	1019.716213
MPa	kg/mm^2	0,101971621
MPa	kg/m^2	1019716.213
MPa	kPa	1000
MPa	kpsi	0,145037738
MPa	mbar	10000
MPa	mm d'acqua	101971.6213
MPa	mm Hg	7500.637554
MPa	N/cm^2	100
MPa	N/dm^2	10000

Tabelle di conversione unità di misura

Measure unit conversion tables

Da *From*	A *To*	Moltiplicare per *Multiply by*
MPa	N/mm^2	1
MPa	N/m^2	1000000
MPa	Pa	1000000
MPa	psi	145.0377377
MPa	torr	7500.637554
mrad	rad	0,001
mrad	deg	0.05729578
N	daN	0.1
N	kg	0.101971621
N	kg-m/s^2	1
N	lb	0.224808943
N/cm	kg/mm	0,010197162
N/cm	N/mm	0,1
N/cm	lb/in	0,571014715
N/cm^2	bar	0,1
N/cm^2	kg/cm^2	0.101971621
N/cm^2	kg/dm^2	10.19716213
N/cm^2	kg/mm^2	0.001019716
N/cm^2	kPa	10
N/cm^2	MPa	0,01
N/cm^2	N/dm^2	100
N/cm^2	N/mm^2	0,01
N/cm^2	N/m^2	10000
N/cm^2	Pa	10000
N/cm^2	psi	1,450377377
N/cm^2	lb/in^2	1.450377377
N/dm^s	bar	0,001
N/dm^2	kg/cm^2	0.001019716
N/dm^2	kg/dm^2	0.101971621
N/dm^2	kg/mm^2	1.01972E-05
N/dm^2	kPa	0,1
N/dm^2	MPa	0.0001
N/dm^2	N/cm^2	0,01
N/dm^2	N/mm^2	0,0001
N/dm^2	N/m^2	100
N/dm^2	Pa	100
N/dm^2	psi	0.014503773
N/dm^2	lb/in^2	0.014503773
N/m^2	atm	9.8692E-06
N/m^2	bar	0.00001
N/m^2	kg/cm^2	1.01972E-05
N/m^2	kg/dm^2	0.001019716
N/m^2	kg/mm^2	0,000000102
N/m^2	kPa	0,001
N/m^2	mbar	0,01
N/m^2	mm d'acqua	0.101971621
N/m^2	mm Hg	0.007500638
N/m^2	MPa	0.000001

Da *From*	A *To*	Moltiplicare per *Multiply by*
N/m^2	N/cm^2	0.0001
N/m^2	N/dm^2	0.01
N/m^2	N/mm^2	0,000001
N/m^2	Pa	1
N/m^2	psi	0,000145038
N/m^2	torr	0.007500638
N/mm	kg/cm	1.019716213
N/mm	lb/in	5.710147155
N/mm	kg/mm	0.101971621
N/mm	N/cm	10
N/mm^2	at	10.19716213
N/mm^2	atm	9,869232667
N/mm^2	bar	10
N/mm^2	hbar	0.1
N/mm^2	kg/cm^2	10.19716213
N/mm^2	kg/dm^2	1019.716213
N/mm^2	kg/mm^2	0.101971621
N/mm^2	kPa	1000
N/mm^2	MPa	1
N/mm^2	N/cm^2	100
N/mm^2	N/dm^2	10000
N/mm^2	N/m^2	1000000
N/mm^2	Pa	1000000
N/mm^2	kpsi	0.145037738
N/mm^2	psi	145,0377377
N/mm^2	lb/in^2	145.0377377
N-m	J	1
N-m	kg m	0.101971621
N-m	Lb-ft	0,737562149
N-m	lb-in	8.850745791
N-m/deg	kg m/deg	0.101971621
N-m/deg	lbin/deg	8.850745791
N mm	kN-m	1
N-mm/deg	kN-m/rad	57,29577951
Pa	at	1.01972E-05
Pa	atm	9.8692E-06
Pa	bar	0.00001
Pa	hbar	0.0000001
Pa	kg/cm^2	1.01972E-05
Pa	kg/mm^2	0.000000102
Pa	kPa	0.001
Pa	kpsi	0.000000145
Pa	mbar	0.01
Pa	mm d'acqua	0.101971621
Pa	mm Hg	0.007500638
Pa	MPa	0.000001
Pa	N/cm^2	0.0001
Pa	N/dm^2	0.01

Da *From*	A *To*	Moltiplicare per *Multiply by*
Pa	N/mm^2	0.000001
Pa	N/m^2	1
Pa	psi	0,000145038
Pa	torr	0.007500638
psf	bar	0,000478803
psf	kg/cm^2	0.000488243
psf	kg/mm^2	4.88243E-06
psf	psi	0.006944444
psi	at	0.070306958
psi	atm	0.068045964
psi	bar	0.068947573
psi	hbar	0,000689476
psi	kg/cm^2	0.070306958
psi	kg/mm^2	0.00070307
psi	kPa	6.894757293
psi	kpsi	0.001
psi	mbar	68.94757293
psi	mm d'acqua	703.0695796
psi	mm Hg	51.71507548
psi	MPa	0.006894757
psi	N/m^2	6894.757293
psi	Pa	6894.757293
psi	torr	51,71507548
psi	psf	144
psi	N/dm^2	68.94757293
psi	N/cm^2	0.689475729
psi	N/mm^2	0.006894757
rad	deg	57.29577951
rad	mrad	1000
s	h	0.000277778
T/mm^2	kg/dm^2	1000000000
torr	at	0.001359506
torr	atm	0.001315786
torr	bar	0.00133322
torr	hbar	1 33322E-05
torr	kg/cm^2	0.001359506
torr	mbar	1,33322
torr	mm d'acqua	13,59506049
torr	mm Hg	1
torr	MPa	0.000133322
torr	N/m^2	133,322
torr	Pa	133,322
torr	psi	0,019336721
w	cv	0.001359622
W-h	cal	859,8452279
W-h	J	3600
W-h	kW-h	0.001

Terremoto

I terremoti, o sismi, sono una serie di rapide oscillazioni del terreno causate da una brusca liberazione di energia elastica da una zona del sottosuolo detta ipocentro.
Dall'ipocentro, che può essere posizionato a pochi metri o centinaia di km di profondità, si propagano in tutte le direzioni delle onde sismiche.
Esistono diverse scale convenzionali per valutare l'intensità di un terremoto.
Le più utilizzate sono la Scala Mercalli (oggi MSC, Mercalli-Carcano-Sieberg) e la Scala Richter.
La scala Mercalli misura l'intensità in modo empirico, valutando gli effetti provocati dal sisma su ambiente, uomo ed edifici.
La Scala Richter è una valutazione oggettiva, si basa sulla quantità di energia che si libera durante il terremoto.

Earthquake

Earthquakes are a series of rapid oscillations of the ground caused by a sudden release of elastic energy from an area of the subsoil called the hypocenter.
Seismic waves propagate in all directions from the hypocentre, which can be positioned a few metres or hundreds of kilometres deep.
There are several conventional scales for assessing the intensity of an earthquake.
The most commonly used are the Mercalli Scale (now MSC, Mercalli-Carcano-Sieberg) and the Richter Scale.
The Mercalli Scale measures intensity in an empirical way, evaluating the effects caused by the earthquake on the environment, man and buildings.
The Richter Scale is an objective assessment, based on the amount of energy that is released during the earthquake.

Tabella comparativa
Comparative table

Scala mercalli *Mercalli scale*			**Scala richter** *Richter scale*	
Grado *Intensity*	**Descrizione** *Description*	**Scossa** *Tremor*	**Magnitudo** Magnitude	
I	Avvertito solo dagli strumenti *Only noticeable from the instruments*	Strumentale *Not felt*	< 3,5	0
II	Avvertito da poche persone sensibili in condizioni particolari *Noticeable by a few people in particular conditions*	Leggerissima *Weak*	3,5	1
III	Avvertito da poche persone, soprattutto ai piani alti *Noticeable by a few people, mainly on the upper floors*	Leggera *Weak*	4,2	2
IV	Avvertito da molte persone, tremiti di infissi e cristalli, oscillazioni di oggetti sospesi *Noticeable by many people, tremors of windows and crystals, oscillations of suspended objects*	Mediocre *Light*	4,5	3
V	Avvertito anche da persone addormentate; caduta di oggetti *Also warned by sleeping persons; falling objects*	Forte *Moderate*	4,8	4
VI	Lievi danni agli edifici e oscillazione di alberi *Slight damage to buildings and oscillation of trees*	Molto forte *Strong*	5,4	5
VII	Caduta dei comignoli; lesione agli edifici *falling chimneys, building injuries*	Fortissima *Very strong*	6,1	6
VIII	Rovina parziale di alcuni edifici; vittime isolate *Partial ruin of some buildings; isolated victims*	Rovinosa *Severe*	6,5	7
IX	Rovina totale di alcuni edifici; molte vittime umane; crepacci nel suolo *Total ruin of some buildings; many human victims; cracks in the ground*	Distruttiva *Violente*	6,9	8
X	Crollo di parecchi edifici; numerose vittime umane; crepacci nel suolo *Several buildings collapsed; several human victims; cracks in the ground*	Completamente distruttiva *Extreme*	7,3	8,5
XI	Distruzione di agglomerati urbani; moltissime vittime; crepacci; frane; maremoto *Destruction of urban agglomerations; large number of victims; crevasses; landslides; tidal wave*	Catastrofica *Extreme*	8,1	9
XII	Distruzione di ogni manufatto; pochi superstiti; sconvolgimento del suolo; maremoto distruttivo *Destruction of every artefact; few survivors; soil upheaval; destructive tidal wave*	Grande catastrofe *Extreme*	> 8,1	10

Vento

Il vento è lo spostamento di una massa d'aria atmosferica dovuto a differenze di pressione e temperature.
L'intensità del vento viene misurata utilizzando l'anemometro o basandosi sulla Scala Beaufort [scala indicativa della forza del vento sul mare (al largo) e sul terreno piatto ad
un'altezza di 10 m].

Wind

Wind is the displacement of an atmospheric air mass due to differences in pressure and temperature.
Wind intensity is measured using the anemometer or based on the Beaufort scale (scale indicating the wind force on the surface in open sea and on flat land at a height of 10 m).

Scala Beaufort *Beaufort scale*				
Grado *Intensity*	**Velocità** *Speed* [Km/h]	**Velocità** *Speed* [knots]	**Descrizione** *Description*	**Effetti sul mare - sul terreno** *Effects on sea - land*
0	0 – 1	0 - 1	Calma *Calm*	Liscio - Il fumo sale verticale. *Flat - Calm, smoke rises vertically.*
1	1 – 5	1 - 3	Bava di vento *Light air*	Increspato - il fumo è deviato. *Ripples without crests - wind motion visible in smoke*
2	6 – 11	4 – 6	Brezza leggera *Light breeze*	Piccole onde - Le foglie si muovono. *Small wavelets. Crests of glassy appearance - Leaves rustle.*
3	12 – 19	7 – 10	Brezza tesa *Gentle breeze*	Onde con creste che cominciano ad infrangersi - Foglie e rametti costantemente in movimento. *Crests begin to break - Leaves and smaller twings in constant motion*
4	20 - 28	11 - 16	Brezza moderata *Moderate breeze*	Onde piccole ma lunghe - il vento solleva la polvere, le foglie secche e i rami vengono agitati. *Small but long waves - Dust and loose paper raised, small branches move*
5	29 - 38	17 - 21	Vento teso *Fresh breeze*	Onde moderate e allungate - gli arbusti con foglie oscillano. *Moderate longe waves. Some foam and spry - Branches of a moderate size move. Small trees begin to sway.*
6	39 – 49	22 - 27	Vento fresco *Strong breeze*	Onde grosse (cavalloni) con creste di schiuma e spruzzi - Movimento di grossi rami. *Large waves with foam crests and some spray - Large branches in motion.*
7	50 - 61	28 - 33	Vento forte *High wind*	Cavalloni grossi, la schiuma lascia scie - Interi alberi agitati e difficoltà a camminare contro vento. *Sea heaps up and foam begins to streak - Whole trees in motion. Effort needed to walk against the wind.*
8	62 - 74	34 - 40	Burrasca moderata *Fresh gale*	Onde alte, le creste si rompono e formano spruzzi vorticosi - I rami si spezzano e risulta quasi impossibile camminare contro vento. *Moderately high waves with breaking crests forming spindrift - Twigs broken from trees.*
9	75 - 88	41 - 47	Burrasca forte *Strong gale*	Onde alte (6 -7 m) con creste e schiuma intense, gli spruzzi riducono la visibilità - Tegole e camini divelti. *High waves (6-7 m) with dense foam. Wave crests start to roll over. Considerable spray - Damage to circus tents and canopies.*
10	89 - 102	48 - 55	Tempesta *Whole gale/storm*	Onde molto alte con creste a pennacchio, visibilità ridotta - Alberi sradicati e gravi danni alle abitazioni (rara un terraferma). *Very high waves. Large patches of foam from wave crests give the sea a white appearance - Trees are broken off or uprooted, saplings bent and deformed, poorly attached asphalt.*
11	103 - 117	56 - 63	Tempesta fortunale *Violent storm*	Onde enormi che nascondono navi di medie dimensioni, visibilità ridotta - Vasti danni strutturali. *Exceptionally high waves. Very large patches of foam, driven before the wind, cover much of the sea surface. Very large amounts of airborne spray severely reduce visibility - Widespread vegetation damage. More damage to most roofing surfaces, asphalt tiles that have curled up and/or fractured due to age may break away completely.*
12	> 118	> 64	Uragano *Hurricane force*	Onde altissime; aria piena di schiuma e spruzzi, mare completamente bianco - Danni ingenti ed estesi alle strutture. *Huge waves. Sea is completely white with foam and spray. Air is filled with driving spray, greatly reducing visibility - Considerable and widespread damage to vegetation, a few windows broken, structural damage to mobile homes and poorly constructed sheds and barns. Debris may be hurled about.*

Suono

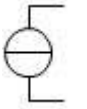
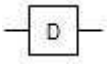
Il suono è la sensazione data dalla vibrazione di un corpo elastico in oscillazione.
Le oscillazioni sono spostamenti di particelle intorno alla posizione di riposo e lungo la direzione di propagazione dell'onda provenienti da un determinato oggetto, chiamato sorgente del suono.
E' possibile misurare l'intensità dei suoni in modo scientifico (dB), classificandoli in base a parametri universali.

Sound

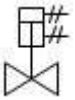
Sound is the sensation given by the vibration of an elastic body in oscillation.
Oscillation is the movement of particles around the resting position and along the direction of propagation of the wave from a certain object, called the sound source.
It is possible to measure the intensity of sounds in a scientific way (dB), classifying them according to universal parameters.

Intensità del suono *Sound intensity* **(dB)**	**Sorgente del suono** *Audio source*
0	Soglia dell'udibilità a 2 kHz *Threshold of audibility*
20	Mormorio udibile a distanza di ~2m - Foresta silenziosa *Audible murmur at ~2m distance - Silent forest*
40	Soggiorno - Biblioteca *Living room - Library*
60	Conversazione udibile a distanza di ~2m - ufficio *Audible conversation at distance of ~2m - Office*
80	Traffico stradale normale - Macchina da scrivere *Normal road traffic - Typewriter*
90	Autotreno udibile a distanza di ~15m *Audible truck at a distance of ~15m*
100	Interno metropolitana - Traffico autostradale *Inside the subway - Motorway traffic*
110	Concerto rock *Rock concert*
120	Avviamento aviogetto udibile a distanza di ~60m -Martello perforatore *Audible jet start at ~60m distance -Perforating hammer*
140	Soglia del dolore - Motore a reazione udibile a distanza di ~25m. *Pain threshold - Reaction motor audible at a distance of ~25m.*
160	Turboreattore *Turbojet*

PFD E P&ID SYMBOLISM AND DESCRIPTIONS
INSTRUMENTATION

 Analyser Transmitter	 Displayed Programmable Indicator	 Indicator 02
 AND Gate	 Double	 Indicator 03
 Averaging Pitot Tube	 Flow Controller	 Indicator 04
 Behind Control	 Flow Element	 Indicator 05
 Behind Local Control	 Flow Indicator	 Level Alarm
 Computer	 Flow Meter	 Level Controller
 Computer Indicator	 Flow Nozzle Meter	 Level Gauge
 Coriolis Flow Sensor	 Flow Recorder	 Level Indicator
 Correcting Element	 Flow Transmitter	 Level Meter
 Diamond	 Flowmeter	 Level Recorder
 Diaphragm Meter	 Flume Meter	 Level Transmitter
 Displayed Configurable	 Indicator 01	 Magnetic Flow Meter

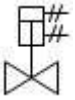
PFD E P&ID SYMBOLISM AND DESCRIPTIONS
INSTRUMENTATION

	Motor Operated Valve		Quarter Turn Spring Acting Valve		Water Flow Meter
	Needle Valve 01		Ram Valve		Weight Gate Valve
	Needle Valve 02		Relief Valve		Quarter Turn Double Acting Valve
	Orifices		Rotary Valve		Three Way Valve 02
	Pilot Gate Valve		Self Draining Valve		Powered Valve
	Pinch Valve		Self Operating Release Valve		Three Way Valve 01
	Piston Operated Valve		Slide Valve		Three Way Plug Valve
	Plug Valve 01		Solenoid Valve		Post Indicator
	Plug Valve 02		Spring Gate Valve		

PFD E P&ID SYMBOLISM AND DESCRIPTIONS
VALVES

 Angle Blowdown Valve	 Check Valve 02	 Gate Valve Closed
 Angle Globe Valve	 Control Valve	 Gate Valve Hand Operated
 Angle Valve	 Diaphragm Valve 01	 Gauge Valve
 Angle Valve Hand Operated	 Diaphragm Valve 02	 Globe Valve
 Auto Circulation Valve	 Electro Hydraulic Valve	 Globe Valve Hand Operated
 Back Pressure Regulator	 Excess Flow Valve	 Hydraulic Valve
 Balanced Diaphragm Gate Valve	 Flanged Valve 01	 Integrated Block Valve
 Ball Valve	 Flanged Valve 02	 Knife Valve
 Ball Valve Normally Closed	 Float Operated Valve	 Manual Integrated Valve
 Bleeder Valve	 Four Way Plug Valve	 Metering Choke
 Butterfly Valve	 Four Way Valve	 Minimum Flow Valve
 Check Valve 01	 Gate Valve	 Motor Operated Valve

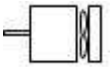
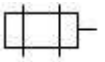
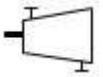
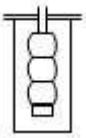
PFD E P&ID SYMBOLISM AND DESCRIPTIONS
VALVES

 Motor Operated Valve	 Quarter Turn Spring Acting Valve	 Water Flow Meter
 Needle Valve 01	 Ram Valve	 Weight Gate Valve
 Needle Valve 02	 Relief Valve	 Quarter Turn Double Acting Valve
 Orifices	 Rotary Valve	 Three Way Valve 02
 Pilot Gate Valve	 Self Draining Valve	 Powered Valve
 Pinch Valve	 Self Operating Release Valve	 Three Way Valve 01
 Piston Operated Valve	 Slide Valve	 Post Indicator
 Plug Valve 01	 Solenoid Valve	 Three Way Plug Valve
 Plug Valve 02	 Spring Gate Valve	

PIPING SYMBOLS

 Clamped Flange Coupling	 End Caps 02	 Reducers
 Coupling	 Flange	 Removable Spool
 End Caps 01	 Flanges	 Union

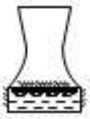
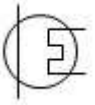
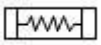
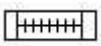
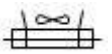
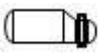
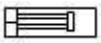
PFD E P&ID SYMBOLISM AND DESCRIPTIONS
MOTORS

 AC Generator	 DC Generator	 Diesel Motor
 AC Motor	 DC Motor	 Electric Motor
 Gear	 Motor 01	 Motor Driven Turbine
 Generator	 Motor 02	 Motor Generator
 Step Motor	 Turbine	 Turbine Driver
 Vertical Turbines		

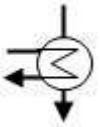
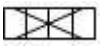
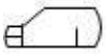
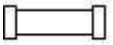
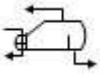
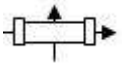
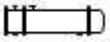
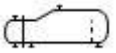
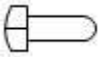
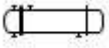
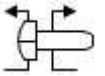
CENTRIFUGES

 Centrifuge High Speed	 Centrifuge Screw	 Centrifuge Skimmer
 Centrifuge Perforated Shell	 Centrifuge Screw Perforated Shell	 Centrifuge Solid Shell
 Centrifuge Pusher	 Centrifuge Separator Disc	

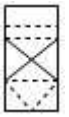
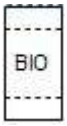
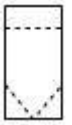
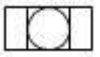
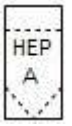
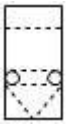
PFD E P&ID SYMBOLISM AND DESCRIPTIONS
HEAT EXCHANGER

 Air Blown Cooler	 Condenser 01	 Cooling Tower 02
 Air Cooled Heat Exchanger	 Condenser 02	 Cooling Tower 03
 Chimney Tower Hyperbolic	 Cooler	 Counter Flow Forced Draft
 Coil Tube Heat Exchanger	 Cooling Tower 01	 Cross Flow Induced Draft
 Electric Heater	 Forced Draft Cooling Tower	 Heat Exchanger 03
 Exchanger	 Furnace 01	 Heater
 Fin Fan Cooler	 Furnace 02	 Induced Draft Cooling Tower
 Finned Tube Heat Exchanger	 Hairpin Exchanger	 Induced Flow Air Cooler
 Fired Heater	 Heat Exchanger 01	 Kettle Heat Exchanger
 Floating Head Heat Exchanger	 Heat Exchanger 02	 Oil Burner

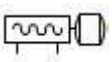
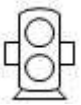
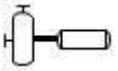
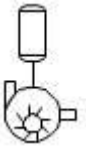
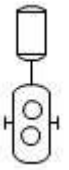
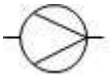
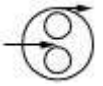
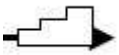
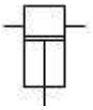
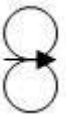
PFD E P&IDSYMBOLISM AND DESCRIPTIONS
HEAT EXCHANGER

 Plate and Frame Exchanger	 Shell and Tube Heat Exchanger 01	 Spiral Exchanger 01
 Plate Exchanger	 Shell and Tube Heat Exchanger 02	 Spiral Exchanger 02
 Plate Heat Exchanger	 Shell and Tube Heat Exchanger 03	 Spray Cooler
 Reboiler 01	 Single Pass Heat Exchanger 01	 Straight Tube Heat Exchangers
 Reboiler 02	 Single Pass Heat Exchanger 02	 TEMA Type AEL
 TEMA Type AEM	 TEMA type BEU	 Thin Film Evaporator
 TEMA Type AEM	 TEMA type BKU	 U Tube Heat Exchanger 01
 TEMA type BEM	 TEMA type NEN	 U Tube Heat Exchanger 02

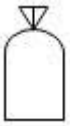
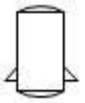
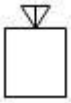
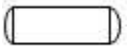
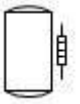
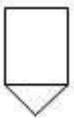
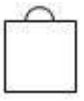
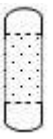
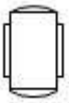
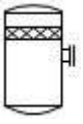
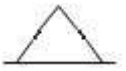
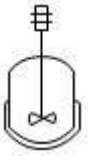
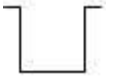
PFD E P&IDSYMBOLISM AND DESCRIPTIONS
FILTERS

 Air Filter 01	 Filter 01	 Filter 06
 Air Filter 02	 Filter 02	 Fixed Bed Air Filter
 Bandpass Filter	 Filter 03	 Fixed Bed Liquid Filter
 Biological Filter	 Filter 04	 Gas Filter
 Cartridge Gas Filter	 Filter 05	 HEPA Gas Filter
 High Efficiency Filter	 LowPass Filter	 Oxygen Enriched Filter
 High Pass Filter	 Mideffect Filter	 Press Filter
 IonExchange Filter	 Mode Filter	 Roll Air Filter
 Liquid Filter	 Mode Filter Indication	 Rotary Filter

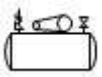
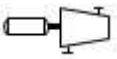
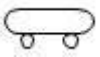
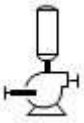
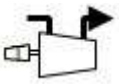
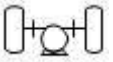
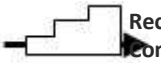
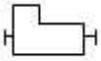
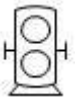
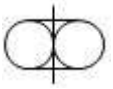
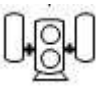
PFD E P&IDSYMBOLISM AND DESCRIPTIONS
PUMPS

 Cavity Pump	 Gear Pump	 ISO Positive Displacement Pump
 Centrifugal Pumps 01	 Horizontal Pump	 ISO Progressive Pump
 Centrifugal Pumps 02	 ISO Centrifugal Pump	 ISO Screw Pump
 Centrifugal Pumps 03	 ISO Diaphragm Pump	 Liquid Ring Vacuum Pump
 Centrifugal Pumps 04	 ISO Gear Pump	 Peristaltic Pump
 Centrifugal Pumps 05	 ISO Liquid Pump	 Positive Displacement Pump 01
 Positive Displacement Pump 02	 Pump 01	 Rotary Gear Pump
 Positive Displacement Pump 03	 Reciprocating Pump 01	 Rotary Pump
 Proportionating Pump	 Reciprocating Pump 02	 Screw Pump 01

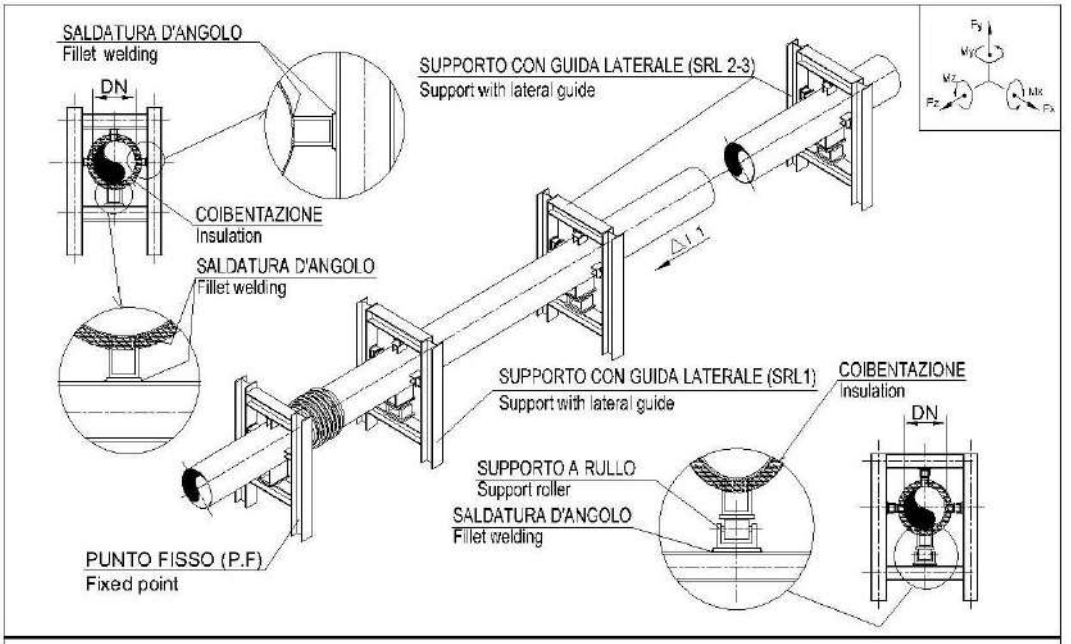
PFD E P&IDSYMBOLISM AND DESCRIPTIONS
VESSELS

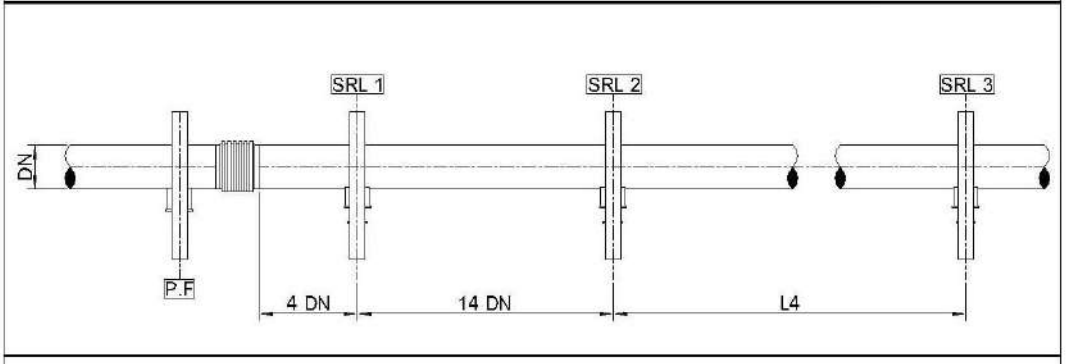
 Bag	 Brackets Vessel	 Dome Roof Tank
 Bag ISO	 Column	 Double Wall Tank
 Barrel	 Cone Roof Tank	 Drum
 Barrel ISO	 Covered Tank	 Electrical Heating Vessel
 Bin	 Dished Ends Vessel	 Floating Roof Tank
 Boiler	 Dome Boiler	 Fluidized Bed Column
 Gas Bottle	 Internal Floating Roof Tank	 Onion Tank
 Heating Cooling Jacket Vessel	 Knockout Drum	 Open Bulk Storage
 Hot Liquid Boiler	 Mixing Vessel	 Open Tank

PFD E P&IDSYMBOLISM AND DESCRIPTIONS
COMPRESSORS

 AC Air Compressor	 Centrifugal Compressor 03	 Diaphragm Compressor
 Air Compressor	 Centrifugal Compressor 04	 Ejector Compressor
 Axial Compressor	 Compressor 01	 Gas Blower
 Centrifugal Blower	 Compressor 02	 Liquid Ring Compressor
 Centrifugal Compressor 01	 Compressor Silencers	 Piston Compressor
 Centrifugal Compressor 02	 Compressor Vacuum Pump	 Reciprocating Compressor 01
 Reciprocating Compressor 02	 Ring Compressor	 Rotary Compressors 01
 Reciprocating Compressor 03	 Roller Vane Compressor	 Rotary Compressors 02
 Rotary Compressors and Silencers	 Selectable Compressor	 Turbo Compressor
 Screw Compressor		

Schema di montaggio
Assembly sketch

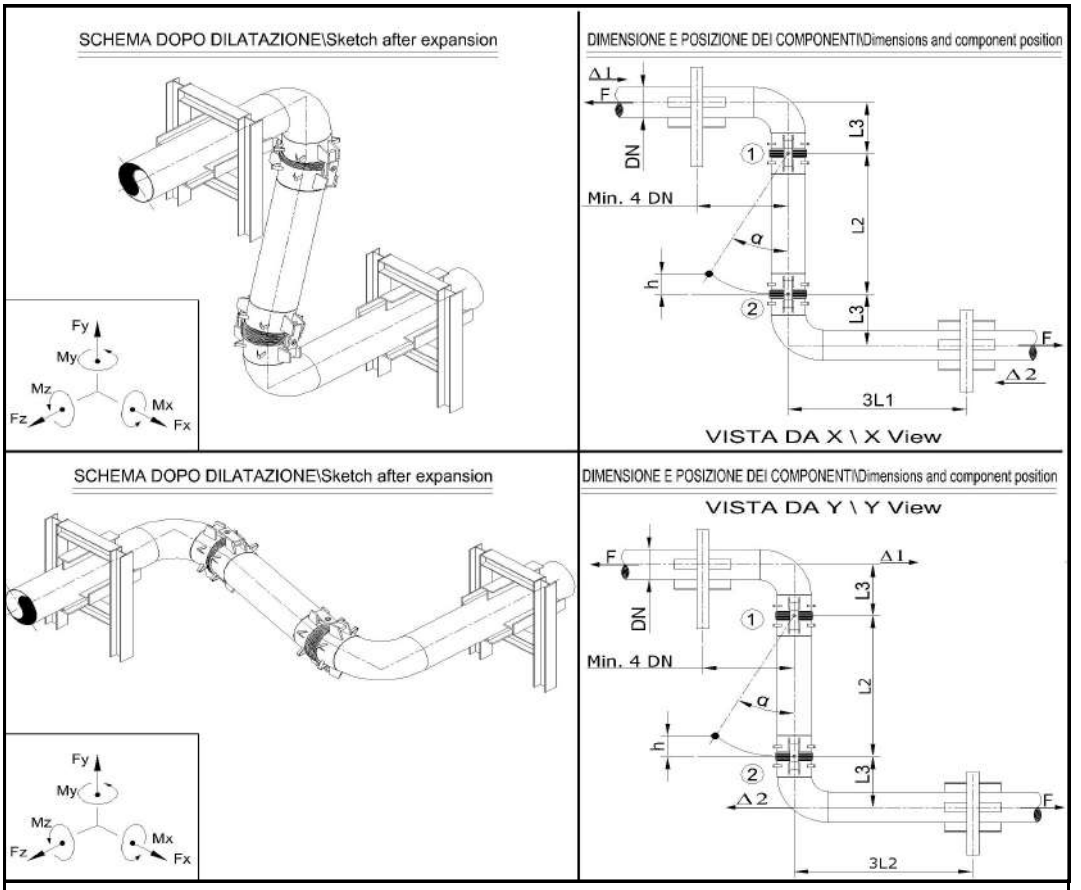




DISTANZA MASSIMA L4 TRA LE GUIDE (m) Maximum distance L4 between guide (m)							
DN ND	POLLICI Inches	PRESSIONE NOMINALE Nominal pressure					
		2.5	6.0	10	16	25	40
40	1 ½"	2.7	2.6	2.4	2.3	2.1	1.8
50	2"	4.0	3.7	3.4	3.2	2.5	2.1
65	2 ½"	5.3	4.7	4.1	3.6	3.1	2.6
80	3"	3.6	3.1	2.7	2.4	2.0	1.7
100	4"	5.0	4.5	4.0	3.5	3.0	2.6
125	5"	7.0	6.0	5.3	4.5	3.9	3.2
150	6"	9.4	7.9	6.8	5.8	4.9	4.0
175	7"	11.6	9.1	7.7	6.3	5.3	4.3

DISTANZA MASSIMA L4 TRA LE GUIDE (m) Maximum distance L4 between guide (m)							
DN ND	POLLICI Inches	PRESSIONE NOMINALE Nominal pressure					
		2.5	6.0	10	16	25	40
200	8"	14.6	11.5	9.6	8.1	6.6	5.4
250	10"	20.6	15.3	12.4	10.1	8.2	6.6
300	12"	25.5	18.8	15.3	12.4	10.1	8.0
350	14"	28.6	20.9	16.8	13.6	11.1	8.9
400	16"	33.2	24.0	19.4	15.7	12.7	10.1
450	18"	36.6	27.8	22.3	18.0	14.6	11.6
500	20"	41.9	30.6	24.7	20.0	16.3	13.0
600	24"	52.7	37.5	29.9	24.1	19.5	15.5

Schema di montaggio
Assembly sketch



L_3 = DIMENSIONE MINIMA POSSIBILE
Minimal dimension as possible

α = ANGOLO GENERATO DAL COMPENSATORE [gradi]
Angle generated by the expansion joint [deg]

D = DILATAZIONE DELLA TUBAZIONE [mm]
Piping expansion [mm]

M_f = MOMENTO DI ATTRITO DEL COMPENSATORE [Nm\gradi]
Expansion joint frictional momentum [Nm\deg]

M_a = MOMENTO ANGOLARE DEL COMPENSATORE [Nm\gradi]
Expansion joint angular momentum [Nm\deg]

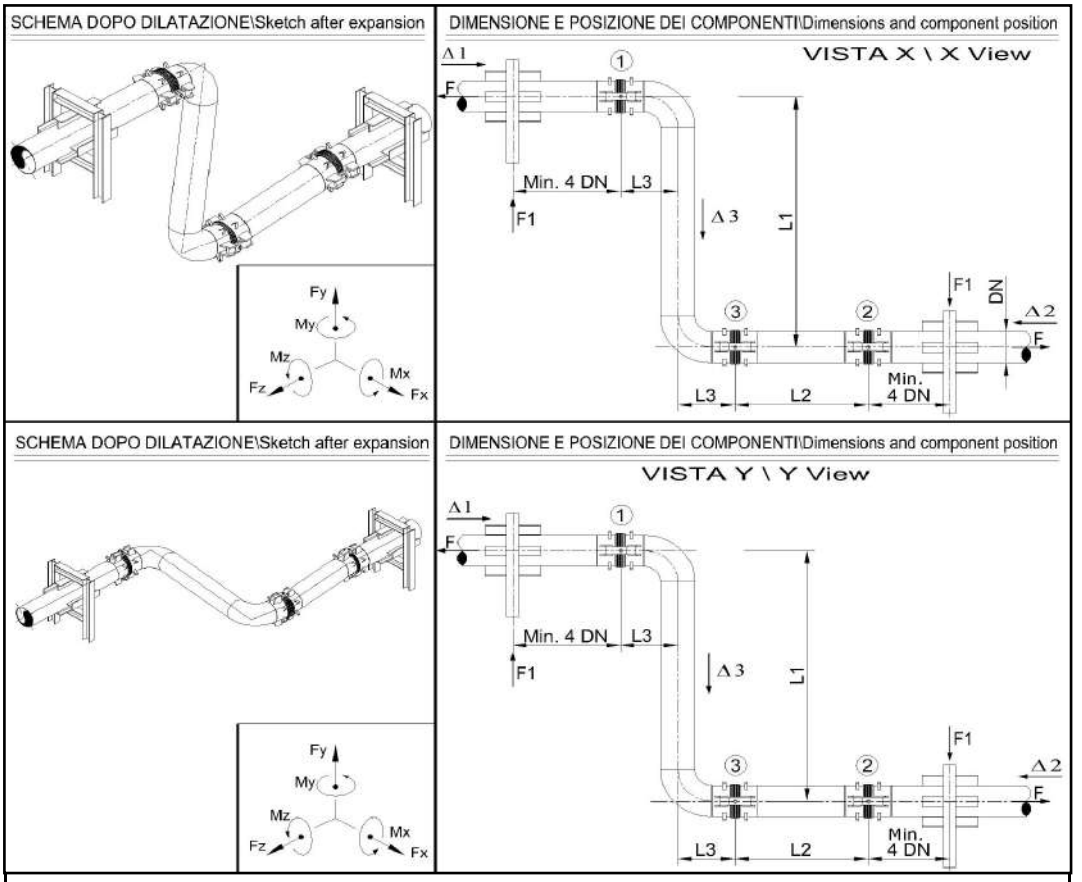
F = FORZA DI REAZIONE DEL SISTEMA [Newton]
Reaction force of the system [Newton]

L1 = DISTANZA [mm]
Distance [mm]

L2 = DISTANZA TRA I CENTRI DI ROTAZIONE [mm]
Distance between rotational centres [mm]

DN = DIAMETRO NOMINALE DELLA TUBAZIONE [mm]
Nominal pipe diameter [mm]

Schema di montaggio
Assembly sketch



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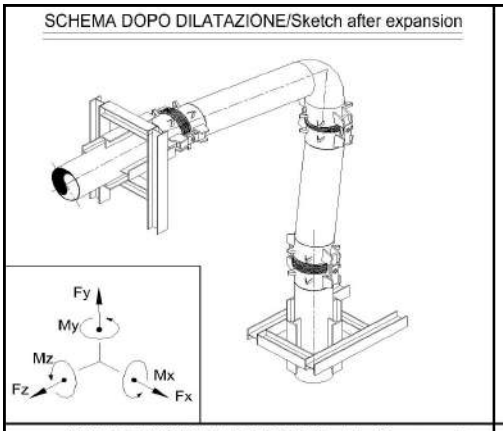

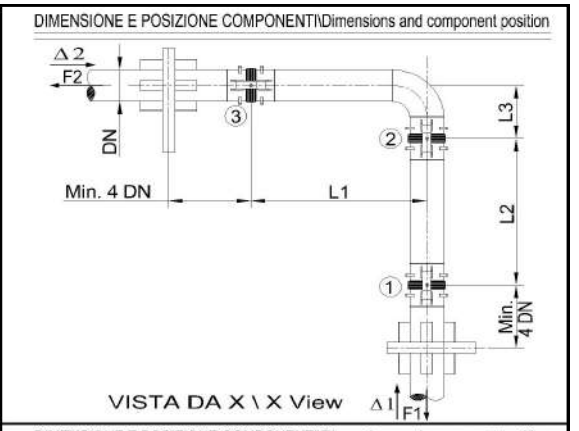

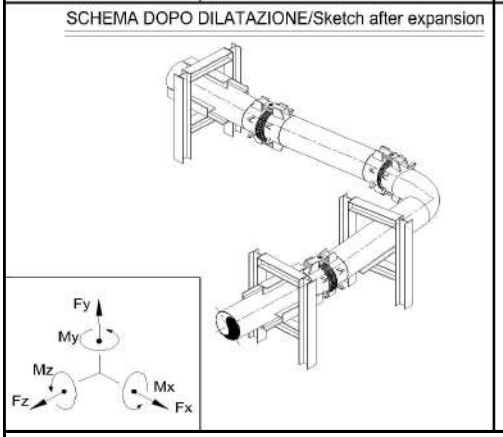

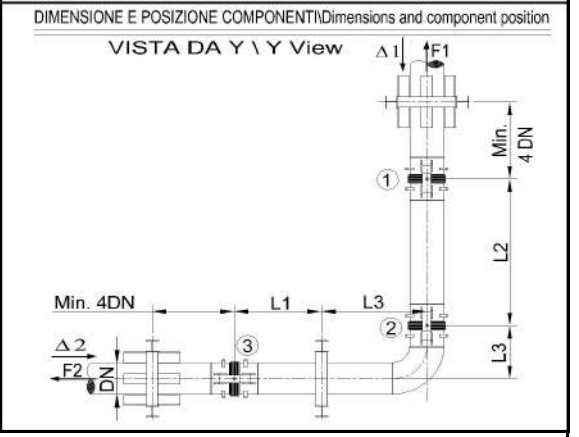

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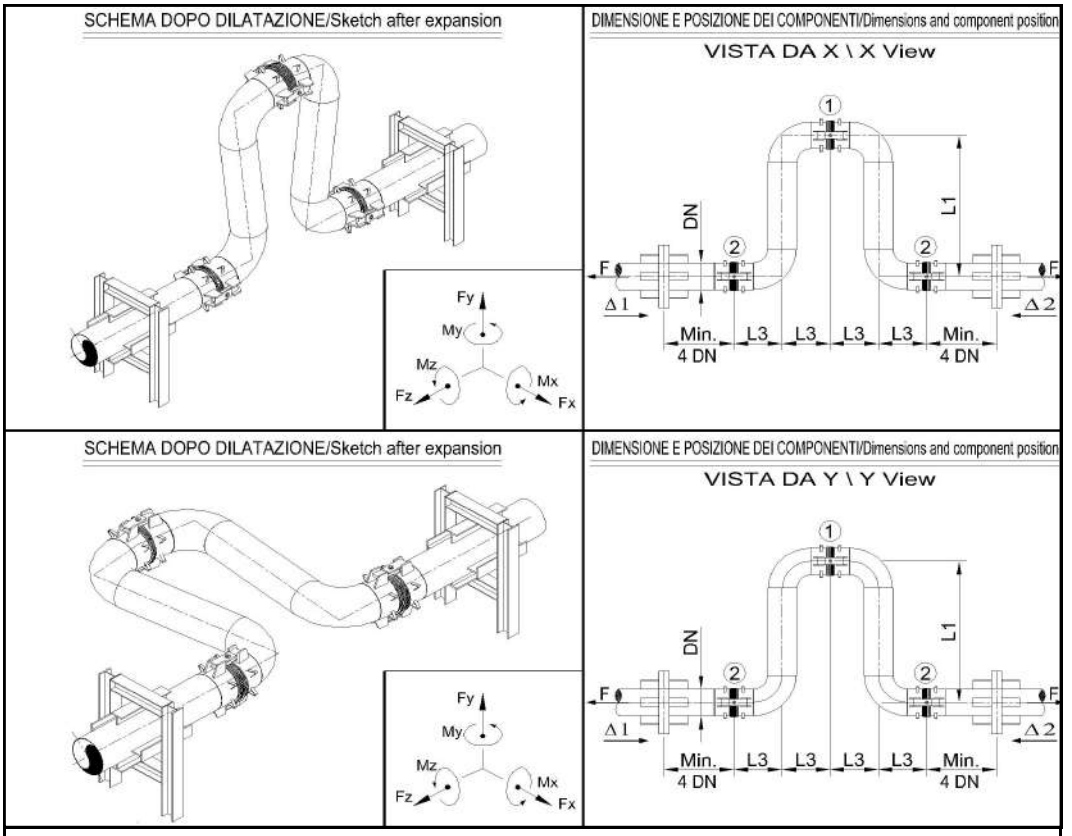

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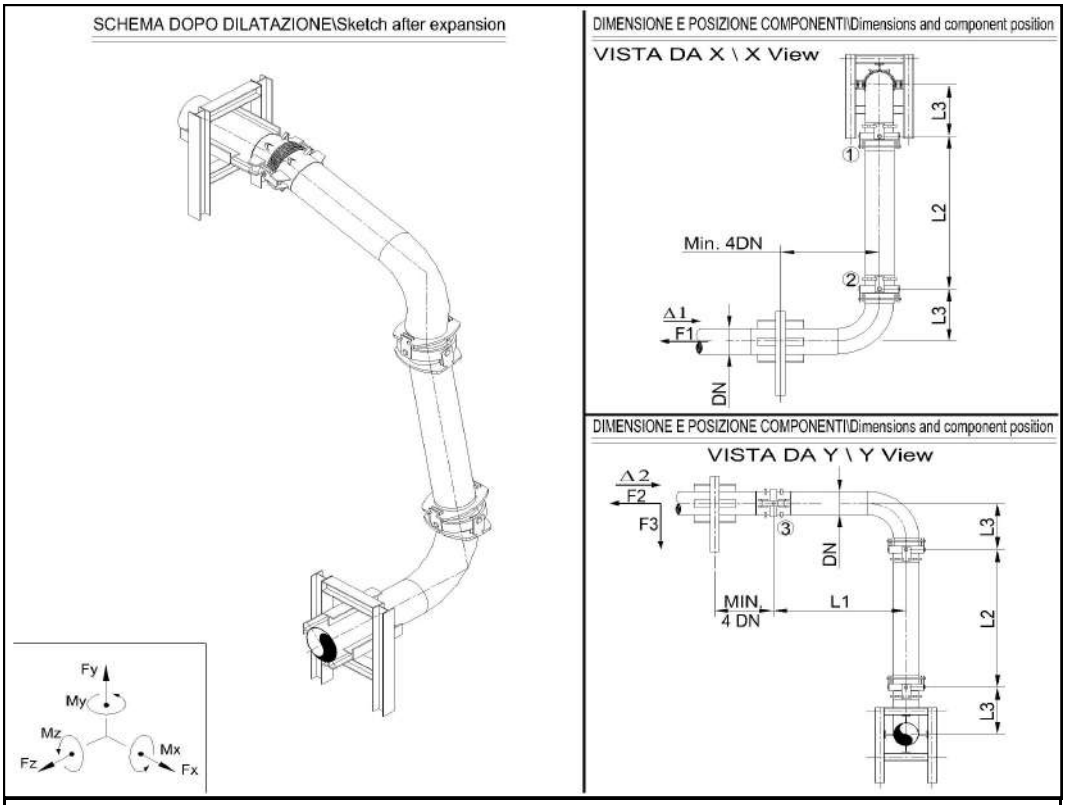

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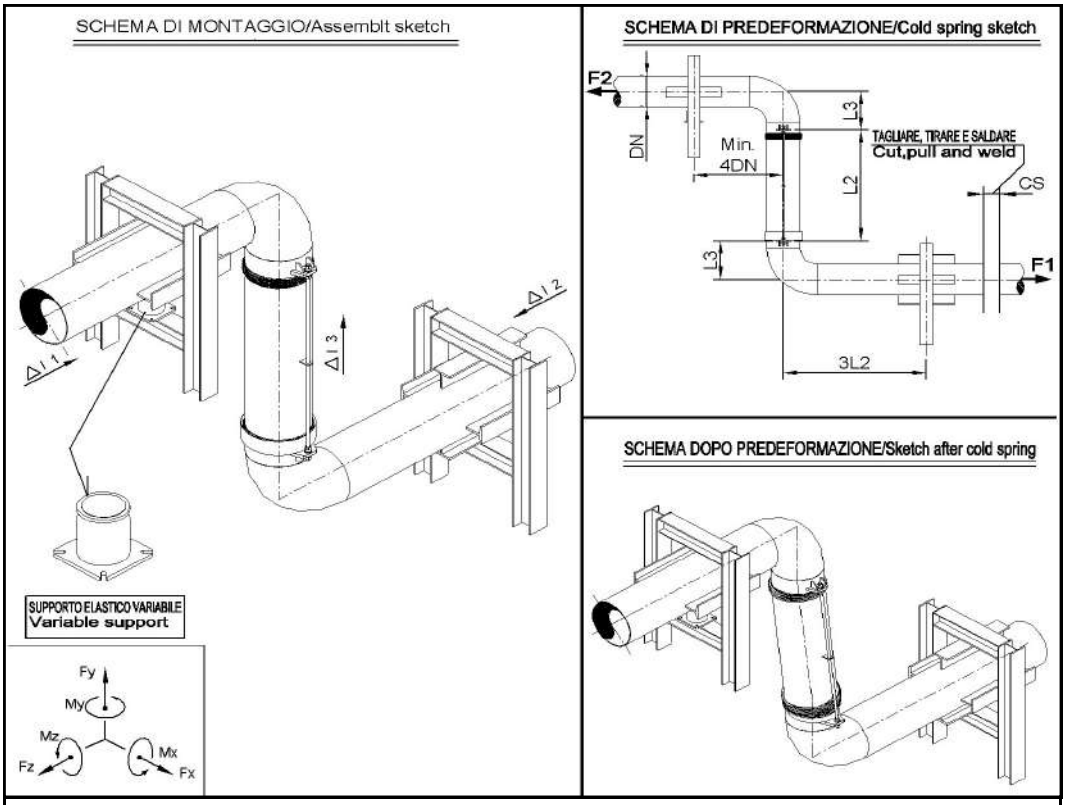

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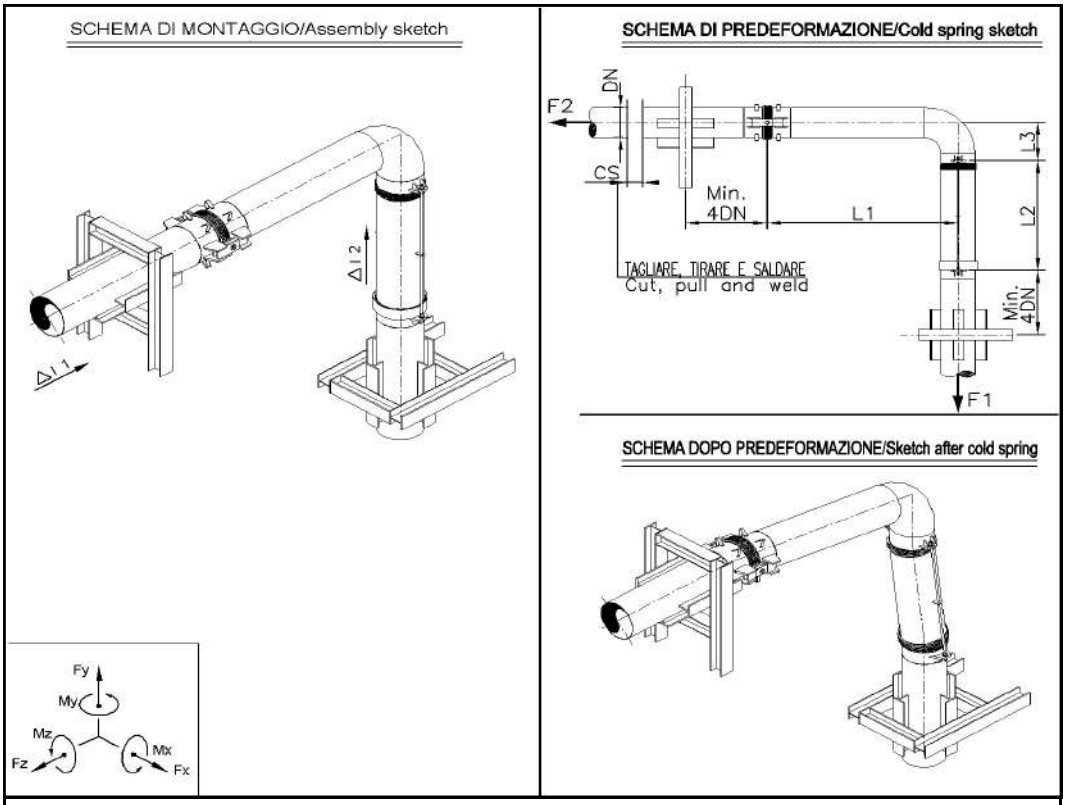

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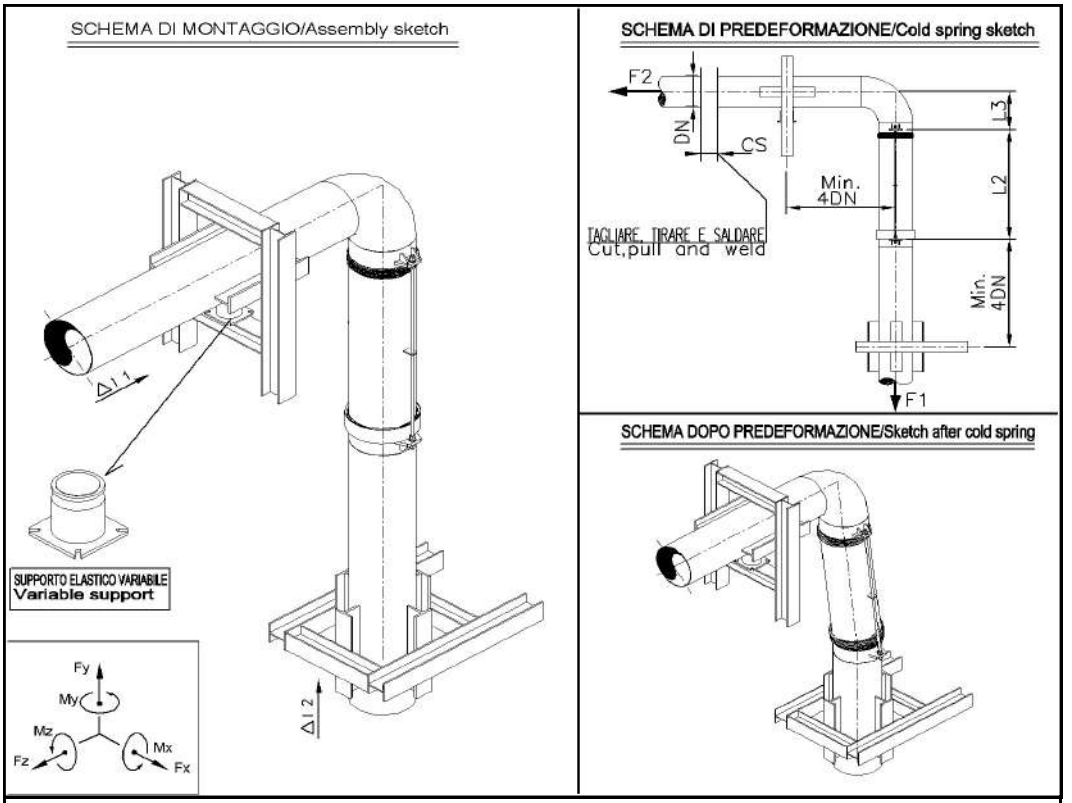

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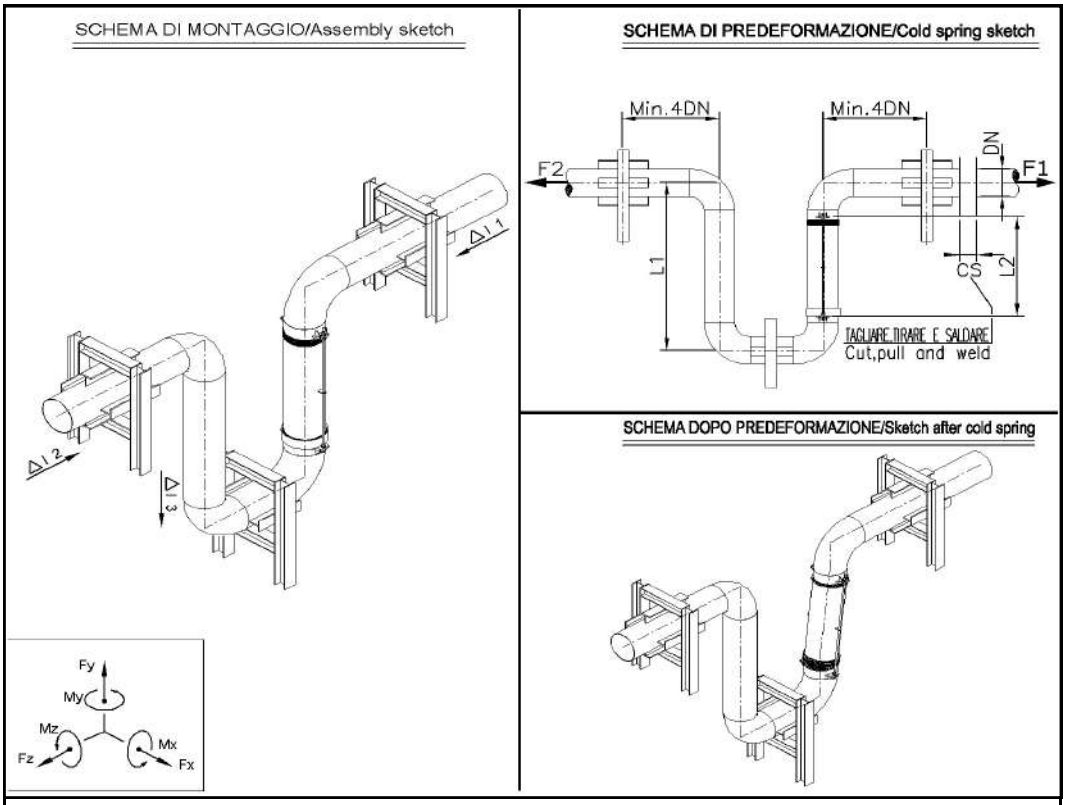

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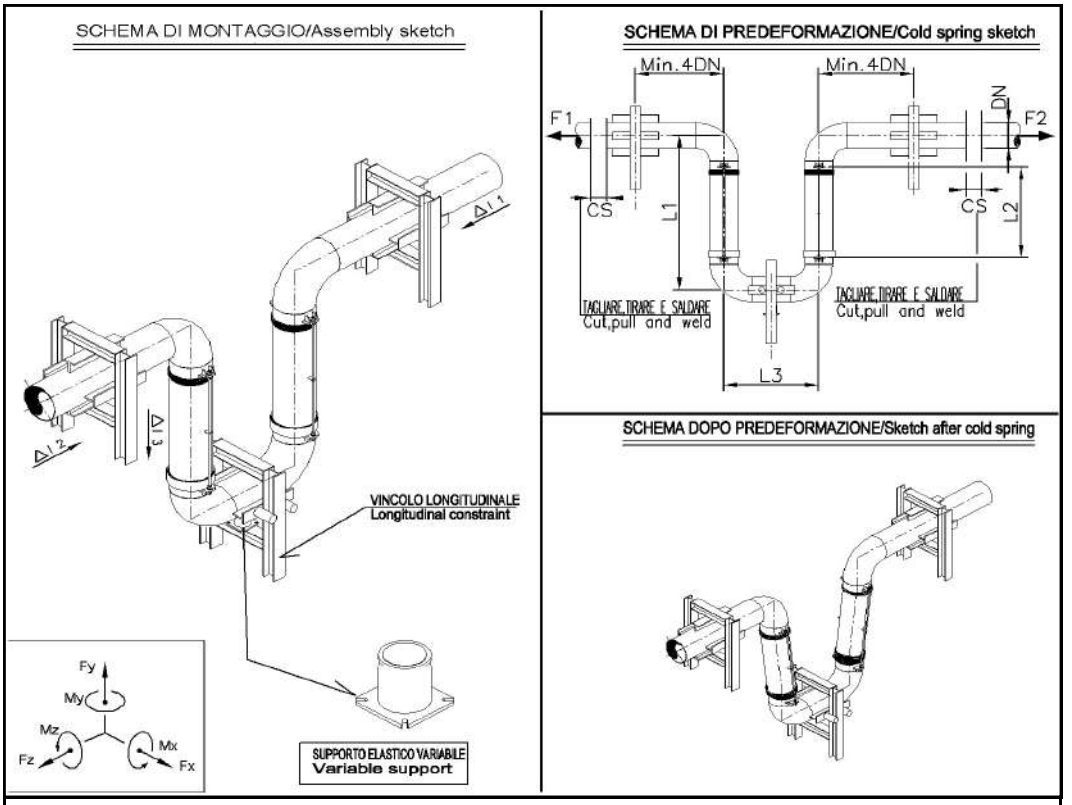

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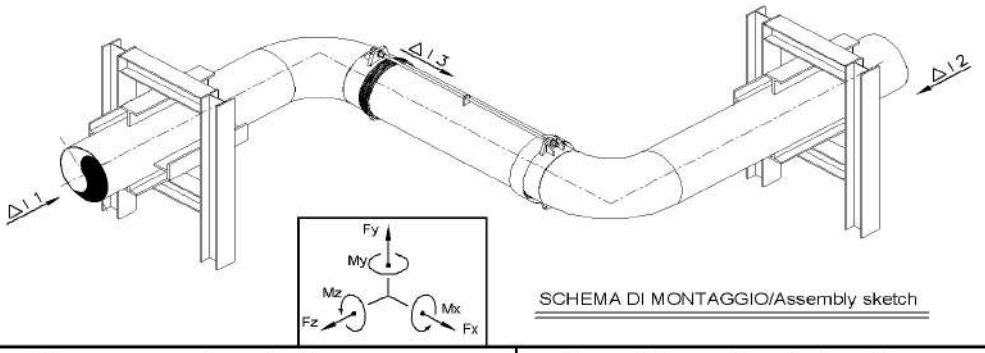

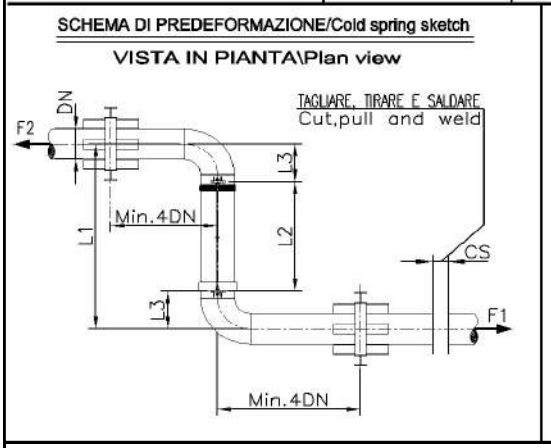

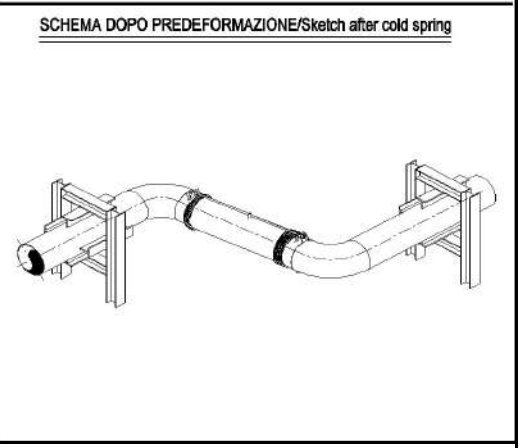

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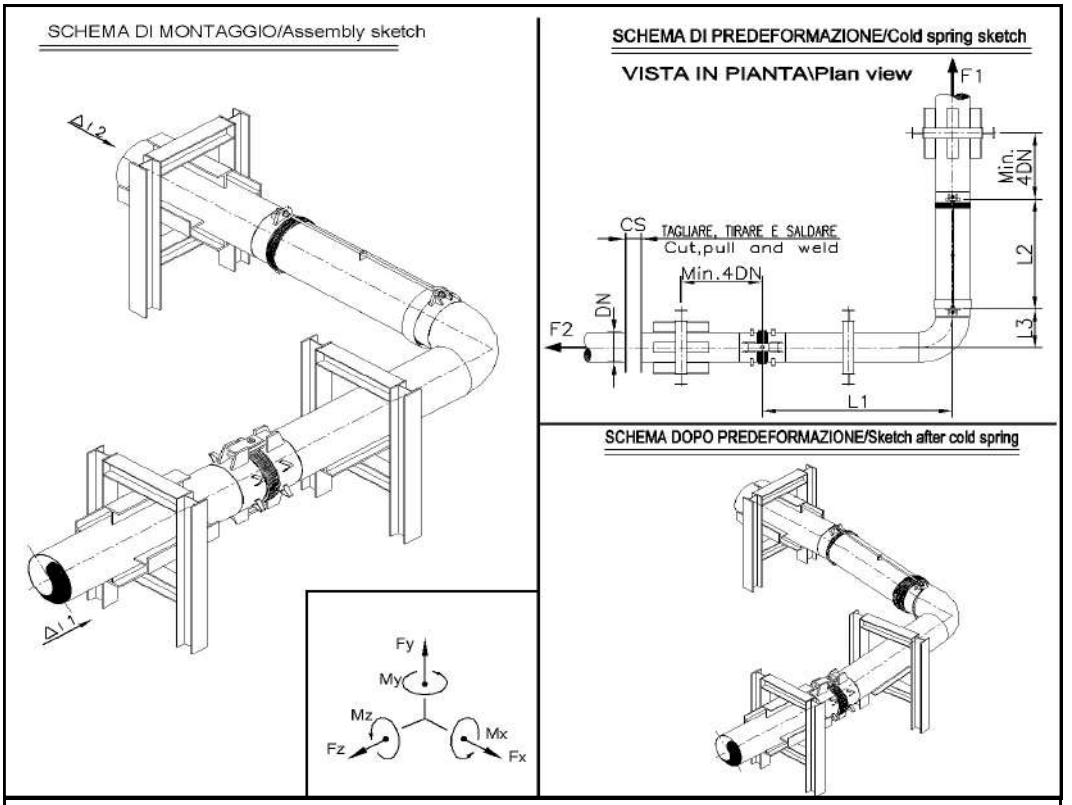

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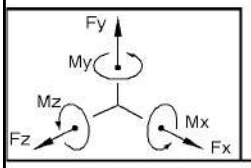
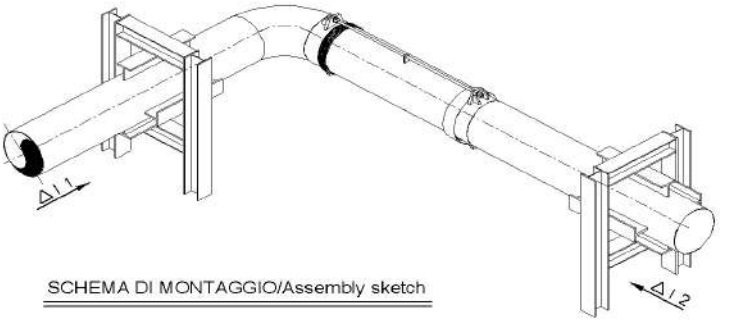
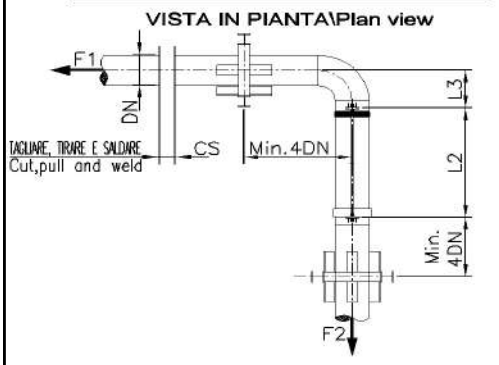


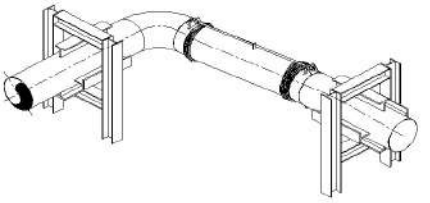


SCHEMA DI MONTAGGIO/Assembly sketch

SCHEMA DI PREDEFORMAZIONE/Cold spring sketch



SCHEMA DOPO PREDEFORMAZIONE/Sketch after cold spring



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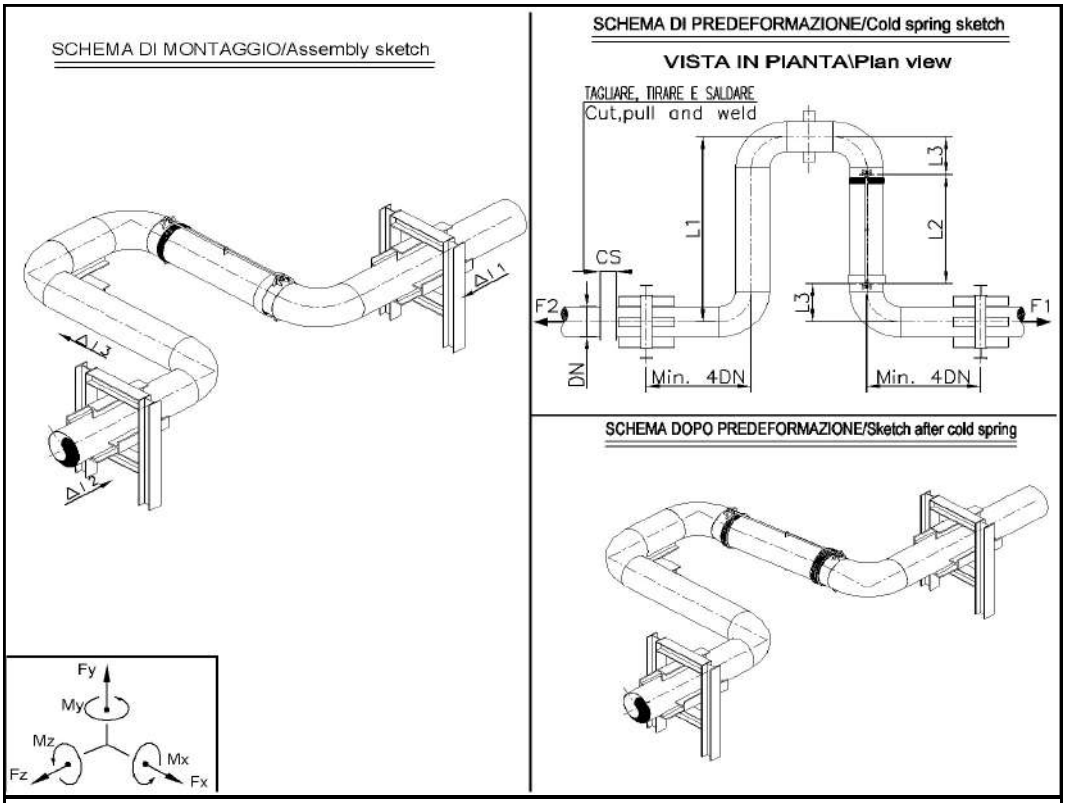

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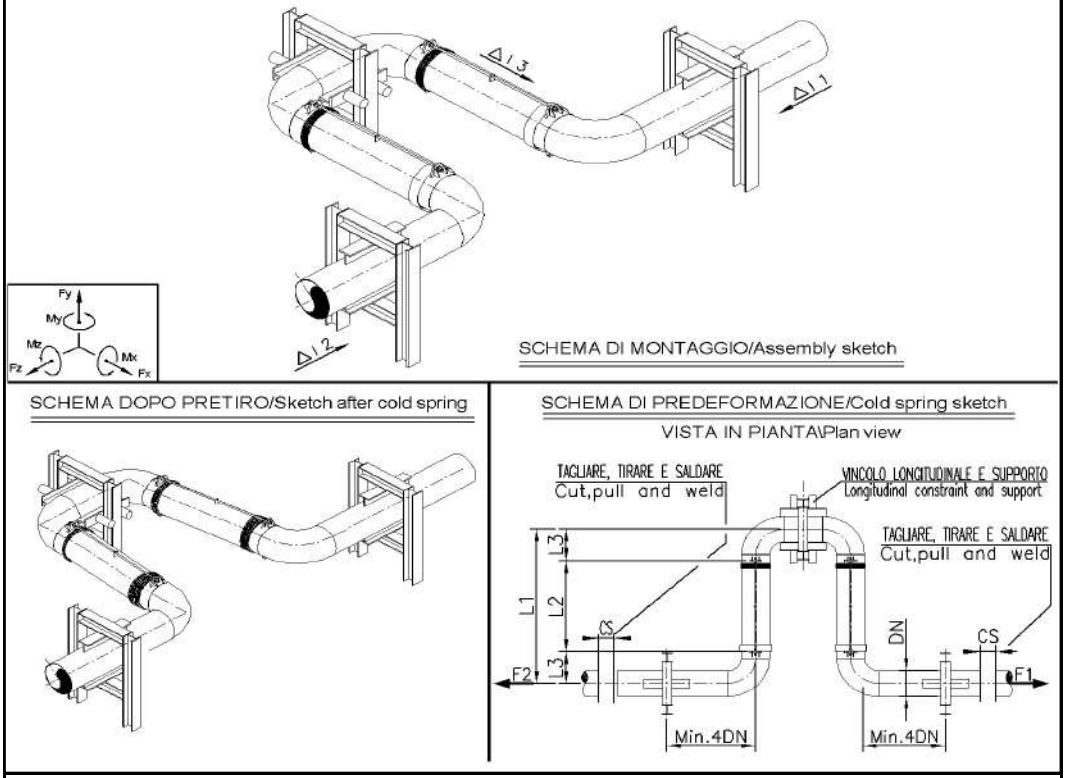

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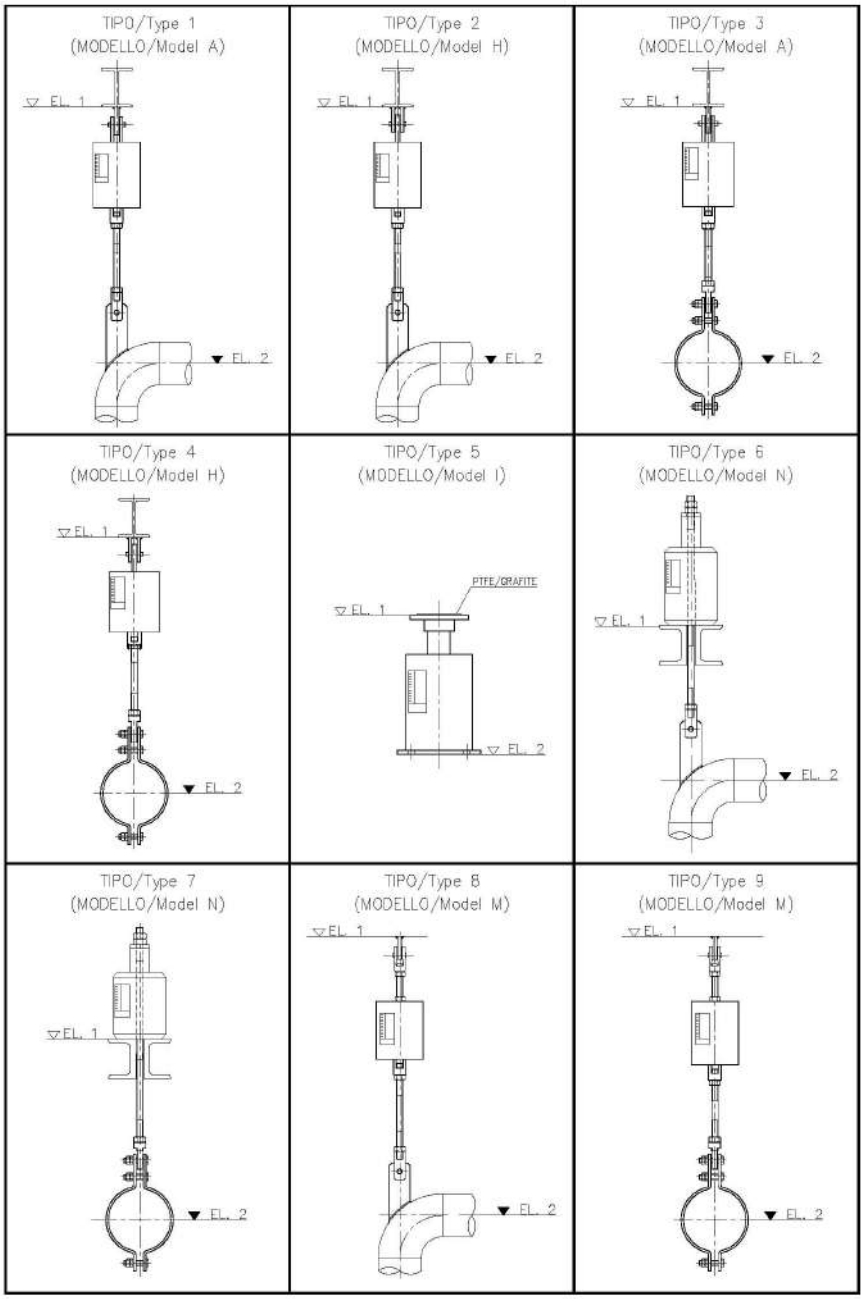
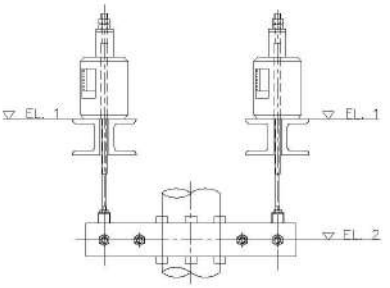
Supporti elastici a carico variabile
Variable spring hangers

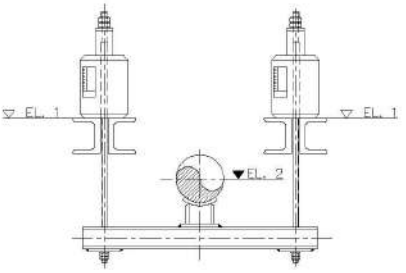


Supporti elastici a carico variabile
Variable spring hangers

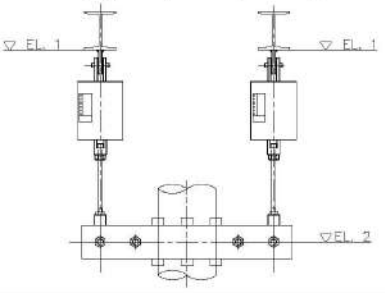
TIPO/Type 10 (MODELLO/Model N)



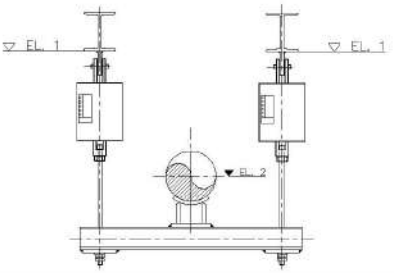
TIPO/Type 11 (MODELLO/Model N)



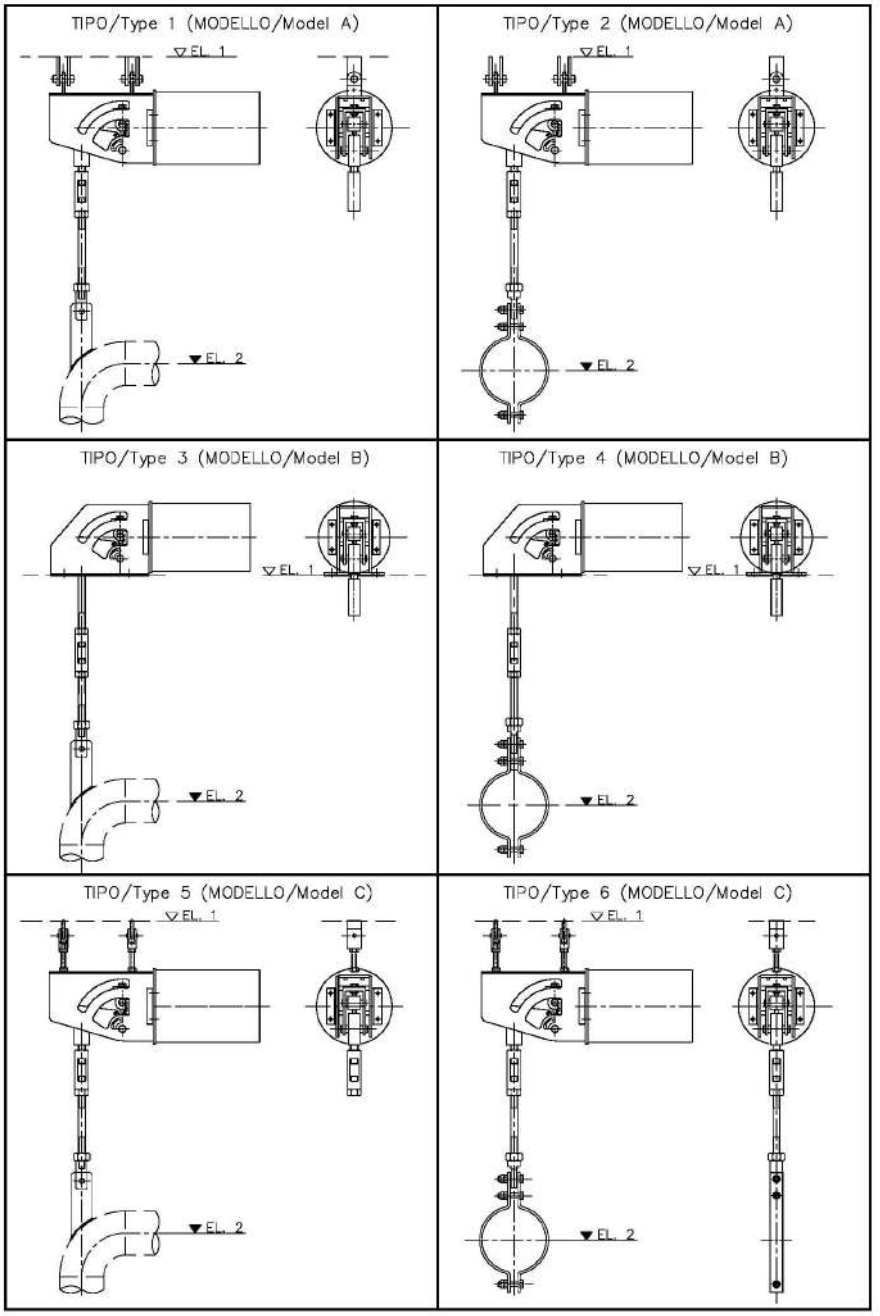
TIPO/Type 12 (MODELLO/Model A)



TIPO/Type 13 (MODELLO/Model A)



Supporti elastici a carico costante
Constant spring hangers



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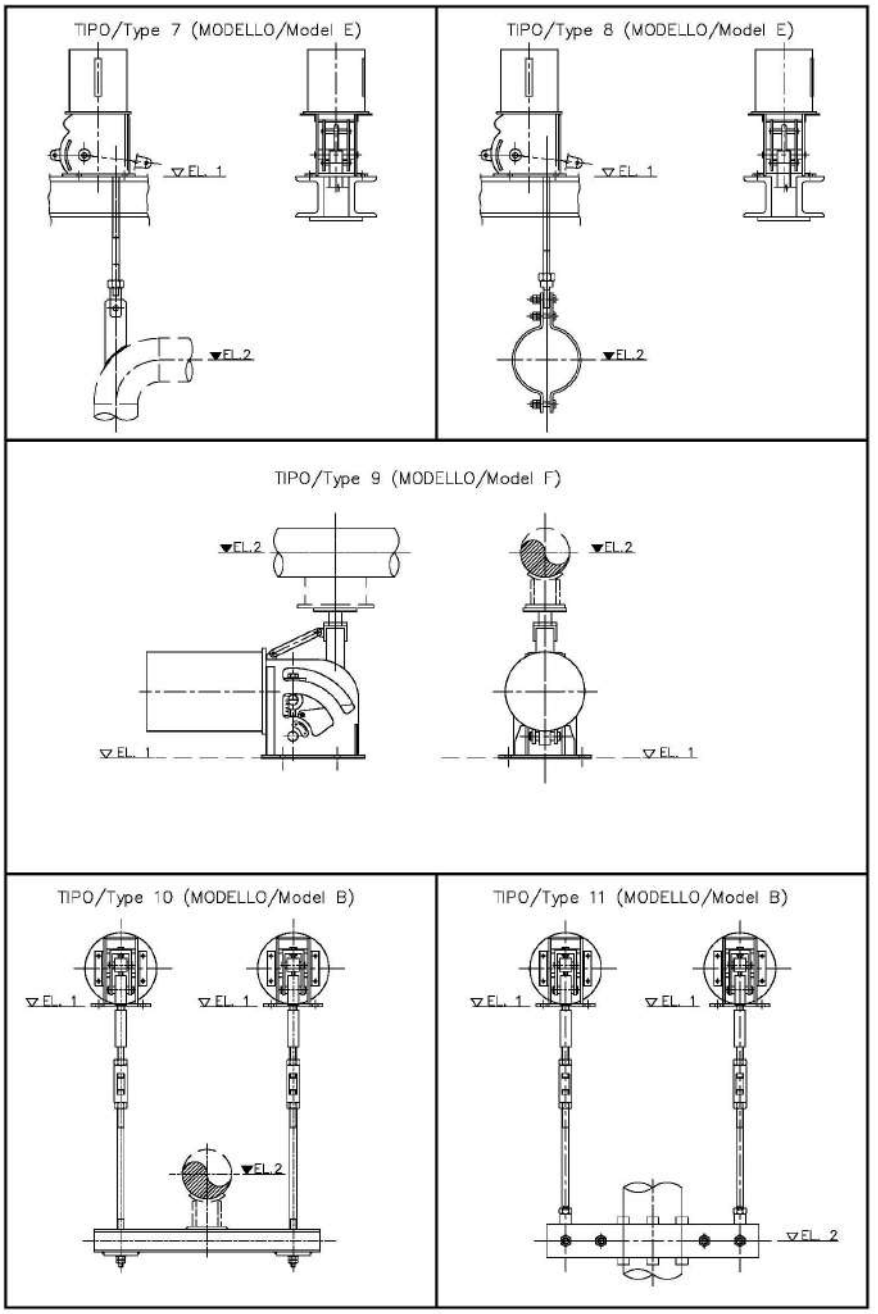

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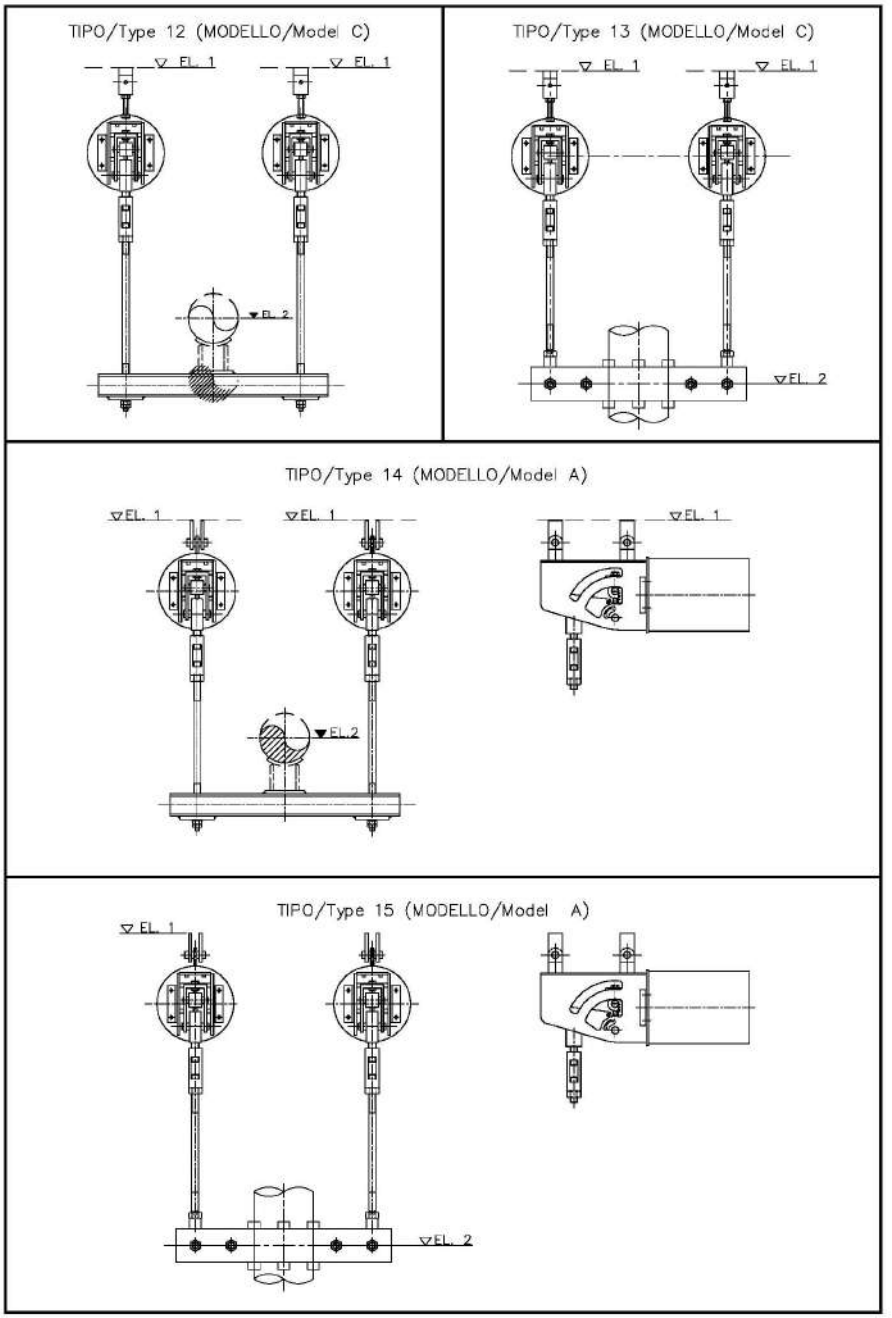
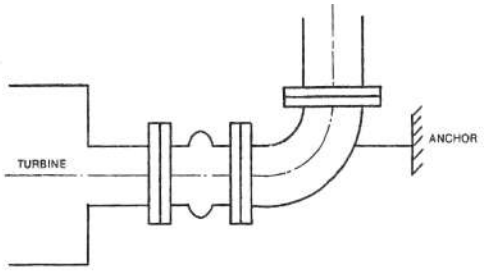
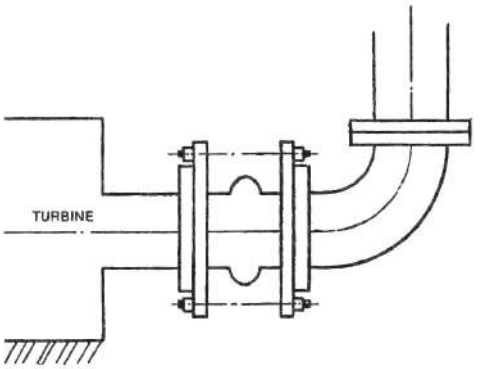
Constant spring hangers



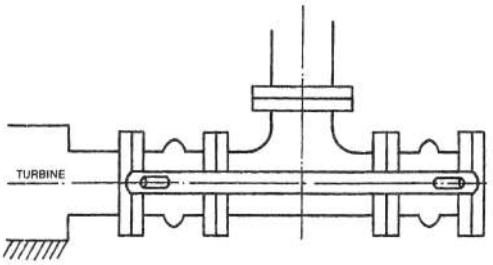
Installazione compensatori su turbine
Expansion joints installation on turbine



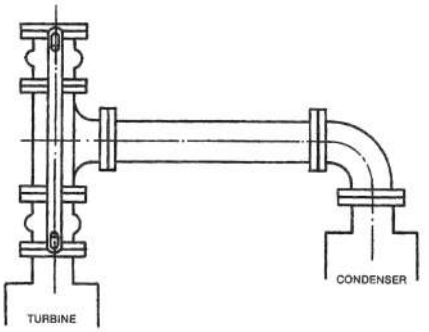
UNRESTRAINED EXPANSION JOINT
(May impose an unacceptable thrust force on the turbine)



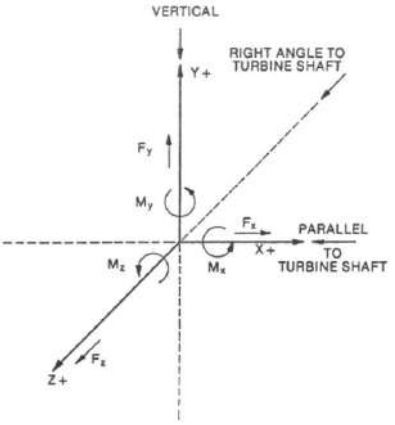
EXPANSION JOINT WITH TIE RODS
(Flexible in sheer only)



EXPANSION JOINT WITH TIE RODS
(Provides axial flexibility without imposing thrust on the turbine)



EXPANSION JOINT WITH TIE RODS FOR CONDENSING OPERATION WITH "UP" EXAUST
(Provides vertical flexibility without imposing thrust on the turbine)



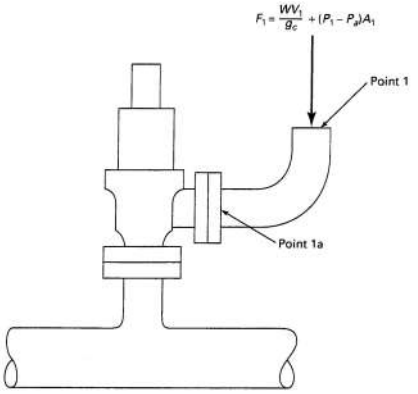
COMPONENTS OF FORCES AND MOMENTUM ON TURBINE CONSTRUCTION
The positive momentum rotates clockwise if you take the force as positive

ALLOWABLE FORCES AND MOMENTS

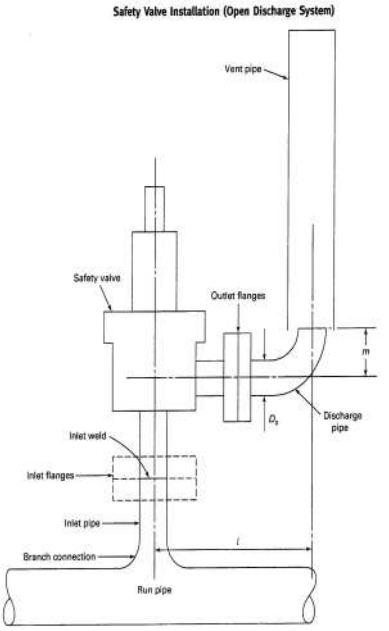
INLET INCHES	EXHAUST INCHES	FX LBS	FY LBS	FZ LBS	MX LB-FT	MY LB-FT	MZ LB-FT
2	6	316	791	632	1581	791	791
2	8	412	1031	825	2062	1031	1031
3	6	335	839	671	1677	839	839
3	8	427	1068	854	2136	1068	1068
4	8	447	1118	894	2236	1118	1118
4	10	480	1199	959	2398	1199	1199
4	12	511	1277	1022	2554	1277	1277
4	16	575	1437	1150	2874	1437	1437
4	18	607	1518	1215	3037	1518	1518
4	20	640	1600	1280	3200	1600	1600
4	24	706	1764	1411	3528	1764	1764
4	30	804	2011	1609	4022	2011	2011
4	36	904	2259	1807	4518	2259	2259
6	12	524	1309	1047	2618	1309	1309
6	16	585	1462	1170	2924	1462	1462
6	18	616	1541	1232	3081	1541	1541
6	20	648	1620	1296	3240	1620	1620
6	24	712	1781	1425	3562	1781	1781
6	30	810	2025	1620	4050	2025	2025
6	36	908	2271	1817	4541	2271	2271
8	12	540	1351	1081	2702	1351	1351
8	16	598	1495	1196	2991	1495	1495
8	18	628	1571	1257	3141	1571	1571
8	20	659	1648	1318	3295	1648	1648
8	24	722	1804	1443	3608	1804	1804
8	30	817	2044	1635	4087	2044	2044
8	36	915	2287	1829	4573	2287	2287
8	48	1111	2778	2222	5555	2778	2778
10	12	560	1401	1121	2802	1401	1401
10	16	614	1536	1229	3072	1536	1536
10	18	643	1608	1286	3216	1608	1608
10	20	673	1682	1345	3363	1682	1682
10	24	733	1833	1467	3667	1833	1833
10	30	827	2068	1654	4135	2068	2068
10	36	923	2307	1845	4614	2307	2307
10	48	1117	2793	2234	5586	2793	2793
12	18	661	1651	1321	3303	1651	1651
12	20	689	1722	1377	3444	1722	1722
12	24	747	1868	1494	3736	1868	1868
12	30	839	2096	1677	4193	2096	2096
12	36	932	2331	1865	4662	2331	2331
12	48	1125	2812	2249	5623	2812	2812
16	24	781	1952	1561	3904	1952	1952
16	30	867	2167	1733	4333	2167	2167
16	36	957	2391	1913	4783	2391	2391
16	48	1143	2858	2287	5716	2858	2858

Installazione valvole di sicurezza
Safety valves installation

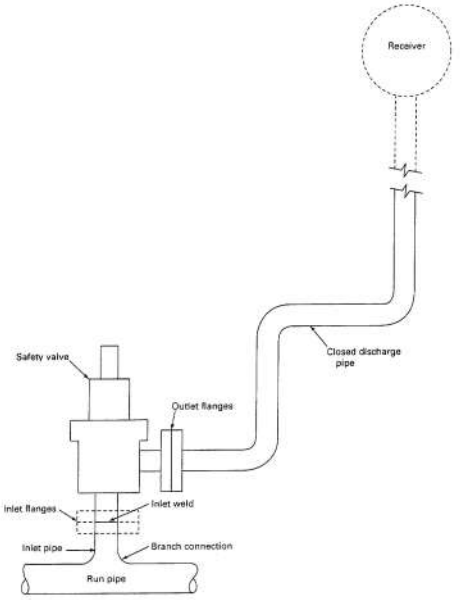
Discharge Elbow (Open Discharge Installation)



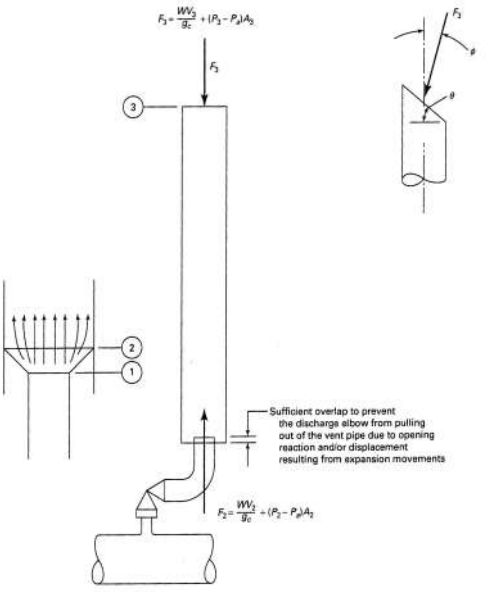
Safety Valve Installation (Open Discharge System)



Safety Valve Installation (Closed Discharge System)



Vent Pipe (Open Discharge Installation)



Carichi ammissibili sulle connessioni delle pompe

Allowable loads on pumps connections

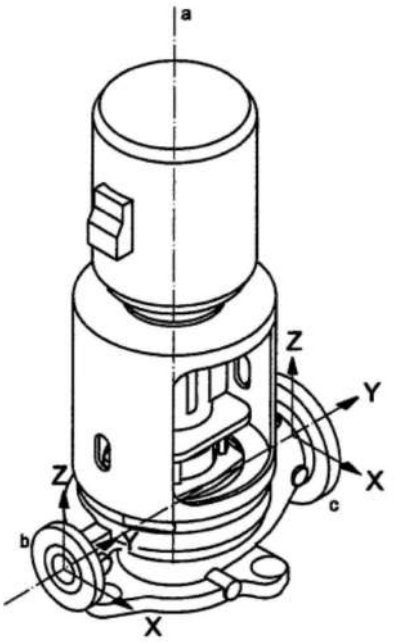
Table 5 — Nozzle loadings

Location/orientation	Nozzle-loading force as a function of flange size — SI units N								
	Nominal size of flange (DN)								
	≤ 50	80	100	150	200	250	300	350	400
Each top nozzle									
F_X	710	1 070	1 420	2 490	3 780	5 340	6 670	7 120	8 450
F_Y	580	890	1 160	2 050	3 110	4 450	5 340	5 780	6 670
F_Z	890	1 330	1 780	3 110	4 890	6 670	8 000	8 900	10 230
F_R	1 280	1 930	2 560	4 480	6 920	9 630	11 700	12 780	14 850
Each side nozzle									
F_X	710	1 070	1 420	2 490	3 780	5 340	6 670	7 120	8 450
F_Y	890	1 330	1 780	3 110	4 890	6 670	8 000	8 900	10 230
F_Z	580	890	1 160	2 050	3 110	4 450	5 340	5 780	6 670
F_R	1 280	1 930	2 560	4 480	6 920	9 630	11 700	12 780	14 850
Each end nozzle									
F_X	890	1 330	1 780	3 110	4 890	6 670	8 000	8 900	10 230
F_Y	710	1 070	1 420	2 490	3 780	5 340	6 670	7 120	8 450
F_Z	580	890	1 160	2 050	3 110	4 450	5 340	5 780	6 670
F_R	1 280	1 930	2 560	4 480	6 920	9 630	11 700	12 780	14 850
Moment N·m									
Each nozzle									
M_X	460	950	1 330	2 300	3 530	5 020	6 100	6 370	7 320
M_Y	230	470	680	1 180	1 760	2 440	2 980	3 120	3 660
M_Z	350	720	1 000	1 760	2 580	3 800	4 610	4 750	5 420
M_R	620	1 280	1 800	3 130	4 710	6 750	8 210	8 540	9 820

Table 5 (*continued*)

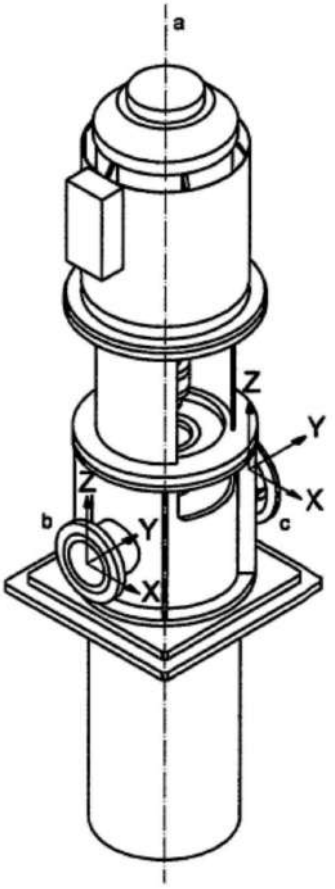
Location/orientation	Nozzle-loading force as a function of flange size — USC units lbf								
	Nominal size of flange (NPS)								
	≤ 2	3	4	6	8	10	12	14	16
Each top nozzle									
F_X	160	240	320	560	850	1 200	1 500	1 600	1 900
F_Y	130	200	260	460	700	1 000	1 200	1 300	1 500
F_Z	200	300	400	700	1 100	1 500	1 800	2 000	2 300
F_R	290	430	570	1 010	1 560	2 200	2 600	2 900	3 300
Each side nozzle									
F_X	160	240	320	560	850	1 200	1 500	1 600	1 900
F_Y	200	300	400	700	1 100	1 500	1 800	2 000	2 300
F_Z	130	200	260	460	700	1 000	1 200	1 300	1 500
F_R	290	430	570	1 010	1 560	2 200	2 600	2 900	3 300
Each end nozzle									
F_X	200	300	400	700	1 100	1 500	1 800	2 000	2 300
F_Y	160	240	320	560	850	1 200	1 500	1 600	1 900
F_Z	130	200	260	460	700	1 000	1 200	1 300	1 500
F_R	290	430	570	1 010	1 560	2 200	2 600	2 900	3 300
Moment ft·lbf									
Each nozzle									
M_X	340	700	980	1 700	2 600	3 700	4 500	4 700	5 400
M_Y	170	350	500	870	1 300	1 800	2 200	2 300	2 700
M_Z	260	530	740	1 300	1 900	2 800	3 400	3 500	4 000
M_R	460	950	1 330	2 310	3 500	5 000	6 100	6 300	7 200

Assi di riferimento delle forze e dei momenti sulle pompe (tab. 5)
Reference axes of the forces and momentum on the pumps (table 5)



Vertical in-line pumps

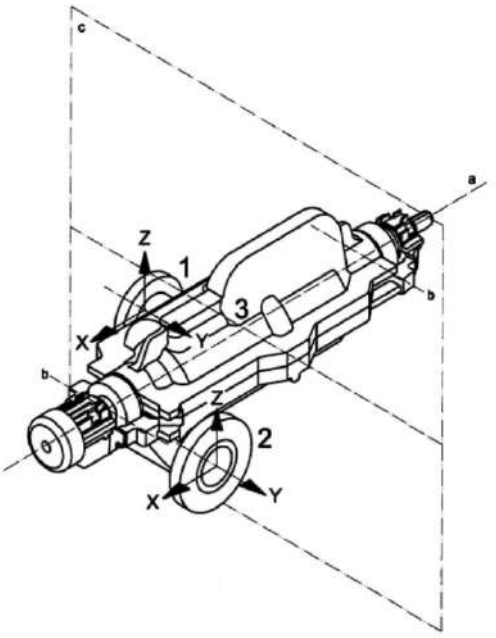
Vertical suspended double-casing pumps



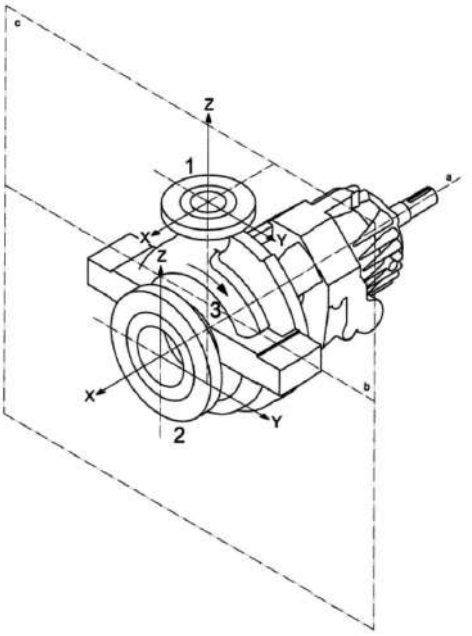
a) shaft centreline
b) discharge
c) suction

Assi di riferimento delle forze e dei momenti sulle pompe (tab. 5)

Reference axes of the forces and momentum on the pumps (table 5)



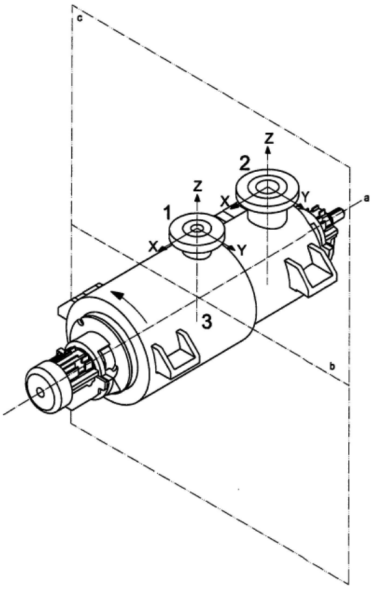
Horizontal pumps with side suction and side discharged nozzles



Horizontal pumps with end suction and top discharge nozzles

a) shaft centreline
b) pedestal centreline
c) vertical plane

1) discharge nozzle
2) suction nozzle
3) centre of pump



Horizontal pumps with top nozzles