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INTRODUCTION

With know-how of over 30 years Conpipe International b.v. is a world-wide operating company manufacturing pipe systems for fluid transportation. Conpipe is certified according to ISO 9001:2008.

We mainly deliver carbon steel (lined and coated) drinking water lines, cooling water lines, water treatment facilities, water disposal lines and fire water lines for chemical, petrochemical, mining and governmental projects.

Our reference list is extensive and includes the mayor oil- and engineering companies.

Please note that our services include the following:

- Design and engineering.
- Procurement and supply of bare carbon steel materials as pipes, fittings, flanges, valves etc.
- Prefabrication of complete pipeline projects from diameter 3" up to 120" per customers' specifications and requirements.
- Internal Lining of pipes, fittings and pre-fabricated spools:
 - Cement lining (both shop and "on site" in-situ)
 - Rubber lining (both shop and "on site" in-situ)
 - Rubber lining of Storage tanks and transport systems
 - Epoxy Lining (both shop and "on site" in-situ)
 - PTFE, PFA, PVDF, PP and other plastic lining
 - Glass flake and glass flake reinforced epoxy lining
- External coating of pipes, fittings and pre-fabricated spools:
 - Polyethylene powder coating
 - Polyurethane coating
 - Variety of epoxy and painting systems
- Complete packages "Ready to Install" of lined and coated products.
- Provision of complete traceability and documentation.
- Packaging and shipping to the job site.
- Support, Supervision, Installation and Maintenance services.

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Since the year 2000 we are working in India as subcontractor for the application of Cement lining. In 2005 we have opened another facility in Chennai, India in which we can prefabricate carbon steel piping and apply cement lining to pipes and fittings.

With our international experience to-date we feel that Conpipe international b.v. is in a position to offer you expertise, efficiency and quality against very competitive prices.

We sincerely hope that with this introduction letter and the attached bulletin, you will consider Conpipe International b.v., to quote future piping requirements.

Yours Faithfully,

Conpipe International b.v.

Jerry van den Oever
Managing Director



Certificate NL10/81826504

Contract number: NL/PRO 386101

SGS

The management system of

Conpipe International B.V.

Simon Lindhoutstraat 1G
4691 GA Tholen, Netherlands



has been assessed and certified as meeting the requirements of

ISO 9001:2008

For the following activities

**The engineering, manufacturing, lining, coating and maintenance of
piping systems.**

Further clarifications regarding the scope of this certificate and the applicability of
ISO 9001:2008 requirements may be obtained by consulting the organisation

This certificate is valid from 16 March 2013 until 16 March 2016
and remains valid subject to satisfactory surveillance audits.
Issue 2

Authorised by
Ir. J. Weide

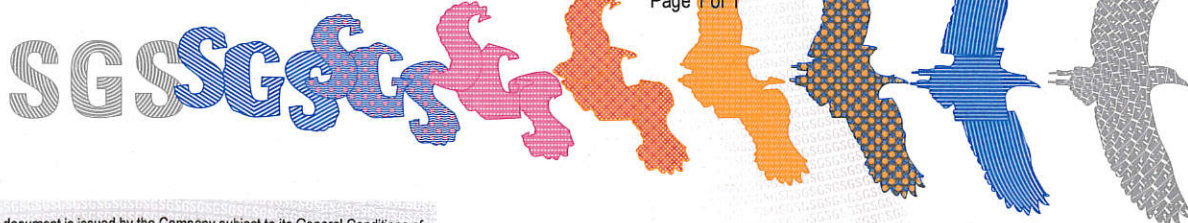
A blue ink signature of Ir. J. Weide.

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REFERENCE LIST

YEAR	PROJECT	CLIENT	SCOPE	SIZE
2014	Sonatrach GL2Z, Algeria	TPF Basse Sambre	supply, prefabrication, cement-lining of piping	4"-12"
2014	RasGas, Flow assurance project, Qatar	Chiyoda Almana	supply, prefabrication, cement-lining of piping	10"
2014	SECO port project Mombassa, Kenya	Siekmann	supply, prefabrication, cement-lining of piping	4"-8"
2014	ExxonMobil, Aurora-EOS project, Singapore	Mitsui Engineering and Shipbuilding Co., Ltd	supply, prefabrication, cement-lining of piping	4"-20"
2014	ZADCO, 7th crude oil storage tank at Zirku Island, U.A.E.	Belleli	supply, prefabrication, painting, cement-lining of piping	4"-30"
2014	ZADCO, replacement of main diesel generators, U.A.E.	Sicon	supply, prefabrication, cement-lining of piping	4"-12"
2014	Hellenic Petroleum, Greece	Van Leeuwen	supply, prefabrication, cement-lining of piping	8"
2014	AGOCO, Nafoora Field Disposal line, Libya	Alimdad	supply, prefabrication, cement-lining of piping	6"-12"
2014	Contractors Camp, Halul Island, Qatar	Target	supply, prefabrication, cement-lining of piping	4"-8"
2014	Laffan Refinery Phase 2, Qatar	CTCI	supply, prefabrication, cement-lining, coating of piping	4"-24"
2013	Bir El Msana Field, Algeria	Hyundai Engineering Co., Ltd	supply, prefabrication, PE-coating, cement-lining of piping	4"-10"
2013	KNPC North LPG Tank Farm, Kuwait	GS	supply, prefabrication, PE-coating, cement-lining of piping	4"-30"
2013	AGOCO Sarir Field, Libya	Zelten Oil	supply, prefabrication, and cement-lining of piping	4"-20"
2013	Tempa Rossa Offshore, Italy	ABB	supply, prefabrication, and cement-lining of piping	6"-14"
2013	SOC Sweet Condensate Stabilizer Unit, Libya	Pireco	supply, prefabrication, rubber-lining of piping	6"
2013	Micco store, U.A.E.	GASCO	supply, prefabrication, PE-coating, cement-lining of piping	4"-42"
2013	RasGas Long Term EPCm, Qatar	Chiyoda Almana	supply, prefabrication, and cement-lining of piping	6"-10"
2013	QatarGas PMP, Qatar	Technip	supply, prefabrication, and cement-lining of piping	16"
2012	Jurong Rock Cavern, Singapore	Hyundai Engineering & Construction	supply, prefabrication, and cement-lining of piping	1"-22"
2012	Sukari Gold Mine, Egypt	Centamin	supply, prefabrication, PE-coating, cement-lining of piping	18"

REFERENCE LIST

2012	Esso Sicily, Italy	Sideco	supply, prefabrication, and cement-lining of piping	4"-30"
2012	RasGas, Qatar	Trags	supply, prefabrication, PTFE-lining of piping	1"-6"
2012	Ineos Lavera Refinery, France	Genoyer	supply, prefabrication, and cement-lining of piping	2"-20"
2012	Jetty Boil-Off Gas Recovery, Qatar	Edgen Murray	supply, prefabrication, and cement-lining of piping	6"-24"
2012	Burgas, Bulgaria	Technip Italy	supply, prefabrication, PE-coating, cement-lining of low temp. piping	6"-16"
2012	AGOCO Nafoora Field, Libya	Zelten Oil	supply, prefabrication, and cement-lining of piping	2"-12"
2012	Pertamina Cilacap, Indonesia	GS	supply, cement-lining of piping	10"-12"
2012	QP Centralized industrial area Halul, Qatar	Ventare	supply, prefabrication, and cement-lining of piping	6"-10"
2011	Plateau Maintenance Project, Qatar	Technip	supply, prefabrication, PTFE-lined piping	2"-6"
2011	ADGAS IGD, U.A.E.	SIXCO	supply, prefabrication, PE-coating, cement-lining of piping	3"-18"
2011	SAMREF, Saudi-Arabia	Van Leeuwen	supply, prefabrication, and cement-lining of piping	4"-12"
2011	SRD, France	Societe de la Raffinerie de Dunkerque	supply, prefabrication, and cement-lining of piping	2"-10"
2011	ADGAS IGD, U.A.E.	HHI	supply, prefabrication, PE-coating, cement-lining of piping	4"-18"
2011	Plateau Maintenance Project, Qatar	Technip	supply, prefabrication, PE-coating and cement-lining of piping	6"
2011	Yeosu Terminal, Korea	Hyundai	supply, prefabrication, and cement-lining of piping	6"-20"
2011	Qatargas Helium plant, Qatar	Chiyoda Almana	supply, prefabrication, and cement-lining of piping	6"-14"
2011	Ruwais shut down, U.A.E.	GASCO	supply, prefabrication, and cement-lining of piping	4"-40"

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2010	AGOCO, Libya	Idreco SpA.	supply, prefabrication, PE-coating and cement-lining of piping	6"-12"
2010	Qatar Vinyl Company, Qatar	Qatar Vinyl Company	supply, prefabrication, and PTFE lining of piping	10"
2010	QP Halul Island, Qatar	CECC	supply, prefabrication and cement-lining of piping	3"-12"
2010	Sonatrach GL2Z, Algeria	PAI	supply, prefabrication, epoxy coating and cement lining of piping	3"-24"
2010	Sirte Oil Company, Libya	Pireco	supply, prefabrication and rubber-lining of piping	6"-14"
2010	Nippon Jordan Fertilizer Co., Jordan	Nippon Jordan	supply, prefabrication, and PTFE lining of piping	2"-6"
2010	ISLA Refineria, Curacao	PDVSA	supply cement lined piping	3"-20"
2010	Akzo Chemical, Netherlands	Stork	supply, prefabrication, epoxy coating, and rubber lining of piping	10"-20"
2010	Magtaa Desalination Plant, Algeria	Hyflux	supply, prefabrication, epoxy lining, and epoxy coating of piping	2"-64"
2010	Societe de la Raffinerie de Dunkerque	SRD	supply, prefabrication, and cement lining of piping	3"-14"
2009	Antifouling System Ship	TVK Shipyard	supply, prefabrication, and PTFE lining of piping	1 1/2"
2009	Ruwais Train I Shutdown, U.A.E.	GASCO	supply, prefabrication, and cement lined piping	4"-30"
2009	QAFAC, Qatar	QAFAC	supply, prefabrication, primer coating, and rubber-lining of piping	16"
2009	Hamada Field, Libya	Alpha United	supply, prefabrication, and cement lined piping	8"-16"
2009	Esso Refinery Sicilia, Italy	Sideco SpA	supply, prefabrication, and cement lined piping	3"-8"
2009	Ras Laffan Port Expansion, Qatar	CCIC	supply, prefabrication, and external epoxy and internal cement lined piping for firewater system	3"-36"

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2009	Pertamina ARUN LNG, Indonesia	PT. Kipra Multi Sarana	supply, prefabrication, and cement lined piping	4"-10"
2009	ISLA Refineria	PDVSA	supply, prefabrication, and cement lined piping	4"-32"
2009	Akzo Chemical, Netherlands	Stork	supply, prefabrication, and rubber lined piping	6"
2009	AGOCO, Libya	Corus	epoxy lined piping	24"
2009	Halul Island Upgrade III, Qatar	CECC	supply, prefabrication, and cement lined piping	1"-12"
2009	AGOCO Desalter, Libya	MAN	supply, prefabrication, and cement lined piping	1"-24"
2008	Chilean LNG, Chili	CB & I	supply of glass flake lined piping	24"
2008	QAFAC upgrade, Qatar	Qatar Fuel Additives Company Ltd.	supply of rubber lined spools	4"-32"
2008	SPT, Singapore	Foster Wheeler Parsons	supply, prefabrication, and external PE and Internal cement lined piping	3"-20"
2008	Hellenic Petroleum, Greece	Van Leeuwen	supply, prefabrication, and cement lined piping	4"-8"
2008	GASCO, U.A.E.	Emirates Petrochemical Services	supply, prefabrication, and cement lined piping	4"-20"
2008	Jetty Pipe Rehab. Brega, Libya	Sirte Oil Company	supply, prefabrication and rubber lined piping	6"
2008	RSE Sulphur Expansion Project, U.A.E.	Dodsai	supply, prefabrication, and external PE and Internal cement lined piping	4"-18"
2008	New LNG Train Skikda, Algeria	KBR	supply, prefabrication, and external PE and Internal cement lined piping	4"-14"
2008	British GAS pipeline project	Allied UK	application of an internal and external epoxy lining	2"-36"
2008	Qatargas Berth 6 project, Qatar	Fluor Corporation	supply, prefabrication, and external epoxy and internal cement lined piping for firewater system	6"-24"

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2008	VOS Logistics Qatofin Terminal, Qatar	D & T Contractors	supply, prefabrication of spools, and cement lined piping for firewater system	2"-12"
2008	Refineria Talara, Peru	Petroperu	supply, prefabrication of spools, and cement lined piping for firewater system	12"
2008	ATLL, Conduccion Desaladore-Barcelona, Spain	COMSA	Stock yard cement lining of pipes and fittings	28"-56"
2007	St.Katherina Water pipe line, Egypt	Petrojet	supply, prefabrication of spools, and cement lined piping for potable water system	4"-12"
2007	RasGas Onshore project Train 6 + 7, Qatar	CTEP	supply, prefabrication and PTFE lined piping	1"-6"
2007	EQUATE LPK Olefins 2, Kuwait	Fluor Corporation	supply, prefabrication of spools, and cement lined piping for firewater system	6"-14"
2007	Vasilikis Power Plant Project, Cyprus	J & P	supply, prefabrication of rubber lined spools	20"
2007	Qatofin Marine Works, Qatar	Archiridon Contruction	supply, prefabrication of spools, and cement lined piping for firewater system	4"-44"
2007	ATLL, Conduccion FontSanta-Trinitat, Spain	Copisa	In-situ cement lining	64"-72"
2007	Caustic Chlorine upgrade pipe line KOC, Kuwait	Al Muntaser	supply, prefabrication and Rubber lined piping	16"-44"
2007	Nafoora Field replacement of Fire water line, Libya	Zelten Oil	supply, prefabrication of spools, and cement lined piping for firewater system	3"-12"
2007	Ras Laffan Refinery Project, Qatar	GS Engineering & Construction	supply, prefabrication of spools, and cement lined piping for firewater system	6"-20"
2007	GASCO, U.A.E.	Emirates Petrochemical Services	supply, prefabrication of spools, and cement lined piping for firewater system	4"-20"

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2007	QGII LNG Storage Facilities, Qatar	IHI Corporation	supply, prefabrication of spools, and cement lined piping for firewater system	6"
2007	KNPC, Kuwait	Al Sabih	supply of cemenlined piping	4"-16"
2007	Bharat Rayon, Indonesia	P.T. INDO Bharat	supply of rubber lined piping	8"-20"
2007	ENOC, U.A.E.	F.A.S. Spa	supply, prefabrication of spools, and cement lined piping for firewater system	3"-6"
2007	Al Zawia Old Terminal, Libya	Bosna-S Oil Services	supply, prefabrication, and cement lined piping for firewater system	4"-8"
2007	British GAS pipeline project, UK	Allied UK	application of an internal and external epoxy lining	2"-36"
2007	Phophatice Fertilizer Plant, Jordan	INDO-Jordan Chemical	Supply of PV Butyl Rubber lined material In situ	
2007	Asprofos Hellinic Petroleum, Greece	Van Leeuwen	supply, prefabrication, and cement lined piping for firewater system	4"-10"
2007	AGOCO replacement of Fire water pumping station, Libya	J&P	supply, prefabrication, and cement lined piping for firewater system	1"-12"
2007	Service Industry, Dubai	Al Dobowli	supply, prefabrication and Ebonite Rubber lined piping	16"-44"
2007	Common Sulphur Handling Facilities, QATARGAS, Qatar	AL Jaber Energy Services	supply, prefabrication, and cement lined piping for firewater system	4"-24"
2007	BAPCO RFDP Refinery, Bahrain	Genoyer	supply, prefabrication, cement lining elbows	4"-20"
2007	Corinth Refinery, Greece	Motor Oil	supply, prefabrication, cement lining elbows	6"
2007	Rasgas Onshore Exp. Phase 2 Train 6 + 7, Qatar	CTEP	supply, prefabrication and cement lining of piping for firewater system	4"-24"
2006	Qatar Vinyl Company, Qatar	Qatar Vinyl Company	suppy, prefabrication and PTFE lined piping	1"-6"

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2006	Caustic Chlorine KOC, Kuwait	Ahlia Industrial Projects	supply of rubber lined spools	12"-44"
2006	GASCO, U.A.E.	Descon	supply, prefabrication, and cement lined piping for cooling water piping	4"-30"
2006	NIGC, Iran	IPS	application of an epoxy phenolic lining	4"-12"
2006	RL(3) Common Offplot Projects, Qatar	Fluor Corporation	supply, prefabrication, and cement lined piping for firewater system	6"-20"
2006	Singapore Fertilizer Project	Kuriya-ohji PTE	supply, prefabrication fo PTFE lined piping	0,5'-4"
2006	Tank Upgrade Project, Qatar	Prashant Projects	supply, prefabrication, and cement lined piping for firewater system	4"-24"
2006	ORC Shutdown, Oman	STS	supply, prefabrication, and cement lined piping for coolingwater system	4"-40"
2006	Mesaieed NGL plant New Condensate Dis Tank-13, Qatar	Galfar Al Misnad Engineering & Contracting WLL	supply, prefabrication, and cement lined piping for firewater system	4"-24"
2006	Caustic Chlorine, Qatar	Qatar Vinyl Company	supply, prefabrication and rubber lined piping	12"-32"
2006	Qatargas II Development Project	CCIC	supply Sinmast jointing compound	6"-24"
2006	New Desalination Plant, Kuwait	Kiran International	supply, prefabrication and neoprene rubber lined material	32"-44"
2006	Costal Azul Regasification Project, Mexico	Mitsubishi Heavy Industries	supply, prefabrication, and cement lined piping for firewater system	6"
2005	Qatargas 3 & 4 Onshore Projects, Qatar	CTEP	supply, prefabrication, and cement lined piping for firewater system	6"-24"
2005	Guangdong LNG Terminal Project, China	Saipem	supply, prefabrication and PTFE lined piping	3"-6"
2005	Pars Petrochemical complex, Iran	Intecsa Uhde	supply, prefabrication, Polyethylene coating and cement lined piping	4"-24"
2005	Isomerisation Project, Oman	CCC Oman LLC	supply, prefabrication, and cement lined piping for firewater system	4"-32"

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2005	Sarir Fire Water Replacement System Project - AGOCO, Libya	J&P Energy and Industrial S.A.	supply, prefabrication, and cement lined piping	4"-12"
2005	Qatargas II Development Project	CTEP	supply, prefabrication, and cement lined piping for firewater system	6"-24"
2005	BOG Capture Maximization & SRU Upgrade Project, U.A.E.	Chiyoda	supply, prefabrication, and cement lined piping	3"-24"
2005	Halul Harbour upgrade phase II, Qatar	CECC	supply, prefabrication, and cement lined piping	2"-12"
2005	ORC Terminal Facilities, Oman	GPS	supply, prefabrication, cement lining of piping	4"-30"
2005	Arya Sasol, Iran	Sidertub	supply, prefabrication, and epoxy lined piping	3"-24"
2004	RasGas LNG Train 5, Qatar	Chiyoda	supply, prefabrication and cement lining of piping for firewater system	4"-24"
2004	Sakhalin LNG Project, Russia	Chiyotec Ltd.	supply, prefabrication, cement lining, PE-coating spools	8"
2004	KNPC, Kuwait	Al-Sabih	supply, cement lining, pipes	8"-28"
2004	Corinth Refinery, Greece	Motor Oil (Hellas)	supply, prefabrication, cement lining of piping	10"-12"
2004	RasGas Onshore Expansion Project Train 4, Qatar	Chiyoda	supply, prefabrication and cement lining of piping for firewater system	4"-24"
2004	Al-Khaleej Gas Project, Qatar	RPCO Ltd.	supply, prefabrication and cement lining of piping for firewater system	4"-24"
2004	Oman Chlorine S.A.O.G.	Bahwan	supply, prefabrication and PTFE lined piping	1"-6"
2004	Acid Regeneration Plant, Kenya	Mabati Rolling Mills	supply of rubber lined equipment	
2004	MRR Project - Bintulu, Malaysia	MITCO PETRONAS	supply, prefabrication, rubber lining, coating of pipe-spools	1"-10"
2003	Corinth Refinery, Greece	Motor Oil	supply, prefabrication, cement lining elbows	8"

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2003	Tobruk Refinery Firefighting system Upgrade, Libya	Petroinvest	supply, prefabrication per client drawing, Epoxy lining, coating of piping	4"-12"
2003	Hellenic Petroleum, Greece	General Commercial & Industrial s.a.	supply, prefabrication, cement lining, PE-coating of piping	3"-10"
2003	Sirte Oil Company, Libya	T&C	supply, cement lining piping	16"-24"
2003	Nafoora Water Disposal for GOSP 4 & 102D, Libya	J&P	supply, prefabrication, cement lining of pipe-spools	6"-12"
2003	Sarir Water Disposal, Libya	MAN Ferrostaal GmbH.	supply, prefabrication, cement lining of pipe-spools	6"-10"
2003	Thai Olefins Plant Expansion, Thailand	Chiyoda	supply, PE-coating pipes	¾"-6"
2003	Esso Italiana Siracusa	Sideco SpA	supply, prefabrication, cement lining of piping	24"-30"
2003	Al-Khaleej Gas Project, Qatar	RPCO Ltd.	supply, prefabrication and cement lining of piping for firewater system	4"-24"
2003	Hellenic Petroleum, Greece	General Commercial & Industrial s.a.	supply, prefabrication, cement lining, PE-coating of piping	6"-10"
2003	National Chemicals, Egypt	Trust Chemicals	supply, prefabrication, rubber lining of piping	12"-32"
2003	Topside Facilities to the Multi-product berth at Messaieed, Qatar	Van Leeuwen	supply, prefabrication, cement lining of piping	1"-20"
2002	KNPC, Kuwait	Al-Sabih	supply, cement-lining of fittings	20"-24"
2002	Transgas Atlantico, Spain	Tractebel Engineering	supply, prefabrication, cement lining, PE-coating of pipe-spools for seawater heating system	24"-40"
2002	Kenya Port Authority	H. Young	supply, prefabrication, cement lining, coating of piping	2"-8"
2002	Ras Laffan Common Cooling Water Project (QCR), Qatar	Chiyoda	supply, prefabrication, cement lining, coating of piping for firewater system	4"-24"

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2002	MRR Project - Bintulu, Malaysia	MITCO PETRONAS	supply, prefabrication, rubber lining, coating of pipe-spools	1"-10"
2001	Tobruk Refinery Firefighting system Upgrade, Libya	Petroinvest	supply, prefabrication per client drawing, Epoxy lining, coating of piping	2"-12"
2001	ISLA Refineria, Curacao	PDVSA	supply, cement lining of piping for cooling water	30"-36"
2001	Hellenic Petroleum, Greece	Sicom Italia	supply, prefabrication, cement lining, PE-coating of piping	4"-16"
2001	Tobruk Refinery Firefighting system Upgrade, Libya	Petroinvest	supply, prefabrication, cement lining, coating of piping for firewater system	2"-16"
2001	MRR Project - Bintulu, Malaysia	MITCO PETRONAS	supply, prefabrication, cement lining, coating of fittings -Sea cooling water line	4"-28"
2001	KOC Gas Oil Desulfurization, Kuwait	LG Engineering & Construction Corp.	supply, prefabrication, cement lining and PE-coating of piping materials	4"-14"
2001	RasGas Onshore Expansion Project, Qatar	Chiyoda	supply, prefabrication and cement lining of piping	4"-24"
2001	NGL-4, Qatar	Silvani Antincendi S.p.A.	supply, prefabrication, cement lining, coating of hydrants	3"-6"
2001	Corinth Refinery, Greece	Motor Oil (Hellas)	supply, prefabrication, cement lining, coating of piping -Sea cooling water line	
2001	Arabian Gulf Oil Company, Libya	A.S.F.	supply, prefabrication and cement lining of piping	4"-12"
2000	MRR Project - Bintulu, Malaysia	MITCO PETRONAS	supply, prefabrication, cement lining, coating of fittings -Sea cooling water line	4"-20"
2000	EKO Refinery, Greece	Themeliodomi S.A.	supply, prefabrication, cement lining, piping materials -Fire water line	6"-10"

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2000	NGL-4, Qatar	Hyundai Engineering & Construction	supply, prefabrication, cement lining of piping materials	4"-24"
2000	KNPC New GOD Project, Kuwait	LG Engineering & Construction Corp.	supply, prefabrication, cement lining and PE-coating of piping materials	4"-14"
2000	Sirte Oil, Libya	U.K.	Supply, prefabrication, cement lining and PE coating of spools for cooling water system	24" - 64"
2000	Corinth Refinery, Greece	Motor Oil (Hellas) S.A.	Supply and cement lining of pipes	6"
2000	Q-CHEM, Qatar	Kellogg Brown & Root	Supply, prefabrication, Epoxy coating & lining of spools	1" - 84"
2000	Petrola Hellas Refinery, Greece	Petrola Hellas S.A.	Supply and cement lining of pipes	6" - 14"
2000	STFA Azzawia, Libya	AVM International Ltd. A/S	Supply, prefabrication, cement lining of branch pipes and fittings	3" - 10"
2000	KNPC, Kuwait	Kuwait National Petroleum Co. (K.S.C.)	Supply and cement lining of pipes	18"
2000	Sirte Oil, Libya	U.K.	Supply, prefabrication and cement lining of pipe-spools for cooling water system	16" - 48"
2000	Kipevu, Kenya	Zaisco Construction & Engineering Ltd.	Cement lined fire fighting safety equipment complete with pipes and hydrants attachments Size - Sea water	8"-10"
1999	Botas, Turkey	Tractebel	Supply, prefabrication and cement lining of pipes and fittings	1" - 60"
1999	Desalter Sarir, Libya	Man GHH Oil & Gas GMBH	Supply, prefabrication and cement lining of pipes	4" - 6"
1999	ADGAS, United Arab Emirates	Emirates Holdings	Supply, prefabrication and cement lining of pipes and fittings	4" - 34"

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1999	Mongstad Vestprosses, Norway	Hanf Industrial Services / Stadoil	Supply and prefabrication of cement lined pipespools	4"-40"
1999	Greece	Motor Oil (Hellas)	Supply and cement lining of pipes	10"
1999	France	KDI CS	Supply, cement lining and PE coatings of pipes	10"
1999	Maglad Basin Oil Development, Sudan	I.T.S. Europe B.V.	Fabrication of manholes, plates and flanges	24"
1999	Disirade	Geocean Solmarine	Supply, prefabrication and PE coating of pipes	10"
1999	Brega Marine Terminal, Libya	STFA Construction Co.	Supply, prefabrication and cement lining of pipes and fittings	1" - 10"
1999	Greece	Motor Oil (Hellas)	Supply and cement lining of fittings	4"
1999	Midor, Egypt	TAD France	PE coating of pipes	1.5" - 24"
1998	Berri Gas, Saudi Arabia	JGC	Supply, prefabrication and cement lining of lateral tees and fittings	4" - 24"
1998	Refinery Isla, Curacao	PDVSA Services, Inc.	Supply and cement lining of pipes and fittings	24" - 36"
1998	Ras Laffan Onshore Facility Project, Qatar	JGC / Kellog Joint Venture	Supply, prefabrication of galvanized fire hydrants	4"-24"
1998	Mobil, Indonesia	Tripatra	Supply, prefabrication of cement lined spools and piping components	12" - 44"
1998	HPCL HGU Plant, India	Hyundai Engineering & Construction	Supply, prefabrication and cement lining of pipes and fittings	3" - 10"
1998	Abu Dhabi International Airport Fuelline, United Arab Emirates	UGA	Supply, jet fuel lining and PE coating of pipes	6" - 12"
1998	Tobruk, Libya	Voest Alpine Oilfield Service Ltd.	Supply, prefabrication and cement lining of segment bends, pipes and fittings	8" - 10"
1998	HAR Modernization	Aktor	Supply, prefabrication, cement lining and PE coating of pipes and fittings	3" - 12"

REFERENCE LIST

1998	Tobruk, Refinery Extension Project C72, Libya	Teknica	Supply, prefabrication, epoxy- and cement lining of pipes, fittings and flanges	4" - 10"
1998	Replacement existing disposal water lines at Sarir Field, Libya	Voest Alpine Oilfield Service Ltd.	Supply, prefabrication, cement lining and PE coating of pipes	8" - 14"
1997	Tender no. D/386/97. Wafra Kuwait	Saudi Arabian Texaco / Kuwait Oil Company - Joint Operation	Insitu cement lining 18" + 20" pipes 33.9 km. Prefabrication and cement lining of pipespools, fittings and pipes. Shop cement lining of fittings and flanges (Sea water mixed with crude oil)	18"-20"
1997	NSO, Indonesia	Tripatra		4" - 44"
1997	Berri Gas Project Saudi Arabia	JGC	Prefabrication and cement lining of fittings	4" - 24"
1997	Replacement Water Outlet Piping Sarir Field for AGOCO, Libya	GTMA	Insitu cement lining of pipes at job site 13 km	18" - 24"
1997	Ras Lanuf Complex - Libya	Silvani Antincendi S.p.A.	Supply, Prefabrication, cement lining and coating of pipe spools	8"
1997	Qafac, Qatar	Chiyoda	Supply and cement lining of fittings	4" - 24"
1997	AGR for KNPC, Kuwait	Sunkyoung	Supply, cement lining and sealcoating of pipes, fittings, flanges and gaskets	4" - 36"
1997	UAB #3, Indonesia	Hyundai Engineering Co., Ltd	Prefabrication and cement lining of pipes, fittings and flanges	4" - 24"
1997	Ras Laffan Onshore Facilities Project LNG Train I	JGC	Prefabrication and cement lining of pipes and fittings	4" - 24"
1996	Saudi Aramco Yu'Aymah	JGC	Prefabrication and cement lining of fittings	4" - 20"
1996	Tobruk Refinery Extension project - C72	Teknica	Prefabrication and epoxy lining of pipes and fittings	4" - 12"

REFERENCE LIST

1996	Qatar-Gas GL-QA, Qatar, Train III	Chiyoda	Prefabrication and cement lining of fittings and flanges	4" - 24"
1996	Asahimas Indonesia / AVC	Toyo Engineering Centre	Prefabrication and rubberlined pipespools	14" - 18"
1996	Kuwait KPP Project	Toyo Engineering Corporation	Prefabrication and rubberlined pipespools	14" - 18"
1996	Asahimas Indonesia / AVC	Toyo Engineering Centre	Prefabricated and cementlined pipespools for cooling water intake and return lines. Size 2" - 42" - Sea water	
1996	Rasco Package "B" Libya	Hyundai Engineering Seoul Korea	Cementlined and PE coated pipes and fittings	4" - 16"
1996	Urea Project Bahrain	Mitsubishi Heavy Industries	Cement lining and bitumen coated piping	6" - 48"
1996	MAFP Project, Mina Al-Ahmadi, Kuwait	Mitsui Engineering and Shipbuilding Co., Ltd	Cementlined piping, bolts & nuts, gaskets, underground and above ground	4" - 26"
1996	Kuwait KPP Project	Toyo Engineering Corporation	Prefabrication cement mortar lined pipespools / headers	10" - 42"
1995	Leuna 2000 Refinery, Germany	Technip / Lurgi	Supply of pipes, fittings and specials, prefabrication, cement lining, PE coating	4" - 60"
1995	National Fertilizer Project, Thailand	Hyundai	Prefabrication, cement lining and PE coating of pipes, fittings and flanges	4" - 36"
1995	Motor Oil Refinery, Greece	Motor Oil	Supply, prefabrication and cement lining of fittings	24" - 28"
1995	Aramco, Saudi Arabia	Eurotube / Bechtel	Supply and prefabrication of sleeve couplings	4" - 36"
1995	TSH, Thailand	Chiyoda	Supply, prefabrication and cement lining of flanges	4" - 68"
1995	SIP, Singapore	Chiyoda	Supply, prefabrication and cement lining of flanges	4" - 68"
1995	Petrola Hellas Refinery, Greece		Cement lining and supply of pipes with sleeves	4" - 24"

REFERENCE LIST

1995	Qapco Ethylene Plant, Qatar	Technip	Prefabrication, cement lining and bitumen coating of pipes, flanges and fittings	4" - 30"
1995	Rasco Package "A", Libya	Hyundai	Supply of cementlined and PE coated pipes and fittings	½" - 16"
1994	1-2, Indonesia	JGC	Supply, prefabrication, cement lining and coating of pipespools and headers	4" - 52"
1994	Qatar-Gas QGL-QA, Qatar, Train I and II	Chiyoda	Prefabrication and cement lining of fittings and flanges	6" - 24"

STANDARD FOR CEMENT LINED PRODUCTS

STANDARD
FOR
CEMENT LINED MATERIALS

CNP-101-01

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STANDARD FOR CEMENT LINED PRODUCTS

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STANDARD FOR CEMENT LINED PRODUCTS

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STANDARD FOR CEMENT LINED PRODUCTS

1. FOREWORD

Conpipe International b.v. is a worldwide operating company which manufactures pipe systems by means of the most advanced production methods for drink water companies in their raw water projects and water treatment plants, off-shore companies and petrochemical industries.

Conpipe International b.v. 's systems can be supplied in any desired configuration, pipe-diameter and wall thickness. We are specialized in lined and coated pipe-line systems. Cement-, PTFE-, Rubber- and Epoxy lining are all in our scope of supply.

This standard is based on shop cement lined products.

This standard is a guidance for the purchaser during inquiry or purchasing activity.

This manual does not constitute a warranty of any kind expressed or implied, of Conpipe's products of their fitness for any particular use. The company does not accept responsibility or liability for inaccuracies in this publication.

Conpipe reserves the right to change product specifications without prior notice.

2. LIST OF ABBREVIATIONS

- NOT APPLICABLE

3. SCOPE

This standard covers the specifications, properties, installation and operation procedures, standard product range of shop cement lined piping.

4. FIELD OF APPLICATION

Cement lining is a process by which steel pipes, fittings and other steel equipment are coated internally with a protective layer of cement mortar. The lining of the pipes is applied by a centrifugal process, creating a smooth finish. Fittings and other steel piping equipment are lined by hand.

Cement lined piping is used in water containing pipe systems.

STANDARD FOR CEMENT LINED PRODUCTS

The areas where cement lining is applied are:

- Drinking water
- Firewater
- Cooling water
- Sewerage

The advantages of cement lined piping equipment are numerous:

- Extends to life-time of piping materials dramatically.
- It provides corrosion protection and protects it from internal deterioration.
- It is non-toxic. In potable water service it keeps the water pure, colorless, odorless and clean.
- It has excellent hydraulic properties.
- Reduces maintenance and stops pipe leakage.
- Good deflection properties.
- It is very cost effective in comparison with other types of lining.

5. MATERIALS

5.1. CEMENT-MORTAR COMPOSITION

5.1.1. Cement

ASTM C150 type V is used (type II optional). When requested by the client max. 25% Trass or Puzzolan cement or equivalent products in accordance with ASTM C618 can be added.

STANDARD FOR CEMENT LINED PRODUCTS

5.1.2. Sand (aggregate)

Well graded sand conform ASTM C33, with maximum impurities as to ASTM C40 should be used. Sieve analyses, minimum – maximum grain size can vary by contract.

5.1.3. Water

Only clean fresh water will be used, of potable quality. Water/cement ratio must be between 0.33 and 0.42. A lower water/cement ratio will produce a more dense lining and thus a lower absorption factor.

5.1.4. General remarks

Above mentioned elements are the basic products for the mortar mix. Conpipe does not use additives to enhance the mortar workability under normal conditions. The above ingredients must be mixed thoroughly in a mixer with sufficient capacity to keep up with the volume of mortar required during the lining operation.

5.2. STEEL COMPONENTS

5.2.1. Flanges

Flanges are in accordance with one of the following standards:

- ASTM A105 N.
- AWWA
- BS-10, table D and E
- DIN
- Special flanges if required.

5.2.2. Piping

Piping is in accordance with one of the following standards:

- ASTM A106 grade B.
- API 5L grade B.
- ASTM A53 grade B.

STANDARD FOR CEMENT LINED PRODUCTS

5.2.3. Fittings

Welded fittings are in accordance with one of the following standards:

- ASTM A234 grade WPB.
- API 5L grade B.
- ASTM A106 grade B.
- ASTM A53 grade B.

Note: Please contact your sales representative for available and technical details.

6. SPECIFICATIONS FOR SHOP CEMENT LINED PIPING

The most widely used specification today is the AWWA C205. This specification highlights all the work to be performed, including the lining thickness, mortar quality, pipe condition and inspection.

Besides this specification Conpipe can produce cement linings according several other specifications, which are all based on the AWWA C205.

The lining specifications are:

- | | |
|-------------------------------------|-----------------------|
| • German industrial norm | DIN 2614 |
| • British Standard | BS 534 |
| • British Petroleum | GS 106-1 |
| • Shell | DEP 30.48.30.31-Gen. |
| • Aramco | 01-SAMSS-005 |
| • Kuwait National Petroleum Company | KNPC ENG STD 87C1 |
| • American Water Works Association | AWWA C205, C104, C602 |
| • American Petroleum Institute | API RP 10E |

STANDARD FOR CEMENT LINED PRODUCTS

7. PROCEDURES

7.1. *PACKING, HANDLING AND STORAGE OF CEMENT LINED PRODUCTS*

This procedure is to ensure that the cement lined pipes and fittings are handled and stored to avoid damages.

7.1.1. Demands

- 7.1.1.1. It is required to handle and store the cement lined products without damaging the product.
- 7.1.1.2. It is required to prevent the lining from drying out. The hydration process of the lining is not a process of drying the cement lining, but a chemical reaction in which water is one of the most important components. Water is chemically bonded to the cement

7.1.2. Manner

- 7.1.2.1. Handle the product with care, by hand or Nylon slings preferably.
- 7.1.2.2. Avoid contact of any foreign matter with the lining that could cause damage to the lining, such as steel pipe, beams, forklift, etc.
- 7.1.2.3. Do not drop the product, or allow sharp blows.
- 7.1.2.4. Load and secure the products in such a way that the lining is not damaged.
- 7.1.2.5. Stack and block products as to preclude and avoid damage to pipe/fittings and lining.
- 7.1.2.6. Do not roll on the products.
- 7.1.2.7. Support / brace large parts to avoid flexing.
- 7.1.2.8. Avoid all impact loading and unloading.
- 7.1.2.9. Do not roll the product to move it to another place.
- 7.1.2.10. Moistening the lining will avoid the lining from drying out. Have the ends closed by plastic caps / bags to stop air circulation inside the product. Preferably spray freshly lined products every day. One end of covering shall have a hole of approximately 5 mm to release expanded air during transit. The storage and handling will spray water inside the fittings when the outside temperature exceeds 25 °C. Water is sprayed or poured into the product using a flexible hose or buckets. Removed end coverings are placed back onto the end.

STANDARD FOR CEMENT LINED PRODUCTS

- 7.1.2.11. Avoid storage in direct radiation of the sun.
- 7.1.2.12. Do not hammer on the product to position or loosening the product.
- 7.1.2.13. Pipes must only be lifted by wide slings, forklift or similar apparatus. Chain chairs, cables, hooks, end clamps or other equipment likely to damage the inline coating shall not be permitted.
- 7.1.2.14. During stacking, pipes shall be adequately supported on a level bed in order to minimize flexing and prevent induced bending. Use of wooden dunnage between each layer required.
- 7.1.2.15. Recommended stack height:

Pipe Diameter	Number of layers
< 12"	10
12" < 16"	8
16" < 24"	5
24" < 32"	4

- 7.1.2.16. Hauling on pipe trailers is not permitted. An overhang of 1 meter is not permitted.
- 7.1.2.17. All cement lined fittings and flanges shall be fixed securely in seaworthy wooden crates. Wooden crates shall be solid, robust and of high quality.

STANDARD FOR CEMENT LINED PRODUCTS

7.2. REPAIR OF CEMENT LINING

This procedure is a recommendation for field repairs of cement lined products.

7.2.1. Damage evaluation

- 7.2.1.1. Hairline cracks not wider than 1.6 mm.
- 7.2.1.2. Hairline cracks wider than 1.6 mm.
- 7.2.1.3. Portions of lining with other damage than hairline cracks.

7.2.2. Solutions / remedial action

- 7.2.2.1. Cracks with a width less than 1.6 mm can be left as they are, as the self-healing effect will close them automatically as soon as the line is filled with water.
- 7.2.2.2. Cracks with a width of over 1.6 mm can be washed in by using a soft brush with a liquid of cement, being a mixture of 1 part Portland cement and 1 part of fine sand 0.1 mm. The mixture should be in a liquid stage like heavy paints.
The lining shall be moistened before start of the repair and after the repair when the mortar has set (4 hours).
- 7.2.2.3. Larger local repairs other than cracks.
 - 7.2.2.3.A. Remove all loose lining and area concerned has to be brushed firmly.
 - 7.2.2.3.B. Etch the side of existing cement lining with Conpipe Cebond (concrete glue).
 - 7.2.2.3.C. Prepare the mortar mix, 1part cement to 1 part of aggregate by weight; add the water (30-35% of the cement-weight). Mix this thoroughly.
 - 7.2.2.3.D. Fill out area concerned, by means of a trowel and spatula and brush flush with a sponge.
 - 7.2.2.3.E. Keep moist as much as possible after lining has become firm, certainly during the following three days after application.
- 7.2.2.4. **Alternative:** use Conpipe Sinmast repair and jointing compound for the very small repairs.

STANDARD FOR CEMENT LINED PRODUCTS

7.3. CUTTING TO SIZE OF CEMENT LINED PIPE

This procedure describes the recommendations for cutting cement lined pipes in the field.

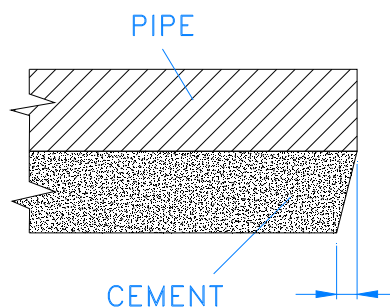
7.3.1. Manner

7.3.1.1. When cutting is necessary this should be performed at required position by means of mechanical grinding.

7.3.1.2. Under no circumstances may pipes be cut by flame.

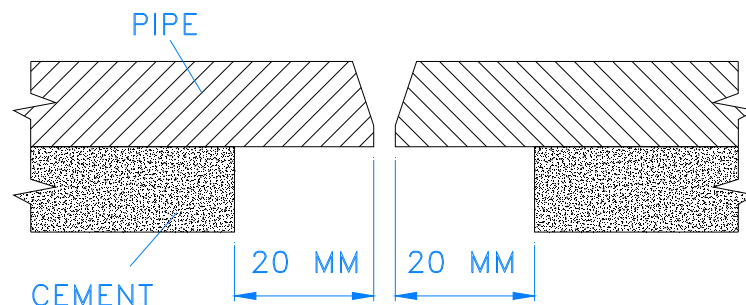
7.3.1.3. We recommend using a grinding disk with a width of 3 mm.

DRAWING OF END PREPARATION FOR SLEEVE JOINTS



CEMENT LINED END TOLERANCE: 0-2 MM.
NO OVERHANG.

DRAWING OF END PREPARATION FOR BUTT-WELD JOINTS



RECESS LENGTH BUTT-WELD JOINTS.

STANDARD FOR CEMENT LINED PRODUCTS

7.4. SLEEVE JOINT

This procedure covers the jointing system for cement lined products by using an external sleeve coupling.

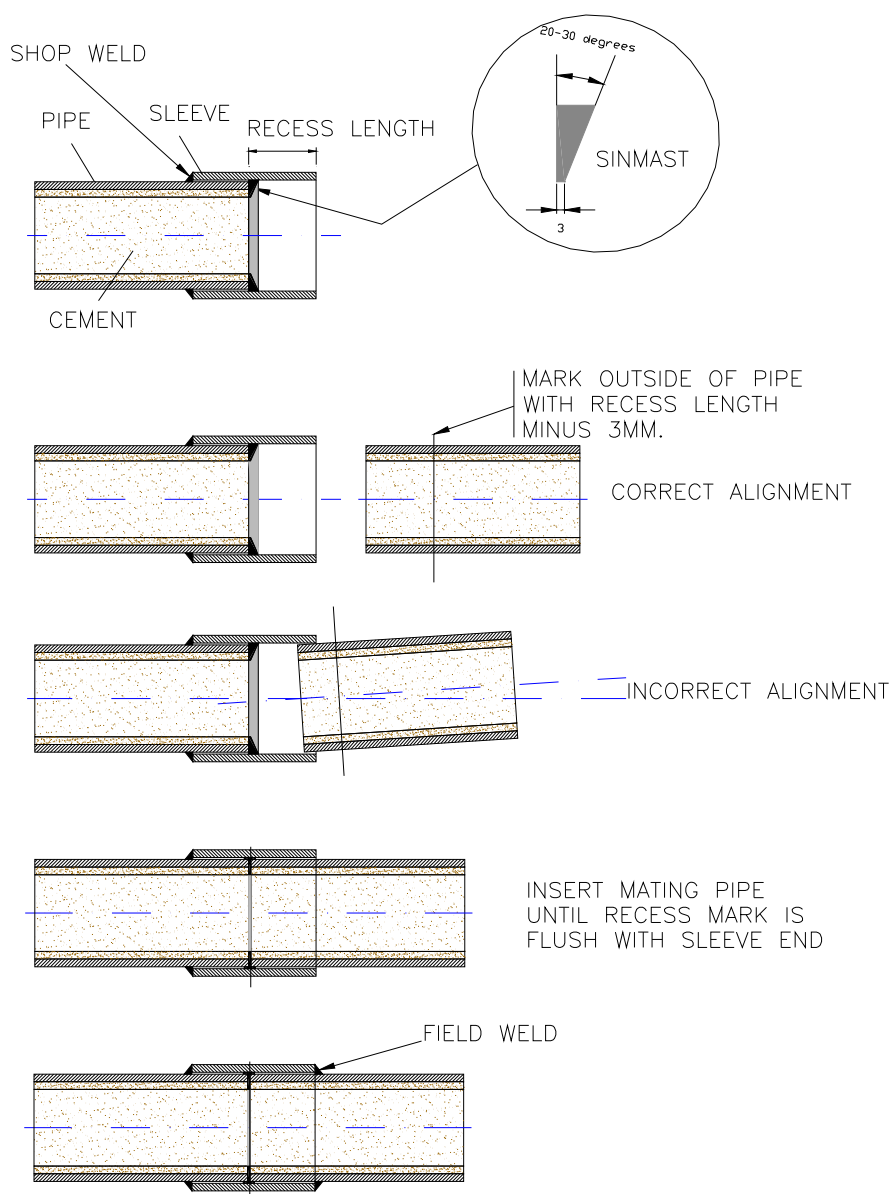
7.4.1. Manner

- 7.4.1.1. Have joints transported and positioned at place of installation.
- 7.4.1.2. Remove plastic end protections of the cement lined products just prior to installation and / or processing.
- 7.4.1.3. Inspect for possible unacceptable cracks and / or damages.
- 7.4.1.4. Make repairs, if so requested, as directed in chapter 7.2.
- 7.4.1.5. Measure free access-length of the sleeve at the female side.
- 7.4.1.6. Mark the male part over full circumference with the measured length of the free access-length of the female interior minus 3 mm.
- 7.4.1.7. The concrete and steel surfaces must be thoroughly cleaned by brush, dry and dust free.
- 7.4.1.8. Work up the Sinmast repair & jointing compound as per chapter 8.
- 7.4.1.9. Apply by means of a spatula or trowel Sinmast under an angle of 75° on the inside of the sleeve. The maximum layer thickness of the Sinmast at the concrete edge is approximately 3 mm.
- 7.4.1.10. Immediately after application of Sinmast, insert the male part of the pipe into the sleeve leaving a gap of 3 mm between the two pipe-ends. The gap is closed / filled by the earlier applied Sinmast.
- 7.4.1.11. Tack-weld the sleeve to the pipe on minimum four points along the circumference. More as the pipe diameter increases to ensure a stable connection).
- 7.4.1.12. After 3 hours make the final welding.
- 7.4.1.12.A. To minimize heat-input perform welding with basic electrode by the Shielded Metal Arc Welding process as follows:
 - Layer 1: electrode 3.25 mm / 110 Ampere
 - Layer 2: electrode 3.25 mm / 125 Ampere
 - Layer 3: electrode 4.00 mm / 150 Ampere
- 7.4.1.12.B. Starts and stops shall be staggered so as not to start or stop more than once in the same place.
- 7.4.1.12.C. Welding slag shall be cleaned from all weld passes.
- 7.4.1.12.D. Welding procedures and welders shall be qualified in accordance with ASME IX.

STANDARD FOR CEMENT LINED PRODUCTS

- 7.4.1.13. Perform welding inspection: visual inspection and non-destructive tests if required.
- 7.4.1.14. Sleeve joint is now ready for operation.

BRIEF INSTALLATION PROCEDURE



STANDARD FOR CEMENT LINED PRODUCTS

7.5. *BUTT-WELD JOINT*

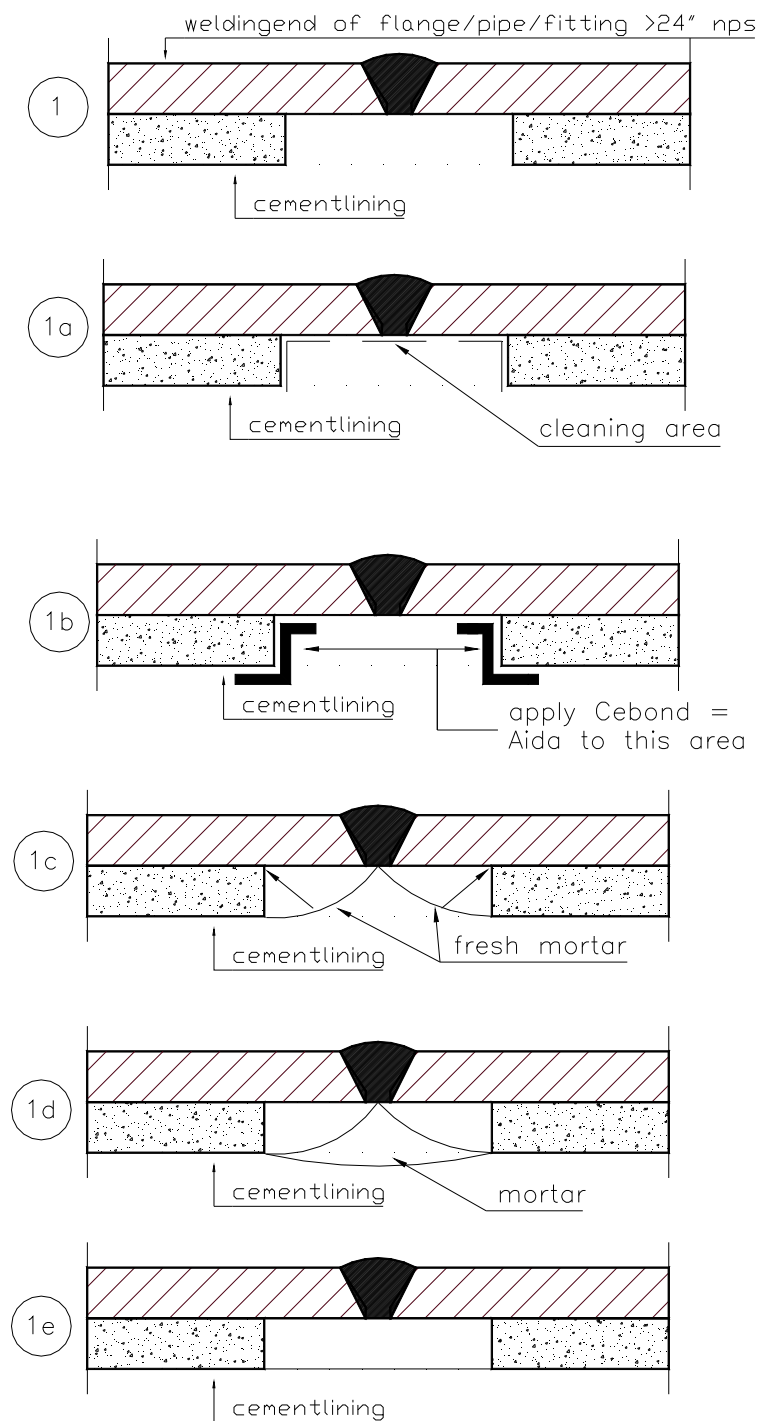
This procedure covers the jointing system for cement lined products by using a butt-weld. This type of joints is only used for diameters of 24 inch and larger.

7.5.1. Manner

- 7.5.1.1. Have joints transported and positioned at place of installation.
- 7.5.1.2. Remove plastic end protections of the cement lined products just prior to installation and / or processing.
- 7.5.1.3. Inspect for possible unacceptable cracks and / or damages.
- 7.5.1.4. Make repairs, if so requested, as directed in chapter 7.2.
- 7.5.1.5. Clean bevel by means of hand- or powered steel-brushing.
- 7.5.1.6. Clean also inside corner (root pass space) with a steel-brush and make sure that all eventual loose particles of concrete are removed.
- 7.5.1.7. Bring pipes in alignment and fit both ends together as per normal practice.
- 7.5.1.8. Perform welding in accordance with the standardized project welding procedure.
- 7.5.1.9. Wait until weld is cold (maximum hand-warm).
- 7.5.1.10. Etch the side corners of the cement lining with Conpipe Aida Cebond. See chapter 9.
- 7.5.1.11. Work up the Conpipe Ready-mix by simple adding water in sufficient quantity to obtain workable cement-mortar. See chapter 10 for the Ready-mix.
- 7.5.1.12. Apply cement-mortar into the gap by means of trowel and spatula.
- 7.5.1.13. Brush flush afterwards.
- 7.5.1.14. Keep humid for the first three days.
- 7.5.1.15. Joint is ready for pressure testing after 28 days, if required.

STANDARD FOR CEMENT LINED PRODUCTS

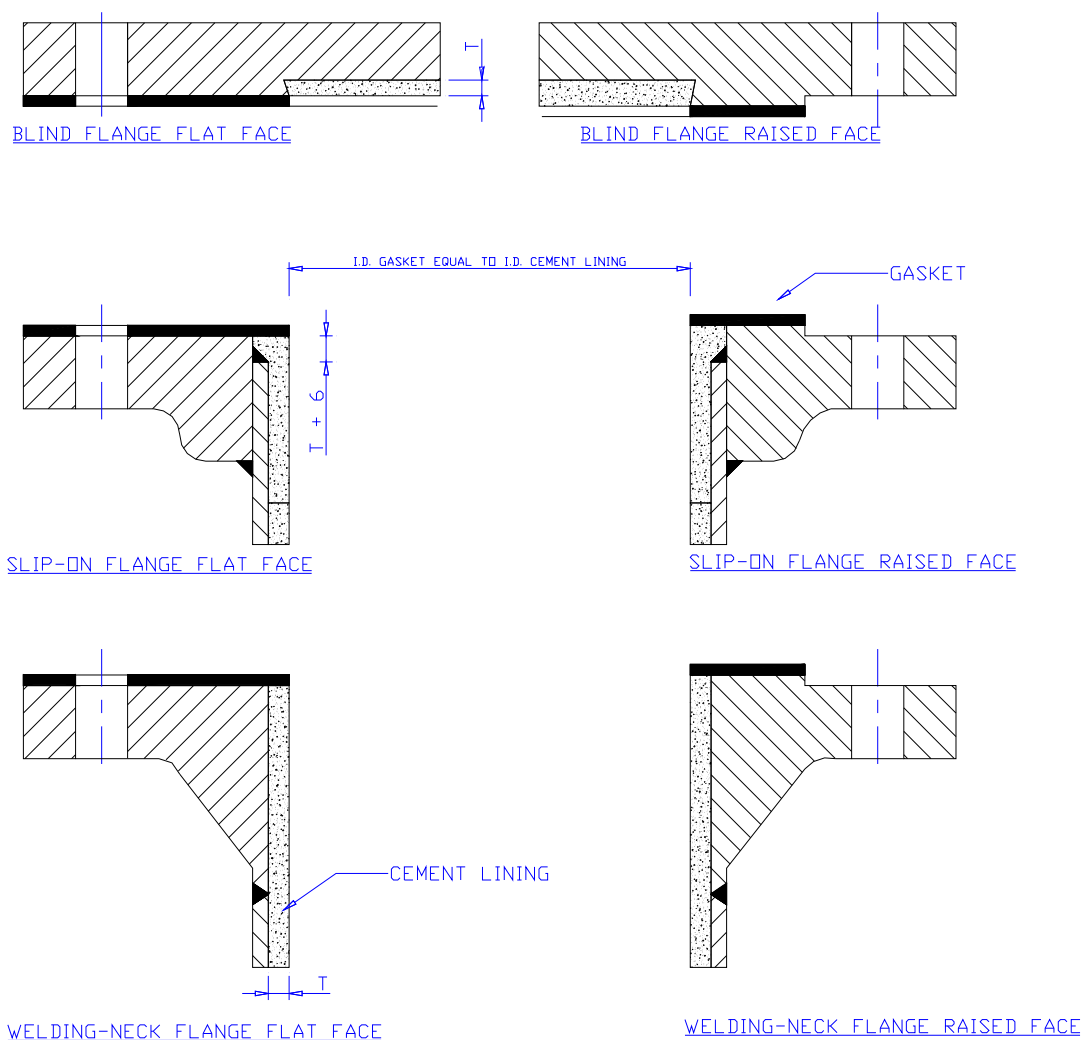
BRIEF SKETCH OF INSTALLATION PROCEDURE



STANDARD FOR CEMENT LINED PRODUCTS

7.6. TYPICAL DETAILS OF FLANGES IN CEMENT LINED PIPING

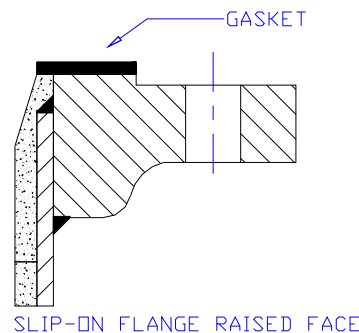
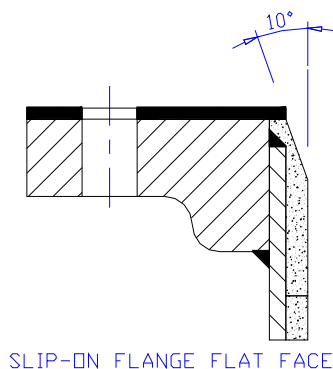
Installation of flanges in cement lined pipes shall be in accordance with following drawings:



STANDARD FOR CEMENT LINED PRODUCTS

7.6.1. MANNER

- 7.6.1.1. After welding of the flange is completed, the end of the flange shall be cleaned of all cement, dirt, paint, oil, moisture, scale etc. before application of cement lining.
- 7.6.1.2. Cement mortar for the flange connection shall be applied in accordance with the drawings. Use the same method as was described in the procedure for BUTT-WELD JOINTS.
- 7.6.1.3. The cement lining applied portion shall be cured completely.
- 7.6.1.4. Inside diameter of the gasket must be equal to the inside diameter of the cement lining.
- 7.6.1.5. For wafer type butterfly valves, it must be ensured that the cement lining of flanges does not hamper the operation of the valves. See drawing below:



STANDARD FOR CEMENT LINED PRODUCTS

7.7. BRANCH CONNECTION

This procedure is a recommendation how to prefabricate branches which must be cement lined.

7.7.1. BRANCHES ON 3 INCH UP TO AND INCLUDING 24 INCH RUN PIPES

7.7.1.1. All branch connections on 3 inch diameters up to and including 24 inch diameters run pipes shall be made with shop fabricated and cement lined standard tees or reducing tees.

7.7.1.2. Dimensions shall be in accordance with Conpipe's Standard Product Range.

7.7.2. BRANCHES ON 26 INCH AND LARGER RUN PIPES.

7.7.2.1. Branch connections on 26 inch diameters and larger must be preferably made with shop fabricated and cement lined standard tees or reducing tees.

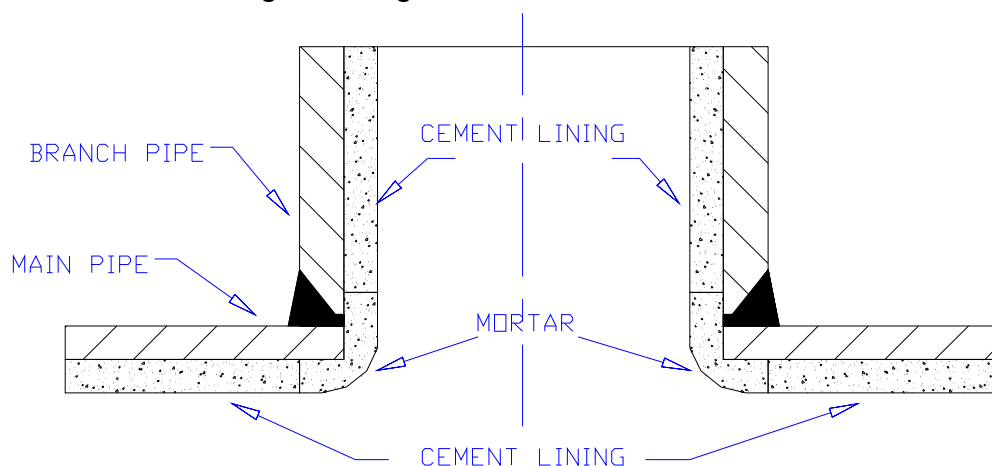
7.7.2.2. In case of fabrication branches in the field, following must be done:

7.7.2.2.A. For the welded branches, cement lined pipe shall be used.

7.7.2.2.B. Cement lined pipe must be cut according chapter 7.3.

7.7.2.2.C. Welding shall be done with a full penetration weld and after completion the broken or damaged cement lining shall be repaired with mortar according the procedure for BUTT-WELD JOINTS.

7.7.2.2.D. Details are given in figure below:



STANDARD FOR CEMENT LINED PRODUCTS

8. SINMAST JOINTING AND REPAIR COMPOUND TECHNICAL DATA SHEET

8.1. COMPOSITION

Sinmast concrete glue is a two component solvent free product.

8.2. PROPERTIES

Specific gravity	: 1650 kg/m ³
Compressive strength	: 95 MPa after 24 hrs.
Tensile strength	: 13 MPa after 24 hrs.
Bend tensile strength	: 51 MPa after 24 hrs.
Shrinkage	: Nil.
Color	: Grey
Chemical resistance	: good
Working up time	: approx. 30 min. at 20 °C.
Hardening time	: approx. 8 hrs. at 20 °C.
Adhesion on concrete	: >2.5 Mpa (fracture in concrete)

8.3. APPLICATION

Sinmast concrete glue can be applied between concrete to concrete elements and concrete to steel. It can be used on the horizontal and vertical plane as well as on moist surfaces.

8.4. WORKING UP

- Prepare the joint fully and wait before mixing the Sinmast until everything is ready. Ideal situation is jointing out of the direct sunlight.
- Keep the Sinmast components 'A' and 'B' cool (refrigerated cooling box) until just before use.
- Thoroughly mix component 'A' until homogenous compound is obtained, without adding the hardener 'B' !!
- Do not mix more than you require for the joint that must be made. For a smaller joint divide the component 'A' and 'B' into small parts. To do this you can mark the plastic container 'A' on the outside at the top of the compound level and divide the distance between level and bottom

STANDARD FOR CEMENT LINED PRODUCTS

into four or more equal parts. Do the same with the bottle of component 'B'.

- Mix intensively, preferably by mechanical means the two components until a not flowing paste is obtained and immediately start to apply the Sinmast.
- The paste must be applied to the surfaces to be treated by using a brush, priming knife, trowel or chip.

8.5. *PRETREATMENT*

The treated surface must be dust free and free from loose particles, free from old paint rests etc. Whenever possible, surfaces should be mechanically cleaned by brush and roughened.

8.6. *STORAGE*

2 years when not stored in direct sun light.
Thoroughly mix component 'A' after long period of storage before adding component 'B'.

STANDARD FOR CEMENT LINED PRODUCTS

SAFETY

When using do not eat or drink

When using do not smoke

May cause sensitization by skin contact

Harmful in contact with skin and if swallowed

Irritating to eyes and skin

Wear protective hand gloves during use

Wear safety goggles to protect eyes during use

FIRST AID

Eyes: immediately flush with fresh water for at least 5 minutes while holding eyelid open.

Skin: wash affected area with water

Ingestion: contact medical center immediately

STANDARD FOR CEMENT LINED PRODUCTS

9. AIDA CEBOND TECHNICAL DATA SHEET

9.1. *PRODUCT BASE*

Bonding emulsion for mortar. Aqueous Alkali resistant plastic dispersion.

9.2. *PROPERTIES AFTER SETTING*

Adhesional / tensile strength(DIN 18555): up to 2.5 N/mm²
Adhesional / shear strength: up to 3 N/mm²
Abrasion: \sim 0.6 g
Flexural / tensile strength: 8 N/mm²

9.3. *PROPERTY PROFILE*

- 9.3.1. Greater adhesional / adhesional-tensile strength of the hardened mortar (at least 2 N/mm²).
- 9.3.2. An increase in the adhesion of the fresh mortar.
- 9.3.3. An improvement of abrasion resistance.
- 9.3.4. Elastifies and increases impact resistance converting brittle-hard mortar joints into tough, impact resistant joints.
- 9.3.5. Improvement of chemical resistance.
- 9.3.6. Joint sealing up to water impermeable.

9.4. *APPLICATION*

The application of Aida Cebond is not usually made in concentrated form (the way it is packaged) but always thinned with water. The following general rule applies: in cases which depend on adhesion and / or impermeability, or when dealing with thin application thickness (up to 2 mm) and fine granulation, thinning 1 : 1 (1 liter Aida Cebond and 1 liter water = 1 kg Aida Cebond and 1 kg water) is suitable. In all other cases thinning lies at 1 : 2 or higher.

STANDARD FOR CEMENT LINED PRODUCTS

9.5. *WORKING PROCEDURE*

Dampen the sub-surfaces, carefully brush on (with long-haired brush, broom, etc.) the adhesive grout (or fine mortar), then wet-on-wet, apply the adhesive, mending or repair grout. Care is to be taken that it takes good hold and adheres to the subsurface by compacting or working over vigorously. Since Aida Cebond produces a film after drying which has the effect of a separation layer for cement-bound materials, **always work wet-on-wet.**

9.6. *STORAGE*

The shelf-life of Aida Cebond is at least 6 months, if stored cool and in closed containers.

9.7. *NOTE*

Do not use at temperatures below +5 °C. The given technical effect for Aida Cebond is achieved when the material has been able to dry out completely (and form a film). Aida Cebond is frost stabilized up to -15 °C, where they solidify. After thawing and stirring (in a moderate temperature room, do not heat!) they are again ready to use.

STANDARD FOR CEMENT LINED PRODUCTS

10. READY-MIX

Conpipe Ready-mix is a unique pre-mixed initial mortar, specially designed to fill-out gaps and damages in any cement structure in the field.

10.1. APPLICATION

- 10.1.1. Conpipe Ready-mix can be made workable within a few minutes by simply adding potable water not exceeding 500 mg. NaCl / liter.
- 10.1.2. Apply the Ready-mix with a spatula or a trowel.
- 10.1.3. The quantity of water added depends on the working conditions and the individual selected to do the job.
- 10.1.4. The general recommendation is to mix thoroughly with a minimum of water and obtain a non flowing solid paste.

10.2. CURING TIME

- 10.2.1. Conpipe's Ready-mix initial curing time is three days, during which time the humidity should be kept as high as possible.
- 10.2.2. After 8 days the Ready-mix cement is at approximately 85% of its maximum strength, usually already exceeding the value asked for normal cement lining.

10.3. PACKAGING

- 10.3.1. Ready-mix is usually available in 25 kg and 50 kg bags or drums.
- 10.3.2. All packages should be prevented from hole punching and freezing.
- 10.3.3. Under no circumstances to be opened as for direct use only.

STANDARD FOR CEMENT LINED PRODUCTS

11. STANDARD PRODUCT RANGE OF CEMENT LINED PRODUCTS

Please find attached the standard product range of Conpipe International b.v.
The standard product range is based on following:

- pressure standard ANSI B16.5 – class 150.
- Wall thickness steel components: STD
- Fittings as per ASTM A234 WPB, ANSI B16.9.
- Extension pieces / pipes as per API 5L grade B.
- Sleeves per ST 37.
- Welding as per ASME IX.
- Cement lining specification AWWA C205 – 95.
- Flange facing: RF (raised face).

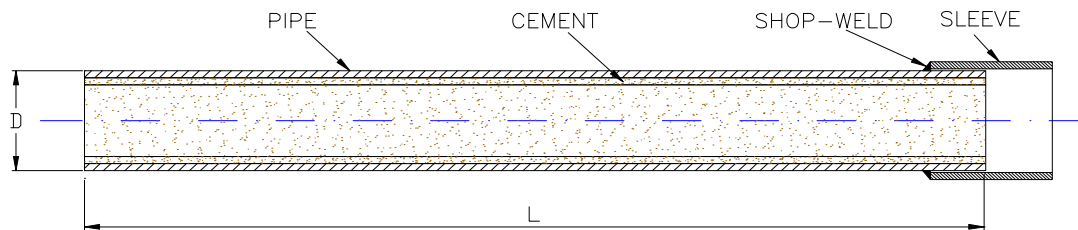
12. OTHER PRODUCTS

Besides the standard product range we also produce in any other desired configurations.

Other products in our scope of supply for cement lining are:

- Special designed spools/ headers according drawing.
- Different diameters.
- Different wall-thickness.
- Alternative cement mortar linings.
- Special design / engineering work.
- Packing /transportation / shipping of all our products all over the world.

CEMENT-LINED PIPE & SLEEVE



PIPE DIAMETER D (INCH)	PIPE WALL (MM)	LENGTH L	WEIGHT/ METER (KG)
			Excl. Sleeve
3	5,5	SRL	14
4	6,0	SRL	20
6	7,1	DRL	35
8	8,2	DRL	51
10	9,3	DRL	71
12	9,5	DRL	91
14	9,5	DRL	100
16	9,5	DRL	115
18	9,5	DRL	130
20	9,5	DRL	145
24	9,5	DRL	182
28	9,5	DRL	213
32	9,5	DRL	245
36	9,5	DRL	275
40	9,5	DRL	307
44	9,5	DRL	338
48	9,5	DRL	369

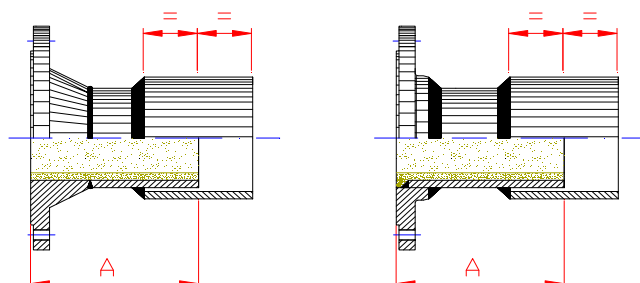
Note:

- * Wall thickness of pipe is based on standard (STD) wall per API 5L
- * SRL = Single Random Length per API 5L
- * DRL = Double Random Length per API 5L
- * Weight calculation is based on most common cement-lining specification AWWA C205
- * Sleeve length = 150mm

Comments:

- * Length of pipe shall be maximum 11.8 meter in case of 40 Ft Flat-Rack/Open-Top container shipment

WELDING NECK + SLIP-ON RF/FF FLANGES 150# with EXTENSION & SLEEVE
Dimensions welding neck + slip-on flanges



	WN	SO	WN	SO
SIZE	DIMENSION in mm		WEIGHT	WEIGHT
NPS	A	A	(KG)	(KG)
			Excl. Sleeve	Excl. Sleeve
3	220	156	7	7
4	226	157	11	10
6	239	158	17	16
8	252	159	27	25
10	252	235	37	36
12	264	235	53	50
14	277	235	65	62
16	277	235	78	73
18	290	235	87	84
20	294	235	103	103
24	302	235	150	135

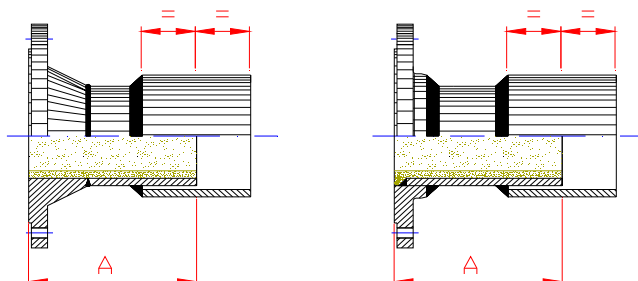
Note:

Weight calculation is based on STD wallthickness
and 150# class flanges per ANSI B16.5
and most common cement lining thickness.

Legend:

Dimension 'A' = Face - to- End
Sleeve length = 150mm

WELDING NECK + SLIP-ON RF/FF FLANGES 300# with EXTENSION & SLEEVE
Dimensions welding neck + slip-on flanges



	WN	SO	WN	SO
SIZE	DIMENSION in mm		WEIGHT	WEIGHT
NPS	A	A	(KG)	(KG)
			Excl. Sleeve	Excl. Sleeve
3	220	220	10	9
4	226	220	15	14
6	239	220	25	25
8	252	220	39	37
10	252	220	54	55
12	264	260	78	75
14	277	260	102	97
16	277	260	131	129
18	290	260	161	159
20	294	260	197	183
24	302	260	279	251

Note:

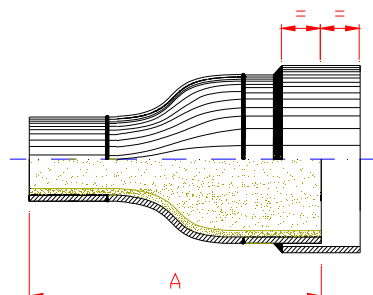
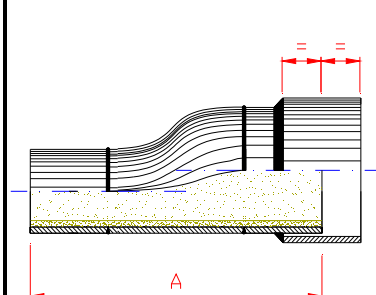
Weight calculation is based on STD wallthickness
and 300# class flanges per ANSI B16.5
and most common cement lining thickness.

Legend:

Dimension 'A' = Face - to- End
Sleeve length = 150mm

REDUCERS WITH EXTENSIONS & SLEEVE

Dimensions reducers



SIZE NPS	DIMENSION in mm A	WEIGHT (KG)
		Excl. Sleeve
4x3	402	8
6x3	440	14
6x4	440	15
8x3	452	20
8x4	452	21
8x6	452	23
10x4	478	30
10x6	478	32
10x8	478	35
12x6	503	41
12x8	503	59
12x10	503	47
14x6	630	59
14x8	630	61
14x10	630	65
14x12	630	68
16x8	656	72
16x10	656	76
16x12	656	78
16x14	656	80

SIZE NPS	DIMENSION in mm A	WEIGHT (KG)
		Excl. Sleeve
18x10	681	88
18x12	681	90
18x14	681	92
18x16	681	94
20x12	808	118
20x14	808	120
20x16	808	122
20x18	808	125
24x16	808	145
24x18	808	147
24x20	808	149

Note:

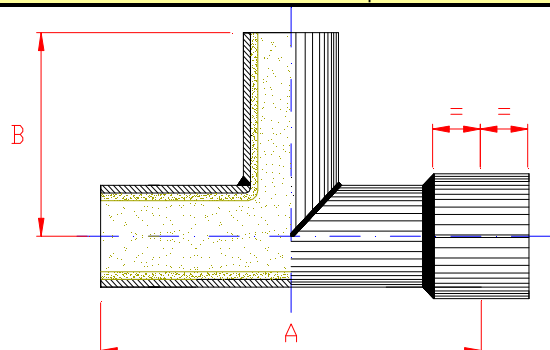
Weight is calculated based on STD wallthickness and most common cement lining thickness.

Legend:

Dimension 'A' = End- to- End Runpipe
Sleeve length = 150mm
Extension length = 150mm

SET-ON TEE with SLEEVE - Series 1

Dimensions equal tees



SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
3	388	194	10
4	414	207	15
6	468	234	30
8	519	259	51
10	573	286	78
12	623	311	105
14	655	327	122
16	706	353	149
18	757	378	181
20	808	404	214
24	909	454	289
26	960	480	323
28	1011	505	366
30	1062	531	411
32	1112	556	459
36	1214	607	562
40	1316	658	675
42	1366	683	735
44	1417	708	798
48	1519	759	930

Note:

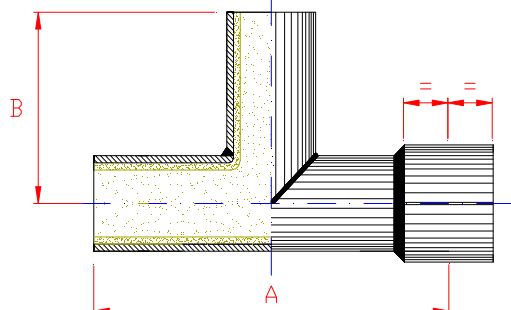
Weight calculation is based on STD wallthickness and most common cement lining thickness.

Legend:

Dimension 'A' = End- to- End Runpipe
Dimension 'B' = Center-Runpipe to End-Branch
Sleeve length = 150mm

SET-ON TEE with SLEEVE - Series 1

Dimensions reduced tees



SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
4x3	388	207	12
6x3	388	234	19
6x4	414	234	23
8x3	388	259	26
8x4	414	259	29
8x6	468	259	40
10x3	388	286	36
10x4	414	286	40
10x6	468	286	49
10x8	519	286	59
12x3	388	311	43
12x4	414	311	48
12x6	468	311	59
12x8	519	311	70
12x10	573	311	82
14x3	388	327	48
14x4	414	327	53
14x6	468	327	64
14x8	519	327	76
14x10	573	327	90
14x12	623	327	101

SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
16x3	388	353	55
16x4	414	353	60
16x6	468	353	72
16x8	519	353	86
16x10	573	353	101
16x12	623	353	114
16x14	655	353	117
18x3	388	378	61
18x4	414	378	67
18x6	468	378	81
18x8	519	378	95
18x10	573	378	112
18x12	623	378	126
18x14	655	378	134
18x16	706	378	148
20x3	388	404	68
20x4	414	404	74
20x6	468	404	89
20x8	519	404	105
20x10	573	404	124
20x12	623	404	139
20x14	655	404	148
20x16	706	404	163
20x18	757	404	177

Note:

Weight calculation is based on STD wallthickness and most common cement lining thickness.

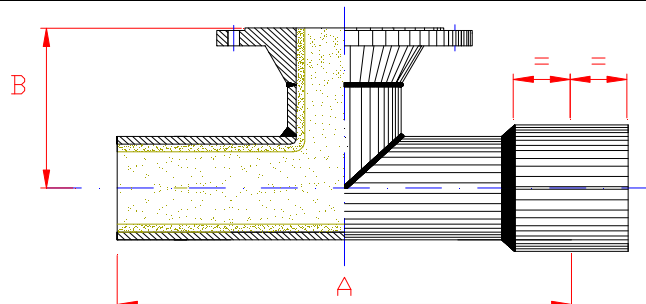
Legend:

Dimension 'A' = End- to- End Runpipe
Dimension 'B' = Center-Runpipe to End-Branch
Sleeve length = 150mm
Extension length = 150mm

24x3	388	454	81
24x4	414	454	89
24x6	468	454	106
24x8	519	454	125
24x10	573	454	146
24x12	623	454	164
24x14	655	454	175
24x16	706	454	192
24x18	757	454	209
24x20	808	454	218

SET-ON TEE with SLEEVE & ANSI B16.5 WN 150# - Series 1

Dimensions equal tees



SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
3	388	264	14
4	414	283	22
6	468	323	41
8	519	361	69
10	573	388	102
12	623	425	142
14	655	454	169
16	706	480	207
18	757	518	245
20	808	548	291
24	909	606	407
26	960	607	463
28	1011	634	509
30	1062	661	574
32	1112	689	656
36	1214	743	798
40	1316	797	985
42	1366	826	1075
44	1417	851	1268
48	1519	905	1493

Note:

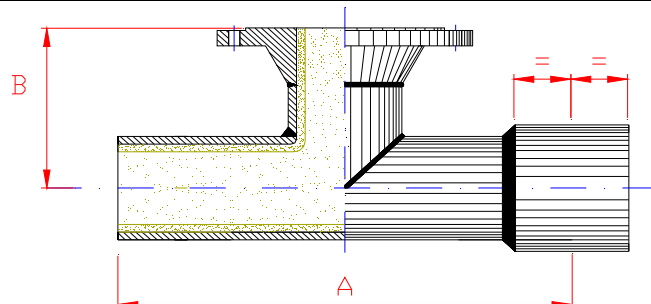
Weight calculation is based on STD wallthickness and 150# class flanges and most common cement lining thickness.

Legend:

Dimension 'A' = End- to- End Runpipe
Dimension 'B' = Center-Runpipe to End-Branch
Sleeve length = 150mm

SET-ON TEE with SLEEVE & ANSI B16.5 WN 150# - Series 1

Dimensions reduced tees



SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
4x3	388	277	16
6x3	388	304	24
6x4	414	310	30
8x3	388	329	31
8x4	414	335	36
8x6	468	348	51
8x8	519	361	63
10x3	388	356	40
10x4	414	362	47
10x6	468	375	60
10x8	519	388	77
12x3	388	381	48
12x4	414	387	55
12x6	468	400	69
12x8	519	413	88
12x10	573	413	106
14x3	388	397	52
14x4	414	403	60
14x6	468	416	75
14x8	519	429	94
14x10	573	429	114
14x12	623	441	138

SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
16x3	388	423	60
16x4	414	429	67
16x6	468	442	83
16x8	519	455	104
16x10	573	455	125
16x12	623	467	151
16x14	655	480	164
18x3	388	448	65
18x4	414	454	74
18x6	468	467	92
18x8	519	480	113
18x10	573	480	136
18x12	623	492	163
18x14	655	505	181
18x16	706	505	206
20x3	388	474	72
20x4	414	480	81
20x6	468	493	100
20x8	519	506	123
20x10	573	506	148
20x12	623	518	176
20x14	655	531	195
20x16	706	531	221
20x18	757	544	241

Note:

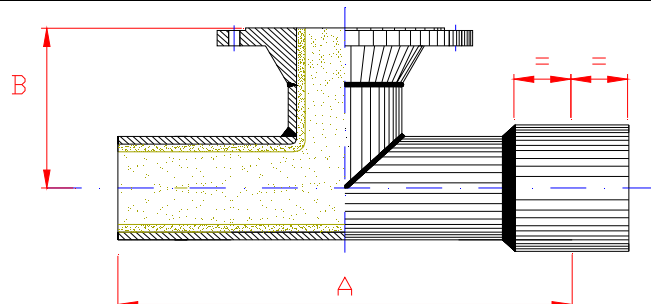
Weight calculation is based on STD wallthickness and 150# class flanges and most common cement lining thickness.

Legend:

Dimension 'A' = End- to- End Runpipe
Dimension 'B' = Center-Runpipe to End-Branch
Sleeve length = 150mm

SET-ON TEE with SLEEVE & ANSI B16.5 WN 150# - Series 1

Dimensions reduced tees



SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
24x3	388	524	85
24x4	414	530	96
24x6	468	543	117
24x8	519	556	143
24x10	573	556	170
24x12	623	568	201
24x14	655	581	222
24x16	706	581	250
24x18	757	594	273
24x20	808	598	303

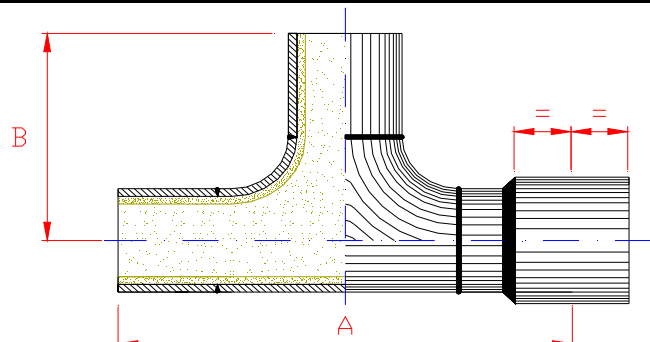
Note:

Weight calculation is based on STD wallthickness and 150# class flanges and most common cement lining thickness.

Legend:

Dimension 'A' = End- to- End Runpipe
Dimension 'B' = Center-Runpipe to End-Branch
Sleeve length = 150mm

TEE ANSI B16.9 with EXTENSIONS & SLEEVE - Series 2
Dimensions equal tees



SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
3	472	236	12
4	510	255	18
6	586	293	39
8	656	328	70
10	732	366	103
12	808	404	133
14	858	429	175
16	910	455	212
18	986	493	246
20	1062	531	298
24	1164	582	410
26	1290	645	482
28	1342	671	556
30	1418	709	632
32	1494	747	725
36	1646	823	922
40	1798	899	1075
42	1824	861	1273
44	1926	912	1425
48	2078	988	1675

Note:

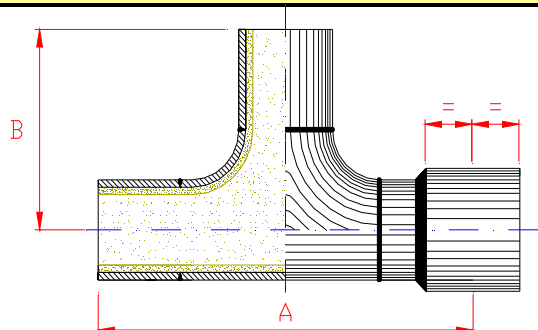
Weight calculation is based on STD wallthickness and most common cement lining thickness.

Legend:

Dimension 'A' = End- to- End Runpipe
Dimension 'B' = Center-Runpipe to End-Branch
Sleeve length = 150mm
Extension length = 150mm

TEE ANSI B16.9 with EXTENSIONS & SLEEVE - Series 2

Dimensions reduced tees



SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
4x3	510	248	16
6x3	586	274	35
6x4	586	280	36
8x4	656	306	58
8x6	656	318	61
10x4	732	334	112
10x6	732	344	115
10x8	732	353	119
12x6	808	369	121
12x8	808	379	124
12x10	808	391	127
14x6	858	388	183
14x8	858	398	186
14x10	858	407	190
14x12	858	420	198
16x6	910	414	200
16x8	910	423	203
16x10	910	433	207
16x12	910	445	213
16x14	910	455	215
18x8	986	448	167
18x10	986	458	170
18x12	986	471	178
18x14	986	480	179
18x16	986	480	181

SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
20x8	1062	474	205
20x10	1062	483	207
20x12	1062	496	209
20x14	1062	506	210
20x16	1062	506	217
20x18	1062	518	219
24x10	1164	534	255
24x12	1164	547	271
24x14	1164	556	277
24x16	1164	556	278
24x18	1164	569	285
24x20	1164	582	287

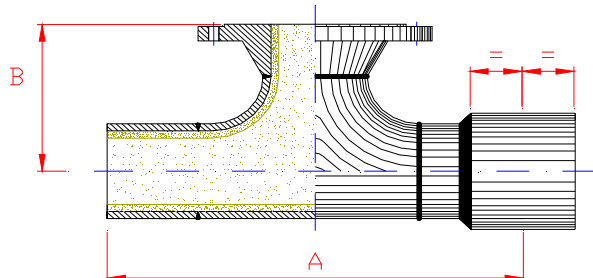
Note:

Weight calculation is based on STD wallthickness and most common cement lining thickness.

Legend:

Dimension 'A' = End- to- End Runpipe
Dimension 'B' = Center-Runpipe- to End-Branch
Sleeve length = 150mm
Extension length = 150mm

TEE ANSI B16.9 with EXTENSIONS and WN FLANGE ANSI B16.5 150# - series 2
Dimensions equal tees



SIZE	DIMENSION in mm		WEIGHT
NPS	A	B	(KG)
			Excl. Sleeve
3	472	156	14
4	510	181	22
6	586	232	44
8	656	280	80
10	732	318	115
12	808	368	155
14	858	406	205
16	910	432	251
18	986	483	289
20	1062	525	351
24	1164	584	499
26	1290	622	587
28	1342	649,6	666
30	1418	689,2	759
32	1494	730,3	884
36	1646	809,5	1115
40	1798	888,7	1337
42	1824	853,9	1563
44	1926	904,9	1774
48	2078	984	2180

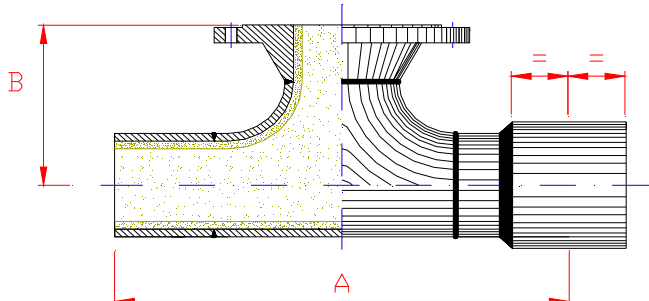
Note:

Weight calculation is based on STD wallthickness and 150# class flanges and most common cement lining thickness.

Legend:

Dimension 'A' = End- to- End Runpipe
Dimension 'B' = Center-Runpipe to End-Branch
Sleeve length = 150mm
Extension length = 150mm

TEE ANSI B16.9 with EXTENSIONS and WN FLANGE ANSI B16.5 150# - series 2
Dimensions reduced tees



SIZE NPS	DIMENSION in mm		WEIGHT (KG)
	A	B	Excl. Sleeve
4x3	510	168	18
6x3	586	194	38
6x4	586	206	40
8x4	656	232	62
8x6	656	257	66
10x4	732	260	87
10x6	732	283	91
10x8	732	305	98
12x6	808	308	126
12x8	808	331	133
12x10	808	343	139
14x6	858	327	188
14x8	858	350	195
14x10	858	359	201
14x12	858	384	220
16x6	910	353	205
16x8	910	375	212
16x10	910	385	218
16x12	910	409	235
16x14	910	432	245

SIZE NPS	DIMENSION in mm		WEIGHT (KG)
	A	B	Excl. Sleeve
18x8	986	400	235
18x10	986	410	241
18x12	986	435	262
18x14	986	457	272
18x16	986	457	283
20x8	1062	426	285
20x10	1062	435	291
20x12	1062	460	304
20x14	1062	483	314
20x16	1062	483	332
20x18	1062	508	338
24x10	1164	486	357
24x12	1164	511	388
24x14	1164	533	404
24x16	1164	533	415
24x18	1164	559	428
24x20	1164	576	441

Note:

Weight calculation is based on STD wallthickness and 150# class flanges and most common cement lining thickness.

Legend:

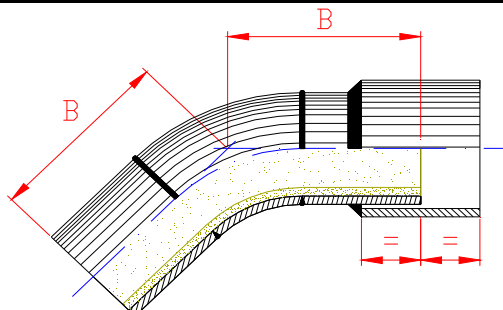
Dimension 'A' = End- to- End Runpipe

Dimension 'B' = Center-Runpipe to End-Branch

Sleeve length = 150mm

Extension length = 150mm

LONG RADIUS ELBOWS 45° with EXTENSIONS & SLEEVE
Dimensions elbow 45°



SIZE	DIMENSIONS in mm		WEIGHT
NPS	B		(KG)
			Excl. Sleeve
3	201		6
4	214		9
6	245		18
8	277		32
10	309		52
12	340		66
14	372		79
16	404		103
18	436		124
20	468		144
24	531		196
26	556		231
28	588		269
30	620		297
32	652		334
36	715		376
40	782		487
42	810		542
44	845		593
48	909		713

Note:

Weight calculation is based on STD wallthickness and most common cement lining thickness.

Legend:

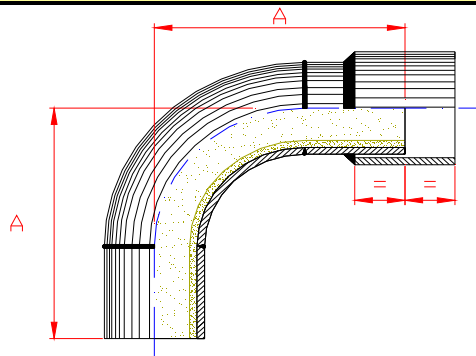
Dimension 'B' = Center-to-End

Sleeve length = 150mm

Extension length = 150mm

LONG RADIUS ELBOWS 90° with EXTENSIONS & SLEEVE

Dimensions elbow 90°



SIZE	DIMENSIONS in mm			WEIGHT
NPS	'A'			(KG)
				Excl. Sleeve
3	264			7
4	302			12
6	379			22
8	455			45
10	531			74
12	607			103
14	683			125
16	760			158
18	836			195
20	912			240
24	1064			330
26	1141			426
28	1217			472
30	1293			521
32	1369			583
36	1522			737
40	1674			879
42	1750			985
44	1826			1065
48	1979			1310

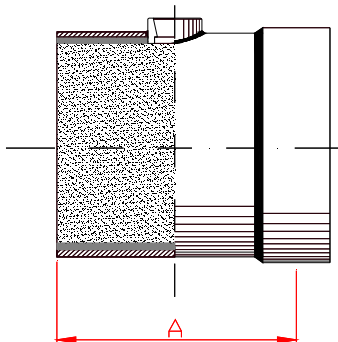
Note:

Weight calculation is based on STD wallthickness
and most common cement lining thickness.

Legend:

Dimension 'A' = Center-to-End
Sleeve length = 150mm
Extension length = 150mm

BRANCHES
Dimensions



SIZE NPS	DIMENSIONS A	WEIGHT (KG)
		Excl. Sleeve
3	350	5
4	350	8
6	350	13
8	350	20
10	350	29
12	350	35
14	350	39
16	350	44
18	350	50
20	350	56
24	350	67
28	350	78
30	350	84
36	350	101
40	350	112
42	350	118
44	350	123
48	350	135

Note:

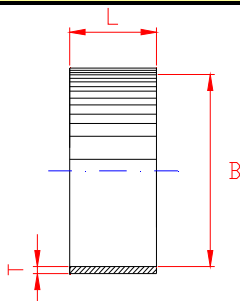
Weight calculation is based on STD
wallthickness and most common cement lining thickness.

Available branchconnection types:

Branch NPS 1/2" - 3"
socket weld
bevelled
screwed NPT

SLEEVES

Dimensions sleeves



SIZE NPS	DIMENSIONS in mm			WEIGHT (KG)
	L	B (MIN)	B (MAX)	
3	150	92	97	2
4	150	117	122	3
6	150	174	176	6
8	150	225	227	8
10	150	278	281	10
12	150	330	332	15
14	150	362	364	13
16	150	412	414	15
18	150	463	465	17
20	150	514	516	19
24	150	616	618	22
26	150	666	669	24
28	150	717	719	26
30	150	768	770	28
32	150	818	820	30
36	150	920	922	34
40	150	1021	1023	37
42	150	1073	1075	39
44	150	1123	1225	41
48	150	1225	1227	45

Legend:

Thickness 'T' = equal or larger than pipe wallthickness
Dimension 'B' = Inside diameter

STANDARD FOR PLASTIC LINED PRODUCTS

STANDARD

FOR

PLASTIC LINED MATERIALS
(PTFE, PFA, PVDF, PP)

CNP-201-01

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STANDARD FOR PLASTIC LINED PRODUCTS

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STANDARD FOR PLASTIC LINED PRODUCTS

1. FOREWORD

Conpipe International b.v. is a world-wide operating company which manufactures pipe systems by means of the most advanced production methods for drink water companies in their raw water projects and water treatment plants, off-shore companies and petrochemical industries.

Conpipe International b.v. 's systems can be supplied in any desired configuration, pipe-diameter and wall thickness. We are specialised in lined and coated pipe-line systems. Cement-, PTFE-, Rubber- and Epoxy lining are all in our scope of supply.

This specification defines the materials, technical features, recommendation for assembly and inspection of Conpipe PTFE, PFA, PVDF and PP lined steel pipes and fittings, produced to the standard ANSI B16.5 – class 150.

The information contained herein should be considered as a guide for the use of Conpipe lined piping systems. Nevertheless, the data are intended for technically skilled persons who use them at their own risk.

This manual does not constitute a warranty of any kind expressed or implied, of Conpipe's products of their fitness for any particular use. The company does not accept responsibility or liability for inaccuracies in this publication.
Conpipe reserves the right to change product specifications without prior notice.

STANDARD FOR PLASTIC LINED PRODUCTS

2. MATERIALS

2.1. LININGS

2.1.1. PTFE

Linings are made from virgin PTFE (Polytetrafluoroethylene) resins in accordance with ASTM D4894.

Minimum physical properties (in accordance with ASTM F1545):

- Tensile strength: $\geq 21 \text{ N/mm}^2$ (measured according to ASTM D4894).
- Elongation at break: $\geq 250\%$ (measured according to ASTM D4894).
- Spec. Gravity: $2.13\text{-}2.19 \text{ g/cm}^3$ (measured according to ASTM D792).

2.1.2. PFA

Linings are made from PFA (Perfluoroalkoxy) resins in accordance with ASTM D3307.

Minimum physical properties (in accordance with ASTM F1545):

- Tensile strength: $\geq 26 \text{ N/mm}^2$ (measured according to ASTM D3307).
- Elongation: $\geq 300\%$ (measured according to ASTM D3307).
- Spec. Gravity: $2.12\text{-}2.17 \text{ g/cm}^3$ (measured according to ASTM D792).

2.1.3. PVDF

Linings are made from PVDF (Polyvinylidene fluoride) resins in accordance with ASTM D3222.

Minimum physical properties (in accordance with ASTM F1545):

- Tensile strength: $\geq 34.5 \text{ N/mm}^2$ (measured according to ASTM D3222).
- Elongation: $\geq 8\%$ (measured according to ASTM D3222).
- Spec. Gravity: 1.76 g/cm^3 (measured according to ASTM D792).

2.1.4. PP

Linings are made from PP (Polypropylene) resins in accordance with ASTM D4101.

Minimum physical properties (in accordance with ASTM F1545):

- Tensile strength: $\geq 206 \text{ N/mm}^2$ (measured according to ASTM D4101).
- Elongation: $\geq 10\%$ (measured according to ASTM D4101).
- Specific gravity: 0.90 g/cm^3 (measured according to ASTM D792).

STANDARD FOR PLASTIC LINED PRODUCTS

2.2. *STEEL COMPONENTS*

2.2.1. Flanges

Flanges are in accordance with one of the following standards:

- ASTM A105 N.

2.2.2. Piping

Piping is in accordance with one of the following standards:

- ASTM A106 grade B.
- API 5L grade B.

2.2.3. Fittings

2.2.3.1. Welded Construction

Welded fittings are in accordance with one of the following standards:

- ASTM A234 grade WPB.
- API 5L grade B.
- ASTM A106 grade B.

2.2.3.2. Cast Fittings

Cast ductile-iron fittings are in accordance with the following standards:

- DIN 1693 (GGG 40.3), properties in accordance with ASTM A536 (60. 40. 18).
- ASTM A 216 grade WCB.

Note: certain fittings can be supplied with a cast steel body. Please contact your sales representative for available and technical details.

2.3. *EXTERIOR PRIMER*

After external surfaces preparation to SA 2 1/2, the pipe and fittings are protected by an epoxy chromate zinc primer, unless otherwise specified.

STANDARD FOR PLASTIC LINED PRODUCTS

3. TECHNICAL FEATURES

3.1. NOMINAL LINER THICKNESSES

NB	PTFE/PFA	PTFE/PFA	PVDF	PP
INCH	Std.	vacuum	vacuum	Vacuum
0.5"	2.8	2.8		
0.75"	2.8	2.8		
1"	3.0	3.0	2.5	3.4
1.5"	3.0	3.0	2.5	3.8
2"	3.0	3.0	2.5	4.3
3"	4.0	4.0	2.8	4.4
4"	5.0	5.0	3.1	5.3
6"	3.5	6.0	3.7	5.6
8"	3.7	8.0	4.0	5.6
10"	3.7	8.5		6.3
12"	4.0	8.5		6.3
14"	4.5			
16"	4.5			
18"	5.0			
20"	5.0			
24"	5.0			
30"	5.0			

Other wall-thicknesses are available on request for special applications.

3.2. PIPE

The thickness of the carbon steel pipe (straight lengths) conforms to the specification below:

- ASTM sch.40 0.5" - 8" and 10" for vacuum
- sch.30 10" and 12" for vacuum
- sch.20 12" - 30"

Pipe used to fabricate fittings will be at least of the same thickness.

STANDARD FOR PLASTIC LINED PRODUCTS

3.3. *FLANGES*

Each straight length is equipped with at least one loose flange. Standard fittings are supplied with fixed flanges, fittings with loose flanges are available on request.
Drilling of standard flanges is in accordance with: ANSI B16.5 - class 150.

3.4. *DIMENSIONS OF FITTINGS*

All standard fittings are produced with ANSI B16.5 standard dimensions. For items which are not mentioned in this standard, Conpipe defines its own dimensions, see detailed product information.

3.5. *TOLERANCES*

All tolerances are in accordance with DIN 2848.

3.5.1. Wall thickness

Tolerance on the wall-thicknesses as mentioned in 3.1 is -10%.
At the collars the lining thickness shall be not less than 80% of the original liner thickness. This tolerance is not valid for items produced by isostatic and injection moulding, where more difference can occur due to tooling design.

3.5.2. Length

3.5.2.1. Pipe spools

LENGTH (mm)	TOLERANCE (mm)
0 – 120	+0, -3.0
120 – 315	+0, -3.5
315 – 1000	+0, -4.5
1000 - 6000	+0, -5.0

3.5.2.2. Spacers

LENGTH (mm)	TOLERANCE (mm)
0 – 45	+0, -2.0
45-100	+0, -3.0

STANDARD FOR PLASTIC LINED PRODUCTS

3.5.2.3. Reducing flanges: +0, -3.0 mm

3.5.2.4. All other fittings

LENGTH (mm)	TOLERANCE (mm)
0 – 315	+/- 2.0
315-1000	+/- 3.0
1000-2000	+/- 4.0

3.5.2.5. Collar diameters

On PTFE, PFA, PVDF and PP collar diameters as mentioned in this catalogue, the tolerance is +/- 5%.

3.6. MAKE UP SPOOLS

3.6.1. PTFE

Because of its unique method of PTFE liner production, Conpipe offers an in site field-flaring facility which is very easy to use.

3.6.2. PVDF/PP

Also for PVDF and PP a field-flaring facility is available, however, using the system with PTFE liners is much easier and therefore we advise the PTFE field-flaring system.

3.7. VENTHOLES

All PTFE, PFA and PVDF lined pipe and fittings are supplied with ventholes. Straight lengths will have at least two ventholes of 3 mm diameter, located approximately 150 mm from each end. Fittings shall have at least one venthole of 3 mm. Reducing flanges and spacers have no ventholes.

STANDARD FOR PLASTIC LINED PRODUCTS

3.8. *END PROTECTION*

The flared ends of pipes and fittings will be equipped with protective wooden or plastic covers.

3.9. *MAXIMUM SERVICE TEMPERATURE*

Maximum service temperatures for liner materials are:
PTFE 230 °C*, PFA 230 °C*, PVDF 135 °C*, PP 107 °C*.

- These temperatures are under optimum conditions. Medium, pressure, vacuum or medium velocity may change this temperature.

3.10. *SPECIAL ITEMS*

On request we can produce, at extra cost, a wide variety of special items, for example:

- Non standard dimensions.
- Extra branches on pipes and fittings.
- Double jacket pipes and fittings for steam-tracing.
- Special steel qualities: stainless, low temperature, etc.
- Columns.
- Anti-static lining.
- Etc.

If you have any special requirement, please contact our company.

STANDARD FOR PLASTIC LINED PRODUCTS

4. QUALITY CONTROL AND INSPECTION

In addition to the numerous in house tests carried out during each manufacturing step (receipt of resins, physical properties of liners, etc.), the pipes and fittings will be subject to the following controls:

4.1. VISUAL / DIMENSIONAL

All pipes and fittings are visually and dimensionally inspected in compliance with chapter 1 and 2 of this specification.

4.2. ELECTROSTATIC TEST

All pipes and fittings are Electro-statically tested over the entire surface of the liner.

- PTFE/PFA (5 x wallthickness) x 1000 = voltage with a maximum of 25000 Volts.
- PVDF 15000 Volts.
- PP 10000 Volts.

4.3. HYDROSTATIC TEST

On most items a hydrostatic test is standard procedure. On request, a hydrostatic test up to 25 Bar can be performed on all or a percentage of the total number of items.

4.4. QUALIFICATION TEST

All new or changed products are tested to methods as described in ASTM F423, including vacuum, temperature and steam cold water cycling test. More details and test results are available on request.

4.5. MARKING

Each item with indelible ink, showing nominal bore and length. After final inspection, our inspector marks the item with a cold-stamp.

** Additional controls, records, certification of marking is available upon request in response to special specifications.

STANDARD FOR PLASTIC LINED PRODUCTS

5. VACUUM RESISTANCE

5.1. PTFE/PFA

TEMPERATURE DEGR. CELCIUS						
NB.	20	50	100	150	190	230
0.5" std	Full	full	full	full	full	full
0.75" std	full	full	full	full	full	full
1" std	full	full	full	full	full	full
1.25" std	full	full	full	full	full	full
1.5" std	full	Full	full	full	full	full
2" std	full	Full	full	full	full	full
2.5" std	full	Full	full	full	full	full
3" std	full	Full	full	full	full	full
4" std	full	Full	full	full	full	100
5" std	full	180	460	760		
5" vac						
6" std	full	180	460	760		
6" vac	full	Full	full	full	full	100
8" std	250	500	760			
8" vac	full	full	full	full	full	100
10" std	560	760				
10" std	full	Full	full	full	150	300
12" std	600					
12" vac	full	Full	full	150	300	500

- *these figures are in TORR.*
- *std = standard wallthickness*
- *vac = heavy duty wallthickness (see 3.1)*

5.2. PVDF

PVDF lined pipes and fittings are for full-vacuum service up to 130 °C from NB. 1" to NB. 8".

5.3. PP

PP lined pipes and fittings are for full-vacuum service up to 105 °C from NB 1" up to NB 12".

STANDARD FOR PLASTIC LINED PRODUCTS

6. CHEMICAL RESISTANCE GUIDE

This guide is presented as an aid to design engineers in the selection of the most cost-effective lining material. The chemical resistance ratings shown in this guide are based on tests, field experience and published technical literature. They do not constitute a warranty for any particular service or application. PTFE and PFA are essentially chemical inert up to their upper temperature use to virtually all chemicals except molten alkali metals, fluorine and certain complex halogenated compounds at elevated temperatures and pressures. Additional chemical resistance data can be obtained by contacting your Conpipe representative.

	MAXIMUM TEMPERATURE DEGR. CELCIUS	
CHEMICAL	PP	PVDF
ACIDS		
Acetic, 50%	107	100
Acetic, glacial	21	21
Benzoic	66	168
Benzene sulfonic	21	49
Chlorosulfonic	NR	NR
Chromic, 50%	71	77
Citric	60	135
Formic	60	121
Hydrobromic, 50%	66	135
Hydrochloric, 10%	85	135
Hydrochloric, 35%	66	135
Hydrofluoric, 30%	49	121
Hydrofluoric, 70%	37	100
Nitric, 10%	66	77
Nitric, 50%	21	49
Nitric, fuming	NR	NR
Oxalic	21	49
Phenol, 10%	66	77
Phenol, 100%	60	49
Phtalic	21	100
Phosphoric, 30%	107	135
Phosphoric, 85%	60	110
Succinic	66	121
Sulphuric, 50%	80	110
Sulphuric, 85%	63	77

STANDARD FOR PLASTIC LINED PRODUCTS

Sulphuric, 98%	21	49
Sulphuric, fuming	NR	NR
BASES		
Ammonium, Hydroxide, 30%	107	100
Aniline	60	49
Barium Hydroxide	107	135
Calcium Hydroxide	107	135
Hexamethylene Diamine	*	NR
Magnesium Hydroxide	107	135
Propyl Amine	NR	NR
Sodium Carbonate	107	135
Sodium Hydroxide, 10%	107	77
Sodium Hydroxide, 50%	107	49
HALOGENS		
Bromine. Liquid	NR	77
Chlorine, liquid	NR	100
Iodine, liquid	24	77
OXIDANTS		
Benzoyl Peroxide	*	77
Chlorine Dioxide, 15%	NR	100
Hydrogen Peroxide, 30%	21	100
Nitrogen Dioxide	21	77
Ozone	NR	110
Potassium Chlorate	107	100
Potassium Permanganate	49	121
Sodium Hypochlorite, 17%	66	100
Sulphur Dioxide	21	77
ALIPHATIC HYDROCARBONS		
Acetylene	*	121
Butadiene	*	121
Butylene	*	135
Gasoline	NR	135
Kerosene	NR	135
Hexane	24	135

STANDARD FOR PLASTIC LINED PRODUCTS

Mineral Oil	21	135
Naphta	21	135
AROMATIC HYDROCARBONS		
Benzene	NR	77
Naphtaline	107	100
Toluene	NR	77
HOLOGENATED HYDROCARBONS		
Allyl Chloride	NR	100
Carbon Tetrachloride	NR	135
Chlorobenzene	NR	77
Chloroform	NR	100
Dichloroethylene	77	110
Ethylene Bromide	NR	110
Refrigerant 113, Freon	*	100
OXYGENATED SOLVENTS & ESTERS		
Acetone, 10%	49	49
Acetone, 100%	49	NR
Acetophenone	NR	NR
Dimethyl Formamide	107	NR
Ethyl Ether	*	49
Ethyl Acetate	NR	NR
Ethylene Oxide	NR	100
Ethylene Glycol	107	135
Glycerine	107	135
Methyl Cellosolve Ether	24	135
Methyl Ethyl Ketone	21	NR
Triethyl Phosphate	*	NR
SALTS		
Ammonium Nitrate	107	135
Calcium Phosphate	*	135
Calcium Sulphate	107	135
Calcium Chloride	107	135
Sodium Acetate	107	135
Sodium Chlorate	107	135
Sodium Chloride	107	135

STANDARD FOR PLASTIC LINED PRODUCTS

GASES

Ammonia	60	NR
Carbon Dioxide	66	135
Hydrogen	60	135
Hydrogen Sulphide	60	135
Methane	21	135

NR : not recommended

** : no date available*

STANDARD FOR PLASTIC LINED PRODUCTS

7. INSTALLATION PROCEDURE

7.1. PROTECTIVE COVERS

Do not remove covers until installation. Protective covers should be replaced after inspection and when the item is removed from service.

7.2. CLEANING

Ensure sealing surfaces are clean before assembly.

7.3. RECOMMENDED BOLT TORQUES

- clean and grease the nuts and bolts.
- finger tighten all nuts.
- tighten each bolt, with a torque wrench, using the criss-cross method, to the torque value following table:

NB	BOLTS	PTFE PFA	PVDF	PP
INCH	mm	Kg.m	Kg.m	kg.m
1"	4x1/2"	3.0	4.0	3.5
1.25"	4x1/2"	4.5	4.5	3.8
1.5"	4x1/2"	6.0	5.0	4.0
2"	4x5/8"	8.0	5.2	5.8
2.5"	4x5/8"	10.0	7.0	6.0
3"	4x5/8"	12.0	10.0	9.0
4"	8x5/8"	7.0	10.0	9.0
5"	8x3/4"	9.0	11.0	10.0
6"	8x3/4"	13.0	12.0	11.0
8"	8x3/4"	18.0	14.0	14.0
10"	12x7/8"	16.0		14.0
12"	12x7/8"	21.0		17.0
14"	16x1"	39.0		
16"	16x1"	36.0		
18"	16x1 1/8"	37.0		
20"	20x1 1/8"	34.0		
24"	20x1 1/4"	46.0		
30"	28x1 1/4"	49.5		

STANDARD FOR PLASTIC LINED PRODUCTS

- These torque's can vary depending on greasing, surface condition of the threads.
- The clamping torque's are given for cold-clamping and should be checked at cold, after 24 hours of operation, after thermo-cycling and then periodically.

7.4. GASKETS

Auxiliary gaskets must be used when connecting lined items to flanges of dissimilar material. Otherwise, gaskets are not required excepts when repeated connections and disconnection's are to be made.

7.5. WELDING

No welding must be done on the metal housing after the lining is in place.

7.6. VENTHOLES

Ventholes should not be plugged with insulation, paint etc.
Where spools and fittings are to be jacket insulated, venthole extensions can be supplied.

7.7. STEAM TESTING

Field testing with steam shall not be conducted without first obtaining the approved procedure.

7.8. INSTALLATION IN WINTER

At lower temperatures, plastics can become brittle (PVDF and PP more than PTFE and PFA), therefore extra care should be taken during installation in cold periods.

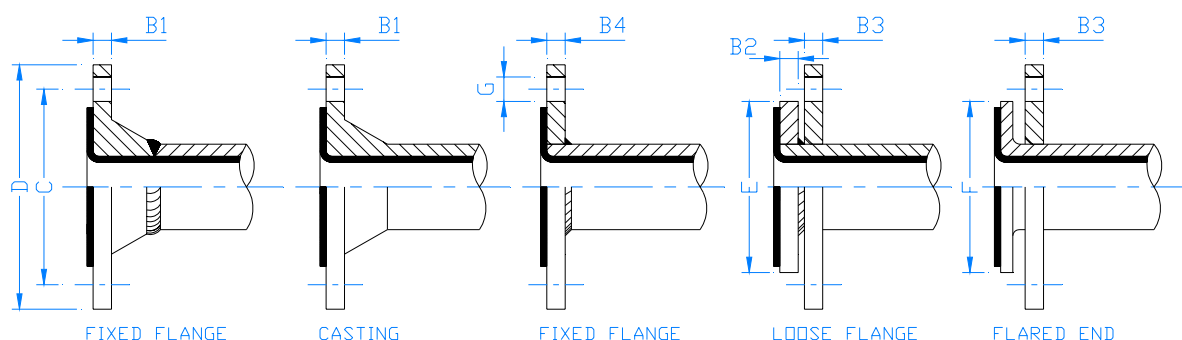
STANDARD FOR PLASTIC LINED PRODUCTS

8. PRODUCT RANGE

8.1. FLANGES FOR STRAIGHT LENGTHS AND FITTINGS.

Dimensions in mm except NB (inches)

NB	D	B1	B2	B3	B4	C	G	E	F	PIPE Diameter x wall
0.5"	88.9	9.5	10		11.1	60.3	4x16	43		26.7x2.9
0.75"	98	11.1	12		12.7	69.8	4x16	43		26.7x2.9
1"	108	12.7	12	14.2	14.1	79.4	4x16	52	51	33.4x3.4
1.5"	127	15.9	12	17.5	17.5	98.4	4x16	72	72	48.3x3.7
2"	152	17.4	14	19.0	19.0	120.6	4x19	90	90	60.3x3.9
3"	191	22.2	16	23.8	23.8	152.4	4x19	125	125	88.9x5.5
4"	229	22.2	16	23.8	23.8	190.5	8x19	155	155	114.3x6.0
6"	279	23.8	18		25.4	241.3	8x22	210	210	168.3x7.1
8"	343	27.0	20		28.6	298.4	8x22	262	262	219.1x8.2
10"	406	28.6	22		28.6	361.9	12x25	318		273.0x7.8
12"	483	30.1	24		30.1	431.8	12x25	370		323.9x6.4
14"	533	33.3	25		33.3	476.2	12x29	410		355.6x7.9
16"	597	34.9	25		34.9	539.7	16x29	465		406.4x7.9
18"	635	38.1	25		38.1	577.8	16x32	530		457.2x7.9
20"	698	41.3	25		41.3	635.0	20x32	580		508.0x9.5
24"	813	46.0	25		46.0	749.3	20x32	685		609.8x9.5
30"	984	52.4	25		52.4	914.4	28x35	857		762.0x12.7



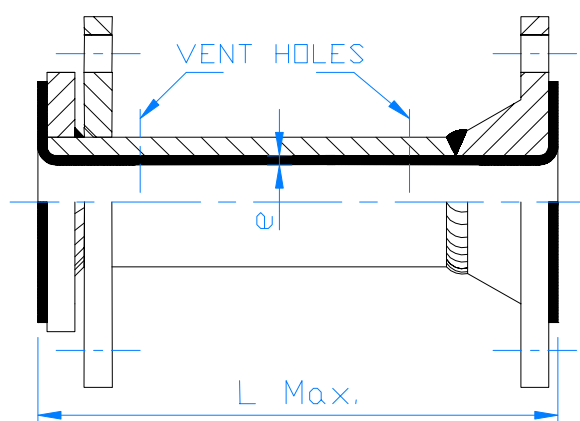
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8.2. STRAIGHT LENGTHS

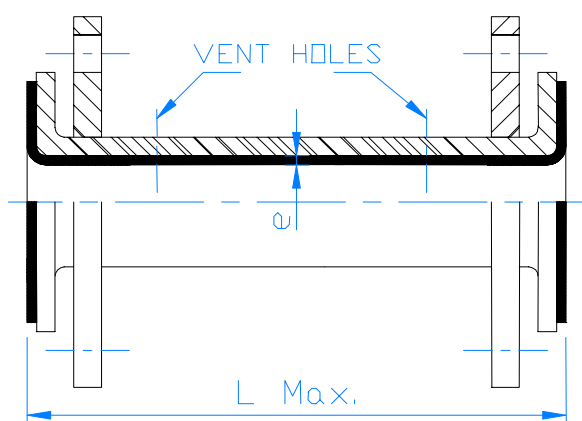
Dimensions in mm except NB (inches)

NB	PTFE e std vac		PP e vac	PVDF e vac	L Max.	L* Min.	TYPE 1	TYPE 2
0.5"	2.8				3000	78	*	
0.75"	2.8				3000	78	*	
1"	3.0		3.4	2.5	6000	78	*	*
1.5"	3.0		3.8	2.5	6000	84	*	*
2"	3.0		4.3	2.5	6000	90	*	*
3"	4.0		4.4	2.8	6000	101	*	*
4"	5.0		5.3	3.1	6000	105	*	*
6"	3.5	6.0	5.6	3.7	6000	136	*	*
8"	3.7	8.0	5.6	4.0	6000	148	*	*
10"	3.7	8.5	6.3		3000	154	*	
12"	4.0	8.5	6.3		3000	160	*	
14"	4.5				3000	160	*	
16"	4.5				3000	160	*	
18"	5.0				3000	170	*	
20"	5.0				3000	170	*	
24"	5.0				3000	180	*	
30"								

TYPE 1



TYPE 2



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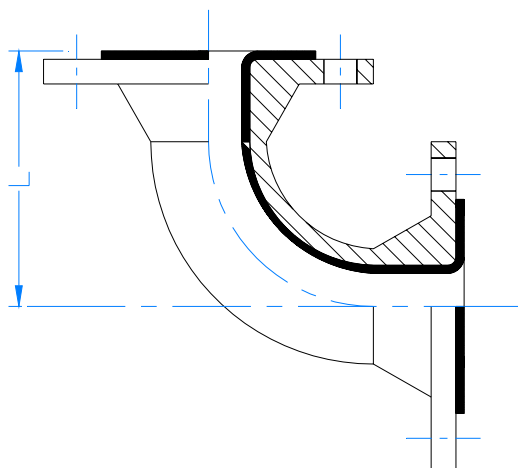
8.3. ELBOWS 90°

Dimensions in mm except NB (inches)

NB	L	e std	e vac	PTFE		PP vac	PVDF vac
				Std	vac		
0.5"	65	3.0	3.0	*	*		
0.75"	75	3.0	3.0	*	*		
1" ■	89	3.0	3.0	*	*	*	*
1.5" ■	102	3.0	3.0	*	*	*	*
2" ■	114	3.0	3.0	*	*	*	*
3" ■	140	4.0	4.0	*	*	*	*
4"	165	5.0	5.0	*	*	*	*
6"	203	3.5	6.0	*	*		
8"	229	3.7	8.0	*	*	*	*
10"	279	3.7	8.5	*	*		
12"	305	4.0	8.5	*	*		
14"	356	4.5		*			
16"	625	4.5		*			
18"	700	5.0		*			
20"	580	5.0		*			
24"	685	5.0		*			
30"							

■ = Ductile Iron

*: Available



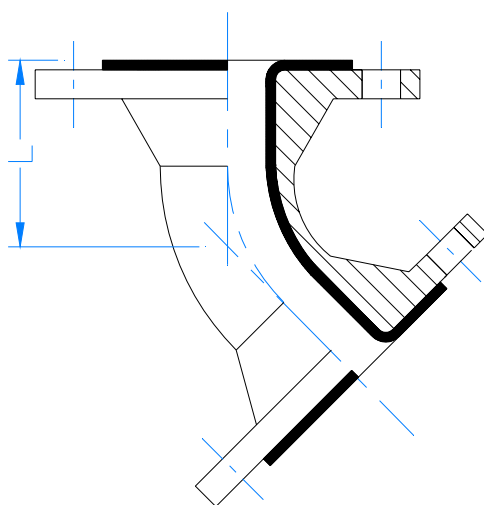
STANDARD FOR PLASTIC LINED PRODUCTS

8.4. ELBOWS 45°

Dimensions in mm except NB (inches)

NB	L	e std	e vac	PTFE		PP vac	PVDF vac
				std	vac		
0.5"	45	3.0	3.0	*	*		
0.75"	45	3.0	3.0	*	*		
1"	45	3.0	3.0	*	*	*	*
1.5"	57	3.0	3.0	*	*	*	*
2"	64	3.0	3.0	*	*	*	*
3"	76	4.0	4.0	*	*	*	*
4"	103	5.0	5.0	*	*		
6"	127	3.5	6.0	*	*		
8"	140	3.7	8.0	*	*	*	*
10"	165	3.7	8.5	*	*		
12"	190	4.0	8.5	*	*		
14"	190	4.5		*			
16"	268	4.5		*			
18"	298	5.0		*			
20"	343	5.0		*			
24"	412	5.0		*			
30"							

*: Available



STANDARD FOR PLASTIC LINED PRODUCTS

8.5. TEES NB 0.5"-8"

Dimensions in mm except NB (inches)

NB	L	e		PTFE/PFA		PP vac	PVDF vac
		std	Vac	std	vac		
0.5"	65	3.0	3.0	*	*	*	*
0.75"	75	3.0	3.0	*	*	*	*
1" ■	89	3.0	3.0	*	*	*	*
1.5" ■	102	3.0	3.0	*	*	*	*
2" ■	114	3.0	3.0	*	*	*	*
3" ■	140	4.0	4.0	*	*	*	*
4"	165	5.0	5.0	*	*	*	*
6"	203	3.5	6.0	*	*	*	*
8"	229	3.7	8.0	*	*	*	*
10"	279	3.7	8.5	*	*		
12"	305	4.0	8.5	*	*		

■ = Ductile Iron

PTFE/PFA:

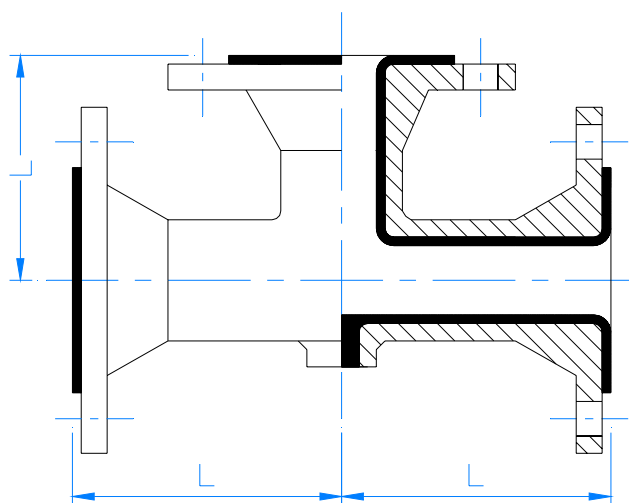
NB 0.5"-NB 4"

PFA

NB 6" - NB 8"

PTFE

*: Available



STANDARD FOR PLASTIC LINED PRODUCTS

8.6. TEES NB 10"-30"

Dimensions in mm except NB (inches)

NB	L	e	e	PTFE/PFA		PP vac	PVDF vac
		std	vac	std	vac		
10"	279	3.7	8.5	*	*		
12"	305	4.0	8.5	*	*		
14"	356	4.5		*			
16"	381	4.5		*			
18"	419	5.0		*			
20"	457	5.0		*			
24"	559	5.0		*			
30"							

Details on request.

*: Available

STANDARD FOR PLASTIC LINED PRODUCTS

8.7. REDUCING TEES NB 0.75"-8" (FIG. 8.7)

Dimensions in mm except NB (inches)

NB1	NB2	L	e1		e2		PFA		PP	PVDF
			std	vac	std	vac	std	vac	vac	vac
0.75"	0.5"	75	3.0		3.0		*		*	*
1"	0.5"	89	3.0		3.0		*		*	*
1"	0.75"	89	3.0		3.0		*		*	*
1.5"	0.5"	102	3.0		3.0		*		*	*
1.5"	0.75"	102	3.0		3.0		*		*	*
1.5"	1"	102	3.0		3.0		*		*	*
2"	0.5"	114	3.0		3.0		*		*	*
2"	0.75"	114	3.0		3.0		*		*	*
2"	1"	114	3.0		3.0		*		*	*
2"	1.5"	114	3.0		3.0		*		*	*
3"	0.5"	140	4.0		3.0		*		*	*
3"	0.75"	140	4.0		3.0		*		*	*
3"	1"	140	4.0		3.0		*		*	*
3"	1.5"	140	4.0		3.0		*		*	*
3"	2"	140	4.0		3.0		*		*	*
4"	1"	165	5.0		3.0		*		*	*
4"	1.5"	165	5.0		3.0		*		*	*
4"	2"	165	5.0		3.0		*		*	*
4"	3"	165	5.0		4.0		*		*	*
6"	1"	203	3.5	6.0	3.0		*	*	*	*
6"	1.5"	203	3.5	6.0	3.0		*	*	*	*
6"	2"	203	3.5	6.0	3.0		*	*	*	*
6"	3"	203	3.5	6.0	4.0		*	*	*	*
6"	4"	203	3.5	6.0	5.0		*	*	*	*
8"	1"	229	3.7	8.0	3.0		*	*	*	*
8"	1.5"	229	3.7	8.0	3.0		*	*	*	*
8"	2"	229	3.7	8.0	3.0		*	*	*	*
8"	3"	229	3.7	8.0	4.0		*	*	*	*
8"	4"	229	3.7	8.0	5.0		*	*	*	*
8"	6"	229	3.7	8.0	3.5 6.0		*	*	*	*

*: Available

PTFE/PFA:

NB 0.5"-4" PFA

NB 6" -8" PTFE

STANDARD FOR PLASTIC LINED PRODUCTS

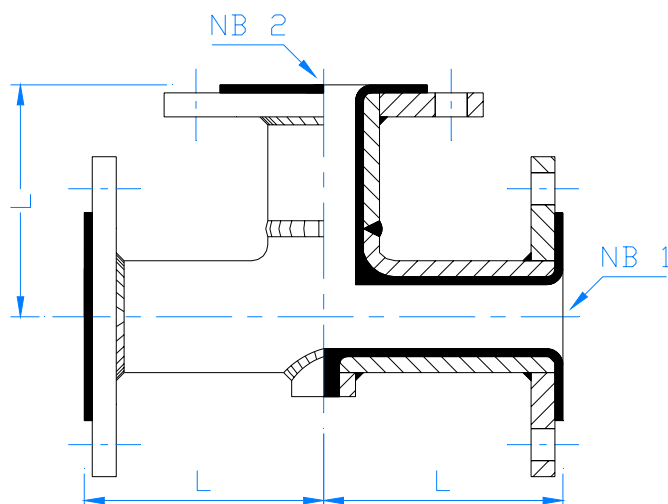


Fig. 8.7

8.8. REDUCING TEES NB 10"-24"

Dimensions in mm except NB (inches)

NB1	NB2	L	e1 std	e2 std	PTFE std
10"	3"	279	3.7	4.0	*
10"	4"	279	3.7	5.0	*
10"	6"	279	3.7	3.5	*
10"	8"	279	3.7	3.7	*
12"	4"	305	4.0	5.0	*
12"	6"	305	4.0	3.5	*
12"	8"	305	4.0	3.7	*
12"	10"	305	4.0	3.7	*
14"	6"	356	4.5	3.5	*
14"	8"	356	4.5	3.7	*
14"	10"	356	4.5	3.7	*
14"	12"	356	4.5	4.0	*
16"	8"	381	4.5	3.7	*
16"	10"	381	4.5	3.7	*
16"	12"	381	4.5	4.0	*
16"	14"	381	4.5	4.5	*
18"	10"	419	5.0	3.7	*
18"	12"	419	5.0	4.0	*
18"	14"	419	5.0	4.5	*

STANDARD FOR PLASTIC LINED PRODUCTS

18"	16"	419	5.0	4.5	*
20"	12"	457	5.0	4.0	*
20"	14"	457	5.0	4.5	*
20"	16"	457	5.0	4.5	*
20"	18"	457	5.0	5.0	*
24"	14"	559	5.0	4.5	*
24"	16"	559	5.0	4.5	*
24"	18"	559	5.0	5.0	*
24"	20"	559	5.0	5.0	*

All branch sizes NB 1"-14" are possible, details on request.

*: Available.

STANDARD FOR PLASTIC LINED PRODUCTS

8.9. CROSSES NB 0.5"-8"

Dimensions in mm except NB (inches)

NB	L	e std	e vac	PTFE/PFA std vac	PP vac	PVDF vac
0.5"	65		3.0	*	*	*
0.75"	75		3.0	*	*	*
1"	89		3.0	*	*	*
1.5"	102		3.0	*	*	*
2"	114		3.0	*	*	*
3"	140		4.0	*	*	*
4"	165		5.0	*	*	*
6"	203	3.5	6.0	*	*	*
8"	229	3.7	8.0	*	*	*

Reducing crosses on request.
Larger diameters on request.

PTFE/PFA:

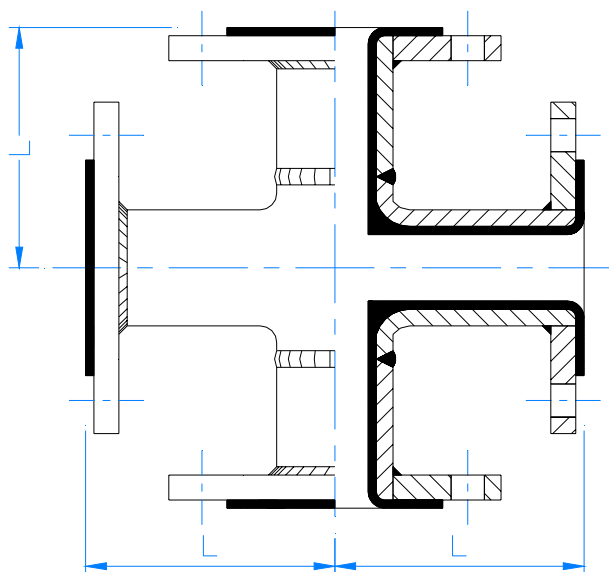
NB 0.5" - NB 4"

PFA

NB 6" - NB 8"

PTFE

*: Available



STANDARD FOR PLASTIC LINED PRODUCTS

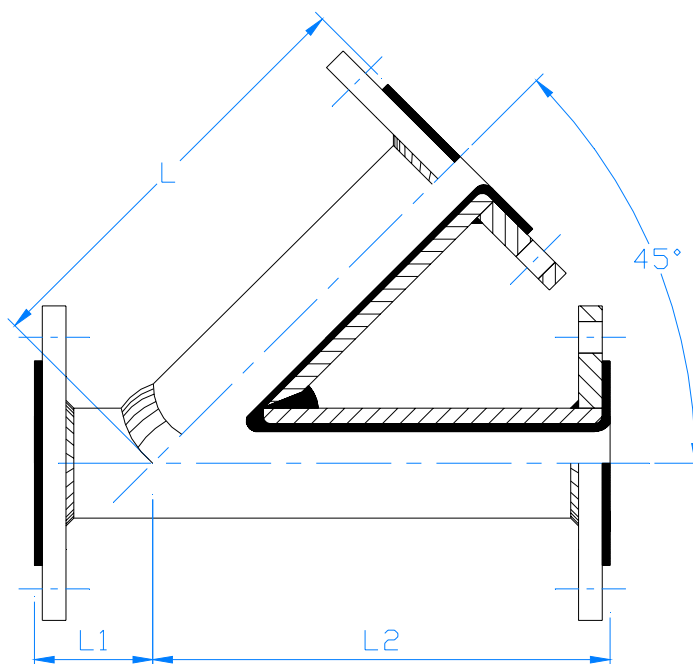
8.10. LATERAL TEES 45°

Dimensions in mm except NB (inches)

NB	L	L1	e std	e vac	PFA std vac	PP vac	PVDF vac
1"	146	44	3.0		*	*	*
1.5"	178	51	3.0		*	*	*
2"	203	63	3.0		*	*	*
3"	254	76	4.0		*	*	*
4"	305	76	5.0		*	*	*

Reducing lateral tees on request.

*: Available.



STANDARD FOR PLASTIC LINED PRODUCTS

8.11. CONCENTRIC REDUCERS (FIG. 8.11)

Dimensions in mm except NB (inches)

NB1	NB2	L	e1		e2		PTFE/PFA		PP	PVDF
			std	vac	std	vac	std	vac	vac	vac
1"	0.5"	114	3.0		3.0		*		*	*
1"	0.75"	114	3.0		3.0		*		*	*
1.5"	0.75"	114	3.0		3.0		*		*	*
1.5"	1"	114	3.0		3.0		*		*	*
2"	1"	127	3.0		3.0		*		*	*
2"	1.5"	127	3.0		3.0		*		*	*
2.5"	1"	140	3.5		3.0		*			
2.5"	1.5"	140	3.5		3.0		*			
2.5"	2"	140	3.5		3.0		*		*	*
3"	1"	152	4.0		3.0		*		*	*
3"	1.5"	152	4.0		3.0		*		*	*
3"	2"	152	4.0		3.0		*		*	*
3"	2.5"	152	4.0		3.5		*			
4"	1.5"	178	5.0		3.0		*		*	*
4"	2"	178	5.0		3.0		*		*	*
4"	3"	178	5.0		4.0		*		*	*
6"	2"	228	3.5	6.0	3.0		*	*	*	*
6"	3"	228	3.5	6.0	4.0		*	*	*	*
6"	4"	228	3.5	6.0	5.0		*	*	*	*
6"	5"	228	3.5		3.5		*			
8"	3"	280	3.7	8.0	4.0	5.0	*	*	*	*
8"	4"	280	3.7	8.0	5.0	6.0	*	*	*	*
8"	6"	280	3.7	8.0	3.5	8.0	*	*	*	*
10"	4"	304	3.7	8.5	5.0	6.0	*	*		
10"	6"	304	3.7	8.5	3.5	8.0	*	*		
10"	8"	304	3.7	8.5	3.7	8.5	*	*		
12"	6"	356	4.0	8.5	3.5		*	*		
12"	8"	356	4.0	8.5	3.7		*	*		
12"	10"	356	4.0	8.5	3.7		*	*		
14"	8"	406	4.5		3.7		*			
14"	10"	406	4.5		3.7		*			
14"	12"	406	4.5		4.0		*			
16"	14"	457	4.5		4.5		*			

*: Available

STANDARD FOR PLASTIC LINED PRODUCTS

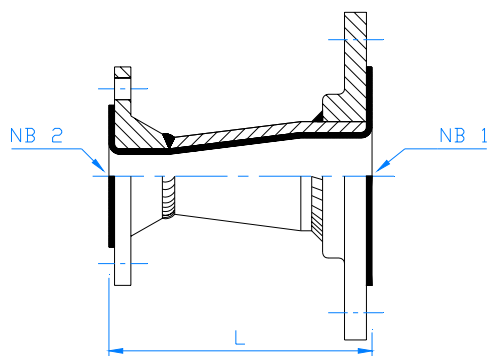


Fig. 8.11

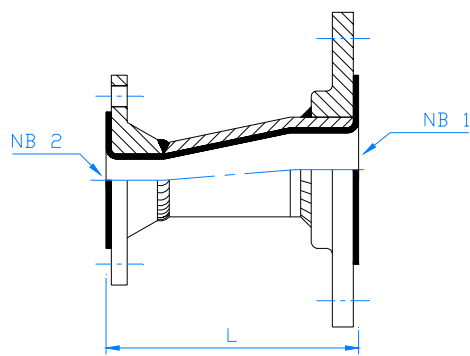


fig. 8.12

8.12. ECCENTRIC REDUCERS (FIG. 8.12)

Dimensions in mm except NB (inches)

NB1	NB2	L	e1		e2		PTFE/PFA		PP vac	PVDF vac
			std	vac	std	vac	std	vac		
1"	0.75"	114	3.0		3.0		*	*	*	*
1.5"	0.75"	114	3.0		3.0		*			
1.5"	1"	114	3.0		3.0		*	*	*	*
2"	1"	127	3.0		3.0		*	*	*	*
2"	1.5"	127	3.0		3.0		*	*	*	*
2.5"	2"	140	3.5		3.0		*			
3"	1"	152	4.0		3.0		*	*	*	*
3"	1.5"	152	4.0		3.0		*	*	*	*
3"	2"	152	4.0		3.0		*	*	*	*
3"	2.5"	152	4.0		3.5		*			
4"	1.5"	178	5.0		3.0		*	*	*	*
4"	2"	178	5.0		3.0		*	*	*	*
4"	3"	178	5.0		4.0		*	*	*	*
6"	2"	228	3.5	6.0	3.0		*	*	*	*
6"	3"	228	3.5	6.0	4.0		*	*	*	*
6"	4"	228	3.5	6.0	5.0		*	*	*	*
8"	3"	280	3.7	8.0	4.0		*	*	*	*
8"	4"	280	3.7	8.0	5.0		*	*	*	*
8"	6"	280	3.7	8.0	3.5	6.0	*	*	*	*
10"	4"	304	3.7	8.5	5.0	5.0	*	*	*	*
10"	6"	304	3.7	8.5	3.5	6.0	*	*	*	*
10"	8"	304	3.7	8.5	3.7	8.0	*	*	*	*

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12"	8"	356	4.0	8.5	3.7	8.0	*	*		
12"	10"	356	4.0	8.5	3.7	8.0	*	*		
14"	10"	406	4.5		3.7		*	*		
14"	12"	406	4.5		4.0		*			
16"	14"	457	4.5		4.5		*			
18"	16"									
20"	18"									
24"	20"									

*: Available

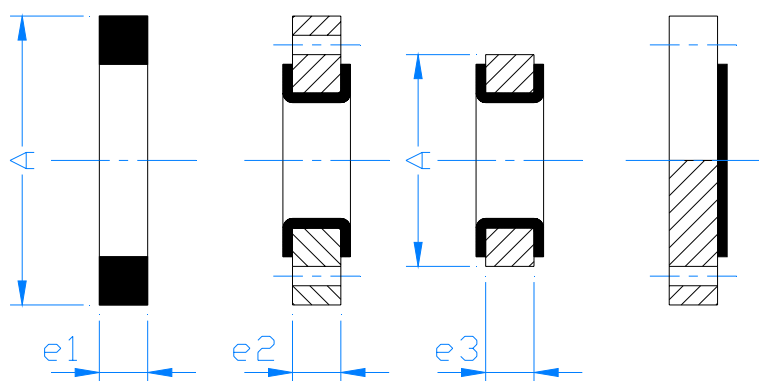
STANDARD FOR PLASTIC LINED PRODUCTS

8.13. SPACERS AND BLIND FLANGES

Dimensions in mm except NB (inches)

NB	A	e1	e2	e3	PTFE/PFA		PP	PVDF
					std	vac	vac	vac
1"	62	5-20	10-50	10-70	*	*	*	*
1.5"	81	5-20	10-50	10-70	*	*	*	*
2"	100	5-20	10-50	10-70	*	*	*	*
3"	132	5-20	20-50	10-70	*	*	*	*
4"	170	5-20	25-60	10-70	*	*	*	*
6"	218	5-20	30-70	10-70	*	*	*	*
8"	275	5-20	30-70	10-70	*	*	*	*
10"	336	5-20	30-70	10-70	*	*		
12"	405	5-20	40-70	10-70	*	*		
14"	444	5-20	40-70	10-70	*			
16"	509	5-20	40-70	10-70	*			
18"	544	5-20	40-70	10-70	*			
20"								
24"								
30"								

*:Available



STANDARD FOR PLASTIC LINED PRODUCTS

8.14. REDUCING FLANGES

Dimensions in mm except NB (inches)

NB1	NB2	L	Type	PTFE/PFA		PP	PVDF
				std	vac		
0.75"	0.5"	35	2	*		*	*
1"	0.5"	35	2	*		*	*
1"	0.75"	35	2	*		*	*
1.25"	0.5"	35	1	*		*	*
1.25"	0.75"	35	1	*		*	*
1.25"	1"	35	1	*		*	*
1.5"	0.5"	35	1	*		*	*
1.5"	0.75"	35	1	*		*	*
1.5"	1"	35	1	*		*	*
1.5"	1.25"	35	2	*		*	*
2"	0.5"	35	1	*		*	*
2"	0.75"	35	1	*		*	*
2"	1"	35	1	*		*	*
2"	1.5"	35	2	*		*	*
2.5"	0.75"	35	1	*		*	*
2.5"	1"	35	1	*		*	*
2.5"	1.25"	35	1	*		*	*
2.5"	1.5"	35	1	*		*	*
2.5"	2"	35	2	*		*	*
3"	1"	35	1	*		*	*
3"	1.25"	35	1	*		*	*
3"	1.5"	35	1	*		*	*
3"	2"	35	1	*		*	*
3"	2.5"	35	1	*		*	*
4"	1"	45	1	*		*	*
4"	1.25"	45	1	*		*	*
4"	1.5"	45	1	*		*	*
4"	2"	45	1	*		*	*
4"	2.5"	45	1	*	*	*	*
4"	3"	45	2	*	*	*	*
5"	1"	45	1	*		*	*
5"	1.5"	45	1	*		*	*

STANDARD FOR PLASTIC LINED PRODUCTS

Dimensions in mm except NB (inches)

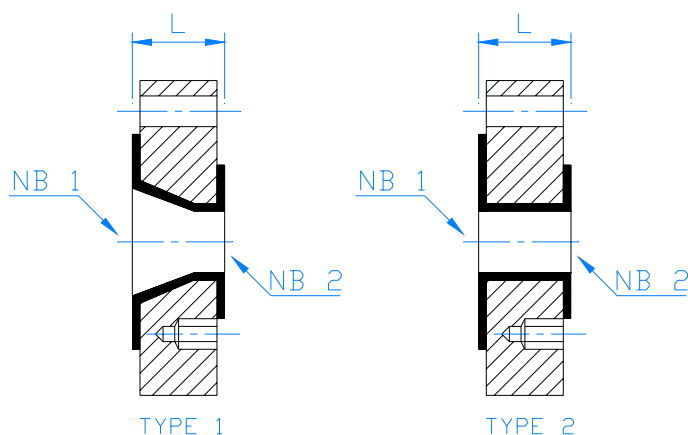
NB1	NB2	L	Type	PTFE/PFA		PP	PVDF
				std	vac		
5"	2"	45	1	*		*	*
5"	2.5"	45	1	*			
5"	3"	45	1	*		*	*
5"	4"	45	2	*		*	*
6"	1"	45	1	*	*	*	*
6"	1.5"	45	1	*	*	*	*
6"	2"	45	1	*	*	*	*
6"	3"	45	1	*	*	*	*
6"	4"	45	1	*	*	*	*
6"	5"	45	2	*			
8"	1"	45	1	*	*	*	*
8"	1.5"	45	1	*	*	*	*
8"	2"	45	1	*	*	*	*
8"	3"	45	1	*	*	*	*
8"	4"	45	1	*	*	*	*
8"	5"	45	1	*	*	*	*
8"	6"	45	2	*	*	*	*
10"	3"	45	1	*	*		
10"	4"	45	1	*	*		
10"	6"	45	1	*	*		
10"	8"	45	2	*	*		
12"	2"	50	1	*	*		
12"	3"	50	1	*	*		
12"	4"	50	1	*	*		
12"	6"	50	1	*	*		
12"	8"	50	1	*	*		
12"	10"	50	2	*	*		
14"	3"	50	1	*	*		
14"	4"	50	1	*	*		
14"	6"	50	1	*	*		
14"	8"	50	1	*	*		
14"	10"	50	1	*	*		
14"	12"	50	2	*			
16"	4"	50	2	*			
16"	6"	50	2	*			
16"	8"	50	2	*			

STANDARD FOR PLASTIC LINED PRODUCTS

Dimensions in mm except NB (inches)

NB1	NB2	L	Type	PTFE/PFA		PP	PVDF
				std	vac		
16"	10"	50	2	*			
16"	12"	50	2	*			
16"	14"	50	2	*			
18"	6"	50	2	*			
18"	8"	50	2	*			
18"	10"	50	2	*			
18"	12"	50	2	*			
18"	14"	50	2	*			
18"	16"	50	2	*			
20"	10"	50	2	*			
20"	12"	50	2	*			
20"	14"	50	2	*			
20"	16"	50	2	*			
20"	18"	50	2	*			
24"	10"	50	2	*			
24"	12"	50	2	*			
24"	14"	50	2	*			
24"	16"	50	2	*			
24"	18"	50	2	*			
24"	20"	50	2	*			
30"	24"						

*:Available



STANDARD FOR PLASTIC LINED PRODUCTS

8.15. GENERAL NOTES

- 8.15.1. Dip pipes, expansion joints, instrument tees, sight flow indicators, ball check valves etc. are also in our scope of supply. Details are available on request.
- 8.15.2. Other sizes are also available. Please contact our company for details.
- 8.15.3. This manual does not constitute a warranty of any kind expressed or implied, of Conpipe's products of their fitness for any particular use. The company does not accept responsibility or liability for inaccuracies in this publication. Conpipe reserves the right to change product specifications and drawings without prior notice.

STANDARD

FOR

RUBBER LINED MATERIALS

CNP-301-01

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STANDARD FOR RUBBER LINED PRODUCTS

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STANDARD FOR RUBBER LINED PRODUCTS

1. FOREWORD

Conpipe International b.v. is a world-wide operating company which manufactures pipe systems by means of the most advanced production methods for drink water companies in their raw water projects and water treatment plants, off-shore companies and petrochemical industries.

Conpipe International b.v. 's systems can be supplied in any desired configuration, pipe-diameter and wall thickness. We are specialised in lined and coated pipe-line systems. Cement-, PTFE-, Rubber- and Epoxy lining are all in our scope of supply.

This specification defines the materials, technical features, recommendation for assembly and inspection of Conpipe Rubber lined steel pipes and fittings.

The information contained herein should be considered as a guide for the use of Conpipe lined piping systems. Nevertheless, the data are intended for technically skilled persons who use them at their own risk.

This manual does not constitute a warranty of any kind expressed or implied, of Conpipe's products of their fitness for any particular use. The company does not accept responsibility or liability for inaccuracies in this publication.
Conpipe reserves the right to change product specifications without prior notice.

STANDARD FOR RUBBER LINED PRODUCTS

2. SCOPE

The life-time of metal equipment reduces because of corrosion and erosion. Durable internal protection as Conpipe Rubber-lining is therefore required to withstand chemical and physical attack which will reduce or eliminate costs when erosion and corrosion occur.

This standard covers the properties, specifications, applicable procedures and standard product range of Conpipe's Rubber lining.

3. MATERIALS

3.1. LININGS

3.1.1. Natural Semi Ebonite

Linings suitable for equipment operating under cyclic change in temperature. This lining is better to withstand thermal shocks.

Normal lining thickness: 4 to 6 mm as single layer or 1 to 2 mm as backing layer for Ebonite. Curing system: Autoclave Cure.

Resistant to: 54 % Phosphoric Acid, 25 % Sulphuric Acid at ambient temperature, sea-water 33 % Caustic at 80°C.

Minimum physical properties:

- Tensile strength: 150 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 30 % (tested to ASTM D 412).
- Hardness: 65° +/- 5° shore D.
- Specific gravity: 1.27 +/- 0.03 g/cm³.
- Maximum recommended temperature: 100 °C.

3.1.2. Natural Semi Ebonite

Low Ca.Mg compound with excellent bonding properties. Used in membrane cell plants.

Normal lining thickness: 4 to 6 mm as single layer or 1 to 2 mm as backing layer for low Ca.Mg Ebonite. Curing system: Autoclave cure.

Lining is resistant to Acid & Alkalies.

Minimum physical properties:

- Tensile strength: 150 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 30 % (tested to ASTM D 412).
- Hardness: 65° +/- 5° shore D.

STANDARD FOR RUBBER LINED PRODUCTS

- Specific gravity: 1.26 +/- 0.03 g/cm³.
- Maximum recommended temperature: 100 °C.

3.1.3. Hard natural rubber

Low Ca.Mg compound used in membrane cell plants.

Normal lining thickness: 4 to 5 mm.

Curing system: Autoclave cure.

Lining is resistant to Hydrogen fluoride traces and fluorine brine solution, alkalies.

Minimum physical properties:

- Tensile strength: 180 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 15 % (tested to ASTM D 412).
- Hardness: 70° +/- 5° shore D.
- Specific gravity: 1.17 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.4. Hard Natural rubber

A fast setting compound. Hence requires AC storage and refrigerated containers during transport.

Normal lining thickness: 4 to 5 mm.

Curing system: Autoclave cure.

Lining is resistant to 310 gpl Brine, wet Chlorine, 33 % Hydro Chloric Acid, 30 % Sodium Hydroxide.

Minimum physical properties:

- Tensile strength: 300 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 4(max) % (tested to ASTM D 412).
- Hardness: 80° +/- 5° shore D.
- Specific gravity: 1.32 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.5. Hard natural rubber

Lining suitable for pipes, fittings and process equipment for Chlorine Plants.

Normal lining thickness: 3 to 4 mm with 1 to 2 mm Natural Rubber –Semi-Ebonite as backing layer.

Curing system: Autoclave curing.

STANDARD FOR RUBBER LINED PRODUCTS

Lining is resistant to 310 gpl Brine, wet Chlorine, 33 % Hydro Chloric Acid, 30 % Sodium Hydroxide, Sodium Hypochlorite, free Chlorine less than 50 gpl up to 50°C.

Minimum physical properties:

- Tensile strength: 300 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 4(max) % (tested to ASTM D 412).
- Hardness: 80° +/- 5° shore D.
- Specific gravity: 1.29 +/- 0.03 g/cm³.
- Maximum recommended temperature: 100 °C.

3.1.6. Soft natural rubber

Lining suitable for pipes, fittings and process equipment.

Normal lining thickness: 5 to 10 mm.

Curing system: Autoclave curing.

Lining is resistant to slurry abrasion for fine particle size solids.

Minimum physical properties:

- Tensile strength: 200 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 600 % (tested to ASTM D 412).
- Hardness: 40° +/- 5° shore A.
- Specific gravity: 1.01 +/- 0.03 g/cm³.

Maximum recommended temperature: 70 °C.

3.1.7. Soft natural rubber

Lining suitable for storage tanks, day tanks and vessels.

Normal lining thickness: 4 to 5 mm.

Curing system: Cold bound lining.

Lining is resistant to 54 % Phosphoric Acid traces of Hydro Fluo Silic Acid.

Minimum physical properties:

- Tensile strength: 130 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 400 % (tested to ASTM D 412).
- Hardness: 52° +/- 5° shore A.
- Specific gravity: 1.17 +/- 0.03 g/cm³.

Maximum recommended temperature: 75 °C.

3.1.8. Soft natural rubber

Lining suitable for process equipment of Fertilizer plants.

Normal lining thickness: 4 to 5 mm.

STANDARD FOR RUBBER LINED PRODUCTS

Curing system: Autoclave curing / pressurised steam curing.

Resistant to heavy abrasives, Fluorine.

Minimum physical properties:

- Tensile strength: 160 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 350 % (tested to ASTM D 412).
- Hardness: 57° +/- 5° shore A.
- Specific gravity: 1.15 +/- 0.03 g/cm³.

Maximum recommended temperature: 70 °C.

3.1.9. Soft natural rubber

Lining suitable for process equipment which are too big to be accommodated in an autoclave. Fast setting compound. Hence requires AC storage and refrigerated containers during storage.

Normal lining thickness: 4 to 5 mm.

Curing system: Exhausted steam curing.

Resistant to 10 to 54 % Phosphoric Acid, Gypsum slurry.

Minimum physical properties:

- Tensile strength: 160 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 300 % (tested to ASTM D 412).
- Hardness: 60° +/- 5° shore A.
- Specific gravity: 1.15 +/- 0.03 g/cm³.
- Maximum recommended temperature: 70 °C.

3.1.10. NR soft

Lining suitable for autoclave as well as pressure cure with steam.

Normal lining thickness: 1.5 mm and larger.

Curing system: Autoclave curing /pressurised steam curing.

Resistant to abrasion, chemical corrosion, mechanical and thermal shocks, Phosphoric Acid, Gypsum slurry.

Minimum physical properties:

- Tensile strength: 180 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 350 % (tested to ASTM D 412).
- Hardness: 55° +/- 5° shore A.
- Specific gravity: 1.15 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.11. NR Ebonite

STANDARD FOR RUBBER LINED PRODUCTS

Lining suitable for autoclave as well as pressure cure with steam.
Normal lining thickness: 2.5 mm and larger.
Curing system: Autoclave curing /pressurised steam curing.
Resistant to abrasion, chemical corrosion, mechanical and thermal shocks, Phosphoric Acid, Gypsum slurry.

Minimum physical properties:

- Tensile strength: 300 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 2 % (tested to ASTM D 412).
- Hardness: 60° +/- 5° shore D.
- Specific gravity: 1.2 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.12. Soft natural rubber

Food grade compound meeting American and German standards.
Normal lining thickness: 4 to 5 mm.

Curing system: Autoclave curing.

Resistant to starch, milk, glucose, fructose etc.

Minimum physical properties:

- Tensile strength: 130 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 600 % (tested to ASTM D 412).
- Hardness: 65° +/- 5° shore A.
- Specific gravity: 1.26 +/- 0.03 g/cm³.
- Maximum recommended temperature: 70 °C.

3.1.13. NR Semi Ebonite

Low Ca.Mg compound for valve lining.

Normal lining thickness: 4 to 5 mm.

Curing system: Autoclave curing.

Resistant to Brine solutions, Dilute Acids and Alkalies.

Minimum physical properties:

- Tensile strength: 150 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 30 % (tested to ASTM D 412).
- Hardness: 68° +/- 5° shore D.
- Specific gravity: 1.26 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.14. NR Ebonite

STANDARD FOR RUBBER LINED PRODUCTS

Low Ca.Mg compound for membrane Cell Plant.

Normal lining thickness: 3 mm layer with 2 mm Natural rubber Semi-Ebonite as backing layer.

Curing system: Autoclave curing.

Lining is resistant to 310 gpl Brine, wet Chlorine, 33 % Hydro Chloric Acid, 30 % Sodium Hydroxide, Sodium Hypochlorite, free Chlorine less than 50 gpl up to 50°C.

Minimum physical properties:

- Tensile strength: 250 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 3 % (tested to ASTM D 412).
- Hardness: 80° +/- 5° shore D.
- Specific gravity: 1.26 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.15. Neoprene

For process equipment of Fertiliser Plants.

Normal lining thickness: 4 to 5 mm.

Curing system: Cold bonding lining / Autoclave curing.

Resistant to: 54 % Phosphoric Acid, 26 % Sulphuric Acid at ambient temperature, 33 % Sodium Hydroxide up to 80°C, 20 % Magnesium Chloride at 60°C, 15 % Ammonium Chloride at ambient temperature, 35 % Calcium Chloride at 90°C.

Minimum physical properties:

- Tensile strength: 80 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 450 % (tested to ASTM D 412).
- Hardness: 68° +/- 5° shore A.
- Specific gravity: 1.55 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.16. Neoprene

For process equipment too big to be accommodated in autoclave and also for repair works.

Normal lining thickness: 3 to 5 mm.

Curing system: Exhausted steam curing.

Minimum physical properties:

- Tensile strength: 120 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 500 % (tested to ASTM D 412).

STANDARD FOR RUBBER LINED PRODUCTS

- Hardness: 55° +/- 5° shore A.
- Specific gravity: 1.36 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.17. Butyl

Lining suitable for Storage tanks, day tanks and vessels. Low Ca.Mg compound used in Membrane Cell Plants.

Normal lining thickness: 3 to 5 mm.

Curing system: Autoclave curing / Cold bonding lining.

Resistant to: 54 % Phosphoric Acid, 33 % Hydrochloric Acid, 25 % Sulphuric Acid, 310 gpl Brine, Bicarbonate at ambient temperature, 35 % Calcium Chloride at 60°C, Sulphates of Zinc, Sodium etc.

Minimum physical properties:

- Tensile strength: 70 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 300 % (tested to ASTM D 412).
- Hardness: 52° +/- 5° shore A.
- Specific gravity: 1.15 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.18. Butyl

Lining suitable for Storage tanks and vessels.

Normal lining thickness: 3 to 5 mm.

Curing system: Autoclave curing / Cold bonding lining.

Lining is resistant to Acids such as 54 % Phosphoric Acid, 33 % Hydrochloric Acid, 25 % Sulphuric Acid.

Minimum physical properties:

- Tensile strength: 70 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 300 % (tested to ASTM D 412).
- Hardness: 57° +/- 5° shore A.
- Specific gravity: 1.35 +/- 0.03 g/cm³.
- Maximum recommended temperature: 90 °C.

3.1.19. EPDM

Low Ca.Mg compound used as gasket in Membrane Cell (Chlorine Plants).

Curing system: Pressurised moulding.

Resistant to compression.

STANDARD FOR RUBBER LINED PRODUCTS

Minimum physical properties:

- Tensile strength: 60 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 200 % (tested to ASTM D 412).
- Hardness: 75° +/- 5° shore A.
- Specific gravity: 1.24 +/- 0.03 g/cm³.
- Maximum recommended temperature: 110 °C.

3.1.20. Hypalon

Lining suitable for process equipment, pipes and fittings.

Curing system: Autoclave curing / Cold bonding lining.

Lining is resistant to Calcium Hypochlorite, Sodium Hypo Chlorite with available Chlorine up to 140 gpl, 75 % Sulphuric Acid up to 75°C.

Minimum physical properties:

- Tensile strength: 170 Kg/cm² (tested to ASTM D 412).
- Elongation at break: 300 % (tested to ASTM D 412).
- Hardness: 60° +/- 5° shore A.
- Specific gravity: 1.44 +/- 0.03 g/cm³.
- Maximum recommended temperature: 95 °C.

3.2. *STEEL COMPONENTS*

3.2.1. Flanges

Flanges are in accordance with one of the following standards:

- ASTM A105 N.
- AWWA
- BS-10, table D and E
- DIN
- Special flanges if required.

3.2.2. Piping

Piping is in accordance with one of the following standards:

- ASTM A106 grade B.
- API 5L grade B.
- ASTM A53 grade B.

3.2.3. Fittings

STANDARD FOR RUBBER LINED PRODUCTS

3.2.3.1. Welded Construction

Welded fittings are in accordance with one of the following standards:

- ASTM A234 grade WPB.
- API 5L grade B.
- ASTM A106 grade B.
- ASTM A53 grade B.

3.2.3.2. Cast Fittings

Cast ductile-iron fittings are in accordance with the following standards:

- DIN 1693 (GGG 40.3), properties in accordance with ASTM A536 (60. 40. 18).
- ASTM A 216 grade WCB.

Note: certain fittings can be supplied with a cast steel body. Please contact your sales representative for available and technical details.

3.3. *EXTERIOR PRIMER*

Materials can be protected externally by a coating. Contact our Conpipe representative for further details.

STANDARD FOR RUBBER LINED PRODUCTS

4. QUALITY CONTROL AND INSPECTION

The following inspections are generally carried out on rubber lined products:

4.1. VISUAL / DIMENSIONAL CHECK BEFORE LINING

4.1.1. Inspection of steel surface.

Steel is checked on following: continuous weld, no porosity, high spots, under-cutting, rounded edges etc.

4.2. INSPECTION OF BLASTING.

4.2.1. Blasted Surfaces Are Checked On Following: Clean Surfaces, Silver Grey White Appearance According Sa 2 ½.

4.3. RUBBER MATERIALS BEFORE LINING

Raw materials, Soft rubber, Hard rubber and Laminated sheet are checked as per standard specifications. Properties of moulded samples are controlled.

4.4. RUBBER LINED MATERIALS (BEFORE VULCANISATION)

Spark testing as per BS 6374 (part 5) at 12 to 15 kV and visual examination for imperfection in the lining.

4.5. VULCANISATION OF THE RUBBER LINING

Pressure and temperature of steam during vulcanisation.

4.6. VULCANISED RUBBER LINED MATERIALS

4.6.1. Inspect and check of the rubber lined materials for workmanship.

STANDARD FOR RUBBER LINED PRODUCTS

4.6.2. Tests

- 4.6.2.1. Hardness to be checked on flat surface only.
- 4.6.2.2. Pin hole as per BS 6374 (part 5). Spark gap method using high frequency spark tester.
- 4.6.2.3. Adhesion test as per BS 6374 (part 5) – only for Soft rubber.
- 4.6.2.4. Thickness to be checked on a flat surface only.
- 4.6.2.5. Vacuum test.

STANDARD FOR RUBBER LINED PRODUCTS

5. STORAGE OF RUBBER LINED EQUIPMENT

5.1. OUTSIDE STORAGE

Rubber lined equipment should be stored away from direct sunlight and heat. If stored outside the equipment should be covered with tarpaulins protectively and should not be subjected to extreme temperature conditions, e.g.: below 0 °C or above 49 °C. Sudden changes in temperature should be avoided to protect against thermal stress. Equipment stored or used outdoors may be painted with light colour externally to reflect heat. Primer paints are not adequate.

5.2. EXTENDED STORAGE

Rubber lined equipment may also be protected for extended periods of time by storing the tank filled with clean water to minimise expansion and contraction and to keep the lining protected from atmospheric ozone attack (this to avoid deterioration prematurely). Do not permit the liquid contained to freeze. It is not advisable to use sea / contaminated water for this purpose.

5.3. SHORT-TERM STORAGE

For short-term protection, shelter larger rubber lined equipment that can not be filled with clean water under a suitable structure to protect it from the direct rays and heat of the sun. Provide sufficient air space between tank and covering to allow air circulation.

5.4. INSIDE STORAGE

For small tanks that can be stored inside, cover any open top, manhole, other openings and outlets with plywood or other suitable material and store them away from steam coils or other high temperature sources.

5.5. STORAGE ON THE GROUND

Any rubber lined surface shall not be placed / rested on the ground directly. Suitable protector shall be used under the equipment.

STANDARD FOR RUBBER LINED PRODUCTS

6. HANDLING & TRANSPORTATION

6.1. *LIFTING*

While lifting ensure chains and other lifting aids do not come into contact with lined surfaces. Use appropriate lifting devices and practices.

6.2. *STRESSES ON LINING*

Localised loads or stresses on lined surfaces must be avoided.

6.3. *FITTINGS*

Loose fittings should not be kept inside lined equipment while it is being transported.

6.4. *TRANSPORTERS*

Transporters, handlers and erection crew shall be adequately instructed about precautions in handling rubber lined equipment.

6.5. *FULLY RUBBER COVERED PRODUCTS*

Fully rubber covered items like agitators, impeller, centrifuges, et., should be handled properly during maintenance to avoid damage to rubber lining. Sharp profiled objects / tools & tackles should not be used as these will cause damage to rubber lining.

6.6. *UNLOADING*

Rubber lined equipment shall be unloaded without any shock and damage. Any rough treatment such as throwing or dropping down of lined equipment shall be strictly prohibited and disciplined handling is a must.

6.7. *LIFTING DEVICES*

Canvass cloth, Manila rope or Nylon rope may be used while lifting of equipment. Steel hooks and / or clamps are prohibited.

STANDARD FOR RUBBER LINED PRODUCTS

7. INSTALLATION & OPERATION PROCEDURE

7.1. INSPECTION

Inspect any stored vessel before taking onto service by spark test and visual inspection to ensure freedom from cracks, damages & defects.

7.2. WELDING

Do not carry on any welding or any other activity which generates heat in the vicinity of a lined tank. Do not use the equipment as earthing. This should be strictly prohibited.

7.3. MARKING

All rubber lined equipment including pipes and fittings shall be clearly marked "RUBBER LINED – DO NOT CUT OR WELD".

7.4. FOOTWEAR

It is essential to wear soft clean footwear when entering lined equipment. It is necessary to protect lined surfaces from ladders and scaffold poles by providing soft cushion at the resting points.

7.5. CHANGE OF MEDIUM / NECESSITY

Please consult the us for usage of the rubber lining equipment if any change in the medium / necessity.

7.6. PARAMETERS

Rubber lined materials should always be operated within the parameters specified & agreed. Any deviation or impurities or chemical other than specified, even in traces can be detrimental to rubber lining. When the lined item is not meant to handle abrasion or not provided originally for any mechanical agitation do not subject the lined equipment to these new conditions. When the lined item is not meant for cyclic operation of temperature, pressure, vacuum – do not subject the lined item to these variations.

STANDARD FOR RUBBER LINED PRODUCTS

7.7. DRAINING

Drain out the filled up lined equipment always by opening the vent line, , as otherwise it will collapse damaging the lining. Always slow draining is recommended.

7.8. PLACEMENT

Place the lined tank on consolidated earth / foundation only.

7.9. GASKET

Proper quality of gasket is to be used between the flanges. Apply correct torque while tightening to avoid damages.

7.10. CLEANING EQUIPMENT

Use of shovels and hard implements should be avoided to clean out sludge, etc.

7.11. SPILLING

Spilling and overflow of contents should be avoided as the corrosive medium will damage the external surfaces including the bottom plate.

7.12. EVACUATION OF VAPOUR

During evacuating the vapour etc., from the lined tanks, do not use water flushing-cum-water seal arrangements.

7.13. INSPECTION / REPAIR

During inspection or repair do not keep inflammable solvents or adhesive inside the tank. Avoid any electrical sparks inside the tank.

7.14. CLEANING

While cleaning Acid Storage Tanks inject water slowly. Sudden flush of water increases the temperature appreciably thereby damaging the lining.

STANDARD FOR RUBBER LINED PRODUCTS

7.15. *PROTECTIVE LAYER*

In some types of rubber lining, the medium handled provides a protective layer over the rubber lining. During maintenance, do not remove this protective layer. Otherwise the effective life of the lining will get reduced.

7.16. *FLANGE PROTECTIONS*

Flange protection cover shall be removed just before installation of equipment.

7.17. *REPAIR WORK*

While carrying out repair work inside lining equipment, rubber lined surface shall be protected with suitable rubber sheets to avoid damage.

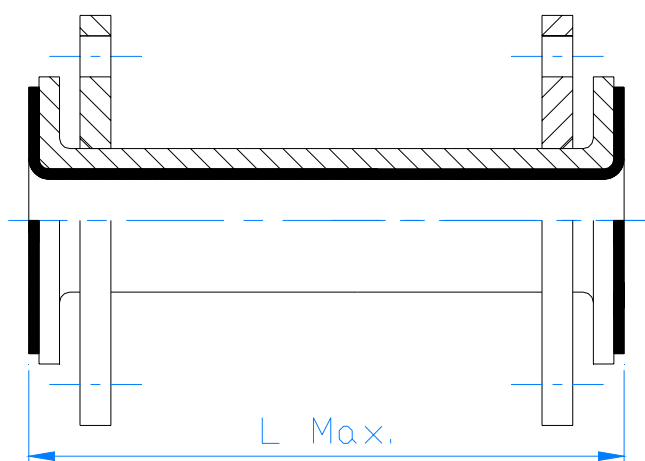
STANDARD FOR RUBBER LINED PRODUCTS

8. STANDARD PRODUCT RANGE

8.1. GENERAL NOTES

Please find herewith the standard product range of Conpipe International b.v. Besides the standard product range we also produce in any other desired configuration. Different dimensions, wall thicknesses, configurations or even site application of rubber lining are part of our scope of supply.

8.2. STRAIGHT LENGTHS

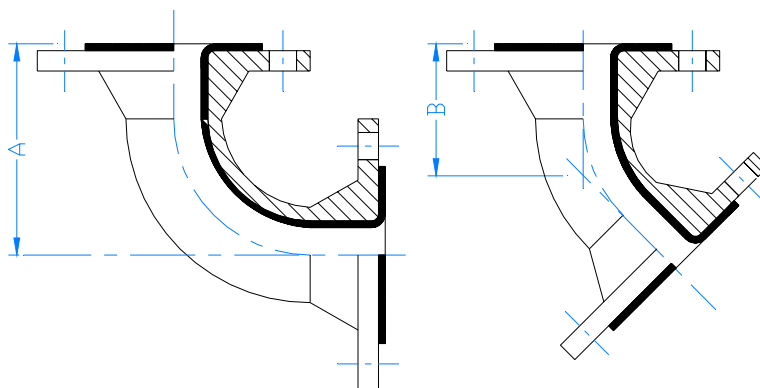


Dimensions in mm

NB	L(max)
25	1000
40	2000
50	3000
65	4000
80	5000
100 and above	6000

STANDARD FOR RUBBER LINED PRODUCTS

8.3. ELBOW 45° - 90°

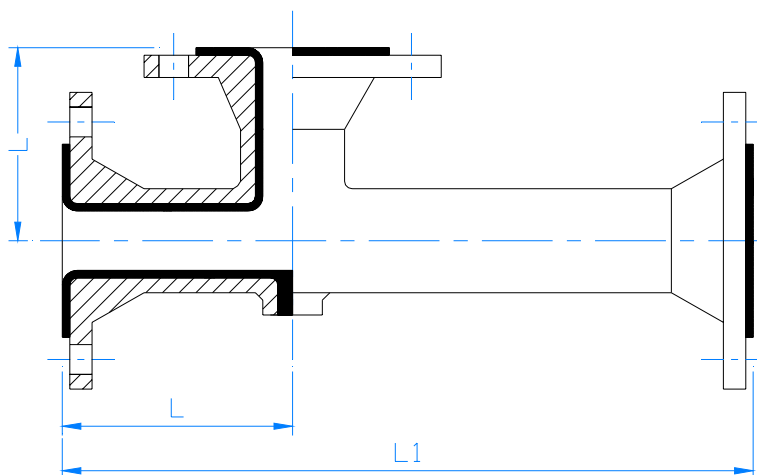


Dimensions in mm

NB	A	B
25	100	100
40	145	145
50	155	155
65	170	170
80	185	185
100	205	205
150	350	250
200	400	300
250	450	350
300	520	400
350	600	450
400	600	450
500	650	500

STANDARD FOR RUBBER LINED PRODUCTS

8.4. *TEES*

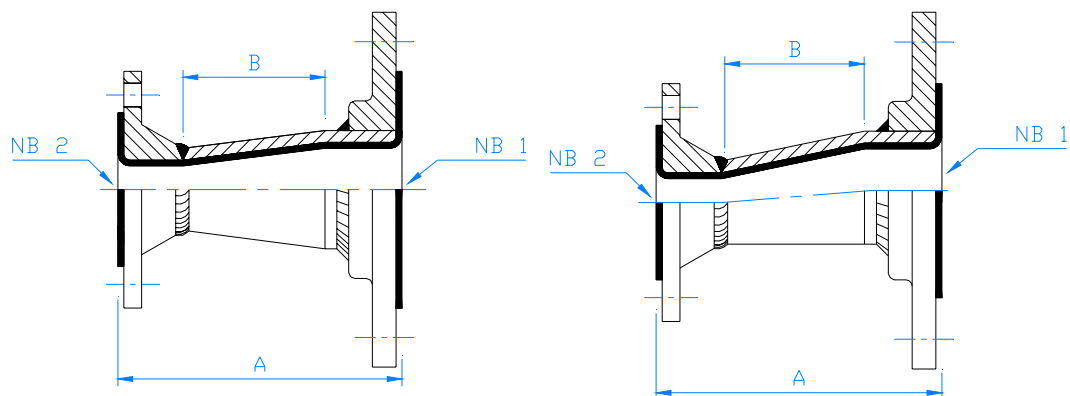


Dimensions in mm

NB	L (max.)	L1 (max.)
25	80	1000
40	100	2000
50	120	3000
65	130	4000
80	140	5000
100	160	6000
150	200	6000
200	270	6000
250	320	6000
300	360	6000
350	420	6000
400	470	6000
500	580	6000

STANDARD FOR RUBBER LINED PRODUCTS

8.5. CONCENTRIC AND ECCENTRIC REDUCER



Dimensions in mm

NB 1	NB 2	A	B
80	40	250	89
	50		
100	50	300	102
	65		
	80		
125	80	400	127
	100		
150	80	400	140
	100		
	125		
200	80	400	152
	100		
	125		
	150		
250	125	400	178
	150		
	200		
300	80	470	203
	100		
	150		
	200		
	250		

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NB 1	NB 2	A	B
350	150	620	330
	200		
	250		
	300		
400	200	650	356
	250		
	300		
	350		
450	250	670	381
	300		
	350		
	400		
500	300	800	508
	350		
	400		
	450		
550	350	790	508
	400		
	450		
	500		
600	400	790	508
	450		
	500		
	550		
650	450	890	610
	500		
	550		
	600		
700	450	890	610
	500		
	600		
	650		
750	500	890	610
	600		
	650		
	700		

STANDARD FOR RUBBER LINED PRODUCTS

NB 1	NB 2	A	B
800	600	890	610
	650		
	700		
	750		
850	600	890	610
	650		
	750		
	800		
900	600	890	610
	650		
	750		
	800		
	850		

STANDARD FOR EPOXY-LINED PIPING

STANDARD

FOR

INTERNALLY EPOXY LINED C.S. PIPING

CNP-1001-01

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DOCUMENT NO.: CNP-1001-01
REVISION: 00
REPLACES: N/A

STANDARD FOR EPOXY-LINED PIPING

LIST OF CONTENTS:

1. GENERAL INFORMATION
2. DESIGN
3. SURFACE FINISH REQUIREMENTS
4. SURFACE PREPARATION
5. LINING SYSTEM
6. QUALITY OF LINING
7. INSPECTION
8. HANDLING AND MARKING

STANDARD FOR EPOXY-LINED PIPING

1. GENERAL INFORMATION

- 1.1. This lining specification covers specific requirements for application of an epoxy lining system to carbon steel piping, and supplements the lining manufacturer's technical data sheets and application instructions.
- 1.2. This lining specification is normally used for water service. Type of water determines the type of epoxy.
- 1.3. Client is fully responsible for transmission of the correct data of the medium. Temperatures, pressure, and chemical details of the medium are essential to determine what type of epoxy can be used.
- 1.4. This standard will be read in conjunction with the applicable piping material specification.
- 1.5. The sketch with reference 03254-1.dwg is part of this specification.

2. DESIGN

- 2.1. The following notes are accompanying the sketch on last page. This sketch will be used for guidance during the sign and drafting of piping isometrics.
- 2.2. The maximum length L will be 11.8 meters for all sizes, so piping can be loaded in 40 Ft containers.
- 2.3. The minimum diameter of the piping will be 4 inch.
- 2.4. Dimensions marked "A" on last page will be based on built-up dimension of fitting(s) plus flange, with a minimum of 2 inches between welds and weldolet or reinforcing pad and flange. When a valve is attached, this dimension is to be based on bolt removal.
- 2.5. All spool pieces will be flanged.

STANDARD FOR EPOXY-LINED PIPING

3. SURFACE FINISH REQUIREMENTS

3.1. Surfaces to be lined will contain no gouges, handling marks, deep scratches, metal stamp marks, slivered steel, or other surface flaws. All flaws will be repaired by welding and/or grinding.

3.2. WELDING FINISH REQUIREMENTS

3.2.1. All welds will be continuous, have 100 percent penetration and will be ground as necessary to remove sharp edges. Welds will be free of undercuts, pinholes or other irregularities. Smooth, ripple finished machine welds are acceptable, but are subject to inspection and approval by the designated inspector.

3.2.2. All weld spatters will be removed. Use of non-silicone anti-spatter lining supplied adjacent to the weld area is acceptable provided the selected lining is of a type that will be completely removed by the final blasting.

3.2.3. Use of peeling, caulking components, etc, to remove defects or fill crevices is prohibited.

3.3. GRINDING REQUIREMENTS

3.3.1. Grinding: all welds will be ground smooth prior to beginning the grit blasting preparatory to lining.

3.3.2. All sharp edges will be ground to a smooth radius of 1.6 mm minimum, with 3.2 mm radius preferred.

4. SURFACE PREPARATION

4.1. Degreasing may be performed by one of the following processes:

- Organic solvent degreasing
- Alkaline cleaning followed by neutralization
- Steam cleaning
- Detergent washing

STANDARD FOR EPOXY-LINED PIPING

- Other systems that will be completed remove all oil, grease and other dirt.

- 4.2. All surfaces to be coated will have a SA 2 1/2 surface as defined in the Swedish Standard SIS 05.59.00 (equivalent to ISO 8501-1 or BS7079:PTAI).
- 4.3. All grit blasting operations will be conducted in an area where the finished surface will be free of moisture contamination. The abrasive will be sharp, dry, of high quality and will be free of contamination by dirt or other foreign matter, and of such a mesh size as to produce the required anchor pattern.
- 4.4. The resultant anchor pattern will be sharp and will have a clean anchor profile of 25um to 37um (1 to 1.5 mil), or as specified by lining manufacturer. The anchor pattern will be verified using a profile comparator, profile tape or other client (engineer) approved technique.
- 4.5. Following grit blasting, all traces of sand, grit, dust, or other loose material will be removed with a vacuum cleaner or other client (engineer or inspector) approved means.

5. LINING SYSTEM

- 5.1. The lining as specified/recommended by Conpipe will be as follows:

Epoxy lining selected from the following:

SERVICE	LINING TYPE NUMBER	MANUFACTURER	TOTAL DRY FILM THICKNESS
Sea water	Copon Hycote 162 HB	Copon	+/- 600 microns

Other products are acceptable provided they are of equal properties and quality as above.

STANDARD FOR EPOXY-LINED PIPING

5.2. THICKNESS

The lining for pipes will have a dry film thickness after final curing of an average of 600 microns. The film thickness will not apply to sharply concave surfaces.

In all cases the minimum and maximum lining thickness will comply with lining manufacture's written recommendations or specifications.

- 5.3. If the piping is to be welded the finish linings will have a minimum of 40mm (1.5 inch) and a maximum of 65mm (2.5 Inch) cutback on the ends. Where threads or other joint procedures are to be used, the client will specify the ends at the time of purchase.

5.4. ADDITIONAL GENERAL REQUIREMENTS

- 5.4.1. The lining manufacturer will approve solvents and thinners in writing.
- 5.4.2. A batch number and date of manufacture will identify all lining materials.
- 5.4.3. A batch number and date of application will identify each individual coat applied.
- 5.4.4. For sketch of application of lining at flanges see page 12.
- 5.4.5. Repair of damaged or improperly coats areas following curing will be in strict accordance with a written procedure.
- 5.4.6. No lining system will be applied:
- 5.4.6.1. To any surface with a temperature of below 5°C above 60°C.
- 5.4.6.2. When the humidity is above the value as given by the lining supplier.
- 5.4.7. Abrasive cleaning and-or subsequent lining application will not be performed is the substrate temperature is less than 5°C above the dew point.

STANDARD FOR EPOXY-LINED PIPING

- 5.4.8. No steel surface be blasted and left uncoated for more than an eight-hour period.

6. QUALITY OF LINING

6.1. VISUAL

The cures lining will in general be of uniform color and appearance. It will be free of blisters, pinholes, sags and any other irregularities.

6.2. THICKNESS

The dry film thickness will be determined at point to be selected by the client (inspector) and will be as specified in paragraph 5.2 or 5.3.

- 6.2.1. An "electrometer inspector gauge", "micro test magnetic gauge", or equal will be used to determine lining thickness.

- 6.2.2. Use of any gauge, which penetrates or otherwise damages the lining, is prohibited.

6.3. HARDNESS

The lining hardness will be determined at one spot to be selected by the designated client representatives. The method and hardness will conform to recommendations of the lining vendor.

6.4. CONTINUITY

The complete coated surface will be inspected after final baking using a non-destructive type holiday detector of the wet sponge type. The following are the guidelines for the use of this detector unless the lining supplier advises differently.

Applied Voltage:	100 +/- 10 volt DC
Connection:	positive to sponge negative to pipe spook
Solution:	salt, within range 1 to 5 percent

STANDARD FOR EPOXY-LINED PIPING

Sponge area:	12 square inches
Sponge speed:	1 foot per second
Alarm point:	advice from the lining supplier

7. INSPECTION REQUIREMENTS

7.1. GENERAL

The client's inspector will have access to the fabrication and lining areas at all times during the progress of the work. All supervisors and inspectors will be familiar with the health hazards involved in lining application, and will take the precautions as laid down in the vendor's specifications.

7.2. INSPECTION SEQUENCE QUALITY ASSURANCE/QUALITY CONTROL

The applicator will set up and maintain a quality control system to ensure that the lining complies in all respects with the requirements of this specification. This system will include as a minimum, the following:

- 7.2.1. Accepted storage conditions.
- 7.2.2. Checking cleanliness of substrates immediately before blasting.
- 7.2.3. Checking dew point of the surface, just before blasting and lining application.
- 7.2.4. Monitoring of size, shape, dryness and cleanliness of the abrasive.
- 7.2.5. Checking visually if all sharp protrusions, weld spatters and welds have been dressed smooth prior to lining.
- 7.2.6. Checking the anchor pattern after blasting.
- 7.2.7. Checking lining thickness and color.
- 7.2.8. Witnessing holiday testing.
- 7.2.9. Supervision of adequate and proper repair of all defects.

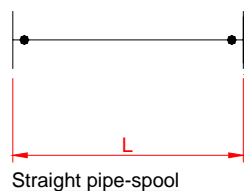
STANDARD FOR EPOXY-LINED PIPING

- 7.2.10. The client (inspector) may inspect the pipe spools at each of the following intermediate steps, unless a waiver has been granted in writing in advance.
- 7.2.10.1. Before hydro testing: to ensure that the requirements specified in chapter 3.0 area are met.
- 7.2.10.2. After grind blasting: to ensure cleanliness, surface finish and anchor pattern are in accordance with the requirements of paragraph 4.2 and 4.3.
- 7.2.10.3. After final lining application and curing: to ensure that the quality of the lining is in accordance with paragraphs 6.1 and 6.4.

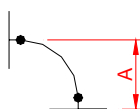
8. HANDLING

- 8.1. All flanged ends will be covered by a strong soft-seated plate to protect the internal of the pipe spool piece during transportation.
- 8.2. Handle the product with care, by hand or Nylon slings preferably.
- 8.3. Avoid contact of any foreign matter with the lining that could cause damage to the lining, such as steel pipe, beams, forklift, etc.
- 8.4. Do not drop the product, or allow sharp blows.
- 8.5. Load and secure the products in such a way that the lining is not damaged.
- 8.6. Stack and block products as to preclude and avoid damage to pipe/fittings and lining.
- 8.7. Support / brace large parts to avoid flexing.
- 8.8. Pipes must only be lifted by wide slings, forklift or similar apparatus. Chain chairs, cables, hooks, end clamps or other equipment likely to damage the inline coating shall not be permitted.

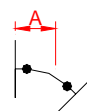
ANNEX 1



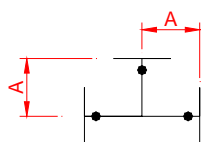
Straight pipe-spool



Elbow90



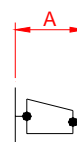
Elbow45



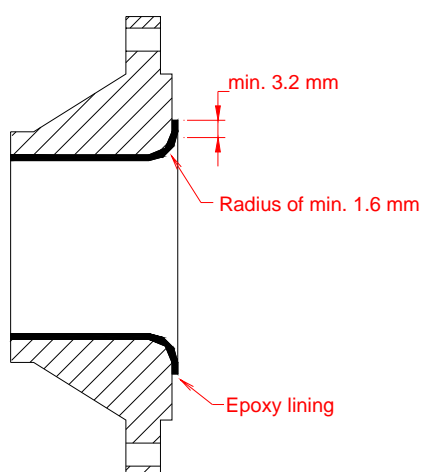
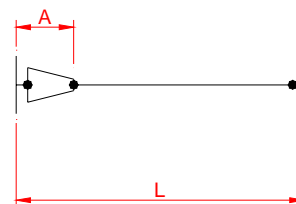
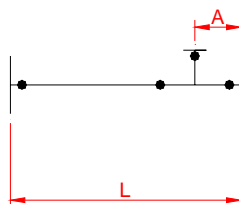
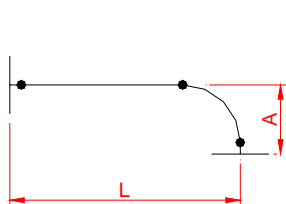
Tee



Con. reducer



Ecc. reducer



NOTES:

L = maximum length = 11.8m

A = "built-up" dimensions of fitting(s) plus flange

STANDARD FOR PE-COATING

STANDARD
FOR
POLYETHYLENE COATING

CNP-601-01

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STANDARD FOR PE-COATING

LIST OF CONTENTS:

1. FOREWORD
2. LIST OF ABBREVIATIONS
3. SCOPE
4. FIELD OF APPLICATION
5. METHODS TO APPLY COATING
6. SPECIFICATIONS FOR POLYETHYLENE EXTERNAL COATING
7. PROPERTIES OF COATING SYSTEM
8. COATING THICKNESS
9. PROCEDURES
 - 9.1. *PACKING, HANDLING AND STORAGE OF PE-COATED MATERIALS*
 - 9.2. *CUTTING OF PE-COATED PIPES*
 - 9.3. *APPLICATION OF CORROSION PROTECTION TAPES AND HEAT SHRINKABLE MATERIAL IN THE FIELD*

STANDARD FOR PE-COATING

1. FOREWORD

Conpipe International b.v. is a worldwide operating company which manufactures pipe systems by means of the most advanced production methods for drink water companies in their raw water projects and water treatment plants, off-shore companies and petrochemical industries.

Conpipe International b.v.'s system can be supplied in any desired configuration, pipe-diameter and wall thickness. We are specialized in lined and coated pipe-line systems, PE-coating and cement-, PTFE-, rubber- and epoxy lining are all in our scope of supply.

This standard describes the application of external Polyethylene-coated steel materials.

This standard is a guidance for the purchaser during inquiry or purchasing activity.

This manual does not constitute a warranty of any kind expressed or implied, of Conpipe's products of their fitness for any particular use. The company does not accept responsibility or liability for inaccuracies in this publication.

2. LIST OF ABBREVIATIONS

- NOT APPLICABLE

3. SCOPE

The aim of this standard is to ensure that Polyethylene pipe coatings provide adequate protection against the mechanical, thermal and chemical stresses occurring in service, transit and storage, and during installation.

4. FIELD OF APPLICATION

External Polyethylene coating provides excellent external anti-corrosion protection due to its high quality, long-term adhesion properties, and its resistance to various soil conditions.

The areas where Polyethylene coating is applied are:

STANDARD FOR PE-COATING

- Underground steel piping for transportation of gas, water and oil.

The advantages of PE-coated piping are:

- Long service life can be expected.
- High adhesion properties.
- High mechanical strength.
- Very low water permeability.
- High bending properties.
- High resistance to soil stress.
- Pipe maintenance at low cost.

5. METHODS TO APPLY COATING

5.1. ON FITTINGS, SPOOLPARTS, SMALL PIPES

- 5.1.1. Steel material inspection.
- 5.1.2. Cleaning of materials by solvent if necessary.
- 5.1.3. The temperature of the bare materials must be at least 3 °C above the dew point.
- 5.1.4. Blast cleaning of external surface to SA 2 ½ in accordance with ISO8501-1.
- 5.1.5. Heating of materials to the temperature of approximately 280 °C.
- 5.1.6. Application of Polyethylene powder which will fuse in one layer to correct thickness, also called the sinter method.
- 5.1.7. Cooling down with water.

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5.2. ON PIPES

- 5.2.1. Steel material inspection.
- 5.2.2. Cleaning of materials by solvent if necessary.
- 5.2.3. The temperature of the bare materials must be at least 3 °C above the dew point.
- 5.2.4. Blast cleaning of external surface to SA 2 ½ in accordance with ISO 8501-1.
- 5.2.5. Heating of materials to the temperature of 180 °C to 220 °C.
- 5.2.6. Application of the first layer: 60 to 80 microns FBE using an automatic electrostatic spray system.
- 5.2.7. Application of a second layer: 200 microns of adhesive layer using an automatic electrostatic spray system.
- 5.2.8. Application of a third layer: Polyethylene top layer using a side head or cross head extrusion system. Two types of Polyethylene coating are frequently used, LDPE (Low Density Polyethylene) and MDPE (Medium Density Polyethylene) coating. Total thickness of the coating to comply with project specifications or international standards.
- 5.2.9. Cooling down with water.
- 5.2.10. Edge preparation: ends of pipes shall be free from Polyethylene over a length of 150mm, unless otherwise specified by the purchaser.

6. SPECIFICATIONS FOR POLYETHYLENE EXTERNAL COATING

The most widely used specification today is the DIN 30670, a German specification and the NF-A 49.710, a French specification. These standards specify requirements for and methods of testing extruded and fused Polyethylene coatings applied at the works to steel pipes that will be in contact with soil or water.

The German standard DIN 30670 includes two types of coatings. The normal type (N) is suitable for service temperatures up to 50 °C, and a special type of coating (S) is suitable for temperatures up to 70 °C. These two types are available in two thickness-classes, a normal (n) and a reinforced (v) thickness-class. The reinforced (v) class is 1.7 mm thicker than the normal one.

The French standard NF-A 49.710 includes 3 thickness classes.

Besides these specifications Conpipe can produce Polyethylene coating according specific project requirements.

STANDARD FOR PE-COATING

7. PROPERTIES OF COATING SYSTEM

COATING SPECIFICATION	DIN 30670 N-n	DIN 30670 S-n	NF-A 49710
Max. service temp.	50 °C	70 °C	-20 °C to 70 °C
Electrical non porosity	25 kV	25 kV	10 kV/mm
Impact strength	5 Nm/mm	5 Nm/mm	e ≤ 2 mm; 5 Nm per mm e > 2 mm; 7,5 Nm per mm
Peel adhesion	20 ± 5 °C ≥ 175 N (50 mm)	20 ± 5 °C ≥ 175 N (50 mm)	15 to 25 °C ≥ 400 N (50 mm)
Penetration resistance to a punch load	23 °C ≤ 0,2 mm 50 °C ≤ 0,3 mm	23 °C ≤ 0,2 mm 50 °C ≤ 0,3 mm 70 °C ≤ 0,3 mm	20 °C ≤ 0,4 mm 70 °C ≤ 1,0 mm
Specific electrical insulation resistance	$R_s > 10^8 \Omega m^2$	$R_s > 10^8 \Omega m^2$	$R_s > 10^8 \Omega m^2$
Elongation at break	≥ 200%	≥ 200%	≥ 300%
Heat ageing	2400h at 100 °C 0,65 ≤ IF ≤ 1,35	4800h at 100 °C 0,65 ≤ IF ≤ 1,35	At a maxi service temperature increase of 50 °C 1000h 0,5 ≤ IF ≤ 1,25

8. COATING THICKNESS

COATING THICKNESS	DIN 30670 N-n Minimum thickness of coating (mm)	DIN 30670 S-n Minimum thickness of coating (mm)	NF-A 49710 Class 1 Minimum thickness of coating (mm)
Up to DN 100	1,8	1,8	1,2
Over DN 100 up to DN 250	2,0	2,0	1,5
Over DN 250 up to DN 500	2,2	2,2	2,0
Over DN 500 up to DN 800	2,5	2,5	2,2
From DN 800	3,0	3,0	2,2

STANDARD FOR PE-COATING

9. PROCEDURES

9.1. *PACKING, HANDLING AND STORAGE OF PE-COATED MATERIALS*

This procedure is to ensure that the PE-coated materials are packed, handled and stored in such a manner that damages will be avoided.

9.1.1. Demands

- 9.1.1.1. It is required to pack, handle and store PE-coated materials without damaging the product.

9.1.2. Manner

- 9.1.2.1. Handle the PE-coated product with care. Materials shall be raised and lowered using non-metallic (Nylon) slings preferably. Chains and wire ropes shall never be used on coated materials.
- 9.1.2.2. Do not drop the product, or allow sharp blows.
- 9.1.2.3. Load and secure the products in such a way that the coating is not damaged.
- 9.1.2.4. Stack and block products as to preclude and avoid damage to pipe/fittings and lining.
- 9.1.2.5. Do not roll on the products.
- 9.1.2.6. Support / brace large parts to avoid flexing.
- 9.1.2.7. Avoid all impact loading and unloading.
- 9.1.2.8. Do not roll the product to move it to another place.
- 9.1.2.9. Avoid storage in direct radiation of the sun.
- 9.1.2.10. During stacking, pipes shall be adequately supported on a level bed in order to minimize flexing and prevent induced bending. Use of wooden dunnage between each layer required.
- 9.1.2.11. Hauling on pipe trailers is not permitted. An overhang of 1 meter is not permitted.
- 9.1.2.12. Ensure the containers or trailers being used for transportation of the pipes and fittings are clean and free from protruding nails, sharp edges, etc.

STANDARD FOR PE-COATING

9.1.2.13. All PE-coated fittings, spool-pieces and flanges < 24 inch shall be fixed securely in seaworthy wooden crates. Wooden crates shall be solid, robust and of high quality. Larger diameters secured on wooden pallets.

9.1.2.14. Recommended pipe-stack height:

Pipe diameter	Number of layers
< 12"	10
12" < 16"	8
16" < 24"	5
24" < 32"	4
32" < 40"	3
≥ 40"	2

STANDARD FOR PE-COATING

9.2. CUTTING PE-COATED PIPES

This procedure describes the recommendations for cutting PE-coated pipes in the field.

9.2.1. Manner

- 9.2.1.1. First step is to remove PE-coating. With two cuts, at 150mm distance from the place where the pipe will be separated, the PE-coating will be split up to the steel surface of the pipe.
- 9.2.1.2. Easiest way is than to heat up the area from the inside of the pipe up to 80 °C, than remove the PE-strip with the help of a scraper. If it is not possible to heat up the area from the inside, than heat up to 80 °C from the outside with a propane burner. The PE-coating may not be burned. Burned PE-coating must be removed and repaired.
- 9.2.1.3. The pipe can now be cut by means of a mechanical grinder.
- 9.2.1.4. Remove dust, contamination's etc. over 20 mm from the welding zone with a steel brush.
- 9.2.1.5. Welding zone is now ready.

STANDARD FOR PE-COATING

9.3. APPLICATION OF CORROSION PROTECTION TAPES AND HEAT SHRINKABLE MATERIAL IN THE FIELD

This is a recommendation how to apply corrosion protection tapes and heat shrinkable materials in the field. To protect the field-weld area which has not a PE-coating, two types of systems are available. A system which must be installed without any heat-input and a system which needs heat-input.

9.3.1. Remarks

- 9.3.1.1. The materials used must be conform DIN 30672 or equivalent specifications.
- 9.3.1.2. Important is that the area which must be covered and protected is thoroughly cleaned with a steel brush and / or solvent. The area must be free from dust, rust, oil, grease or any other kind of external preservation. The area must also be dry.
- 9.3.1.3. PE-coating which is situated on the edges of the area must be carefully roughened by means of a steel brush or rasp.
- 9.3.1.4. Cut a bevel at the edge of the PE-coating, to make sure a smooth transition is made from coating to pipe wall.
- 9.3.1.5. Large pits must be filled up with mastic.
- 9.3.1.6. Apply the heat shrinkable sleeves or tape wrap according manufacturer's recommendations.
- 9.3.1.7. Testing of the corrosion protection according the specifications of the purchaser.