European Technology In Egypt

Scan Migagreen QR to check everything about us ..

MIGA **PLASTIC INDUSTRIES**

UPVC PRESSURELISD FITTINGS

Miga Green provides many valves, connectors, fittings and solutions with various sizes and shapes. Moreover, it provides a variety of practical solution to different sectors; (Irrigation system, water treatment plant stations (in all its forms), infrastructure, swimming pools, foods, gas and petroleum).

www.migagreen.com

info@migagreen.com
www.**migagreen**.com
migagreenplast

CONTACT US

we here to serve you, this is important to us ..

Head Office.
15 Nablus St, from Shehab St,
Floor 4, App 10, Mohandessin, A.R.E
T. +202 **33024067** **F.** +202 **33423085**

Factory.
2nd Industrial Zone Plot BG/9,
Sadat City, Al Monofia Governorate A.R.E
T. +2048 2656307 **M.** +201000443663

CONTENTS

Miga
plastic industries

ABOUT **US.**

Chairman's Address

From the beginning, we have aimed to provide water and foreign currency and create demand for the Egyptian product by transferring the technology of water infrastructure connection parts industry. We are now exporting to more than 23 countries and we are continuing to develop to keep up with all the developments that may occur in the industry to always provide the best.

About

Miga founded in 2017, although it was recently founded, it has a highly impact on the local market as if it was being found ten years ago... In fact, these years are considered to be the outcome of the company's administrative experience; who studied and keep up studying the market and its requirements and how to fulfill them in well-studied scientific way, and within a frame of a competitive style which enables the company to last on a supportive basis to make a well reputable name not only in the local market but also in the international markets.

Vision

For Miga to be a beacon in Technology for the Industry of Water Transportation Supplies i.e valves, connectors and connections in Egypt and the Middle East and to become the benchmark against which the performance of other factories is measured.

Mission

Providing customer needs of consultants and contractors through a team of experts of quality control and constant research and the continuous development to manufacture a high quality locally made products and conforming to local and international measurements so that the Egyptian market can achieve some self-sufficiency of Egyptian products and not rely entirely on imported products through the manufacture of local products with German technology and 100% Egyptian hands.

ABOUT **US.**

Products

MIGA provides many valves, connectors, fittings and solutions with various sizes and shapes. Moreover, it provides a variety of practical solution to different sectors; (Irrigation system, water treatment plant stations (in all its forms), infrastructure, swimming pools, foods, gas and petroleum).

Advantages:

The most important advantages of MIGA's Products:

The life time of its products may be over 50 years, and guarantee period up to 1 year.

It offer the required spare parts (Internal & external) in case of damage as a result of misuse, this ensure maintaining performance proficiency throughout its operation time.

Distinction & Quality

Both of them are considered to be the essential pillars of success established by MIGA, since it has created a different product, compared to the other markets. Although the Egyptian market has some reputable companies, the name of MIGA began to flourish quickly that pushed other competitive companies to review, compare and stand over the success criteria of those developed products with steady steps heading to the peak of success in a short period of time; regarded by some as a miracle, in the field of U-PVC.

Technical Usage

"Unplasticized Polyvinyl Chlorideis" (considered to be, a non-sticky substance) is the most used material in water pipes industries, and fittings which are applied in construction fields. It is characterized with its strong resistance against chemicals. Thus, it is considered to be the most ideal for drinking purposes which is truly valid, and doesn't interact with any other liquids passing through them. Accordingly, it is also utilized in some nutritional liquids, because it neither affecting the color, taste nor smell. And not interact with the acidic and the alkaline solutions.

Team Work

MIGA's has got a considerable experienced team in all sectors (Administrative, Operation, Sales, and Technical Support) where sales plans and marketing policies are being set to achieve the desired goals. The company also is concerned with specialists to make a good use of their suggestions in all fields, especially irrigation and infrastructure which are consider to be the biggest sectors of MIGA's products.

نبذة عنا ..

كلمه رئيس مجلس الاداره

لقد استهدفنا من البدايه توفير المياه و ذلك بنقل تكنولوجيا الري الحديث و تصنيعها و ذلك لاهميه توفير المياه و اصبحنا الان نصدر مستلزمات الري و قطع الاتصال البنيه التحيه لاكثر من 23 دوله لنثبت أن أننا خبراء صناعه البلاستك في الشرق الأوسط.

تأسست فى عام 2017 ، وعلى الرغم من وجودها الحديث فقد أثّرت فى السوق المحلى بشكل أوحى للجميع أن عمرها يتعدى عشرات السنين ، و فى حقيقة الأمر تلك السنوات ماهى إلا خبرات مجلس إدارة الشركة ؛ الذى ظل يدرس السوق ومتطلباته وكيفية توفير احتياجاته بشكل علمى مدروس وبأسلوب تنافسى يُمكن الشركة من الوقوف الراسخ ليصبح اسم ميجا لامعا فى السوق المحلى ومنه إلى الأسواق العالمية .

الرؤية :

أن تكون النخيل و ميجا مناره تكنولوجيا صناعه مستلزمات الري و نقل المياه في مصر و الشرق الأوسط و اتكون هي المعيار الذي يقيسون عليه اداء المصانع الأخري .

نبذة عنا ..

مهمتنا :

توفير احتياجات العملاء من الاستشاريين والمقاولين من خلال فريق من خبراء مراقبة الجودة والبحوث المستمرة والتطوير المستمر لتصنيع منتجات محلية الصنع عالية الجودة ومطابقة للقياسات المحلية والدولية حتى يتمكن السوق المصري من تحقيق بعض الاكتفاء الذاتي للمنتجات المصرية وعدم الاعتماد بالكامل على المنتجات المستوردة من خلال تصنيع المنتجات المحلية بالتكنولوجيا الألمانية وبأيدي مصرية 100٪.

المنتجات :

توفر ميجا العديد من المحابس والوصلات والقطع والحلول بمختلف المقاسات وبعدة أشكال ، كما توفر حلول عملية فى كافة القطاعات المستخدمة لمنتجاتها ؛ ومنها ..
(أنظمة الرى ، محطات معالجة المياة بكافة أشكالها ، البنية التحتية ، حمامات السباحة، المواد الغذائية، الغاز والبترول).

التميز و الجودة :

المتلازمان لمنتجات ميجا ما هما إلا أعمدة النجاح التى أسستها ميجا وعملت على خلق منتج يختلف عن غيره ، فإن كان السوق المصرى يحتوى على عدة أسماء فى نفس المجال ، إلا ان اسم ميجا ازدهر بشكل سريع .. مما دفع كثير من الشركات المنافسة لإعادة النظر والمقارنة والوقوف على معاير نجاح تلك المنتجات المتطورة التى صعدت بخطوات ثابتة نحو القمة فى زمن قياسى اعتبره البعض بمثابة معجزة فى مجال تصنيع الـ U-PVC

المميزات :

من أحد أهم مميزات منتجات ميجا :

- طول العمر الافتراضى لها يصل الى خمسون عام وفترة ضمان قد تصل الى عام .
- توفير قطع الغيار اللازمة (الداخلية / الخارجية) حالة حدوث تلف ناتج عن سوء الإستخدام ، مما يضمن الحفاظ على كفاءة الأداء طوال فترة تشغيلها .

المواصفات الفنية :

تعتبر مادة البولى فينيل كلوريد غير اللدن من المواد الاكثر استخداما فى صناعات المواسير والقطع التي تدخل فى الأعمال الإنشائية ، و تتميز بمقاومتها الشديدة للمواد الكيماوية ؛ لذا تعتبر المادة الأمثل لاستخدامها فى شبكات المياه الصالحة للشرب ، ونظراً لعدم تفاعلها مع أي سوائل تمر من خلالها فقد يتم استخدامها ايضا للسوائل الغذائية فهى لا تؤثر على اللون أو الطعم أو الرائحة ولاتتفاعل مع معظم المحاليل الحمضية والقلوية.

فريق العمل :

تضم ميجا فريق عمل ذو خبرات كبيرة فى جميع الأقسام .. (الإدارية ، التشغيلية ، والبيعية ، والدعم الفنى) حيث يتم رسم السياسات التسويقية والخطط البيعية التى من شأنها تحقق الأهداف المرجوة ، كما تحرص دائما على الاستعانة بالإستشاريين للاستفادة من خبراتهم ومقترحاتهم فى جميع المجالات ، وبالأخص مجال الري والبيئة التحتية بإعتبارهم من أكبر قطاعات منتجات ميجا .

Certifications & Testing.

Certifications

- ISO 9001:2015
- IQNet 9001:2015
- ISO 45001:2018
- National Organization for Potable Water & Sanitary Drainage
- DIN 8063 - EN 1452

CERTIFICATE

This is to certify that Management System of:

MIGAGREEN FOR PLASTIC INDUSTRIES

Has been assessed and found compliant with the requirements of below:

ISO 9001:2015

TUVSW STANDARDIZATION CERTIFICATIONS

IQNet

THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

DQS Holding has issued an IQNet recognized certificate that the organization:

Migagreen for Plastic Industries

has implemented and maintains a

Quality Management System

for the following scope:

Production and Injection of Plastic Products.

which fulfils the requirements of the following standard:

ISO 9001:2015

Issued on: 2021-11-27

Expires on: 2024-11-26

Registration Number DE-40050184 QM15

الشهادات

نتيجة تكامل العوامل السابقة وتضافر جهود جميع العاملين بالشركة فقد اجتازت ميجا جرين عدة اختبارات وحصلت على شهادات تؤكد مدى جودة منتجاتها .

- نظام ادارة الجودة
- نظام إدارة الصحة والسلامة
- شهادة اعتماد الهيئة القومية لمياة الشرب والصرف الصحي

National Organization For Potable Water & Sanitary Drainage

الهيئة القومية لمياه الشرب والصرف الصحي

Miga
export

MIGA succeeded to invade the Arabian and african markets with its products, and gained a lot of interactional customers with highly quality products, which is similar to the international standards, competitive prices, commitment of delivery dates and this success has been extended to go to for global markets

- Kingdom of Saudi Arabia
- Sudan.
- Libya.
- Kuwait
- UAE
- Morocco
- Algiers
- Qatar
- Palestine
- Sultanate of Oman
- Syria
- Lebanon
- Yemen
- Tunisia

and On the african side we had a great chance to exist in the following countries :

- Tanzania (Dar es Salam)
- Tanzania (Zanzibar)
- Zambia
- Uganda
- Kenya

Original **PRODUCTs**

Distinction and high quality, both go an eye to an eye, are considered two essential pillars enhancing success established by MIGA since it has created a distinctive different product, compared to the others. Though the Egyptian marketing has some reputable companies

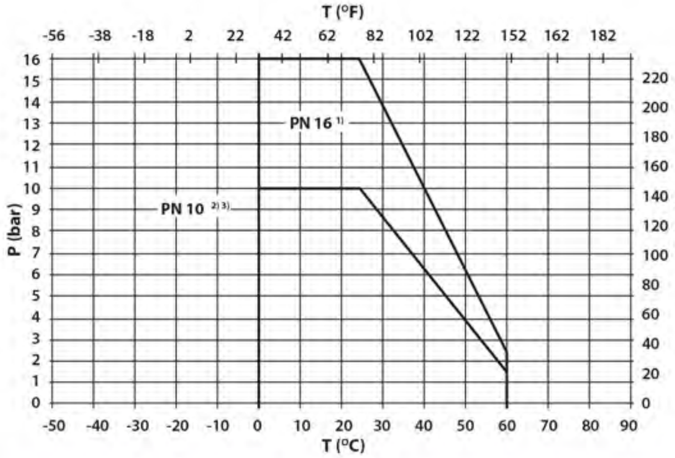
WE AIM TO PROVIDE THE HIGHEST QUALITY OF PRODUCTS

MIGA
UPVC VALVES

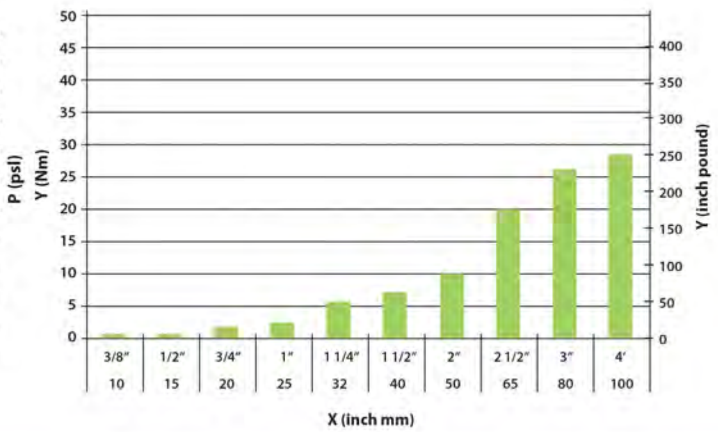
UPVC Pressurelisd

UPVC Valves | Technical Data

ضغط التشغيل
Max working pressure :



عزم التدوير
Torque :



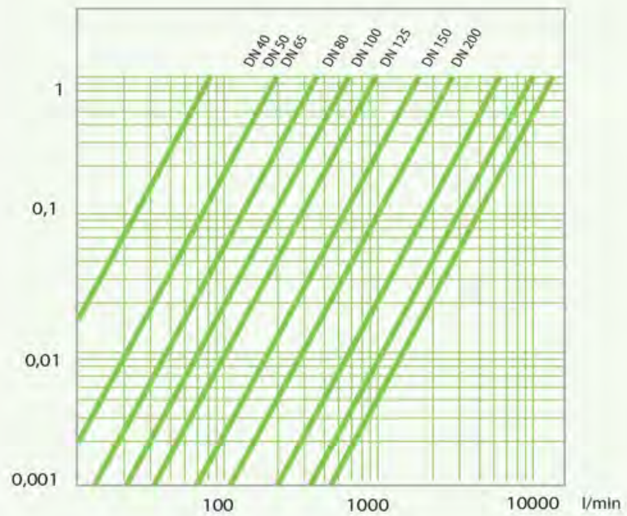
General Characteristic :

All our check valves are manufactured to the same dimentions as our valves BVD 10/11/13 and can be removed from the instalation by unscrewing the union nuts. Our whilst type CVD is a spring loaded check valve. Types FVD are foot valves, ARV is an air release valve.

يتم تصنيع جميع المحابس بنفس المقاسات للمحابس BVD - CRD - ARV - FVD مما يمكنك من إستبدالهم بفك صامولة المحبس.

X Nominal width DN (mm, inch)
Y Torque (Nm, inch pound)
Guide values at nominal pressure

مخطط الضغط
Pressure Chart :



Flow Coefficient KV 100 :

kV100 is the number of litres per minute of water at a temperature of 20 C that will flow throught a valve with one-bar pressure differential at a specified rate. the kV100 valves shown in the table are calculated with the valve completely open.

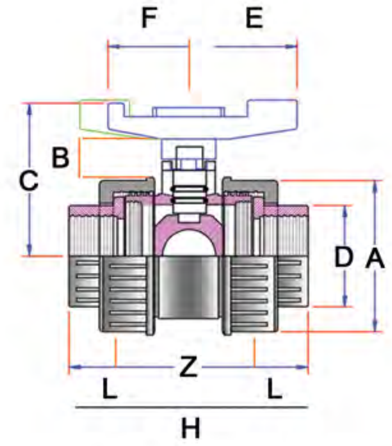
KV100 هو عدد اللترات المتدفقة فى الدقيقة عند درجة حرارة 20 درجة مئوية ومعدل ضغط 1 بار. الأرقام الموضحة بالجدول لـ KV100 عند فتح المحبس كاملاً.

Medium : Water, 2 0 °C
X Flow Rate (l/min), (US gal./min)
Y Pressure Loss Δp (bar), (psi)

Pressure/temperature rating for water and other suitable fluids to which PVC is Resistant.

معدل الضغط / الحرارة للماء والسوائل المختلفة التى يقاومها الـ PVC

PRODUCTs
Ball Valves



Double union ball valve with plain ends for solvent cement *Din 8063 standerd*

UPVC VALVES DBV6000

UPVC Pressurelisd

محبس 2 لاكور لصق

CODE	D	DN	L	Z	H	A	B	C	E	F	PN
DBV60001	32 mm	25	22	56	105	68	20	68	49	37	16
DBV60002	50 mm	40	25	74	129	94	24	90	70	49	16
DBV60003	63 mm	50	45	109	210	124	23	105	77	40	16
DBV60004	75 mm	65	44	130	218	145	25	123	90	45	16
DBV60005	90 mm	80	51	148	250	166	28	138	100	50	10
DBV60006	110 mm	100	61	168	290	210	28	160	120	60	10

Double union ball valve with plain ends for solvent cement *Bs standerd*

UPVC VALVES DBV6050

UPVC Pressurelisd

محبس 2 لاكور لصق بالبوصة

CODE	D	DN	L	Z	H	A	B	C	E	F	PN
DBV60501	1"	25	22	56	105	68	20	68	49	37	16
DBV60502	1 ½ "	40	25	74	129	94	24	90	70	49	16
DBV60503	2"	50	45	109	210	124	23	105	77	40	16
DBV60504	2 ½"	65	44	130	218	145	25	123	90	45	16
DBV60505	3"	80	51	148	290	166	28	138	100	50	10
DBV60506	4"	100	61	168	290	210	28	160	120	60	10

Double union ball valve with female threaded ends *Bs standerd*

UPVC VALVES DBV6100

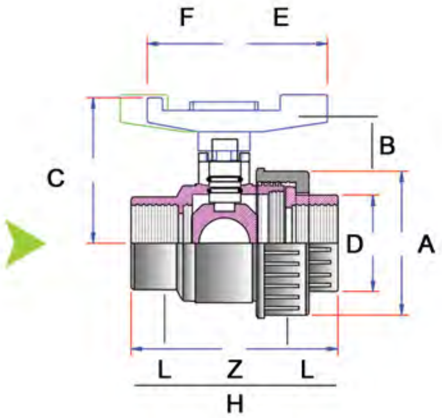
UPVC Pressurelisd

محبس 2 لاكور سن بالبوصة

CODE	D	DN	L	Z	H	A	B	C	E	F	PN
DBV61001	1"	25	22	56	105	68	20	68	49	37	16
DBV61002	1 ½ "	40	25	74	129	94	24	90	70	49	16
DBV61003	2"	50	45	109	210	124	23	105	77	40	16
DBV61004	2 ½"	65	44	130	218	145	25	123	90	45	16
DBV61005	3"	80	51	148	250	166	28	138	100	50	10
DBV61006	4"	100	61	168	290	210	28	160	120	60	10

PRODUCTs

Single Union Ball Valves



| Single union ball valve with female plain ends for solvents cement *Din 8063* |

UPVC VALVES
SBV5000

UPVC Pressurelisd

محبس لاكور لصق

CODE	D	DN	L	Z	H	A	B	C	E	F	PN
SBV50001	32	25	22	42	97	68	19	68	49	37	16
SBV50002	50	40	25	72	124	94	23	90	70	49	16
SBV50003	63	50	45	92	186	124	23	105	80	40	16
SBV50004	75	65	44	126	214	145	25	123	90	45	16
SBV50005	90	80	51	133	235	166	28	138	100	50	10
SBV50006	110	100	61	153	275	210	28	160	120	60	10

| Single union ball valve with female plain ends for solvent cement *Bs standerd* |

UPVC VALVES
SBV5050

UPVC Pressurelisd

محبس لاكور لصق بالبوصة

CODE	D	DN	L	Z	H	A	B	C	E	F	PN
SBV50501	1"	25	22	42	97	68	19	68	49	37	16
SBV50502	1 ½"	40	25	72	124	94	23	90	70	49	16
SBV50503	2"	50	45	92	186	124	23	105	80	40	16
SBV50504	2 ½"	65	44	126	214	145	25	123	90	45	16
SBV50505	3"	80	51	133	235	166	28	138	100	50	10
SBV50506	4"	100	61	153	275	210	28	160	120	60	10

| Single union ball valve with female threaded ends *Bs standerd* |

UPVC VALVES
SBV5100

UPVC Pressurelisd

محبس لاكور سن بالبوصة

CODE	D	DN	L	Z	H	A	B	C	E	F	PN
SBV51001	1"	25	22	42	97	68	19	68	49	37	16
SBV51002	1 ½"	40	25	72	124	94	20	90	70	49	16
SBV51003	2"	50	45	92	186	124	23	105	86	40	16
SBV51004	2 ½"	65	44	126	214	145	25	123	90	45	16
SBV51005	3"	80	51	138	240	166	28	138	100	50	10
SBV51006	4"	100	61	153	275	210	28	160	120	60	10

محبس عدم رجوع كورة

PRODUCTs

Check Valve

Double Union Check Valve | (Metric/Plain)

Code	D	l	d1	d2	d	C
DCV2351	20	50	42	16	48	80
DCV2352	25	59	48	19	53	91
DCV2353	32	68	54	22	58	102
DCV2354	40	80	62	26	68	120
DCV2355	50	94	72	31	78	140
DCV2356	63	115	86	38	93	169
DCV2357	75	145	110	44	118	206
DCV2358	90	168	128	51	140	242

Double Union Check Valve | (Imperial/BS)

Code	D	l	d1	d2	d	C
DCV2358	1/2"	50	42	16	48	80
DCV2359	3/4"	59	48	19	53	91
DCV2360	1"	68	54	22	58	102
DCV2361	1 1/4"	80	62	26	68	120
DCV2362	1 1/2"	94	72	31	78	140
DCV2363	2"	115	86	38	93	169
DCV2364	2 1/2"	145	110	44	118	206
DCV2365	3"	168	128	51	140	242

Double Union Check Valve | (Imperial/Threaded)

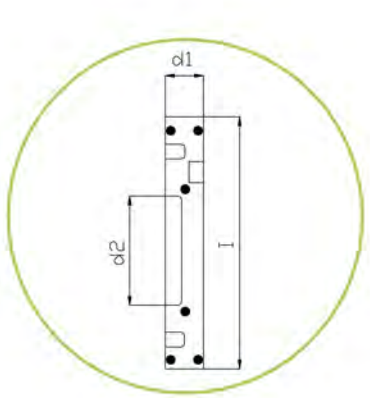
Code	D	l	d1	d2	d	C
DCV2365	1/2"	50	42	16	48	80
DCV2366	3/4"	59	48	19	53	91
DCV2367	1"	68	54	22	58	102
DCV2368	1 1/4"	80	62	26	68	120
DCV2369	1 1/2"	94	72	31	78	140
DCV2370	2"	115	86	38	93	169
DCV2371	2 1/2"	145	110	44	118	206
DCV2372	3"	168	128	51	140	242

PRODUCTs

محبس عدم رجوع بوابة

U-PVC Flap Valve

Code	D	l	d1	d2
FV2401	63	109	20	32
FV2402	75	129	20	40
FV2403	90	144	20	52
FV2404	110	164	22	70
FV2405	125	170	25	83
FV2406	140	195	23	92
FV2407	160	220	25	112
FV2408	200	247	28	139



Characteristics

Working pressure at 20° c (73°F) water temperature:

- D63 - D140 (2" - 5") PN 10 bar (150 p.s.i)

- D160 - D315 (6" - 12") PN 6 bar (90 p.s.i)

Components / Composants	Material / Materiale
1 Body / Corps	PVC-U
2 Flap / Clapet battant	PVC-U
3 Cap / Bouchon	PP
4 Body O-Ring / Joint de corps	EPDM / FPM
5 Flap O-Ring / Joint battant	EPDM / FPM

Installation

- Install with flanges and PN 10 pipe.
- Do not install the valve at a distance lower than 5xD of the pump out.
- The valve must be installed in vertical horizontal pipework.
- On horizontal pipework the flange hinge must be at the top.
- Ensure the direction of flow is in accordance with the arrowon the valve body.
- Use the centralising screw to ensure the valve is positioned centrally in the flanges.
- WARNING: To ensure the valves work correctly, the stub flanges must be perfectly lined up.

التركيب

- يتم التركيب بفلانشات وأنابيب 10 بار.
- يراعى تركيب المحبس على بعد لايقل عن 5 أضعاف مخرج الطلمبة.
- يراعى التركيب فى وضع رأسى.
- ويراعى وضع مسمار التعليق لأعلى.
- تأكد من إتجاه تدفق المياه من السهم على المحبس.
- إستخدم مسمار التعليق للتأكد من وضع المحبس فى منتصف الفلانشات.

المواصفات الفنية

Technical Data

Dimentions :

المقاسات :

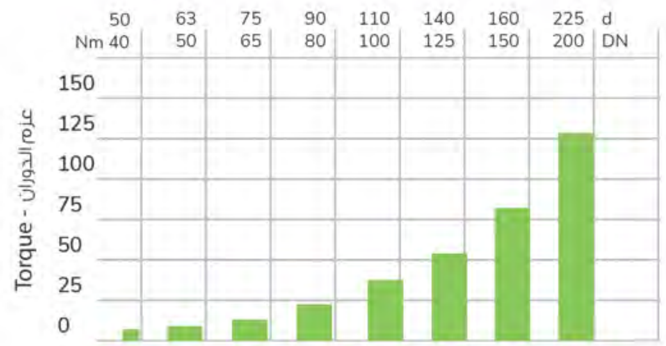
The overall dimentions of the FE butterfly valve comply with the following standards: ISO 5752 Medium series 25, DIN 3202 K2. Oval holes in the valve body allow connections to flanges with different drillings:

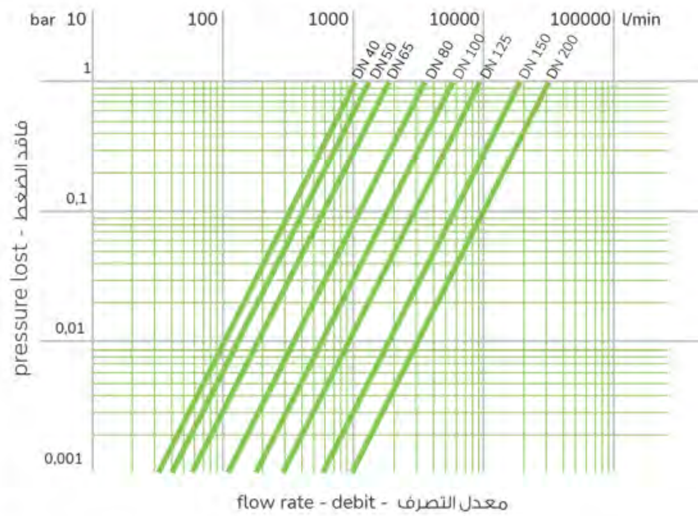
- DIN 2501, ISO DIS 9624, UNI 2223
- BS 10 table D/E
- ASA B 16.5 class 150
- JIS 2212 (K10 except for DN 200), JIS 2212 (K5 except for DN 50)

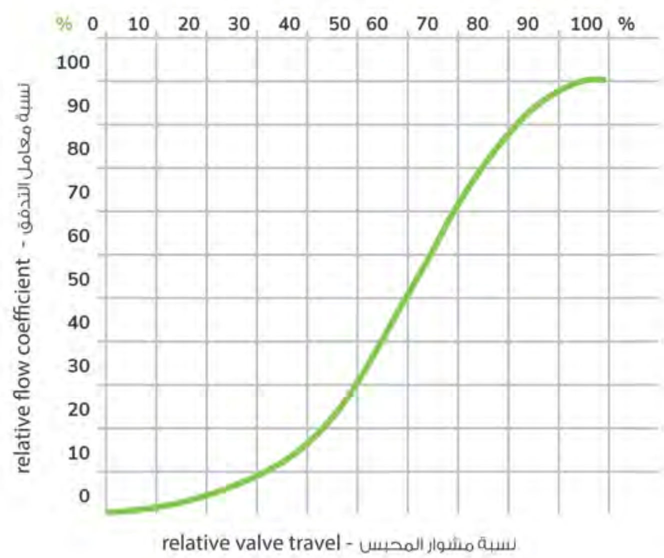
- جميع مقاسات محابس الفراشة FE تتطابق مع المواصفات الفنية ISO 752/ 25 - DIN 3202K2
- الفتحات البيضاوية فى جسم المحبس تسمح للإتصال بأنواع مختلفة من الفلانشات طبقاً للمواصفات التالية.

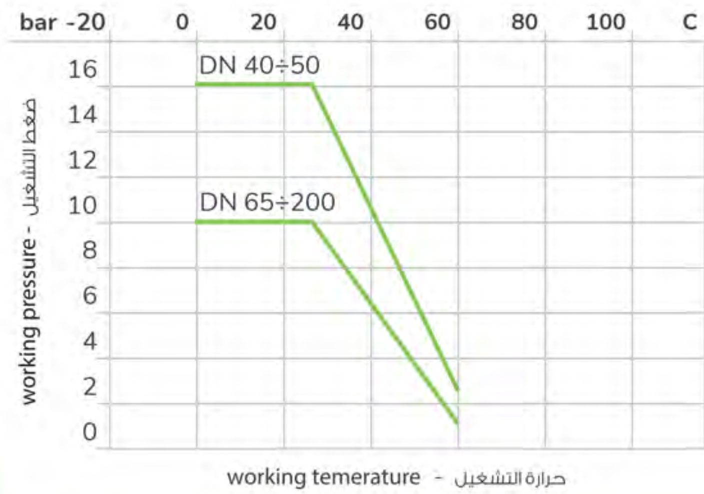
DN	40	50	65	80	100	125	150	200
Kv100	1000	1285	1700	100	5900	9850	18700	30500

valves certified according to EN 1267







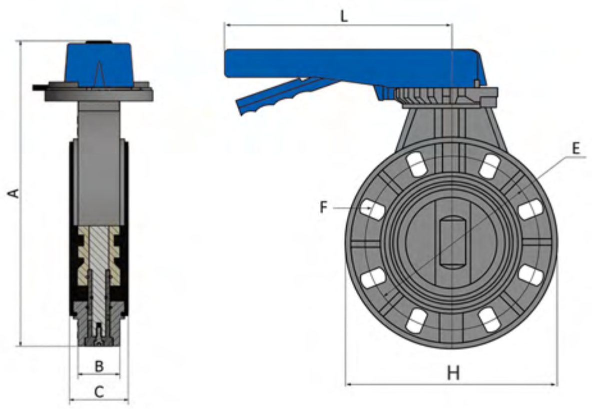


- Max torque at maximum working pressure.
- Pressure loss chart.
- Relative flow chart
- pressure/Temperature rating for water and harmless fluids to which the material is RESISTANT (25 years with safety factor included)
- Flow coefficient Kv100 Kv100 is the number of litres per minute of water at a temperature of 20° C that willflow through a valve with a one-bar pressure differential at a specified rate. The Kv100 valves shown in the table are calculated with the valve completely open.

- أقصى عزم للدوران عند أكبر ضغط تشغيل.
- مخطط فاقد الضغط.
- مخطط نسبة التصرف.
- معدل الضغط / الحرارة للماء والسوائل التى يقاومها الـ PVC
- KV100 هو عدد اللترات المتدفقة فى الدقيقة عند درجة حرارة 20 درجة مئوية ومعدل ضغط 1 بار. الأرقام الموضحة بالجدول للـ KV100 عند فتح المحبس كاملاً.

محبس فراشة

Butterfly Valve



Single union ball valve with female plain ends for solvents cement *Din 8063*

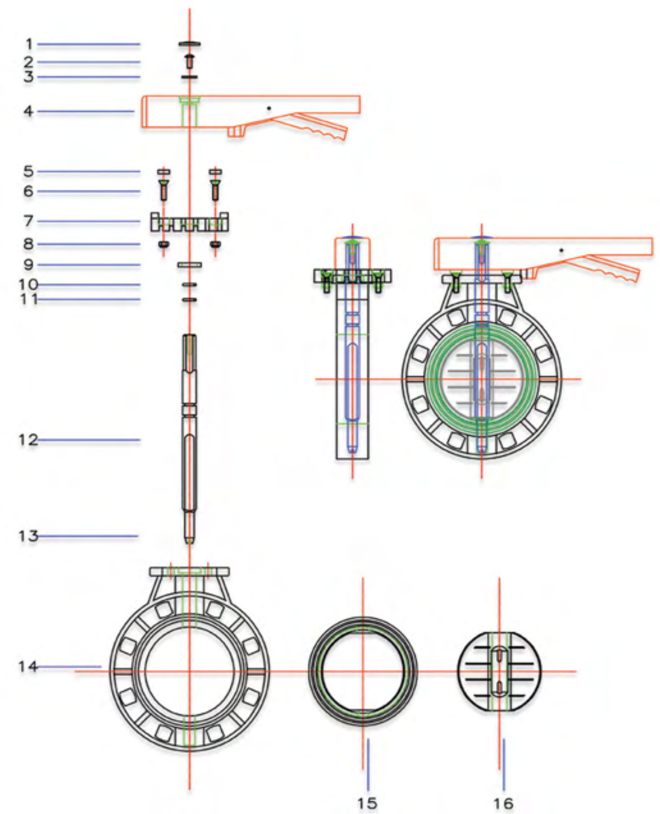
BUTTERFLY VALVE
BFV230

Premium Quality

محبس فراشة

CODE	D	DN	A	B	C	H	E	F	L	PN
BFV2301	90	83	285	37	45	195	156	20*24	240	10
BFV2302	110	100	325	44	50	225	173	21*28	240	10
BFV2303	125	129	380	51	66	255	189	24*30	310	10
BFV2304	160	148	400	55	70	280	230	25*30	310	10
BFV2305	200	200	425	60	71	298	280	35*31	425	10
BFV2306	225	200	425	60	71	298	280	35*31	425	10

Pos	Components	N"	Material
1	protection cap	1	Abs
2	screW	1	stainless
3	washer	1	stainless
4	handle	1	Abs
5	cap	2	pvc
6	screw	2	stainless
7	LOCKING PLATE	1	pvc
8	washer	2	stainless
9	NUT	1	pvc
10	shaft O-RANG	1	EPDM
11	shaft O-RANG	1	EPDM
12	shaft	1	stainless
13	shaft	1	steel
14	BODY	1	pvc
15	PRIMARY LINER	1	rubber
16	DISC	1	pvc



MIGA

FITTING VALVES

وصلات لصق نظام متري / طبقاً للمواصفات الألمانية DIN 8063

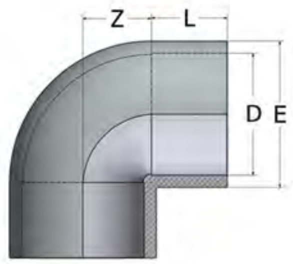
UPVC Pressurelisd

U-PVC Metric Series for **Solvent** Cement Jointing according to german standers DIN 8063

وصلات لصق نظام متري طبقا للمواصفات الألمانية DIN 8063

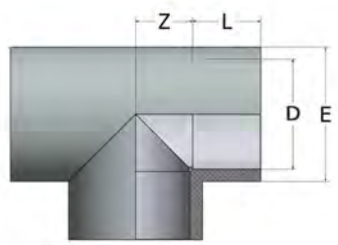
Fitting VALVES ELB100 — 90° EIBOW — كوع 90°

CODE	d	L	Z	E	PN
ELB1001	20	16	11	26.5	16
ELB1002	25	19	14	32.5	16
ELB1003	32	22	17	41	16
ELB1004	40	26	23	50	16
ELB1005	50	31	28	60	16
ELB1006	63	38	34	75	16
ELB1007	75	44	40	89	16
ELB1008	90	51	48	106	16
ELB1009	110	61	58	129	16
ELB1010	125	69	66	145	16
ELB1011	140	76	73	164	16
ELB1012	160	86	81	188	16
ELB1013	200	106	102	232	10
ELB1014	225	119	115	258	10
ELB1015	250	131.5	187.5	286	10
ELB1016	280	146	210	316	10
ELB1017	315	162	239	358	10
ELB1018	355	184	177	393	6
ELB1019	400	206	202	439	6



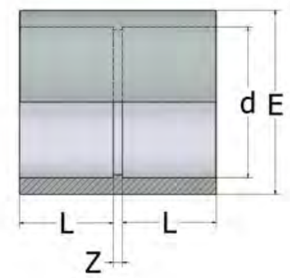
Fitting VALVES TEE150 — 90° Tee — مشترك 90°

CODE	d	L	Z	E	PN
TEE1501	20	16	11	27.5	16
TEE1502	25	19	14	33.5	16
TEE1503	32	22	17	42	16
TEE1504	40	26	21	51	16
TEE1505	50	31	26	61	16
TEE1506	63	38	33	75	16
TEE1507	75	44	39	89	16
TEE1508	90	51	47	106	16
TEE1509	110	57	57	129.5	16
TEE1510	125	69	64	145	16
TEE1511	140	76	72	162.5	16
TEE1512	160	86	81	188	16
TEE1513	200	106	102	232	10
TEE1514	225	119	114	258	10
TEE1515	250	131.5	127	286	10
TEE1516	280	146	142	319	10
TEE1517	315	162	159	360	10
TEE1518	355	184	294	386	6
TEE1519	400	206	280	432	6



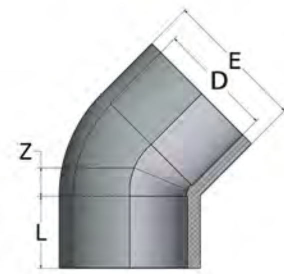
Fitting VALVES SKT200 — Socket — جلبة

CODE	d	L	Z	E	PN
SKT2001	20	16	3	28	16
SKT2002	25	19	3	34	16
SKT2003	32	22	3	42	16
SKT2004	40	26	3	51	16
SKT2005	50	31	3	61	16
SKT2006	63	38	3	75	16
SKT2007	75	44	4	88	16
SKT2008	90	51	5	106	16
SKT2009	110	61	6	126	16
SKT2010	125	69	7	145	16
SKT2011	140	76	9	161	16
SKT2012	160	86	8	181	16
SKT2013	200	106	11	226	10
SKT2014	225	119	11	258	10
SKT2015	250	131.5	10	287	10
SKT2016	280	146	10	320	10
SKT2017	315	162	12	335	10
SKT2018	355	184	11	386	6
SKT2019	400	206	12	432	6



Fitting VALVES ELB250 — 45° Elbow — كوع 45°

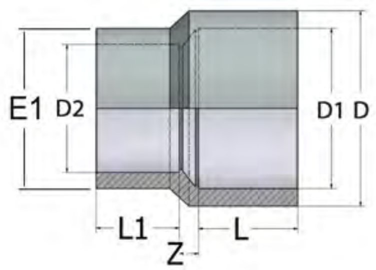
CODE	d	L	Z	E	PN
ELB2501	20	16	5.5	28	16
ELB2502	25	19	6	34	16
ELB2503	32	22	8	42	16
ELB2504	40	26	10	51	16
ELB2505	50	31	12	61	16
ELB2506	63	38	15	75	16
ELB2507	75	44	18	88	16
ELB2508	90	51	21	106	16
ELB2509	110	61	25	128	16
ELB2510	125	69	27	145	16
ELB2511	140	76	32	164	16
ELB2512	160	86	36	184	16
ELB2513	200	106	43	232	10
ELB2514	225	119	49	258	10
ELB2515	250	131.5	58	287	10
ELB2516	280	146	62	320	10
ELB2517	315	162	66	360	10
ELB2518	355	184	77	393	6
ELB2519	400	206	83	439	6



Fitting VALVES RMF300

Reducing Piece M/F مسلوب

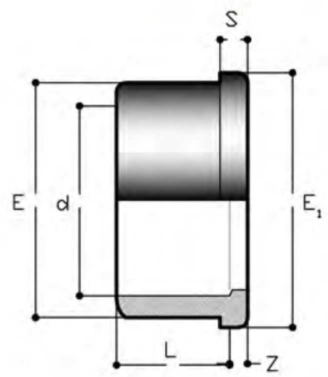
CODE	dxd1xd2	L	L1	Z	E1	PN
RMF3001	25x32x20	19	16	6	28	16
RMF3002	50x63x25	32	19	19	33	16
RMF3003	50x63x32	31	22	12	41	16
RMF3004	63x75x50	38	31	12.3	60.5	16
RMF3005	75x90x50	44	31	17.5	60.5	16
RMF3006	75x90x63	44	38	11.1	75	16
RMF3007	90x110x50	51	31	28	60.5	16
RMF3008	90x110x63	51	38	21.5	75	16
RMF3009	90x110x75	51	44	15.7	88	16
RMF3010	110x125x50	61	31	34	60.5	16
RMF3011	110x125x63	61	38	27.5	75	16
RMF3012	110x125x75	61	44	22.8	88	16
RMF3013	110x125x90	61	51	17	106	16
RMF3014	140x160x110	76	61	18	129	16
RMF3015	140x160x125	76	69	8	145	16



Fitting VALVES STB400

Stub Serrated بردة

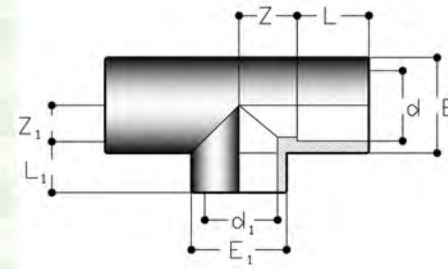
CODE	d	DN	L	Z	S	E	E1	PN
STB4001	90	80	51	5	11	108	125	16
STB4002	110	100	61	5	12	131	150	16
STB4003	125	110	69	5	12	147	167	16
STB4004	160	150	86	6	16	185	213	16
STB4005	200	200	106	7	18	231	253	10
STB4006	225	200	119	8	19	247	274	10



Fitting VALVES TER350

90° Tee reduced مشترك منخفض

CODE	dxd1	L	L1	Z	Z1	E	E1	PN
TER3501	25x20	19	14	14	14	33.5	23.5	16
TER3502	32x20	22	16	17	17	42	28	16
TER3503	32x25	26	19	17	17	42	23.5	16
TER3504	40x20	26	16	21	21	51	28	16
TER3505	40x25	26	19	21	21	51	34	16
TER3506	40x32	31	22	21	21	51	42	16
TER3507	50x20	31	16	26	26	61	28	16
TER3508	50x25	31	19	26	26	61	34	16
TER3509	50x32	31	22	26	26	61	42	16
TER3510	50x40	31	26	26	26	61	51	16
TER3511	63x20	38	16	33	33	75	28	16
TER3512	63x25	38	19	33	33	75	34	16
TER3513	63x32	38	22	33	33	75	42	16
TER3514	63x40	38	26	33	33	75	51	16
TER3515	63x50	38	31	33	33	75	61	16
TER3516	75x32	44	22	39	39	89	42	16
TER3517	75x40	44	26	39	39	89	51	16
TER3518	75x50	44	31	39	39	89	61	16
TER3519	75x63	44	38	39	39	89	75	16
TER3520	90x40	51	26	47	47	106	51	16
TER3521	90x50	51	31	47	47	106	61	16
TER3522	90x63	51	38	47	47	106	75	16
TER3523	90x75	51	44	47	47	106	89	16
TER3524	110x50	61	31	57	57	129	61	16
TER3525	110x63	61	38	57	57	129	75	16
TER3526	110x75	61	44	57	57	129	89	16
TER3527	110x90	61	51	57	57	129	106	16
TER3528	125x63	69	44	66	66	148	75	16
TER3529	125x75	69	44	66	66	148	89	16
TER3530	125x90	69	51	66	66	148	106	16
TER3531	125x110	69	61	66	66	148	129	16
TER3532	140x75	76	44	72	72	163	89	16
TER3533	140x90	76	51	72	72	163	106	16
TER3534	140x110	76	61	72	72	163	129	16
TER3535	140x125	86	69	72	72	163	148	16
TER3536	160x90	86	51	82	82	184	106	16
TER3537	160x110	86	61	82	82	184	129	16
TER3538	160x125	86	69	82	82	184	148	16
TER3539	160x140	86	76	82	82	184	163	16
TER3540	225x110	119.5	63	58	114	258	135	10
TER3541	225x160	119.5	88	84	153	158	193	10
TER3542	250x110	132	61	128	128	188	128	10
TER3543	250x160	132	86	128	128	288	184	10
TER3544	250x200	132	106	128	128	288	232	10

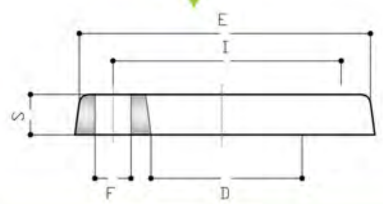


Fitting VALVES FLG450

Loose Flange فلانشة متحركة

DIN 8063 PN 10-16

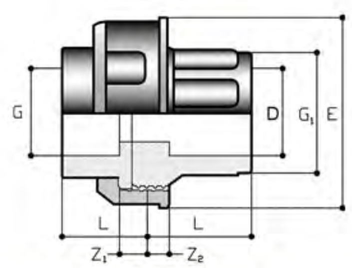
CODE	d	DN	D	E	S	I	F	drill	Bolts	PN
FLG4501	90	80	110	200	20	160	18	8	M16x90	16
FLG4502	110	100	133	220	22	180	18	8	M16x100	16
FLG4503	125	110	149	230	24	190	18	8	M16x100	16
FLG4504	160	150	190	285	28	240	22	8	M16x120	16
FLG4505	200	200	235	340	30	295	22	8	M16x120	10
FLG4506	225	200	250	340	30	295	22	8	M16x120	10



Fitting VALVES UOR550

Union with O-Ring لاكور تجميع

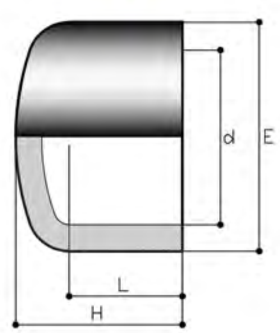
CODE	d	Z1	Z2	G1	E	O-Ring	PN
UOR5501	20	16	10	1"	42	4081	16
UOR5502	25	19	10	1 1/4"	52	4112	16
UOR5503	32	22	10	1 1/2"	59	4131	16
UOR5504	40	26	12	2"	72	6162	16
UOR5505	50	31	14	2 1/4"	79	6187	16
UOR5506	63	38	18	2 3/4"	96	6237	16
UOR5507	75	44	18	3 1/2"	119	6312	16
UOR5508	90	51	18	4"	134	6362	16
UOR5509	110	61	18	5"	163	6450	16



Fitting VALVES CAP600

Cap طبة

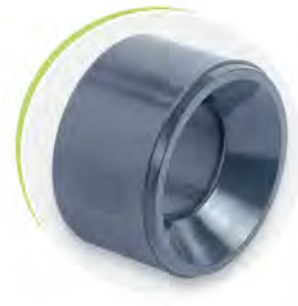
CODE	d	L	H	E	PN
CAP6001	20	16	27	28	16
CAP6002	25	19	31	33	16
CAP6003	32	22	36	41	16
CAP6004	40	28	43	52	16
CAP6005	50	32	49	60.5	16
CAP6006	63	39	57	75	16
CAP6007	75	44	67	89	16
CAP6008	90	51	80	106	16
CAP6009	110	61	95	129	16
CAP6010	125	69	102	145	16
CAP6011	140	77.5	114	161	16
CAP6012	160	86	126	181	16
CAP6013	200	106	145	227	10
CAP6014	225	119	160	254	10
CAP6015	250	131	208	286	10



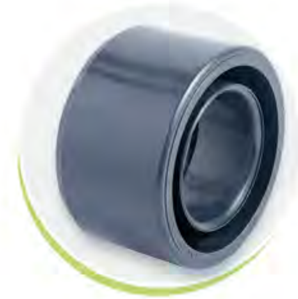
Fitting VALVES REB500

Reducing Bush بوش مخفض

CODE	dxd1	L	L1	Z	Fig	PN
REB5001	25x20	19	16	3	A	16
REB5002	32x20	22	16	6	A	16
REB5003	32x25	22	19	3	A	16
REB5004	40x20	26	16	10	B	16
REB5005	40x25	26	19	7	A	16
REB5006	40x32	26	22	4	A	16
REB5007	50x25	33	19	14	B	16
REB5008	50x32	33	22	9	B	16
REB5009	50x40	33	28	5	A	16
REB5010	63x25	38	19	19	B	16
REB5011	63x32	38	22	16	B	16
REB5012	63x40	38	26	12	B	16
REB5013	63x50	38	31	7	A	16
REB5014	75x32	44	22	22	B	16
REB5015	75x40	44	26	18	B	16
REB5016	75x50	44	31	14	B	16
REB5017	75x63	44	38	6	A	16
REB5018	90x50	51	31	20	B	16
REB5019	90x63	51	38	13	B	16
REB5020	90x75	51	44	7	A	16
REB5021	110x63	61	38	23	B	16
REB5022	110x75	61	44	17	B	16
REB5023	110x90	61	51	10	A	16
REB5024	125x75	69	44	25	B	16
REB5025	125x90	69	51	18	B	16
REB5026	125x110	69	61	8	A	16
REB5027	140x90	76	51	25	B	16
REB5028	140x110	76	61	15	B	16
REB5029	140x125	76	69	7	A	16
REB5030	160x90	88	56	30	B	16
REB5031	160x110	88	63	25	B	16
REB5032	160x125	88	71	17	B	16
REB5033	160x140	86	76	10	A	16
REB5034	200x110	106	79	18	B	10
REB5035	200x125	106	83	19	B	10
REB5036	200x160	106	86	20	B	10
REB5037	225x160	119	86	33	B	10
REB5038	225x200	119	106	13	A	10
REB5039	250x160	134	87	47	B	10
REB5040	250x200	134	107	27	B	10
REB5041	250x225	132	120	12	A	10
REB5042	280x225	147	120	27	B	10
REB5043	280x250	147	132	15	A	10
REB5044	315x200	165	107	58	B	10
REB5045	315x225	165	132	33	B	10
REB5046	315x250	165	132	33	B	10
REB5047	315x280	165	149	16	A	10
REB5048	355x315	184	163	21	A	6
REB5049	400x315	206	165	41	B	6
REB5050	400x355	206	185	21	A	6

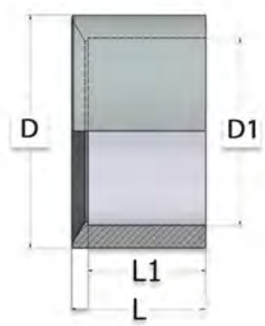


A

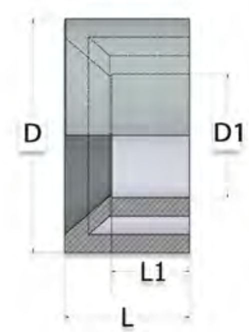


B

A



B

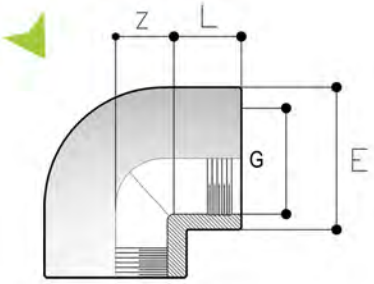


U-PVC BSP Parallel Threaded Fittings وصلات نظام انجليزى سن (قلاووظ)

Fitting VALVES ELB650

90˚ Elbow Threaded كوع سن 90°

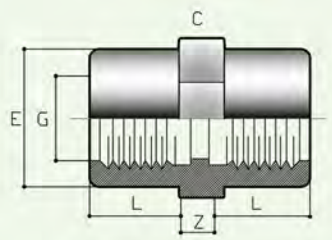
CODE	G	L	Z	E	PN
ELB6501	½"	15	12	26.5	16
ELB6502	¾"	16.3	16.7	32.5	16
ELB6503	1"	19.1	19.9	41	16
ELB6504	1 ¼"	21.4	27.6	50	16
ELB6505	1 ½"	21.4	37.6	60	16
ELB6506	2"	25.7	46.3	75	16
ELB6507	2 ½"	30.2	53.8	89	16
ELB6508	3"	33.3	65.7	106	16
ELB6509	4"	39.3	79.7	129	16



Fitting VALVES SKT800

Socket Threaded جلبة سن

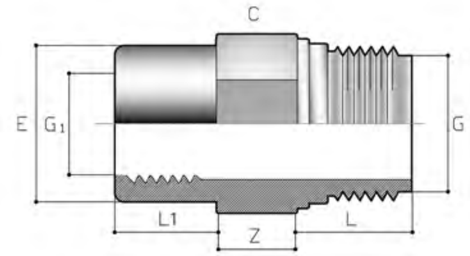
CODE	G	L	Z	E	C	PN
SKT8001	½″	15	7	26.5	30	16
SKT8002	¾″	16.3	7	33.5	36	16
SKT8003	1"	19.1	8	41	46	16
SKT8004	1¼″	21.4	8	50	55	16
SKT8005	1½″	21.4	8	60	60	16
SKT8006	2″	25.7	8	75	75	16
SKT8007	2½″	30.2	9	89	90	16
SKT8008	3″	33.3	10	106	105	16
SKT8009	4″	39.3	11	129	130	16



Fitting VALVES RMF750

Reducer male / female مسلوب سن خارجي/سن داخلي

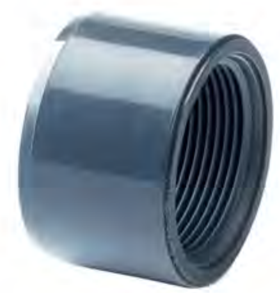
CODE	GxG1	L	L1	Z	C	E	PN
RMF7501	3/4″ x ½″	16.3	15	26	30	28	16
RMF7502	1″ x ½″	19.1	15	29	36	28	16
RMF7503	1″ x ¾″	19.1	16.3	30	36	24	16
RMF7504	1¼″ x ½″	21.4	15	33	46	28	16
RMF7505	1¼″ x 3/4″	21.4	16.3	34	5	34	16
RMF7506	1¼″ x 1″	21.4	19.1	33	46	42	16
RMF7507	1½″x ¾″	21.4	16.3	34	50	34	16
RMF7508	1½″ x 1″	21.4	19.1	34	50	42	16
RMF7509	1½″ x 1¼″	25.7	21.4	34	55	51	16
RMF7510	2″ x 3/4″	25.7	18.7	37	65	51	16
RMF7511	2″ x 1″	25.7	19.1	37	65	42	16
RMF7512	2″ x 1¼″	25.7	21.4	37	65	51	16
RMF7513	2″ x 1½″	25.7	21.4	37	65	58	16
RMF7514	2½″x 1¼″	30.2	21.4	43	80	51	16
RMF7515	2½″x 1½″	30.2	21.4	43	80	58	16
RMF7516	2½″x 2″	30.2	25.7	43	80	72	16
RMF7517	3″ x 1½″	33.3	21.4	47	95	58	16
RMF7518	3″ x 2″	33.3	25.7	47	95	72	16
RMF7519	3″ x 2½″	33.3	30.2	47	95	89	16
RMF7520	4″ x 2″	39.3	25.7	53	120	72	16
RMF7521	4″ x 2½″	39.3	30.2	53	120	89	16
RMF7522	4″ x 3″	39.3	33.3	53	120	103	16

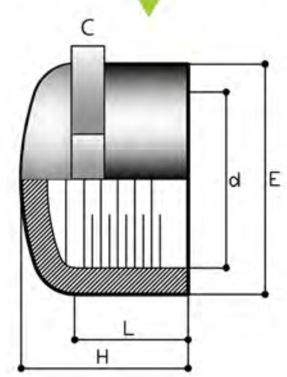


Fitting VALVES CAP850

Cap Threaded طبة سن

CODE	G	L	H	E	C	PN
CAP8501	½″	15	7	28	30	16
CAP8502	¾″	16.3	7	34	36	16
CAP8503	1"	19.1	8	42	46	16
CAP8504	1¼″	21.4	8	51	55	16
CAP8505	1½″	21.4	8	58	60	16
CAP8506	2″	25.7	8	72	75	16
CAP8507	2½″	30.2	9	89	90	16
CAP8508	3″	33.3	10	103	105	16
CAP8509	4″	39.3	11	130	130	16





Fitting VALVES NPL900

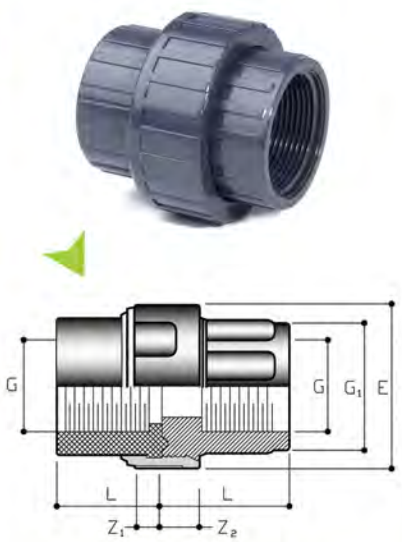
Nipple threaded نبل سن

CODE	G	L	H	C	PN
NPL9001	½″	15	42	24	16
NPL9002	¾″	16.3	44	30	16
NPL9003	1"	19.1	50	36	16
NPL9004	1¼″	21.4	58	46	16
NPL9005	1½″	21.4	58	55	16
NPL9006	2″	25.7	66	65	16
NPL9007	2½″	30.2	78	80	16
NPL9008	3″	33.3	85	95	16
NPL9009	4″	39.3	96	120	16

Fitting VALVES UOR950

Union with O-Ring threaded لاكور تجميع سن

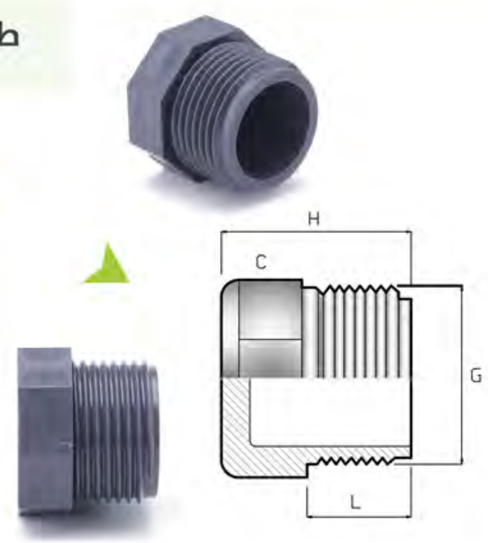
CODE	G	L	Z1	Z2	G1	E	O-Ring	PN
UOR9501	½″	15	4	11	1"	42	4.081	16
UOR9502	¾″	16.3	5.7	12.7	1¼″	52	4.112	16
UOR9503	1"	19.1	5.9	12.9	1½″	59	4.131	16
UOR9504	1¼″	21.4	7.6	16.6	2″	72	6.162	16
UOR9505	1½″	21.4	12.6	23.6	2¼″	79	1.187	16
UOR9506	2″	25.7	15.3	30.3	2 3/4″	96	6.237	16
UOR9507	2½″	30.2	16.8	31.8	3″	119	6312	16
UOR9508	3″	33.3	22.7	35.7	4″	134	6362	16
UOR9509	4″	39.3	26.7	39.7	5″	163	6450	16



Fitting VALVES PGT1000

Plug threaded طبة سن خارجي

CODE	G	L	H	C
PGT10001	¾″	16.3	30	30
PGT10002	1"	19.1	33	36
PGT10003	1¼″	21.4	39	46
PGT10004	1½″	21.4	39	55
PGT10005	2″	25.7	43	65
PGT10006	2½″	30.2	53	80
PGT10007	3″	33.3	58	95
PGT10008	4″	39.3	65	120

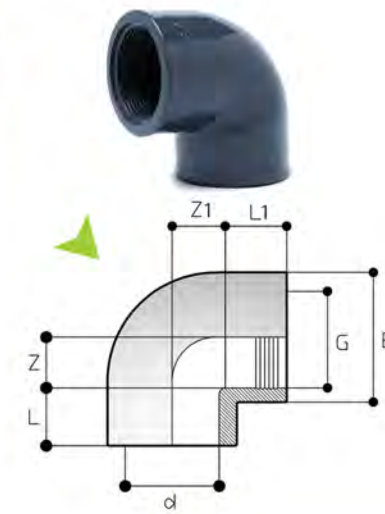


U-PVC Adaptor Set وصلات لصق نظام مترى / وصلات نظام انجليزى سن (قلاووظ)

Fitting VALVES ELB1050

90° Elbow plain / threaded كوع 90° لصق/سن

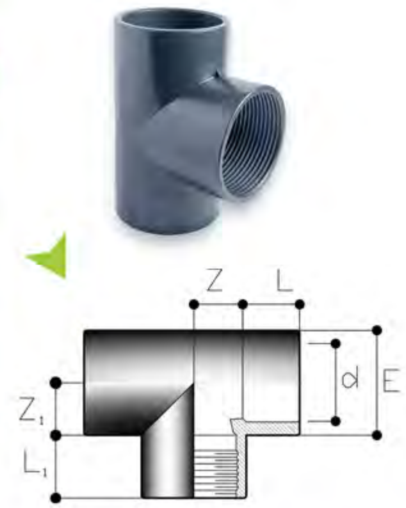
CODE	dxG	L	L1	Z	Z1	E	PN
ELB10501	20x½″	16	15	11	12	26.5	16
ELB10502	25x3/4″	19	16.3	14	16	32.5	16
ELB10503	32x1″	22	19.1	17	19.7	41	16
ELB10504	40x1¼″	26	21.4	23	19.9	50	16
ELB10505	50x1½″	31	21.4	28	27.6	60	16
ELB10506	63x2″	38	25.7	34	37.6	75	16
ELB10507	75x2½″	44	30.2	40	46.3	89	16
ELB10508	90x3″	51	33.3	48	53.8	106	16
ELB10509	110x4″	61	39.3	58	65.7	129	16



Fitting VALVES TEE1100

90° Tee Plain/threaded مشترك 90° لصق/سن

CODE	dxG	L	L1	Z	Z1	E	PN
TEE11001	20x½″	16	15	11	12	27	16
TEE11002	25x3/4″	19	16.3	14	16	33.5	16
TEE11003	32x1″	22	19.1	17	19.7	42	16
TEE11004	40x1¼″	26	21.4	23	19.9	51	16
TEE11005	50x1½″	31	21.4	28	27.6	61	16
TEE11006	63x2″	38	25.7	34	37.6	75	16
TEE11007	75x2½″	44	30.2	40	46.3	89	16
TEE11008	90x3″	51	33.3	48	53.8	106	16
TEE11009	110x4″	61	39.3	58	65.7	129	16

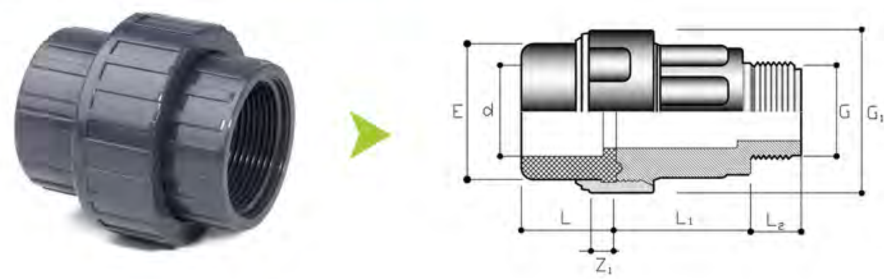


Fitting VALVES UOR1150

US 82

Union male Plain/threaded with O-ring لاكور تجميع لصق / سن خارجي

CODE	dxG	L	L1	L1	Z1	C	G1	E	O-ring	PN
UOR11501	50x1½″	31	21.4	40	3	65	2¼″	79	6187	16
UOR11502	50x2″	31	25.7	40	3	65	2¼″	79	6187	16
UOR11503	63x2″	38	25.7	42	3	70	2¾″	96	6237	16

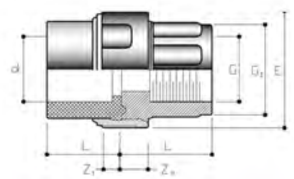


Fitting VALVES UOR1200

UN 82

Union with O-Ring Plain/threaded لاكور تجميع لصق / سن داخلي

CODE	dxG	L	L1	Z1	Z2	G1	E	O-ring
UOR12001	20x½"	16	15	3	11	1"	42	4081
UOR12002	25x¾"	19	16.3	3	12.7	1¼"	52	4112
UOR12003	32x1"	22	19.1	3	12.9	1½"	59	4131
UOR12004	32x1"	26	21.4	3	16.6	2"	72	6162
UOR12005	50x1½"	31	21.4	3	23.6	2¼"	79	6187
UOR12006	63x2"	38	25.7	3	30.3	2¾"	96	6237

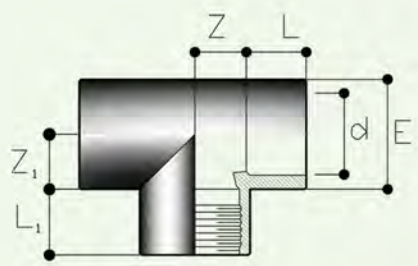


Fitting VALVES TER1250

TR 42

90° Tee reduced Plain/threaded 90° مشترك مخفض لصق/سن

CODE	dxG	L	L1	Z	Z1	E	E1
TER12501	32x¾"	22	16.3	17	16.7	42	33.5
TER12502	50x½"	31	15	26	12	61	28
TER12503	50x1"	31	19.1	26	19.9	61	42
TER12504	63"x½"	38	15	33	12	75	28

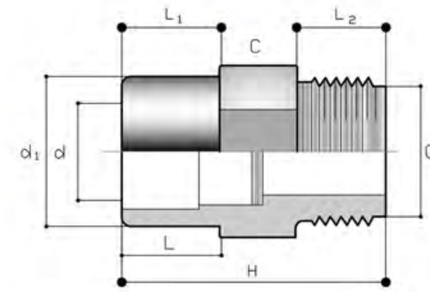


Fitting VALVES MAD1300

AD 12

Male Adaptor رأس خط سن خارجي

CODE	dxd1xG	L2	L1	L	H	C	PN
MAD13001	20x25x½"	16	19	15	46	27	16
MAD13002	20x25x¾"	16	19	16.3	47	30	16
MAD13003	25x32x½"	19	22	15	49	36	16
MAD13004	25x32x¾"	19	22	16.3	50	36	16
MAD13005	25x32x1"	19	22	19.1	53	36	16
MAD13006	32x40x¾"	22	26	16.3	54	42	16
MAD13007	32x40x1"	22	26	19.1	57	42	16
MAD13008	32x40x1¼"	22	26	21.4	60	46	16
MAD13009	40x50x1"	26	31	19.1	64	55	16
MAD13010	40x50x1¼"	26	31	21.4	66.5	55	16
MAD13011	40x50x1½"	26	31	21.4	66.5	55	16
MAD13012	50x63x1¼"	31	38	21.4	74	65	16
MAD13013	50x63x1"	19	38	31	71	14	16
MAD13014	50x63x1½"	22	38	31	74	14	16
MAD13015	50x63x2"	26	38	31	78	14	16
MAD13016	63x75x1½"	23	44	38	80	15	16
MAD13017	63x75x2"	26	44	47	84	10	16
MAD13018	63x75x2½"	38	44	30.2	91	80	16
MAD13019	75x90x1½"	22	51	44	89	17	16
MAD13020	75x90x2"	26	51	44	94	17	16
MAD13021	75x90x2½"	44	51	30.2	99	95	16
MAD13022	75x90x3"	44	51	30.3	102	95	16
MAD13023	90x110x2"	25	61	51	103	16	16
MAD13024	90x110x2½"	51	61	30.2	110	115	16
MAD13025	90x110x3"	33	61	51	110	16	16
MAD13026	90x110x4"	51	61	39.3	118	115	16
MAD13027	110x125x3"	61	69	33.3	115	130	16
MAD13028	110x125x4"	61	69	39.3	120	130	16
MAD13029	110x125x5"	61	69	43.6	125	130	16

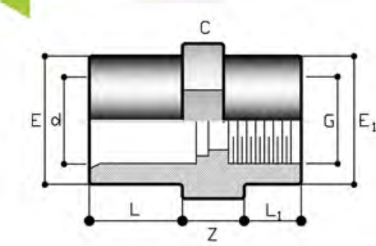


Fitting VALVES UOR1200

SO 12

Female Adaptor جلبة لصق/سن

CODE	dxG	L	L1	Z	E	E1	C	PN
FAD14001	20x½"	16	15	7	26.5	26.5	30	16
FAD14002	25x¾"	19	16.3	7	33.5	33.5	34	16
FAD14003	32x1"	22	19.1	8	41	41	42	16
FAD14004	40x1¼"	26	21.4	8	50	50	55	16
FAD14005	50x1½"	31	21.4	8	60	60	65	16
FAD14006	63x2"	38	25.7	8	75	75	75	16
FAD14007	75x2½"	44	30.2	9	89	89	90	16
FAD14008	90x3"	51	33.3	10	106	106	110	16
FAD14009	110x4"	61	39.3	11	129	129	129	16



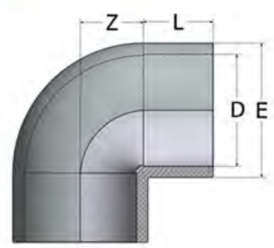
U-PVC Imperial Plain Fittings وصلات نظام انجليزى لصق

Fitting VALVES ELB1450

EL 53

90° Elbow BS كوع 90°

CODE	d	L	Z	E	Class	PN
ELB14501	½″	16	11	26.5	E	16
ELB14502	¾″	19	14	32.5	E	16
ELB14503	1″	22	17	41	E	16
ELB14504	1¼″	26	23	50	E	16
ELB14505	1½″	31	28	60	E	16
ELB14506	2″	38	34	75	E	16
ELB14507	2½″	44	40	89	E	16
ELB14508	3″	51	48	106	E	16
ELB14509	4″	61	59	132	E	16
ELB14510	6″	88	85	198	E	16
ELB14511	8″	119	115	258	E	10

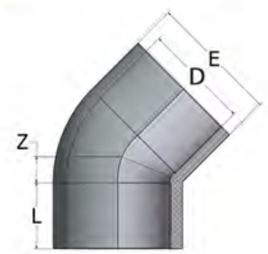


Fitting VALVES ELB1550

EY 53

45° Elbow BS كوع 45°

CODE	d	L	Z	E	Class	PN
ELB15501	½″	16	5.5	28	E	16
ELB15502	¾″	19	6	34	E	16
ELB15503	1″	22	8	42	E	16
ELB15504	1¼″	26	10	51	E	16
ELB15505	1½″	31	12	61	E	16
ELB15506	2″	38	15	75	E	16
ELB15507	2½″	44	18	88	E	16
ELB15508	3″	51	21	106	E	16
ELB15509	4″	61	25	130	E	16
ELB15510	6″	88	36	198	E	16
ELB15511	8″	119	49	258	E	16

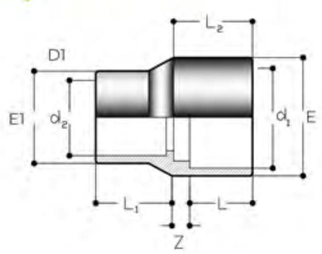


Fitting VALVES RSK1750

RS 13

Reducing Socket BS مسلوب طويل

CODE	dxd1	L	L1	Z	E	E1	Class	PN
RSK17501	¾″x½″	19	16	6	34	28	E	16
RSK17502	1″x¾″	22	19	6	42	33	E	16
RSK17503	1¼″x1″	26	22	6	51	41	E	16
RSK17504	1½″x1¼″	31	26	6	61	50	E	16
RSK17505	2″x1½″	38	31	6	75	60.5	E	16
RSK17506	2½″x2″	44	38	6	89	75	E	16
RSK17507	3″x2½″	51	44	6	106	88	E	16
RSK17508	4″x3″	61	51	6	129	106	E	16



Fitting VALVES RUB1650

RB 93

Reducing Bush BS بوش قصير

A

B

CODE	dxd1	L	L1	Z	Fig	Class	PN
RUB16501	¾″x½″	19	16	3	A	E	16
RUB16502	1″x½″	22	16	6	A	E	16
RUB16503	1″x¾″	22	19	3	A	E	16
RUB16504	1¼″x½″	26	16	10	B	E	16
RUB16505	1¼″x¾″	26	19	7	A	E	16
RUB16506	1¼″x1″	26	22	4	A	E	16
RUB16507	1½″x¾″	31	19	12	B	E	16
RUB16508	1½″x1″	31	22	19	B	E	16
RUB16509	1½″x1¼″	31	26	5	A	E	16
RUB16510	2″x1″	38	22	16	B	E	16
RUB16511	2″x1¼″	38	26	12	B	E	16
RUB16512	2″x1½″	38	31	7	A	E	16
RUB16513	3″x1½″	51	31	20	B	E	16
RUB16514	3″x2″	51	38	13	B	E	16
RUB16515	4″x2″	61	38	23	B	E	16
RUB16516	4″x3″	61	51	10	A	E	16
RUB16517	6″x4″	86	61	25	B	E	16
RUB16518	8″x6″	119	86	33	B	E	16

FIG.A

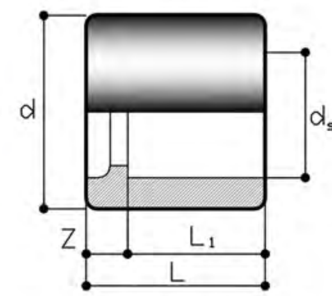
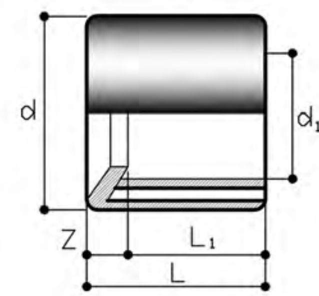


FIG.B

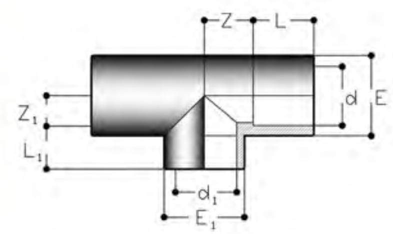


Fitting VALVES TER1700

TR 43

90° Tee reduced BS مشترك منخفض

CODE	dxd1	L	L1	Z	Z1	E	E1	Class	PN
TER17001	1¼″x1″	26	22	21	21	51	42	E	16
TER17002	1½″x½″	31	16	26	26	61	28	E	16
TER17003	1½″x¾″	31	19	26	26	61	34	E	16
TER17004	1½″x1″	31	22	26	26	61	42	E	16
TER17005	1½″x1¼″	31	26	26	26	61	51	E	16
TER17006	2″x1″	38	22	33	33	75	42	E	16
TER17007	2″x1¼″	38	26	33	33	75	51	E	16
TER17008	2″x1½″	38	31	33	33	75	61	E	16
TER17009	3″x1½″	51	31	47	47	106	61	E	16
TER17010	3″x2″	51	38	47	47	106	75	E	16
TER17011	3″x2½″	51	44	47	47	106	89	E	16
TER17012	4″x2″	61	38	57	57	129	75	E	16
TER17013	4″x3″	61	51	57	57	129	106	E	16

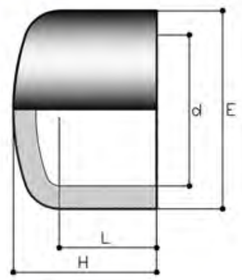


Fitting VALVES CAP1800

CA 73

Cap BS طبة

CODE	d	L	H	E	Class	PN
CAP18001	½″	16	27	28	E	16
CAP18002	¾″	19	31	33	E	16
CAP18003	1″	22	36	41	E	16
CAP18004	1¼″	26	43	50	E	16
CAP18005	1½″	31	49	60.5	E	16
CAP18006	2″	38	57	75	E	16
CAP18007	3″	51	80	106	E	16
CAP18008	4″	61	95	132	E	16
CAP18009	6″	88	126	190	E	16
CAP18010	8″	119	145	258	E	10

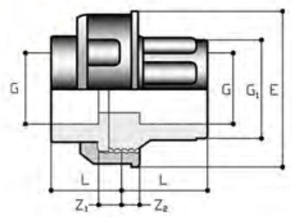


Fitting VALVES UOR1850

UN 83

Union with O-Ring BS لاكور تجميع

CODE	d	L	Z1	Z2	G1	E	O-Ring	Class	PN
UOR18501	½″	16	3	10	1″	42	4.081	E	16
UOR18502	¾″	19	3	10	1¼″	52	4.112	E	16
UOR18503	1″	22	3	10	1½″	59	4.131	E	16
UOR18504	1¼″	26	3	12	2″	72	6.162	E	16
UOR18505	1½″	31	3	14	2¼″	79	6.187	E	16
UOR18506	2″	38	3	18	23/4″	96	6.237	E	16
UOR18507	3″	51	5	18	4	134	6.362	E	16
UOR18508	4″	61	5	18	5	163	6.45	E	16

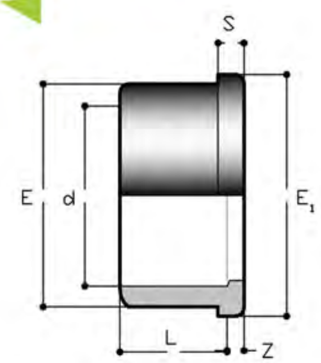


Fitting VALVES STB1900

ST 23

Stub flange BS بردة

CODE	d	L	Z	S	E	E1
STB19001	2″	38	3	9	76	90
STB19002	4″	61	5	12	131	150
STB19003	6″	88	7	14	193	288
STB19004	8″	119	7	19	248	274



U-PVC Adaptor **Plain BS Solvent Weld-ing Plain Metric Solvent Welding**

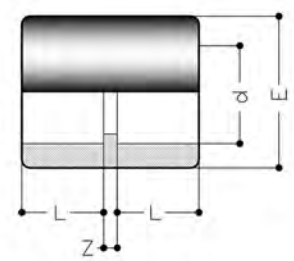
وصلات نظام انجليزى لصق / نظام مترى لصق

Fitting VALVES ADS1950

SO 15

Adaptor socket جلبة

CODE	dxd1	L	L1	Z	E	E1	PN
ADS19501	20 x ½″	16	16	3	28	28	16
ADS19502	25x¾″	19	19	3	33	33	16
ADS19503	32x1″	22	22	3	41	41	16
ADS19504	40x1¼″	26	26	3	50	50	16
ADS19505	50x1½″	31	31	3	60.5	60.5	16
ADS19506	63x2″	38	38	3	75	75	16



U-PVC **Plain/ Threaded** Fittings

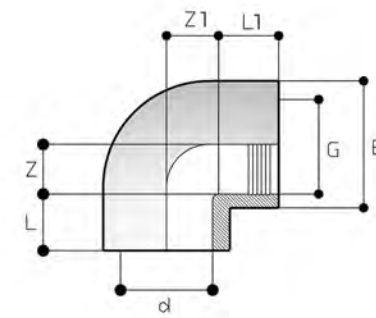
وصلات نظام انجليزى لصق / نظام انجليزى سن قلاووظ

Fitting VALVES ELB2000

EL 54

90° Elbow BS plain/threaded كوع لصق/سن 90°

CODE	dxG	L	L1	Z	Z1	E	PN
ELB20001	20 x ½″	16	15	11	12	26.5	16
ELB20002	25x¾″	19	16.3	14	16	32.5	16
ELB20003	32x1″	22	19.1	17	19.7	41	16
ELB20004	40x1¼″	26	21.4	23	19.9	50	16
ELB20005	50x1½″	31	21.4	28	27.6	60	16
ELB20006	63x2″	38	25.7	34	37.6	75	16

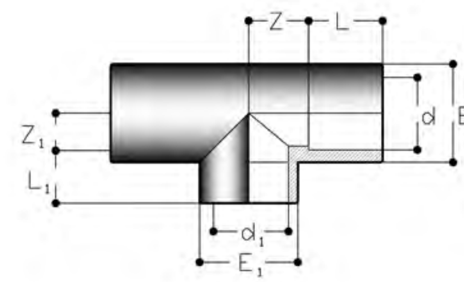


Fitting VALVES TEE2050

TE 44

90° Tee BS plain/threaded مشترك لصق/سن 90°

CODE	dxG	L	L1	Z	Z1	E	PN
TEE20501	½″x½″	16	15	11	12	27.5	16
TEE20502	¾″x¾″	19	16.3	14	16	33.5	16
TEE20503	1″x1″	22	19.1	17	19.7	42	16
TEE20504	1¼″x1¼″	26	21.4	23	19.9	51	16
TEE20505	1½″x1½″	31	21.4	28	27.6	61	16
TEE20506	2″x2″	38	25.7	34	37.6	75	16

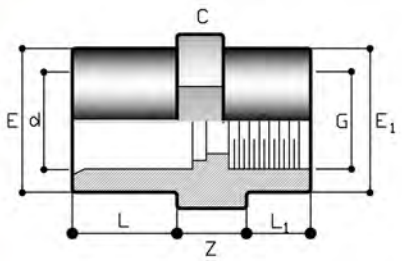


Fitting VALVES FAP2100

SO 14

Female Adaptor جلبة

CODE	dxG	L	L1	Z	E	E1	C	PN
FAP21001	½″x½″	16	15	4	28	28	24	16
FAP21002	¾″x¾″	19	16.3	4	34	34	30	16
FAP21003	1″x1″	22	19.1	5	42	42	34	16
FAP21004	1¼″x1¼″	26	21.4	5	50	50	42	16
FAP21005	1½″x1½″	31	21.4	5	61	75.5	55	16
FAP21006	2″x2″	38	25.7	5	75	71.5	65	16
FAP21007	3″x3″	51	33.3	8	106	106	90	16
FAP21008	4″x4″	61	39.3	8	129	129	110	16

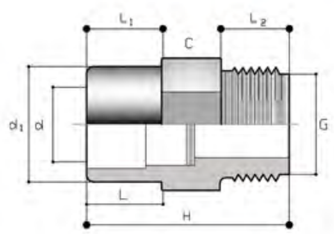


Fitting VALVES MTA2150

AD 14

Male Threaded adaptor BS رأس خط سن خارجي

CODE	d-d1xG	L	L1	L2	H	C	PN
MTA21501	½″x¾″x½″	16	19	15	46	27	16
MTA21502	¾″x1x¾″	19	22	16.3	50	36	16
MTA21503	1″x1¼″x1″	22	26	19.1	57	42	16
MTA21504	1¼″x1½″x1¼″	26	31	21.4	66.5	55	16
MTA21505	1½″x2x1½″	31	38	21.4	74	65	16
MTA21506	1½″x2″x2″	31	38	25.7	78	65	16
MTA21507	2″x2½″x2″	38	44	25.7	84	75	16
MTA21508	3″x4″x3″	53	61	33.3	113	119	16
MTA21509	4″x5″x4″	61	69	39.3	120	130	16

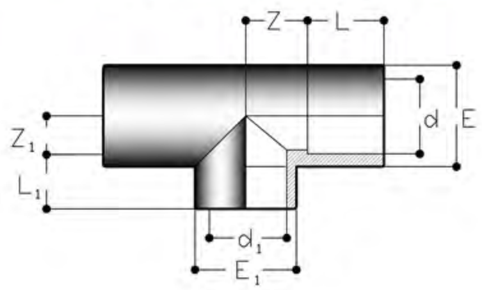


Fitting VALVES TEE2200

TR 44

90° Tee reduced BS plain/threaded مشترك مخفض لصق/سن 90

CODE	dxG	L	L1	Z	Z1	E	E1	PN
TEE22001	1x½″	22	15	17	12	42	28	16
TEE22002	1x¾″	22	16.3	17	16.7	42	34	16
TEE22003	1½″x½″	31	15	26	12	61	28	16
TEE22004	1½″x¾″	31	16.3	26	16.7	61	34	16
TEE22005	2″x½″	38	15	33	12	75	28	16
TEE22006	2″x¾″	38	16.3	33	16.7	75	34	16

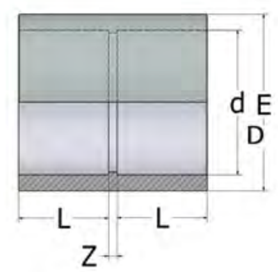


Fitting VALVES SKT1600

SO 13

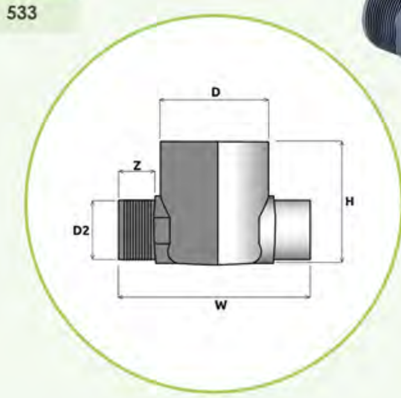
Socket BS جلبة

CODE	d	L	Z	E	Class	PN
SKT16001	½″	16	3	28	E	16
SKT16002	¾″	19	3	34	E	16
SKT16003	1″	22	3	42	E	16
SKT16004	1¼″	26	3	51	E	16
SKT16005	1½″	31	3	61	E	16
SKT16006	2″	38	3	75	E	16
SKT16007	2½″	44	4	88	E	16
SKT16008	3″	51	5	106	E	16
SKT16009	4″	61	6	132	E	16
SKT16010	6″	88	11	191	E	16
SKT16011	8″	119	11	190	E	16



Tee | Double Reducer

Code	D2xDxD2	H	W	Z	PN	Qty	GR
00	2″ x 90 x 2″	115	186	36	16	24	533



Miga plastic industries

MIGA LANDSCAPE IRRIGATION

خراطيم اللاند سكيب

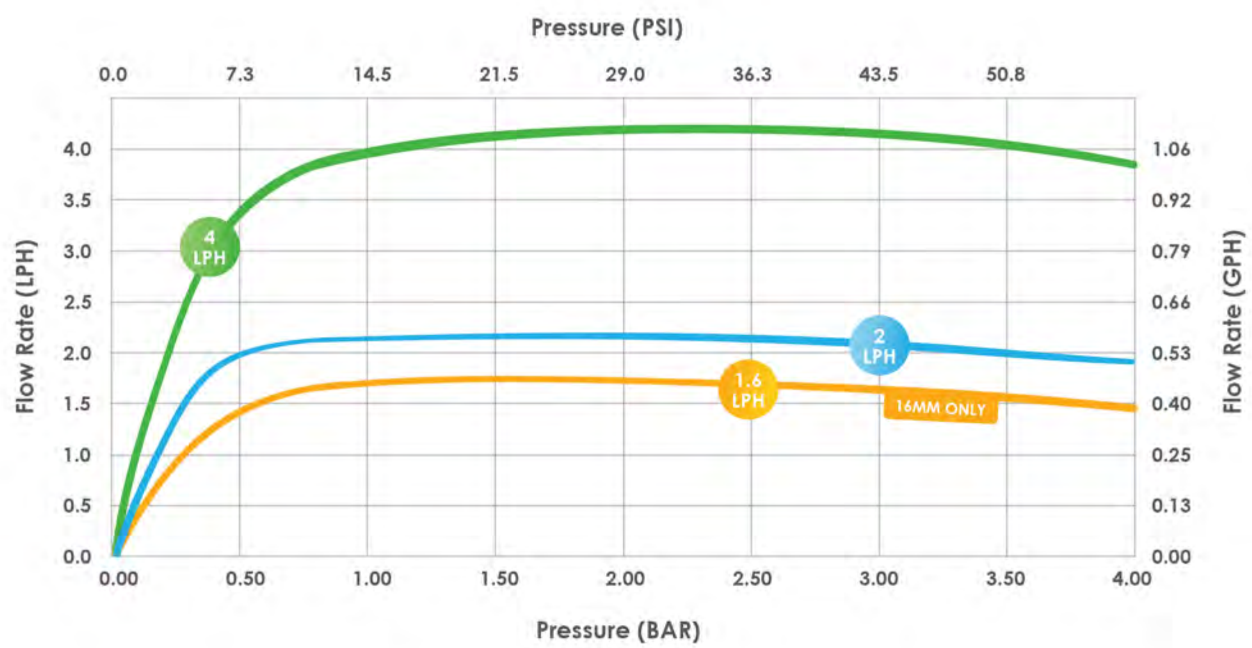
PC round hose features

- Constant flow rate along the hose.
- The pressure compensated drippers used are self-cleaned, which get rids of impurities, on the other hand it contains an internal rubber valve that maintains the required flow rate in case of high or low pressure.
- Suitable for non-flat grounds, with different slopes.
- The Coefficient of Variation "CV" is less than 0.01.

المواصفات الفنية للخرطوم المنظم للضغط

- ضمان المعدل الثابت لتدفق المياه داخل الخرطوم على امتداده.
- النقاطات المنظمة للضغط المستخدمة تقوم بالتنظيف الذاتي، مما يعمل على التخلص من بعض الشوائب، وكذلك تحتوي على صمام داخلي يضمن الحفاظ على معدل التصرف المطلوب في حالة ارتفاع أو انخفاض الضغط .
- مناسب للأماكن الغير مستوية والمختلفة الإنحدار.
- تتسم النقاطات بأن معامل التغير لايتعدى 0.01 مما يعني أن ثبات التصرفات على طول إمتداد الخرطوم.
- امكانيه انتاج الخرطوم اسود / بنى

PC drippers flow rate curve



PC Round PIPE خراطيم الرى ذاتية التنقيط المنظمة للضغط

تقدم ميجا جرين خراطيم الرى المنظمة للضغط اللازمة فى اعمال اللاند سكيب بالسماكات التالية والمتوافقة مع المعايير الاوربية فى هذا المجال .

Nominal	Wall Thickness	Internal	Dripper Spacing	Flow Rate	
mm	mm	mm	cm	2LPH	4LPH
16 ø mm	1.2 mm	13.6 mm	20	22501	40001
			25	22502	40002
			30	22503	40003
			40	22504	40004
			50	22505	40005
			75	22506	40006
			100	22507	40007

Nominal	Wall Thickness	Internal	Dripper Spacing	Flow Rate	
mm	mm	mm	cm	2LPH	4LPH
16 ø mm	1.1 mm	13.8 mm	20	23001	41001
			25	23002	41002
			30	23003	41003
			40	23004	41004
			50	23005	41005
			75	23006	41006
			100	23007	41007

Blind PIPE خراطيم الرى المصمتة (السادة)

كما تقدم خراطيم الرى المصمتة بالسماكات المختلفة والمستخدمة فى اعمال اللاند سكيب ..

Nominal	Wall Thickness	Internal
mm	mm	mm
16 ø mm	1.4 mm	13.6 mm
16 ø mm	1.2 mm	13.6 mm
16 ø mm	1.1 mm	13.8 mm

Valve Boxes

Applications
Commercial , Residential , Golf , Municipal

Features
- High Strength, High Density Polyethylene Constructed Material
- UV Stabilizers with Anti-oxidants
- Resistant To Moisture
- Pre-Installed Lock Nut for All Rectangular Models

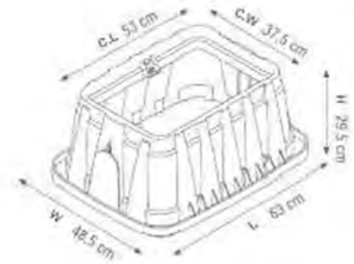
غرف المحابس

الإستخدام
تستخدم غرف محابس المياة فى المزارع ومسطحات اللاند سكيب والمجمعات السكنية لحفظ محابس المياه اليدوية او الاوتوماتيك

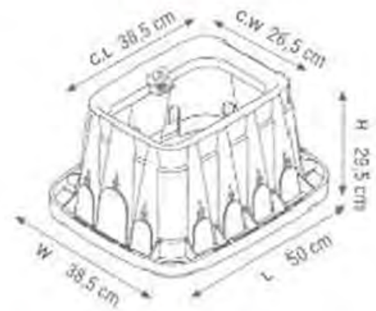
المواصفات
- قدرة عالية على تحمل الضغط فوق الغرفة والتربة المحيطة بها.
- خامات بولي ايثيلين عالي الكثافة مقاومة لأشعة الشمس والعوامل الجوية.
- مقاومة عالية للرطوبة.
- جميع المقاسات المستطيلة مزودة بمسمار وصامولة لإحكام الغلق.

Types of VALVE Boxes with details and dimensions

أنواع غرف المحابس وتفاصيل أبعادها



14" Jumbo Valve Box
غرفة المحابس "14 جامبو



12" Valve Box
غرفة المحابس "12

diam 32 cm

10" CAP Diam 24 cm
غرفة المحابس "10

diam 20 cm

12" Valve Box 6"
غرفة المحابس "6

PVC PIPE
WORLD LEADER

BUSINESS INTRODUCTION

PVC pipe is the world's most widely used medium for conveyance of fluids. After centuries of use of ancient materials such as clay, lead, iron and more recently steel, Ductile Iron and asbestos cement, PVC has, in a comparatively short 50 years, invaded all of the traditional applications of these materials to become the premier pipe material, measured by length or value, in the world today.

The product has well recognised advantages of immunity to corrosion, chemical and micro-/macrobiological resistance, hydraulic capacity, ease of handling and installation together with toughness and flexibility to withstand abuse. Its widespread applications are largely attributable to these features.

Pipe applications fall into two broad categories primarily determined by the dominance of either internal pressure or external loading over design.

They are referred to as 'pressure' or 'non-pressure' applications.
This manual covers pressure applications with particular emphasis on general water supply. Other applications include irrigation, industrial, and pumped sewerage mains.

It provides state of the art information on material characteristics and performance, pipe selection and system design procedures, installation recommendations and detailed product specification data for both pipe and fittings.

INTRODUCTION

MANUFACTURE

Basically, PVC products are formed from raw PVC powder by a process of heat and pressure. The two major processes used in manufacture are extrusion for pipe and injection moulding for fittings.

Modern PVC processing involves highly developed scientific methods requiring precise control over process variables. The polymer material is a free flowing powder, which requires the addition of stabilisers and processing aids.

Formulation and blending are critical stages of the process and tight specifications are maintained for incoming raw materials, batching and mixing. Feed to the extrusion or moulding machines may be direct, in the form of "dry blend", or pre-processed into a granular "compound".

EXTRUSION

Polymer and additives are accurately weighed and processed through the high speed mixing to blend the raw materials into a uniformly distributed dry blend mixture.
A mixing temperature of around 120 °C is achieved by frictional heat.
At various stages of the mixing process, the additives melt and progressively coat the PVC polymer granules.

After reaching the required temperature, the blend is automatically discharged into a cooling chamber which rapidly reduces the temperature to around 50 °C, thereby allowing the blend to be conveyed to intermediate storage where even temperature and density consistency are achieved. The heat of the process, the extruder, has a temperature controlled, zoned barrel in which rotate precision "screws". Modern extruder screws are complex devices, carefully designed with varying flights to control the compression and shear, developed in the material, during all stages of the process. The twin counter-rotating screw configuration used by all major manufacturers offers improved processing. The PVC dryblend is metered into the barrel and screws, which then convert the dry blend into the required "melt" state, by heat, pressure and shear. During its passage along the screws, the PVC passes through a number of zones that compress, homogenise and vent the melt stream. The final zone increases the pressure to extrude the melt through the head and die set which is shaped according to the size of the pipe required and flow characteristics of the melt stream.

Once the pipe leaves the extrusion die,it is sized by passing through a precision sizing sleeve with external vacuum.
This is sufficient to harden the exterior layer of PVC and hold the pipe diameter during final cooling in a controlled water cooling chambers. The pipe is pulled through the sizing and cooling operations by the puller or haul-off at a constant speed. Speed control is very important when this equipment is used because the speed at which the pipe is pulled will affect the wall thickness of the finished product. In the case of rubber ring jointed pipe the haul-off is slowed down at appropriate intervals to thicken the pipe in the area of the socket. An in-line printer marks the pipes at regular intervals, with identification according to size, class, type, date, Standard number, and extruder number.
An automatic cut-off saw cuts the pipe to the required length. A belling machine forms a socket on the end of each length of pipe. There are two general forms of socket.
For rubber-ring jointed pipe, a collapsible mandrel is used, whereas a plain mandrel is used for solvent jointed sockets. Rubber ring pipe requires a chamfer on the spigot, which is executed either at the saw station or belling unit. The finished product is stored.

iNTRODUCTION

INJECTION MOULDING

PVC fittings are manufactured by high-pressure injection moulding. In contrast to continuous extrusion, moulding is a repetitive cyclic process, where a “shot” of material is delivered to a mould in each cycle. PVC material, either in dry blend powder form or granular compound form, is gravity fed from a hopper situated above the injection unit, into the barrel housing a reciprocating screw.

The barrel is charged with the required amount of plastic by the screw rotating and conveying the material to the front of the barrel. The position of the screw is set to a predetermined “shot size”. During this action, pressure and heat “plasticise” the material, which now in its melted state, awaits injection into the mould.

All this takes place during the cooling cycle of the previous shot. After a preset time the mould will open and the finished moulded fitting will be ejected from the mould. The mould then closes and the melted plastic in the front of the barrel is injected under high pressure by the screw now acting as a plunger. The plastic enters the mould to form the next fitting.

After injection, recharge commences while the moulded fitting goes through its cooling cycle.

RAW MATERIAL

All raw materials for MIGA Plastic Industries LLC products must meet detailed specifications and suppliers are required to conform to strict quality assurance standards.

PRODUCTION PROCESS CONTROL

Production processes are enumerated, closely specified and continuously monitored and recorded. Inspection and control are exercised by properly trained personnel using calibrated equipment.

PRODUCT TESTING

Products are examined and tested to ensure compliance with the relevant Standard. Pipe production is fully traceable and test results are recorded for all extrusion and moulded products.

- Effect on water - This is a series of type tests carried out in order to demonstrate that the pipe or fitting does not have a detrimental effect on the quality of drinking water. It assesses the effect of the pipe or fittings on the taste, odour and appearance of water as well as the health aspects due to growth of microorganisms and leaching of toxic substances.
- Vinyl chloride monomer test - This requirement is to ensure that the residual VCM in PVC material does not exceed safe limits.
- Light transmission tests - This test is conducted to ensure that PVC pipes have sufficient opacity to prevent growth of algae in the water conveyed. It is a type test for a given formulation and pipe wall thickness.
- Joint pressure and infiltration tests - Elastomeric ring joints are subjected to both an internal hydrostatic pressure test and an external pressure or internal vacuum test in order to ensure a satisfactory joint design.
- Processing tests - A number of tests are conducted in accordance with Standards to ensure the manufacturing process is consistent and repeated.

DESiGN

SELECTION OF PIPE DIAMETER AND CLASS

The pipe diameter and class of PVC pipes is selected by consideration of the required hydraulic capacity and the expected operating conditions. For determination of the flow capacity, it is the mean internal diameter or bore which is the significant dimension. The mean bore for pipes to accepted Standards is calculated as mean OD minus twice the mean wall thickness. Along with other relevant dimensions, the mean bore of PVC-U.

Amongst the factors to be considered are:

Operating pressure characteristics:

A Maximum steady state or static pressures.
B Dynamic conditions, frequency and magnitude of pressure variations due to system operation or demand variation.

PN	Meters head	(MPa)
4.5	46	0.45
6	61	0.6
8	81	0.8
9	91	0.9
10	102	1.0
12	122	1.2
12.5	127	1.25
15	153	1.5
16	163	1.6
18	184	1.8
20	204	2.0

Temperature:

The stress capability of PVC is temperature dependent.

Other load conditions:

Earth loads, traffic loads, bending stresses, installation loads, expansion and contraction stresses and other mechanical loads.

Service life required:

For short-term projects, e.g. mining, a life of 5 to 15 years could be appropriate; for irrigation, possibly 15 to 30 years; for municipal water supplies, 30 to 100 years.

For situations involving high costs of down-time and repair, a higher factor should be used.

These considerations are discussed in detail later in this section.

Effect of Varying Parameters Charts

For a given discharge Q, the friction head loss H developed in a pipeline will vary with the following parameters:

Parameter	Set Value
Water temperature	20° C
Small changes in pipe diameter	mean diameter
Roughness coefficient	k = 0.003mm

Designers should use their own discretion as to whether or not it is appropriate to vary these parameters.

Water Temperature

The viscosity of water decreases with increasing temperature.

As the temperature increases the friction head will decrease.

An approximate allowance for the effect of the variation in water temperature is as follows:

Increase the chart value of the hydraulic gradient by 1% for each 2 °C below 20 °C. Decrease the chart value of the hydraulic gradient by 1% for each 2 °C above 20 °C.

DESiGN

HAMMER RESISTANCE TO FLOW

Flow considerations

In a pipeline, energy is lost wherever there is a change in cross section or flow direction. These energy losses which occur as a result of disturbances to the normal flow show up as pressure drops in the pipeline.
These "form losses" which occur at sudden changes in section, at valves and at fittings are usually small compared with the friction losses in long pipelines. However, they may contribute a significant part to the total losses in short pipeline systems with several fittings.
It can be shown that form losses in pipes may be expressed as a constant multiplied by the velocity head:
i.e. loss in pressure head

$$H_L\ (m) = K\ \frac{V^2}{2^g}$$

Where:
V = velocity (m/s) from the flow chart
K = resistance coefficient

Fitting Type		K
Pipe Entry Losses		
Square Inlet		0.50
Re-entrant Inlet		0.80
Slightly Rounded Inlet		0.25
Bellmouth Inlet		0.05
Pipe Intermediate Losses		
Elbows R/D < 0.6	45°	0.35
	90°	1.10
Long Radius Bends (R/D > 2)	11¼°	0.05
	22½°	0.10
	45°	0.20
	90°	0.50
Tees		
(a) Flow in line		0.35
(b) Line to branch flow		1.00
Sudden Enlargements		
Ratio	d/D	
	0.9	0.04
	0.8	0.13
	0.7	0.26
	0.6	0.41
	0.5	0.56
	0.4	0.71
	0.3	0.83
	0.2	0.92
	<0.2	1.00
Sudden Contractions		
Ratio	d/D	
	0.9	0.10
	0.8	0.18
	0.7	0.26
	0.6	0.32
	0.5	0.38
	0.4	0.42
	0.3	0.46
	0.2	0.48
	<0.2	0.50

Fitting Type		K
Gradual Enlargements		
Ratio d/D	q = 10° typical	
	0.9	0.02
	0.7	0.13
	0.5	0.29
	0.3	0.42
Gradual Contractions		
Ratio d/D	q = 10° typical	
	0.9	0.03
	0.7	0.08
	0.5	0.12
	0.3	0.14
Valves		
Gate Valve (fully open)		0.20
Reflux Valve		2.50
Globe Valve		10.00
Butterfly Valve (fully open)		0.20
Angle Valve		5.00
Foot Valve with strainer		15.00
Air Valves		zero
Ball Valve		0.10
Pipe Exit Losses		
Square Outlet		1.00
Rounded Outlet		1.00

Example

What is the head loss in a DN 100 short radius 90° elbow when the flow velocity is 1m/s?

$$\text{Head loss } H_L = K \bullet \frac{V^2}{2^g}$$

$$= 1.1 \times \frac{1^2}{2 \times 9.8}$$

$$= 0.06m$$

Hence for any pipeline system the total form resistance to flow can be determined by adding together the individual head losses at each valve, fitting or change in cross section.

Equivalent Length (Le)

Form losses in fittings, valves, etc., are sometimes expressed in terms of an 'equivalent length' of straight pipe which has the same resistance to flow as the valve or fitting. By equating the form loss expression to the Darcy formula for energy loss in pipelines

$$\text{i.e } H_L = K \bullet \frac{V^2}{2^g} = F \bullet \frac{Le}{D} \bullet \frac{V^2}{2^g}$$

the 'equivalent length' Le is given by

$$Le = \frac{KD}{f}$$

As a general rule the 'equivalent length ' method is not preferred as the value of the friction factor f depends not only on the Colebrook White roughness coefficient chosen but also on the particular pipe size and velocity of flow

ID (m)	Friction Factor f
0.5	0.021
0.10	0.018
0.15	0.0165
0.20	0.0158
0.30	0.0146
0.45	0.0135

Value of Darcy Friction Factor f at Flow Velocity of 1 m/s and Roughness Coefficient 0.003 mm

With increasing flow velocity, f will decrease.

At V = 4 m/s, t is approximately 75% of the above values, i.e. the values in the table above are conservative.

Example

What is the equivalent straight pipe length of a DN 100 short radius 90° elbow?

$$Le = \frac{KD}{f} = \frac{1.1}{0.018} \text{ X } 0.096 = 5.9m$$

K = 1.1 D = 0.096m f = 0.018

DESiGN

Worked Examples

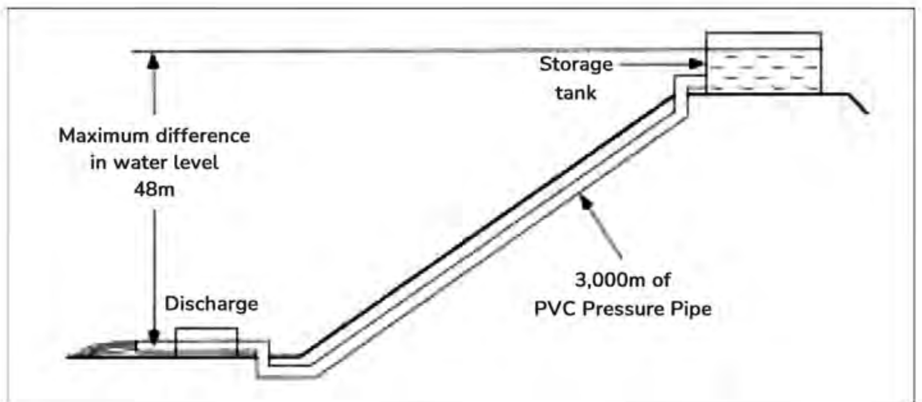
Example 1

Gravity Main

- Water is required to flow at a discharge of 36,000 litres per hour from a storage tank on a hill to an outlet 3 km away.
- The difference in water level between the tank and the discharge end is 48m.

1 What size and class of Dubai Plast PVC-U pipe is required?
2 What is the flow velocity and actual discharge?

Discharge Q = 36,000 L/s = 10 L/s $\frac{H}{L} = \frac{48m}{3.000m} \times 100 = 1.6m/100m$



1 Minimum Class required is PN 6. From flow chart: find intersection of Q = 10 L/s (Left hand scale)
and H/L = 1.6 (Top scale)
Read off nearest larger pipe DN 100 (Right hand scale). Therefore DN 100, PN 6 pipe is
2 Now that the pipe has been selected, check actual flow.
Using PN 6 flow chart find the intersection of DN 100 line and Hydraulic Gradient = 1.6m/100m.

Velocity V = 1.41m/s (Bottom scale) **Discharge** Q = 12.8L/s (Left hand scale) = 46,080L/h

Example 2

Pumping Main & Form Losses

A pumping line is required to deliver 35 L/s from a low level dam to a high level holding tank. The length of the line is 5 km. The maximum level of the holding tank is 100 m and the minimum level of the dam is 60 m. To avoid the need for sophisticated water hammer control gear, the engineer wishes to restrict flow velocity to a maximum 1 m/s. Calculate: Try PN6 PVC-U pipe.

Discharge Q = 35L/s (Left hand scale).

1 The size and class of Miga Plast PVC-U pipe required.

2 The form head losses due to valves and fittings.

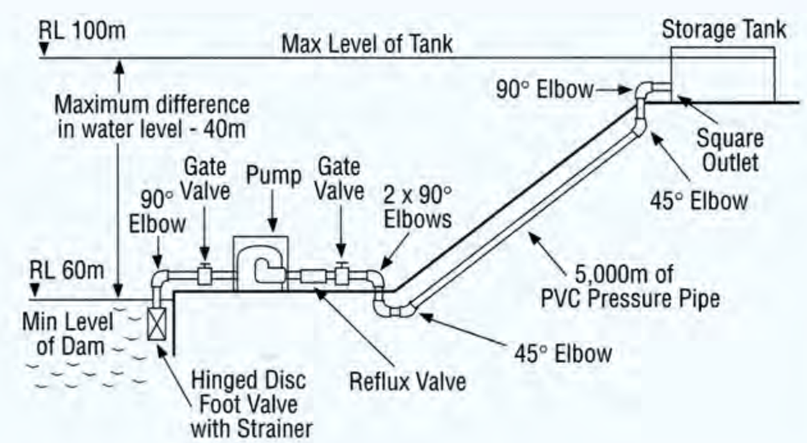
3 The head required at the pump.

This intersects the 1m/sec velocity line (Bottom scale) at approximately DN 200 pipe. Try DN200 and DN225:

Size DN	Flow velocity (Bottom scale)	Hydraulic gradient (Top scale)
200	0.99 m/s	0.36m/100m
225	0.81 m/s	0.22m/100m

Calculate friction head in pipelines

Size DN	Pipe friction head
200	0.36 x 5000m/100m = 18m
225	0.22 x 5000m/100m = 11m



DESiGN

- The pipe friction Head
- Form head losses :

1 **DN200 pipe.** First calculate velocity head $\frac{V^2}{2^9} - \frac{0.99^2}{2 \times 9.8} = 0.05m$

Valve or Fitting	K value	Head loss (m)
Hinge disc foot valve (with strainer)	15.00	15.00 x 0.05 = 0.75
2 Gate valves (fully open)	0.2	2 x 0.2 x 0.05 = 0.02
1 Reflux valve	2.50	2.50 x 0.05 = 0.125
4 x 90° elbows	1.10	4 x 1.10 x 0.05 = 0.220
2 x 45° elbows	0.35	2 x 0.35 x 0.05 = 0.035
1 square outlet	1.00	1.00 x 0.05 = 0.050
	Total form head losses	= 1.2m

2 **DN 225 pipe. Form head losses = 0.72m**

- Total pumping head = pipe friction head + form losses + static head

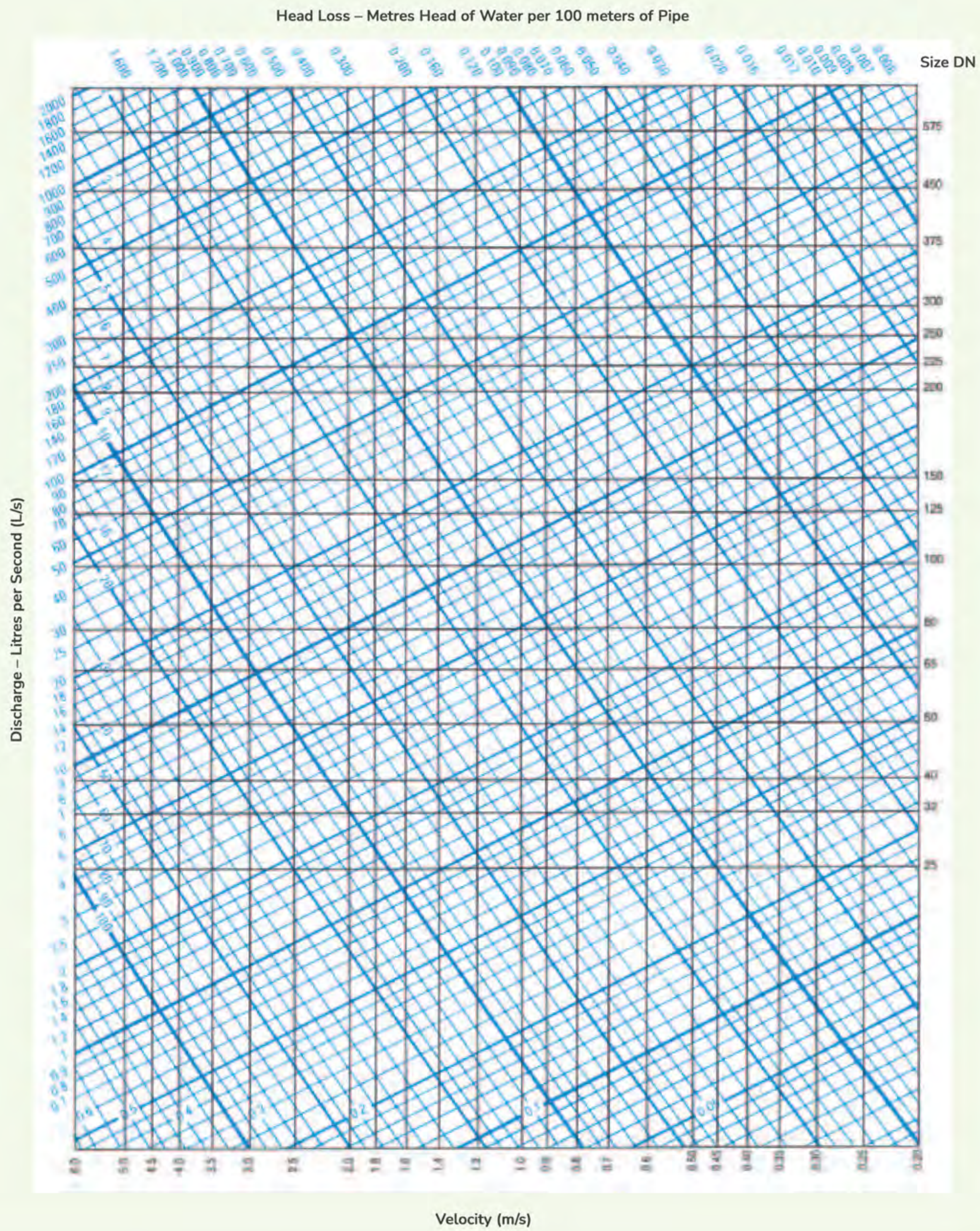
Static head = difference in level storage tank to dam
= 100m - 60m = 40m

Size DN	Friction head	+	Form losses	+	Static head	+	Total head
200	18m	+	1.2m	+	40m	+	59.2m
225	11m	+	0.7m	+	40m	+	51.7m

Conclusion:

It can be seen that PN 6 PVC-U pipe is required. The effect of valves and fittings in a system such as this is far outweighed by the pipe flow friction and static head losses. The most efficient and economic choice would be the DN 200 pipeline, giving a pumping head of 59.2 m and a flow velocity of 0.99 m/s.

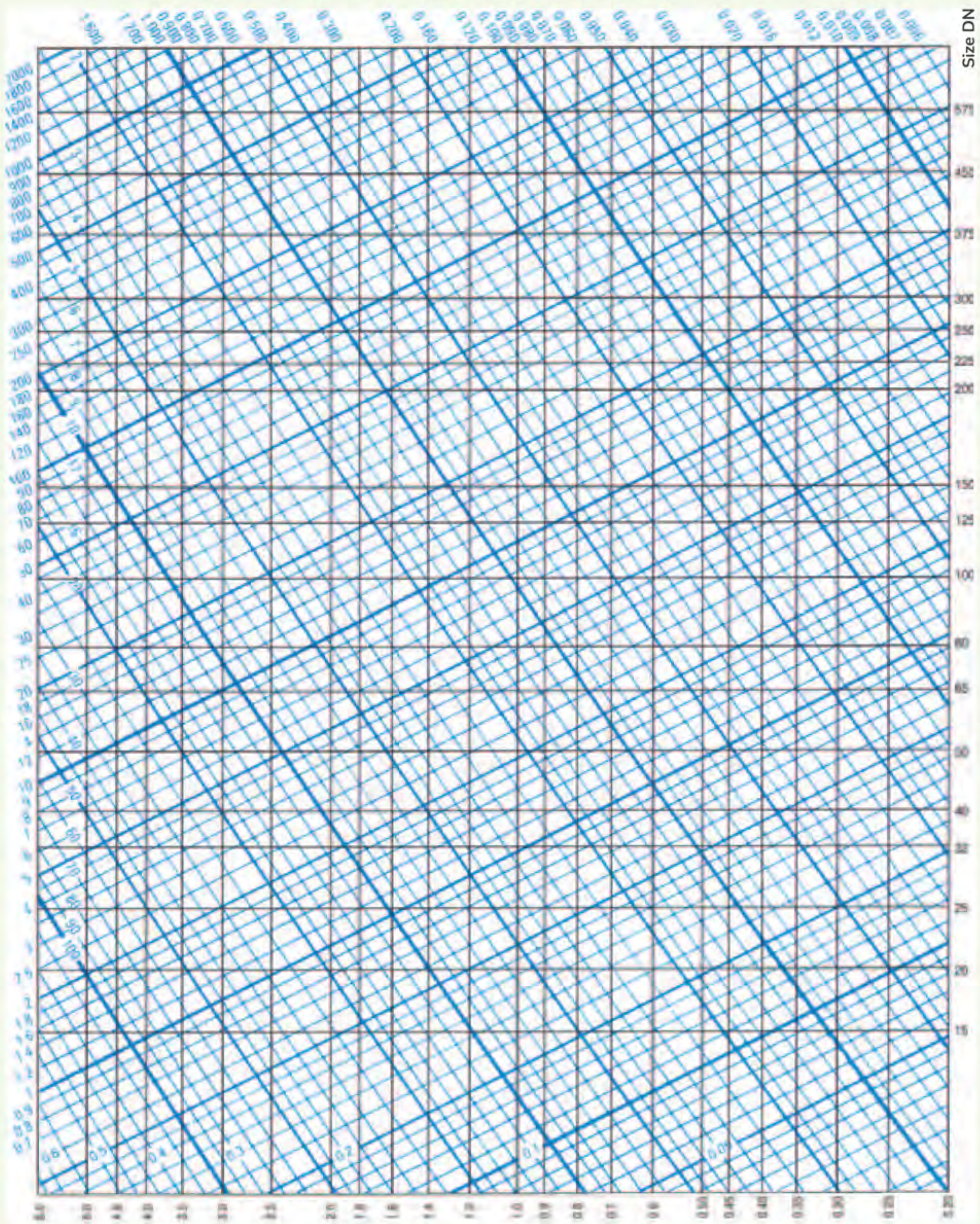
FLOW CHART FOR PVC-U PRESSURE, PIPE SERIES 1 – PN9



FLOW CHART FOR PVC-U PRESSURE, **PIPE SERIES 1 – PN15**

Head Loss – Metres Head of Water per 100 meters of Pipe

Discharge – Litres per Second (L/s)



Velocity (m/s)

PRESSURE CONSIDERATIONS

Static Stresses

The hydrostatic pressure capacity of PVC pipe is related to the following variables:

1. The ratio between the outer diameter and the wall thickness (dimension ratio).
2. The hydrostatic design stress for the PVC material.
3. The operating temperature.
4. The duration of the stress applied by the internal hydrostatic pressure.

The pressure rating of PVC pipe can be ascertained by dividing the long-term pressure capacity of the pipe by the desired factor of safety. Although PVC pipe can withstand short-term hydrostatic pressure applications at levels substantially higher than pressure rating or class, the performance of PVC pipe in response to applied internal hydrostatic pressure should be based on the pipe's long- term strength.

By international convention, the relationship between the internal pressure in the pipe, the diameter and wall thickness and the circumferential hoop stress developed in the wall, is given by the Barlow Formula, which can be expressed in the following forms:

$$P = \frac{2TS}{D_{mean}} = \frac{2T_{min}S}{(D_{mean} - t_{min})}$$

and alternatively, for pipe design,

$$T_{min} = \frac{PDm_{min}}{2S + P}$$

WHERE:

T	=	Wall thickness (mm)
D_m	=	Mean outside diameter (mm)
D_{mean}	=	Diameter the mid wall (mm)
P	=	Internal pressure (MPa)
S	=	Circumferential hoop stress (MPa)

These formulas have been standardised for use in design, routine testing and research work and are thus applicable at all levels of pressure and stress. They form the basis for establishment of ultimate material limitations for plastic pipes by pressure testing.

For design purposes, P is taken as the maximum allowable working pressure with P being the maximum allowable hoop stress (at 20 C) given below:

PVC-U pipes up to DN150	11MPa
DN175 PVC-U pipes and larger	12.3MPa
Material Class 400 Oriented PVC pipes (PVC-O)	25MPa
Material Class 450 Orientated PVC pipes (PVC-O)	28MPa
Material Class 500 Orientated PVC pipes (PVC-O)	32MPa
Modified PVC pipes (PVC-M)	17.5MPa

PRESSURE CONSIDERATIONS

Dynamic Stresses

PVC pressure pipes are designed on the basis of a burst regression line for pipes subjected to constant internal pressure. From this long term testing and analysis, nominal working pressure classes are allocated to pipes as a first indication of the duty for which they are suitable. However, there are many other factors which must be considered, including the effects of dynamic loading. Whilst most gravity pressure lines operate substantially under constant pressure, pumped lines frequently do not. Pressure fluctuations in pumped mains result from events such as pump start-up and shutdown and valves opening and closing. It is essential that the effects of this type of loading be considered in the pipeline design phase to avoid premature failure.

The approach adopted for pipe design and class selection when considering these events depends on the anticipated frequency of the pressure fluctuation. For frequent, repetitive pressure variations, the designer must consider the potential for fatigue and design accordingly. For random, isolated surge events, for example, those which result from emergency shutdowns, the designer must ensure that the maximum and minimum pressures experienced by the system are within acceptable limits.

Definitions Surge

For the purposes of this document, surge is defined as a rapid, very shortterm pressure variation caused by an accidental, unplanned event such as an emergency shutdown resulting from a power failure. Surge events are characterised by high pressure rise rates with no time spent at the peak pressure.

Diurnal pressure changes

Diurnal pressure changes are gradual pressure changes which occur in most distribution pipelines as a result of demand variation. It is generally accepted that diurnal pressure changes will not cause fatigue. The only design consideration required for this type of pressure fluctuation is that the maximum pressure should not exceed the pressure rating of the pipe.

Fatigue

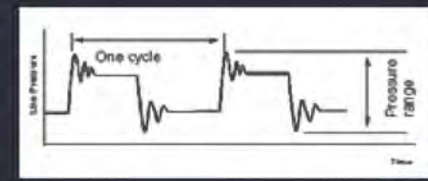
In contrast, fatigue is associated with a large number of repetitive events. Many materials will fail at a lower stress when subjected to cyclic of repetitive loads than when under static loads. This type of failure is known as (cyclic) fatigue. For thermoplastic pipe materials, fatigue is only relevant where a large number of cycles are anticipated. The important factors to consider are the magnitude of the stress fluctuation, the loading frequency and the intended service life.

Pressure Range

Diurnal pressure changes are gradual pressure changes which occur in most distribution pipelines as a result of demand variation. It is generally accepted that diurnal pressure changes will not cause fatigue. The only design consideration required for this type of pressure fluctuation is that the maximum pressure should not exceed the pressure rating of the pipe.

Definition of Pressure Range and effect of Surges

For simplicity, the pressure range is defined as the maximum pressure minus the minimum pressure, including all transients, experienced by the system during normal operations. The effect of accidental conditions such as power failure may be excluded. This is illustrated in the figure near .



This figure also illustrates the definition of a cycle as a repetitive event.
In some cases, the cycle pattern will be complex and it may be necessary to also consider the contribution of secondary cycles.

Pumping systems are frequently subject to surging following the primary pressure transient on switching. Such pressure surging decays exponentially, and in effect the system is subjected to a number of minor pressure cycles of reducing magnitude. In order to take this into account, the effect of each minor cycle is related to the primary cycle in terms of the number of cycles which would produce the same crack growth as one primary cycle. According to this technique, a typical exponentially decaying surge regime is equivalent to 2 primary cycles. Thus for design purposes, the primary pressure range only is considered, with the frequency doubled.

Complex Cycle Patterns

In general, a similar technique may be applied to any situation where smaller cycles exist in addition to the primary cycle. Empirically crack growth is related to stress cycle amplitude according to (II)3.2. Thus n secondary cycles of magnitude nn, may be deemed equivalent in effect to one primary cycle,

Where $n = \left(\frac{\Delta\sigma_0}{\Delta\sigma_2}\right)^{3.2}$

For example a secondary cycle of half the magnitude of the primary cycle: $n = \left(\frac{2}{1}\right)^{3.2} = 9.2$

so it would require 9 secondary cycles to produce the same effect as one primary cycle. If they are occurring at the same frequency, the effective frequency of primary cycling is increased by 1.1 for the purpose of design.

Effect of Temperature

The available data indicates that there is no evidence of a change in response of PVC fatigue crack growth rates with temperature, at least in the lower temperature region where results are available. This is logically consistent with known fatigue behavior, since the propensity to propagate a crack reduces with increasing ductility which results in yielding and blunting of the crack tip and a reduction in local stress intensity. Thus one would expect that PVC, with increasing ductility and decreasing yield strength, would not be degraded in fatigue performance at higher temperatures.

It follows that, while normal derating principles must be applied in class selection for static pressures, (ductile burst), no additional temperature derating need be applied for dynamic design.

ie. Select the highest class arrived via:

- **A** Static design including temperature derating.
- **B** Dynamic design as covered herein.

DESiGN

Safety Factors

The tabulated fatigue cycle factors represent the lower bound of test data generated from a number of different sources over the last few years on commercially produced PVC pipes. The mean line for this data is approximately half a log decade higher than this, and the relationship assumes no threshold stress level at low stress amplitudes and long times.

It is therefore considered conservative and no additional safety factor need be applied in general. However, where the magnitude or frequency of dynamic stresses cannot be estimated in design with any reasonable degree of accuracy, appropriate caution should obviously be applied. This judgement is in the hands of the designer.

Whilst it is always possible to predict the steady operating conditions with good accuracy, it will occasionally be the case, in complex systems, that it is impossible to predict the extent of surge pressures. In such circumstances, relatively low cost surge mitigation techniques, for example the solid state soft-start motor controllers should be considered. It is of course recommended that actual operating conditions for all systems should be checked by measurement, as a matter of routine, when the system is commissioned. Should surge pressure amplitudes in the event exceed expected levels, it is relatively easy matter to retrofit control equipment to ensure that they are kept in check.

Design Hints

To reduce the effect of dynamic fatigue in an installation, the designer can:

Limit the number of cycles by:

A Increasing well capacity for a sewer pumping station.

B Matching pump performance to tank size to eliminate short demand cycles for an automatic pressure unit

C Using double-acting float valves or limiting starts on the pump by the use of a time clock when filling a reservoir

Reduce the dynamic range by:

A Eliminating excessive water hammer

Using a larger bore pipe to reduce friction

Fittings

C fittings present a problem worthy of special consideration. Complex stress patterns in fittings can 'amplify' the apparent stress cycle. An apparently harmless pressure cycle can thus produce a damaging stress cycle leading to a relatively short fatigue life. This factor is particularly severe in the case of branch fittings such as tees, where amplification factors up four times have been noted. The condition can be aggravated further by the existence of stress cycling from other sources, for example bending stresses induced flexing under hydraulic thrust in improperly supported systems.

SCHEDULE 80 IPS PVC PLASTIC PIPE

C = 150 . PRESSURE LOSS (BAR / 100 METERS)

Nominal size		1"		1¼"		1½"		2"		2½"		3"		4"		6"		8"	
Pipe OD		1.315"		1.66		1.900"		2.375"		2.875"		3.500"		4.500"		6.625"		6.625"	
Pipe iD		0.957"		1.278"		1.500"		1.939"		2.323"		2.900"		3.826"		5.761"		5.761"	
Pipe iD mm		24.31		32.46		38.1		49.25		59.00		73.66		97.18		146.33		146.33	
Wall Thick		0.179		0.191"		0.200"		0.218"		0.276"		0.300"		0.337"		0.432"		0.432"	
Flow l/min	Flow m³/hr	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss
3.80	0.25	0.1	0.01																
7.60	0.5	0.3	0.05																
11.40	0.75	0.4	0.11	0.3	0.03														
15.10	1	0.6	0.19	0.3	0.05	0.2	0.02												
26.50	1.5	0.9	0.40	0.5	0.10	0.4	0.04	0.2	0.01										
34.10	2	1.2	0.68	0.7	0.17	0.5	0.08	0.3	0.02										
41.60	2.5	1.5	1.02	0.8	0.25	0.6	0.11	0.4	0.03										
49.20	3	1.8	1.43	1.0	0.35	0.7	0.16	0.4	0.05										
56.80	3.5	2.1	1.90	1.2	0.47	0.9	0.21	0.5	0.06										
68.10	4	2.4	2.44	1.3	0.60	1.0	0.27	0.6	0.08										
83.30	5	3.0	3.69	1.7	0.90	1.2	0.41	0.7	0.12										
98.40	6			2.0	1.26	1.5	0.58	0.9	0.17	0.6	0.07	0.4	0.02						
117.30	7			2.3	1.68	1.7	0.77	1.0	0.22	0.7	0.09	0.5	0.03						
132.50	8			2.7	2.15	1.9	0.99	1.2	0.28	0.8	0.12	0.5	0.04						
151.40	9			3.0	2.68	2.2	1.23	1.3	0.35	0.9	0.15	0.6	0.05						
166.60	10					2.4	1.49	1.5	0.43	1.0	0.18	0.7	0.06						
181.70	11					2.7	1.78	1.6	0.51	1.1	0.21	0.7	0.07						
200.30	12					2.9	2.09	1.7	0.60	1.2	0.25	0.8	0.08						
215.80	13							1.9	0.69	1.3	0.29	0.8	0.10						
234.70	14							2.0	0.80	1.4	0.33	0.9	0.11						
249.80	15							2.2	0.91	1.5	0.38	1.0	0.13						
265.00	16							2.3	1.02	1.6	0.42	1.0	0.14						
283.90	17							2.5	1.14	1.7	0.47	1.1	0.16						
299.00	18							2.6	1.27	1.8	0.53	1.2	0.18						
318.00	19									1.9	0.58	1.2	0.20						
333.10	20									2.0	0.64	1.3	0.22						
348.30	21									2.1	0.70	1.4	0.24						
367.20	22									2.2	0.76	1.4	0.26						
382.30	23									2.3	0.83	1.5	0.28						
401.30	24									2.4	0.9	1.6	0.30						
416.40	25									2.5	0.97	1.6	0.33						
431.50	26											1.7	0.35						
450.50	27											1.8	0.38						
465.60	28											1.8	0.41	1.0	0.11				
484.50	29											1.9	0.43	1.1	0.11				
499.70	30											2.0	0.46	1.1	0.12				
583.00	35											2.3	0.61	1.3	0.16				
666.20	40											2.6	0.78	1.5	0.20				
749.50	45													1.7	0.25				
832.80	50													1.9	0.31				
916.10	55													2.1	0.37				
999.30	60													2.2	0.43				
1082.60	65													2.4	0.50	1.1	0.07		
1165.90	70													2.6	0.57	1.2	0.08		
1249.20	75													2.8	0.65	1.2	0.09		
1332.50	80													3.0	0.73	1.3	0.10		
1415.70	85													3.2	0.82	1.4	0.11		
1499.00	90													3.4	0.91	1.5	0.12		
1665.60	100															1.7	0.15	0.9	0.04
1832.10	110															1.8	0.18	1.0	0.05
1998.70	120															2.0	0.21	1.1	0.05
2165.30	130															2.1	0.25	1.2	0.06
2331.80	140															2.3	0.28	1.3	0.07
2498.40	150															2.5	0.32	1.4	0.08

SCHEDULE 40 IPS PVC PLASTIC PIPE

C = 150 . PRESSURE LOSS (BAR / 100 METERS)

Nominal size		1"		1¼"		1½"		2"		2½"		3"		4"		6"		8"	
Pipe OD		1.315"		1.66"		1.900"		2.375"		2.375"		3.500"		4.500"		6.625"		8.625"	
Pipe ID		1.049"		1.380"		1.610"		2.067"		2.469"		3.068"		4.026"		6.065"		7.981"	
Pipe ID mm		26.64		35.05		40.89		52.50		62.71		77.93		102.26		154.05		202.72	
wall thick		0.133"		0.140"		0.145"		0.154"		0.203"		0.216"		0.237"		0.280"		0.322"	
Flow l/min	Flow m³/hr	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss
3.8	0.25	0.1	0.01																
7.6	0.5	0.2	0.03																
11.4	0.75	0.4	0.07	0.2	0.02														
15.1	1	0.5	0.12	0.3	0.03	0.2	0.01												
26.5	1.5	0.7	0.25	0.4	0.07	0.3	0.03	0.2	0.01										
34.1	2	1.0	0.43	0.6	0.11	0.4	0.05	0.3	0.02										
41.6	2.5	1.2	0.65	0.7	0.17	0.5	0.08	0.3	0.02										
49.2	3	1.5	0.92	0.9	0.24	0.6	0.11	0.4	0.03										
56.8	3.5	1.7	1.22	1.0	0.32	0.7	0.15	0.4	0.04										
68.1	4	2.0	1.56	1.2	0.41	0.8	0.19	0.5	0.06										
83.3	5	2.5	2.36	1.4	0.62	1.1	0.29	0.6	0.09										
98.4	6			1.7	0.87	1.3	0.41	0.8	0.12	0.5	0.05	0.3	0.02						
117.3	7			2.0	1.16	1.5	0.55	0.9	0.16	0.6	0.07	0.4	0.02						
132.5	8			2.3	1.48	1.7	0.70	1.0	0.21	0.7	0.09	0.5	0.03						
151.4	9			2.6	1.84	1.9	0.87	1.2	0.26	0.8	0.11	0.5	0.04						
116.6	10			2.9	2.24	2.1	1.06	1.3	0.31	0.9	0.13	0.6	0.05						
181.7	11					2.3	1.26	1.4	0.37	1.0	0.16	0.6	0.05						
200.6	12					2.5	1.48	1.5	0.44	1.1	0.18	0.7	0.06						
215.8	13					2.7	1.72	1.7	0.51	1.2	0.21	0.8	0.07						
234.7	14					3.0	1.97	1.8	0.58	1.3	0.25	0.8	0.09						
249.8	15					3.2	2.24	1.9	0.66	1.3	0.28	0.9	0.10						
265.0	16							2.1	0.75	1.4	0.31	0.9	0.11						
283.9	17							2.2	0.84	1.5	0.35	1.0	0.12						
299.0	18							2.3	0.93	1.6	0.39	1.0	0.14						
318.0	19							2.4	1.03	1.7	0.43	1.1	0.15						
333.1	20							2.6	1.13	1.8	0.48	1.2	0.17						
348.3	21									1.9	0.52	1.2	0.18						
367.2	22									2.0	0.57	1.3	0.20						
382.3	23									2.1	0.62	1.3	0.21						
401.3	24									2.2	0.67	1.4	0.23						
416.4	25									2.2	0.72	1.5	0.25						
431.5	26									2.3	0.77	1.5	0.27						
450.5	27									2.4	0.83	1.6	0.29						
465.6	28											1.6	0.31						
484.5	29											1.7	0.33						
499.7	30											1.7	0.35						
583.0	35											2.0	0.47	1.2	0.12				
666.2	40											2.3	0.60	1.4	0.16				
749.5	45											2.6	0.74	1.5	0.20				
832.8	50											2.9	0.90	1.7	0.24				
916.1	55													1.9	0.29				
999.3	60													2.0	0.34				
1082.6	65													2.2	0.39	1.0	0.07		
1165.9	70													2.4	0.45	1.0	0.08		
1249.2	75													2.5	0.51	1.1	0.09		
1332.5	80													2.7	0.57	1.2	0.10		
1415.7	85													2.9	0.64	1.3	0.11		
1499.0	90													3.0	0.71	1.3	0.12	0.8	0.03
1665.6	100															1.5	0.15	0.9	0.03
1832.1	110															1.6	0.18	0.9	0.04
1998.7	120															1.8	0.21	1.0	0.04
2165.3	130															1.9	0.25	1.1	0.05
2331.8	140															2.1	0.28	1.2	0.06
2498.4	150															2.1	0.32	1.3	0.07

UPVC PIPE CLASS 5 (16 BAR)

C = 150 . PRESSURE LOSS (BAR / 100 METERS)

Nominal size		25 mm		32 mm		40 mm		50 mm		63 mm		75 mm		90 mm		110 mm		160 mm		200 mm	
Pipe ID		21.2 mm		27.2 mm		34 mm		42.6 mm		53.6 mm		63.8 mm		76.6 mm		93.6 mm		136.2 mm		170.2 mm	
Pipe OD		25 mm		32 mm		40 mm		50 mm		63 mm		75 mm		90 mm		110 mm		160 mm		200 mm	
Wall Thick		1.5 mm		1.8 mm		1.9 mm		2.4 mm		3 mm		3.6 mm		4.3 mm		5.3 mm		7.7 mm		14.9 mm	
Flow l/min	Flow m³/hr	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss
3.8	0.25	0.2	0.03																		
7.6	0.5	0.4	0.10																		
11.4	0.75	0.6	0.21	0.4	0.06																
15.1	1	0.8	0.36	0.5	0.11	0.3	0.04														
26.5	1.5	1.2	0.77	0.7	0.23	0.5	0.08	0.3	0.03												
34.1	2	1.6	1.32	1.0	0.39	0.6	0.13	0.4	0.04												
41.6	2.5	2	1.99	1.2	0.59	0.8	0.20	0.5	0.07												
49.2	3	2.4	2.79	1.4	0.83	0.9	0.28	0.6	0.09												
56.8	3.5			1.7	1.10	1.1	0.37	0.7	0.12												
68.1	4			1.9	1.41	1.2	0.48	0.8	0.16												
83.3	5			2.4	2.13	1.5	0.72	1.0	0.24												
98.4	6					1.8	1.01	1.2	0.34	0.7	0.11										
117.3	7					2.1	1.34	1.4	0.45	0.9	0.15										
132.5	8					2.4	1.72	1.6	0.57	1	0.19										
151.4	9							1.8	0.71	1.1	0.23										
166.6	10							1.9	0.87	1.2	0.28										
181.7	11							2.1	1.03	1.4	0.34	1	0.14								
200.6	12							2.3	1.21	1.5	0.40	1	0.17								
215.8	13									1.6	0.46	1.1	0.20								
234.7	14									1.7	0.53	1.2	0.23								
249.8	15									1.8	0.60	1.3	0.26								
256	16									2.0	0.68	1.4	0.29	1	0.12						
283.9	17									2.1	0.76	1.5	0.32	1	0.13						
299	18									2.2	0.84	1.6	0.36	1.1	0.15						
318	19									2.3	0.93	1.7	0.40	1.1	0.16						
333.1	20									2.5	1.02	1.7	0.44	1.2	0.18						
348.3	21											1.8	0.48	1.3	0.20						
367.2	22											1.9	0.52	1.3	0.21						
382.3	23											2.0	0.57	1.4	0.23						
401.3	24											2.1	0.61	1.4	0.25	1.0	0.09				
416.4	25											2.2	0.66	1.5	0.27	1.0	0.10				
431.5	26											2.3	0.71	1.6	0.29	1.0	0.11				
450.5	27											2.3	0.76	1.6	0.31	1.1	0.12				
465.6	28											2.4	0.82	1.7	0.33	1.1	0.13				
484.5	29											2.5	0.87	1.7	0.36	1.2	0.13				
499.7	30													1.8	0.38	1.2	0.14				
583	35													2.1	0.51	1.4	0.19				
666.2	40													2.4	0.65	1.6	0.24				
749.5	45													2.7	0.81	1.8	0.30				
832.8	50															2.0	0.37	1.0	0.06		
916.1	55															2.2	0.44	1.0	0.07		
999.3	60															2.4	0.52	1.1	0.08		
1082.6	65															2.6	0.60	1.2	0.10		
1156.9	70															2.8	0.69	1.3	0.11		
1249.2	75															3.0	0.78	1.4	0.13		
1332.5	80															3.2	0.88	1.5	0.14		
1415.7	85																	1.6	0.16		
1499	90																	1.7	0.18		
1665.6	100																	1.9	0.21	1.2	0.07
1832.1	110																	2.1	0.26	1.3	0.09
1998.7	120																	2.3	0.30	1.5	0.10
2165.3	130																	2.5	0.35	1.6	0.12
2331.8	140																	2.7	0.40	1.7	0.14
2498.4	150																	2.9	0.45	1.8	0.15

UPVC PIPE CLASS 4 (10 BAR)

C = 150 . PRESSURE LOSS (BAR / 100 METERS)

Nominal size		25 mm		32 mm		40 mm		50 mm		63 mm		75 mm		90 mm		110 mm		160 mm		200 mm	
Pipe ID		22 mm		28.4 mm		36.2 mm		45.2 mm		57 mm		67.8 mm		81.4 mm		99.4 mm		144.6 mm		180.8 mm	
Pipe OD		25 mm		32 mm		40 mm		50 mm		63 mm		75 mm		90 mm		110 mm		160 mm		200 mm	
Wall Thick		1.5 mm		1.8 mm		1.9 mm		2.4 mm		3.0 mm		3.6 mm		4.3 mm		5.3 mm		7.7 mm		9.6 mm	
Flow l/min	Flow m³/hr	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss
3.8	0.25	0.2	0.02																		
7.6	0.5	0.4	0.08																		
11.4	0.75	0.5	0.18																		
15.1	1	0.7	0.30																		
26.5	1.5	1.1	0.64	0.7	0.19																
34.1	2	1.5	1.10	0.9	0.32																
41.6	2.5	1.8	1.66	1.1	0.48	0.7	0.15														
49.2	3	2.2	2.33	1.3	0.67	0.8	0.21														
56.8	3.5	2.6	3.10	1.5	0.89	0.9	0.27														
68.1	4			1.8	1.14	1.1	0.35	0.7	0.12												
83.3	5			2.2	1.73	1.3	0.53	0.9	0.18												
98.4	6			2.6	0.42	1.6	0.74	1.0	0.25	0.7	0.08										
117.3	7					1.9	0.99	1.2	0.34	0.8	0.11										
132.5	8					2.2	1.27	1.4	0.43	0.9	0.14										
151.4	9					2.4	1.58	1.6	0.53	1.0	0.17	0.7	0.07								
166.6	10							1.7	0.65	1.1	0.21	0.8	0.09								
181.7	11							1.9	0.77	1.2	0.25	0.8	0.11								
200.3	12							2.1	0.91	1.3	0.29	0.9	0.13								
215.8	13							2.3	1.06	1.4	0.34	1	0.15								
234.7	14							2.4	1.21	1.5	0.39	1.1	0.17								
249.8	15							2.6	1.38	1.6	0.44	1.2	0.19								
265.0	16									1.7	0.50	1.2	0.22	0.9	0.09						
283.9	17									1.9	0.56	1.3	0.24	0.9	0.10						
299.0	18									2.0	0.62	1.4	0.27	1.0	0.11						
318.0	19									2.1	0.69	1.5	0.30	1.0	0.12						
333.1	20									2.2	0.76	1.5	0.33	1.1	0.13						
348.3	21									2.3	0.83	1.6	0.36	1.1	0.15						
367.2	22									2.4	0.90	1.7	0.39	1.2	0.16						
382.3	23									2.5	0.98	1.8	0.42	1.2	0.17						
401.3	24											1.8	0.46	1.3	0.19						
416.4	25											1.9	0.49	1.3	0.20						
431.5	26											2	0.53	1.4	0.22	0.9	0.08				
450.5	27											2.1	0.57	1.4	0.23	1.0	0.09				
465.6	28											2.2	0.61	1.5	0.25	1.0	0.09				
484.5	29											2.2	0.65	1.5	0.27	1.0	0.10				
499.7	30											2.3	0.69	1.6	0.28	1.1	0.11	0.5	0.02		
583.0	35													1.9	0.38	1.3	0.14	0.6	0.02		
666.2	40													2.1	0.48	1.4	0.18	0.7	0.03		
749.5	45													2.4	0.60	1.6	0.23	0.8	0.04		
832.8	50															1.8	0.28	0.8	0.04		
916.1	55															2.0	0.33	0.9	0.05		
999.3	60															2.1	0.39	1.0	0.06		
1082.6	65															2.3	0.45	1.1	0.07		
1165.9	70															2.5	0.51	1.2	0.08		
1249.2	75															2.7	0.58	1.3	0.09		
1332.5	80															2.9	0.66	1.4	0.11		
1415.7	85															3.0	0.74	1.4	0.12		
1499.0	90															3.2	0.82	1.5	0.13	1.0	0.04
1665.6	100																	1.7	0.16	1.1	0.05
1832.1	110																	1.9	0.19	1.2	0.06
1998.7	120																	2.0	0.22	1.3	0.08
2165.3	130																	2.2	0.26	1.4	0.09
2331.8	140																	2.4	0.30	1.5	0.10
2498.4	150																	2.5	0.34	1.6	0.11

UPVC PIPE CLASS 3 (6 BAR)

C = 150 . PRESSURE LOSS (BAR / 100 METERS)

Nominal size		40 mm		50mm		63 mm		75 mm		90 mm		110 mm		160 mm		200 mm	
Pipe ID		36.4 mm		46.4mm		59.2 mm		70.6 mm		84.6 mm		103.6 mm		153.2 mm		188.2 mm	
Pipe OD		40 mm		50mm		63 mm		75 mm		90 mm		110 mm		160 mm		200 mm	
Wall Thick		1.8 mm		1.8 mm		1.9 mm		2.2 mm		2.7 mm		3.2 mm		3.4 mm		5.9 mm	
Flow l/min	Flow m³/hr	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss	velocity m/s	bar loss
3.8	0.25																
7.6	0.5																
11.4	0.75																
15.1	1	0.3	0.03														
26.5	1.5	0.4	0.06	0.2	0.02												
34.1	2	0.5	0.09	0.3	0.03												
41.6	2.5	0.7	0.14	0.4	0.04												
49.2	3	0.8	0.20	0.5	0.06												
56.8	3.5	0.9	0.27	0.6	0.08												
68.1	4	1.1	0.34	0.7	0.10												
83.3	5	1.3	0.52	0.8	0.16												
98.4	6	1.6	0.72	1	0.22	0.6	0.07	0.4	0.03								
117.3	7	1.9	0.96	1.1	0.30	0.7	0.09	0.5	0.04								
132.5	8	2.1	1.23	1.3	0.38	0.8	0.12	0.6	0.05								
151.4	9	2.4	1.53	1.5	0.47	0.9	0.14	0.6	0.06								
166.6	10	2.7	1.86	1.6	0.57	1	0.17	0.7	0.07								
181.7	11			1.8	0.68	1.1	0.21	0.8	0.09	0.5	0.04						
200.6	12			2	0.80	1.2	0.24	0.9	0.10	0.6	0.04						
215.8	13			2.1	0.93	1.3	0.28	0.9	0.12	0.6	0.05						
234.7	14			2.3	1.07	1.4	0.33	1	0.14	0.7	0.06						
249.8	15			2.5	1.21	1.5	0.37	1.1	0.16	0.7	0.06	0.5	0.02				
265.0	16					1.6	0.42	1.1	0.18	0.8	0.07	0.5	0.03				
283.9	17					1.7	0.47	1.2	0.20	0.8	0.08	0.6	0.03				
299.0	18					1.8	0.52	1.3	0.22	0.9	0.09	0.6	0.03				
318.0	19					1.9	0.57	1.3	0.24	0.9	0.10	0.6	0.04				
333.1	20					2	0.63	1.4	0.27	1.0	0.11	0.7	0.04				
348.3	21					2.1	0.69	1.5	0.29	1.0	0.12	0.7	0.05				
367.2	22					2.2	0.75	1.6	0.32	1.1	0.13	0.7	0.05				
382.3	23					2.3	0.82	1.6	0.35	1.1	0.14	0.8	0.05				
401.3	24							1.7	0.37	1.2	0.16	0.8	0.06				
416.4	25							1.8	0.40	1.2	0.17	0.8	0.06				
431.5	26							1.8	0.43	1.3	0.18	0.9	0.07				
450.5	27							1.9	0.47	1.3	0.19	0.9	0.07				
465.6	28							2	0.50	1.4	0.21	0.9	0.08				
484.5	29							2.1	0.53	1.4	0.22	1.0	0.08				
499.7	30							2.1	0.57	1.5	0.23	1.0	0.09				
583.0	35									1.7	0.31	1.2	0.12				
666.2	40									2.0	0.40	1.3	0.15				
749.5	45									2.2	0.50	1.5	0.19				
832.8	50											1.6	0.23				
916.1	55											1.8	0.27				
999.3	60											2.0	0.32				
1082.6	65											2.1	0.37	1.0	0.05		
1165.9	70											2.3	0.42	1.1	0.06		
1249.2	75													1.1	0.07		
1332.5	80													1.2	0.08		
1415.7	85													1.3	0.09		
1499.0	90													1.4	0.1		
1665.6	100													1.5	0.12	1.0	0.04
1832.1	110													1.7	0.14	1.1	0.05
1998.7	120													1.8	0.17	1.2	0.06
2165.3	130													2.0	0.2	1.3	0.07
2331.8	140													2.1	0.23	1.4	0.08
2498.4	150													2.3	0.26	1.5	0.09

Prudence therefore dictates that a suitable factor of safety be applied to fittings in assessing class requirements. It is recommended that the following factors be applied to the design dynamic pressure cycle for fittings:

Tees	Equal	Dx3/4D	Dx1/2D	Dx1/4D
Safety Factor	4	3	2	1.5

Reducers	Dx3/4D	Dx1/2D	Dx1/4D
Safety Factor	1.5	2	2.5

Bends	90° short	45° short	90° long	45° long
Safety Factor	3	2	2	1.5

Adaptors & Couplings	Equal Size	Wyes
Safety Factor	1	6

Expansion and Contraction

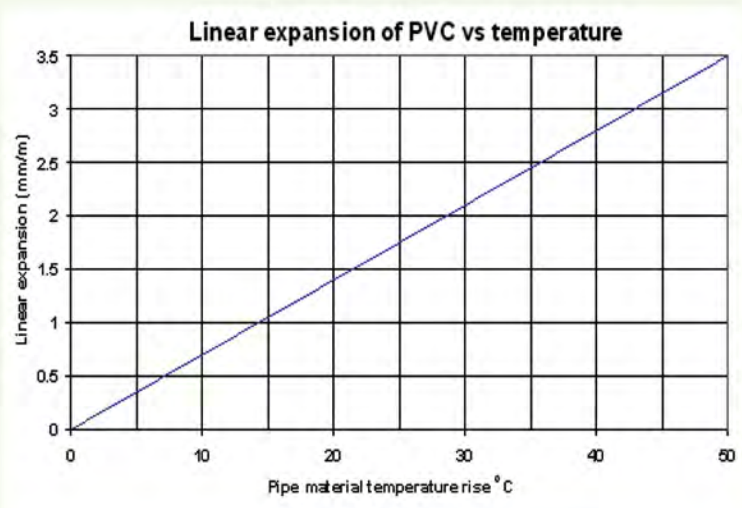
- All materials expand and contract with changes in temperature and PVC has a relatively high rate of change.
- The coefficient of thermal expansion is 7 x 10-5/°C.
- A handy rule is 7 mm change in length for every 10 metres for every 10°C change in temperature

Example

A 150 metre line of PVC pipe is being installed with the temperature at 28°C. The service temperature will be 18°C. What allowance has to be made for expansion?

- Find difference between maximum and minimum temperature, i.e. 28°C - 18° C = 10°C.
- Check chart above for expansion per metre. 10° C = 0.7 mm.
- Multiply answer by total length of line 0.7 x 150 = 105 mm

This means the pipe will contract approximately 0.1 metres when in service.
Methods of providing for thermal expansion or contraction will depend on the nature of the installation and whether it is above or below ground.



Notes.

DESiGN

THRUST SUPPORT

An imbalanced thrust is developed by a pipeline at:

- Direction changes (> 10°), e.g. tees and bends.
- Changes in pipeline size at reducers.
- Pipeline terminations, e.g. at blank ends and valves.

The support system or soil must be capable of sustaining such thrusts.

Pressure thrust results from internal pressure in the line acting on fittings. Velocity thrust results from inertial forces developed by a change in direction of flow. The latter is usually insignificant compared to the former.

PRESSURE THRUST

The pressure thrust developed for various types of fittings can be calculated as follows:

Blank ends, tees, valves	ϕ = AP 10-3
Reducers and tapers	ϕ = (A -A) P 10-3
Bends	ϕ = 2 A P sin(Φ/2) 10-3

Where:
ϕ = resultant thrust force (kN)
A = area of pipe taken at the OD (mm2)
P = design internal pressure (MPa)
ϕ = included angle of bend (degrees)

The design pressure used should be the maximum pressure, including water hammer, to be applied to the line. This will usually be the field test pressure.

DESiGN

THRUST SUPPORT

Pressure Thrust at Fittings in kN for each 10 meters Head of Water
Series 1 pipe

Size	Area	Bends				Tees
DN	(mm²)	11 1/4²	22 1/2°	45°	90°	Ends
15	363	0.01	0.01	0.03	0.05	0.04
20	568	0.01	0.02	0.04	0.08	0.06
25	892	0.02	0.03	0.07	0.12	0.09
32	1410	0.03	0.05	0.11	0.20	0.14
40	1840	0.04	0.07	0.14	0.26	0.18
50	2870	0.06	0.11	0.22	0.40	0.28
65	4480	0.09	0.17	0.34	0.62	0.44
80	6240	0.12	0.24	0.47	0.87	0.61
100	10300	0.20	0.39	0.77	1.43	1.01
125	15500	0.30	0.59	1.16	2.15	1.52
150	20200	0.39	0.77	1.52	2.80	1.98
200	40000	0.77	1.53	3.00	5.55	3.92
225	49400	0.95	1.89	3.71	6.85	4.84
250	61900	1.19	2.37	4.65	8.58	6.07
300	78400	1.51	3.00	5.88	10.87	7.69
375	126000	2.42	4.82	9.46	17.47	12.36

Series 2 pipe

Size	Area	Bends				Tees
DN	(mm²)	11 1/4²	22 1/2°	45°	90°	Ends
100	11700	0.23	0.46	0.89	1.65	1.17
150	24800	0.48	0.96	1.89	3.50	2.47
200	42500	0.83	1.65	3.24	5.99	4.24
250	52900	1.04	2.06	4.04	7.47	5.28
300	93700	1.84	3.66	7.17	13.25	9.37
375	142700	2.80	5.57	10.92	20.18	14.27

VELOCITY THRUST

Applies only at changes in direction of flow:

F = WAV2 • 2 sin(ϕ/2) • 10^-9^ (kN)

Where:
A = cross sectional area of pipe
taken at the inside diameter (mm2)
W = density of fluid (water = 1,000)
(kg/m3) V = velocity of flow (m/s)

THRUST BLOCKS

Concrete thrust blocks are usually required to transfer unbalanced forces in buried pipelines to the surrounding soil. See Installation Guidelines for construction of thrust blocks.

To determine the bearing area of the thrust block required, divide the resultant thrust by the bearing capacity of the soil.

The bearing capacity of the soil is dependent on the mode of failure. For deep situations, compressive characteristics will govern.

For shallow cover, shearing slip failure can occur and bearing loads are very much reduced. For cover less than 600 mm, or less than three pipe diameters, or if the ground is potentially unstable, e.g. embankment conditions, a complete soil analysis should be carried out.

Slip failure may be avoided by extending the thrust block downwards with reinforcement against bending loads.

DESiGN

Example

Thrust block design for a DN100 Tee operating at 120 m head in clayey sand soil, *h=1.0m. Resultant force = 1.01 x 12 = 12.1 kN

Bearing Area = 12.1 / 92 = 0.13 m2

That is, a bearing area 0.25 m high and 0.55 m wide would be suitable.

Soil description	USBR Soil Classification see ASTM D2478	Soil Bearing Strength (kN/m²) for cover height *h			
		0.75m	1.0m	1.25m	1.5m
Well graded gravel-sand mixtures, well graded sands, little or no fines	GW,SW	57	76	95	114
Poorly graded gravels and gravel-sand mixtures, Poorly graded sands, little or no fines	GP,SP	48	64	80	97
Silty gravels, gravel-sand-silt mixtures, silty sands, sand-silt mixtures	GM,SM	48	64	80	96
Clayey gravels, gravel-sand-clay mixtures, Clayey sands, sand-clay mixtures	GC,SC	79	92	105	119
Inorganic clays of low to med plasticity, gravelly clays, sandy clays, silty clays, lean clays	CL	74	85	95	106
Inorganic silits, very fine sands, rock flour, silty or clayey fine sands	ML	69	81	93	106
Organic clays of medium to high plasticity	OH	0	0	0	0
Rock		240	240	240	240

Vertical Thrusts

For resultant upward forces, the mass of the thrust block plus any soil directly above the pipe can be taken as the counterbalancing force, provided the overburden can reasonably be expected to remain there for the life time of the pipeline. It is often better to bury the pipe deeper than to add more concrete to counterbalance an upward thrust.

AIR AND SCOUR VALVES

Air Valves

All water contains dissolved air. Normally this would be about 2% but it can vary largely depending on temperature and pressure. Air trapped in the line in pockets is continually moving in and out of solution.

Air in the line not only reduces the flow by causing a restriction but amplifies the effects of pressure surges. Air valves should be placed in the line at sufficient intervals so that air can be evacuated, or, if the line is drained, air can enter the line.

Air valves should be placed along the pipeline at all high points or significant changes in grade. On long rising grades or flat runs where there are no significant high points or grade changes, air valves should be placed at least every 500 - 1,000 metres at the engineer's discretion.

Size DN	Air Valve Size
Up to 100	25 Single
100 - 200	50 double
200 - 450	80 double

Scour Valves

Scour valves are located at low points or between valved sections of the pipeline. Their function is to allow periodic flushing of the lines to remove sediment and to allow the line to be drained for maintenance and repair work.

The scour valve should be sized to allow a minimum scour velocity of 0.6 m/s to be achieved in the main pipe.

Scour tees over nominal size 100 should be offset tees to 45 allow the debris to be taken from the invert of the pipe. In the absence of specific design criteria, the following sizes are generally acceptable.

Size DN	Scour Valve Size
Up to 100	80
100 - 200	100
200 - 450	150

SOIL AND TRAFFIC LOADS

Loads are exerted on buried pipe due to:

- Soil pressures
- Traffic loads
- Superimposed loads

For normal water supply systems, laid in accordance with the installation guidelines in the Pressure Pipe Installation section, the minimum depths of burial (cover). Under these conditions and up to a maximum of 6 metres cover, soil and traffic loadings are of little significance and design calculations are not warranted. This applies to all classes of pipe.

For depths shallower than those recommended, traffic loading may be of significance.

At greater depths, soil loadings may control selection of pipe class. In these instances, lighter pipe classes may not be suitable and specific design calculations and/or special construction techniques may be required. Wet trench conditions may also require further investigation.

Special construction techniques can involve backfill stabilisation, load bearing overlay or slab protection.

It should be noted that cover of less than 1.5 diameters may result in flotation of empty pipes under wet conditions. Low covers may also result in pipe "jacking" (lifting at vertically deflected joints) when pressurised.

BENDING LOADS

Under bending stress PVC pipe will bend rather than break. However, the following precautions are very important

1. In below-ground installations, the pipes must have uniform, stable support. (See Installation Section - Below Ground Installation)
2. In above ground installations, proper, correctly spaced supports must be provided. (See Installation Section - Above Ground Installation)
3. In above-ground installation, pumps, valves and other heavy appendages must be supported independently.

Installing Pipes on a Curve

When installing PVC piping, some changes in the alignment of the pipe may be achieved without the use of directionchange fittings such as elbows and sweeps. Deflection at rubber ring joints or other mechanical joints and/or controlled longitudinal bending of the pipe, within acceptable limits, can achieve the small direction changes in the pipeline, required to accommodate natural land gradients or to avoid obstacles.

DESiGN

Joint Deflection

The allowable angular deflection at the pipe joint varies depending on the manufacturing tolerances of the spigot and the socket but for design purposes all MIGA rubber ring joints can be assumed to allow a maximum deflection of 1T. This is approximately equivalent to a 100mm offset for a 6m pipe. In most circum- stances, the required change in direction can be taken up over several pipe lengths, perhaps in combination with pipe bending. Tighter curves can be achieved by cutting pipes to insert more joints, and/or the use of PVC couplings that effectively double the deflection available.

Note that this angular deflection is only available when pipes are jointed to the witness marks. If pipes are pushed to the back of the socket, movement of the spigot is restrained and the deflection is severely restricted.

The effective radius of curvature obtainable for various pipe lengths is given in table.

Bending of Pipes

Small diameter PVC pipes are sufficiently flexible to allow some bending of the pipe barrel in order to install on a curve. Deflection through bending is not practicable, due to the large forces required, for pipe sizes above about DN 200 particularly for the higher pressure classes.
The amount of bending that can be applied is limited by the axial flexural stress and strain levels induced in the pipe, which must be acceptable, in combination with other stresses and strains, for long term service. MIGA Plastic Industries LLC recommends that for pipe under pressure, the bending radius should not be less than 300 times the diameter.

Pipe length m	Approximate offset mm	Radius of curvature m
12	200	688
9	150	516
6	100	344
4	70	229
3	50	172
2	35	115
1	20	57

Dept.
iNSTALLATION

JOINTING **PROCED**URES

Cutting

During manufacture pipes are cut to standard length by cut-off saws. These saws have carbidetipped circular blades which produce a neat cut without burrs.

However, pipes may be cut on site with a variety of cutting tools. These are:

- Proprietary cutting tools - These tools can cut, deburr and chamfer the pipe in one operation. They are the best tools for cutting pipe.
- A portable petrol-driven 'quick cut saw - This is quick and easy to use. However, care must be taken and some deburring will be required.
- Air-driven tools - This produces a neat, clean cut. It does, however require a compressor.
- A hand saw and mitre box - This saw produces a square cut but requires more deburring. It takes comparatively more time and effort and requires a stand.

The use of roller cutters is not recommended.

Solvent Cement Joint Principles

Pressure pipes and fittings for solvent cement jointing are tapered, ensuring the right level of interference. This may not apply to all pipes and fittings, particularly from other countries which may have a low interference joint requiring a gap filling solvent cement.

- Type ‘P’ for pressure, including potable water installations, designed to develop high shear strengths with an interference fit (green solvent, green print & lid)
- Type ‘N’ for non-pressure applications, designed for the higher gap filling properties needed for clearance fits.
- Type ‘G’” gap filling for parallel or low interference pressure and non pressure joints (clear)
- Priming fluid for use with all solvent cements (red priming fluid, red label & lid)

Always use the correct solvent cement for the application.

Solvent cement jointing is a ‘chemical welding’, not a gluing process. The priming fluid cleans, degreases and removes the glazed surface thus preparing and softening the surface of the pipe so that the solvent cement bonds the PVC. The solvent cement softens, swells and dissolves the spigot and socket surfaces. These surfaces form a bond into one solid material as they cure.

Procedure

1 ***Prepare the pipe*** Before jointing, check that the pipe has been cut square and all the burrs are removed from the inside and outside edge. Remove the sharp edge from the outside and inside of the pipe with a deburring tool. Do not create a large chamfer that will trap a pool of solvent cement. Remove all dirt, swarf, and moisture from spigot and socket.

2 ***Witness mark the pipe*** It is essential to be able to determine when the spigot is fully home in the socket. Mark the spigot with a pencil line (‘witness mark’) at a distance equal to the internal depth of the socket. Other marking methods may be used provided that they do not damage or score the pipe.

3 ***Dry fit the joint*** ‘Dry fit’ the spigot into the socket, check the pipe for proper alignment. Any adjustments for the correct fit can be made now, not later. For pressure pipes, the spigot should interfere in the socket before it is fully inserted to the pencil line. Ovality in the pipe and socket will automatically be re-rounded in the final solvent cementing process, but heavy-walled pipe may give a false indication of the point of interference. Do not attempt to make a pressure pipe joint that does not have an interference fit. Contact MIGA Plastic Industries LLC if this occurs.

4 ***Prepare with priming fluid*** Dry, degrease and prime the spigot and socket with a lint-free cloth (natural fibres) dampened with fluid.Industries LLC if this occurs.

5 ***Brush selection*** The brush should be large enough to apply the solvent cement to the joint in a maximum of 30 seconds. Approximately one third the pipe diameter is a good guide. Do not use the brush attached to the lid for pipes over 100mm in diameter. Decanting is not advisable, and excess should never be returned to the can. For large diameter pipes, it may be necessary to decant to an open larger vessel for a large brush to be used, in this case decant for one joint at a time.

Diameter of pipe mm	Recommended size of brush mm
15, 20, 25, 32, 40, 50	use brush supplied
65, 80	25
100, 125	38
150	50
200	63
225, 250	75
300, 375	100

6 ***Apply solvent cement*** Using a suitably sized brush, apply a thin even coat of solvent cement to the internal surface of the socket first. Solvents will evaporate faster from the exposed spigot than from the socket. Special care should be taken to ensure that excess solvent cement isn’t built up at the back of the socket (pools of solvent will continue to attack the PVC and weaken the pipe). Then apply a heavier, even coat of solvent cement up to the witness mark on the spigot. Ensure the entire surface is covered. A ‘dry’ patch will not develop a proper bond, even if the mating surface is covered. An unlubricated patch may also make it difficult to obtain full insertion.

7 ***Inserting the spigot*** Make the joint immediately, in a single movement. Do not stop halfway, since the bond will start to set immediately and it will be almost impossible to insert further. It will aid distribution of the solvent cement to twist the spigot into the socket so that it rotates about a 1/4 turn whilst (not after) inserting, but where this cannot be done, particular attention should be paid to uniform solvent application.

8 ***Push the spigot home*** The spigot must be fully homed to the full depth of the socket. The final 10% of spigot penetration is vital to the interference fit. Mechanical force will be required for larger joints. Be ready in advance. Pipe pullers are commercially available for this purpose. Polyester pipe slings are very useful for gripping a pipe, in order to apply a winch or lever.

9 ***Hold the joint*** Hold the joint against movement and rejection of the spigot for a minimum of 30 seconds. Disturbing the joint during this phase will seriously impair the strength of the joint.

10 ***Wipe off excess solvent cement*** For a neat professional joint wipe off excess solvent cement , with a clean rag, immediately from the outside of the joint.

11 ***Do not disturb the joint*** Once the joint is made, do not disturb it for five minutes or rough handle it for at least one hour. Do not fill the pipe with water for at least one hour after making the last joint. Do not pressurise the line until fully cured.

12 ***Cure the joint*** The process of curing, is a function of temperature, humidity and time. Joints cure faster when the humidity is low and the temperature is high. The higher the temperature, the faster the joints will cure. As a guide, at a temperature of 16°C and above, 24 hours should be allowed, at 0°C, 48 hours is necessary.

Precautions to Achieve an Effective Joint

Make sure that the end of each pipe is square in its socket and in the same alignment and grade as the preceding pipes or fittings.

Create a 0.5mm chamfer, as a sharp edge on the spigot will wipe off the solvent and reduce the interface area. Remove all swarf and burrs so that filings cannot later become dislodged and jam taps and valves.

Do not attempt to joint pipes at an angle. Curved lines should be jointed without stress, and then curved after the joint is cured. Support the spigot clear of the ground when jointing, this will avoid contamination with soil or sand.

An unsatisfactory solvent cement joint cannot be re- executed, nor can previously cemented spigots and sockets be re-used. To affect repairs, cut out the joint and remake or use mechanical repair fittings.

Correct Solvent Quantity

The correct amount of solvent is a uniform self-levelling layer without runs, achieved by experience and judgement.

Too much solvent will form pools and continue to attack and weaken the pipe. Too little solvent will require you to brush out excessively, the solvent will quickly evaporate with vigorous brushing.

Take care not to spill solvent cement onto pipes or fittings. Accidental spillage should be wiped off immediately.

Adverse Weather

High temperature and air movement will radically increase the loss of solvents, and solvent cement jointing should not be performed when the temperature is more than 35°C. Some form of protection should be provided when jointing in windy and dusty conditions.

When jointing under wet and very cold conditions, make sure that the mating surfaces are dry and free from ice, as moisture may prevent the solvent cement from obtaining its maximum strength.

INSTALLATION

Storage

Keep the containers stored below 30°C. The solvent cement lids should be tightly sealed when not in use to prevent evaporation of the solvent. Do not use solvent cement that has gone cloudy or has started to gel in the can. Do not use solvent cement after the 'use by' date shown on the can, the chemical constituents can change over a long period, even in a sealed can.

Safety

Forced ventilation should be used in confined spaces. Do not bring a naked flame within the vicinity of solvent cement operations. Spillage onto the skin should be washed off immediately with soap and water.

Should the solvent cement get in the eyes, wash them with clean water for at least 15 minutes and seek medical advice.

Priming Fluid

- If poisoning occurs, contact a doctor or Poisons Information Centre.
- If swallowed, do not induce vomiting give a glass of water.
- For further safety information, refer to Material Safety Data

Average number of joints per 500ml

The following table provides an indication as to the number of joints that are made per 500ml container of priming fluid and solvent cement.

Size DN mm	Priming fluid	Solvent cement
15	105	300
20	625	175
25	450	130
32	325	95
40	250	70
50	150	42
65	125	35
80	100	30
100	70	25
125	60	20
150	45	15
200	20	10
225	15	7
250	12	6
300	12	5
375	12	5

Rubber Ring Joints

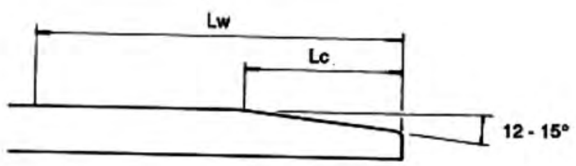
Jointing rings are supplied with the pipe, together with a lubricant suitable for the purpose. Other lubricants may not be suitable for potable water contact and may affect the ring. They should not be substituted without specific knowledge of these effects.

Chamfering

PVC pipes for rubber ring jointing are supplied with a chamfered end. However, if a pipe which has been cut in the field is to be used for making a rubber ring joint, the spigot end must be chamfered. Special chamfering tools are available for this purpose, but in the absence of this equipment a body file can be used provided it does not leave any sharp edges which may cut the rubber ring. Do not make an excessively sharp edge at the rim of the bore and do not chip or break this edge.

When a pipe is cut, a witness mark should be pencilled in. Care should be taken to mark the correct position.

For the correct chamfer lengths and witness mark positions, consult the Joint Assembly and Control Dimensions Table for the relevant pipe type. Where two witness mark positions are given, both should be marked on the pipe and the joint made so that one mark remains visible.

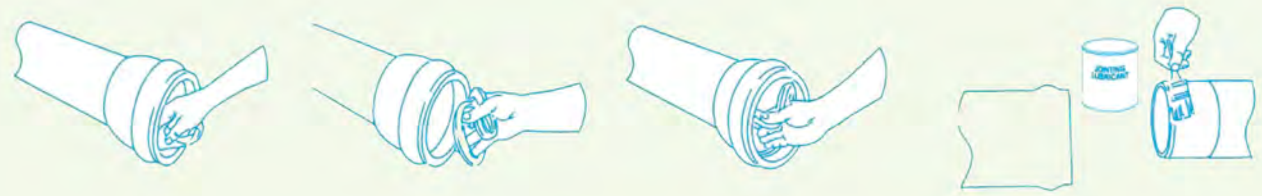


SOCKETED PIPE

Size DN	Approx. length of chamfer Lc	Witness mark Lw
mm	mm	mm
50	6	76
65	8	82
80	10	86
100	11	97
125	13	109
150	14	116
200	17	140
225	18	150
250	20	176
300	23	187
375	28	212

SOCKETED PIPE

Size DN	Approx. length of chamfer Lc	Witness mark Lw
mm	mm	mm
100	12	105
150	14	127
200	18	171
225	21	180
250	23	191
300	28	211
375	36	226



INSTALLATION

Procedure

1 Pipes may be jointed out of the trench but it is preferable that connections be made in the trench to prevent possible "pulling" of the joint.

2 Clean the socket, especially the ring groove. Do not use rag with lubricant on it.

3 Check that the spigot end, if cut in the field, has a chamfer of approximately 12° to 15°. Insert the rubber ring into the groove with the colour marking on the ring facing outwards. The rubber ring is correctly fitted when the thickest cross section of the ring is positioned towards the outside of the socket and the groove in the rubber ring is positioned inside the socket.

4 Run your finger around the lead-in angle of the rubber ring to check that it is correctly seated, not twisted, and that it is evenly distributed around the ring groove.

5 Clean the spigot end of the pipe as far back as the witness mark.

6 Apply jointing lubricant to the spigot end as far back as the witness mark and especially to the chamfered section.

Note: Keep the rubber ring and ring groove free of jointing lubricant until the joint is actually being made.

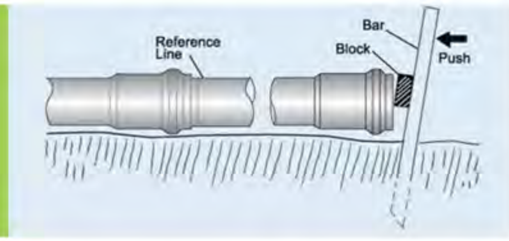
Procedure

7 Align the spigot with the socket and apply a firm, even thrust to push the spigot into the socket. It is possible to joint 100 mm and 150 mm diameter pipes by hand. However, larger diameter pipes such as 200 mm and above may require the use of a bar and timber block as illustrated. Alternatively, a commercially available pipe puller may be used to joint the pipes.

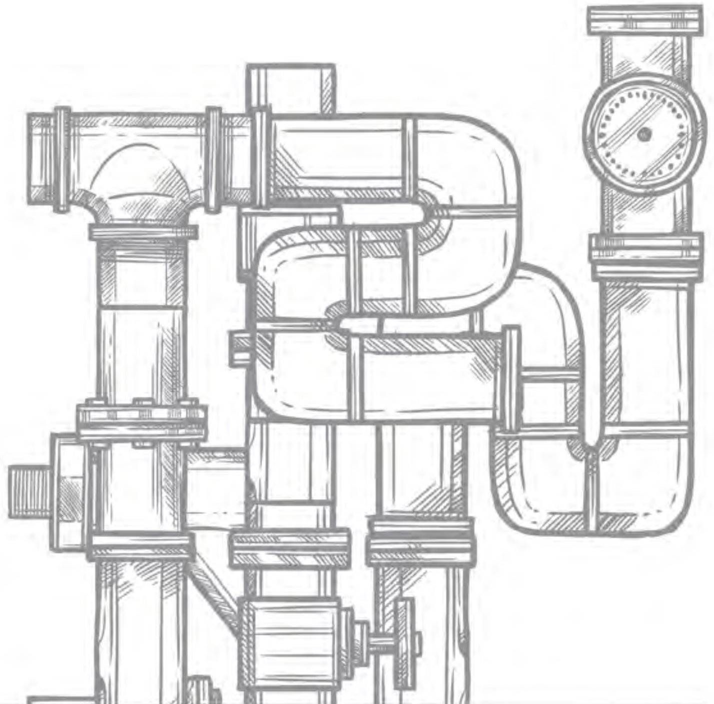
8 Brace the socket end of the line so that previously jointed pipes are prevented from closing up.

9 Inspect each joint to ensure that the witness mark is just visible at the face of each socket.

BAR & BLOCK JOINTING



Hint:
If excessive force is required to make a joint, this may mean that the rubber ring has been displaced. To check placement of the ring without having to dismantle the joint, a feeler gauge can be inserted between the socket and pipe to check even placement of the ring.



10 Pipe joints must not be pushed home to the bottom of the socket. They must go no further than the witness mark. This is to allow for possible expansion of the pipe. Polydex PVC and cast iron fittings use the same rubber ring as Polydex pipe and jointing procedures are identical.

11 If a pipe joint is homed too far, it may be withdrawn immediately, but once the lubricant is dry (which takes only a few minutes in hot weather) mechanical aids are required to pull the joint apart.

12 With mechanical assis tance, rubber ring joints can be recovered and re-made years after the original joint was made. New rubber rings should be used and care should be taken to ensure that there is no damage to pipe or socket. If the joint is likely to be dismantled in the future the task is much easier if silicone lubricant is used.

JOINTING PIPES WITH **COUPLINGS**

Procedure

To simplify the jointing process it is suggested that the initial joint made with the coupling is carried out before the pipe is placed in the trench.

1 Clean the socket of the coupling and spigot of the pipe.

2 Apply jointing lubricant to the spigot of the pipe as far back as the witness mark and especially to the chamfered section. Align the spigot with the coupling and apply a firm even thrust to push the spigot into the coupling. For this joint, ensure that the spigot is inserted until the witness mark is no longer visible. It is possible to joint the 150mm pipe by hand. It may be found helpful to brace the coupling against a solid vertical surface.The second joint is made with the coupling of the pipe already in the trench.

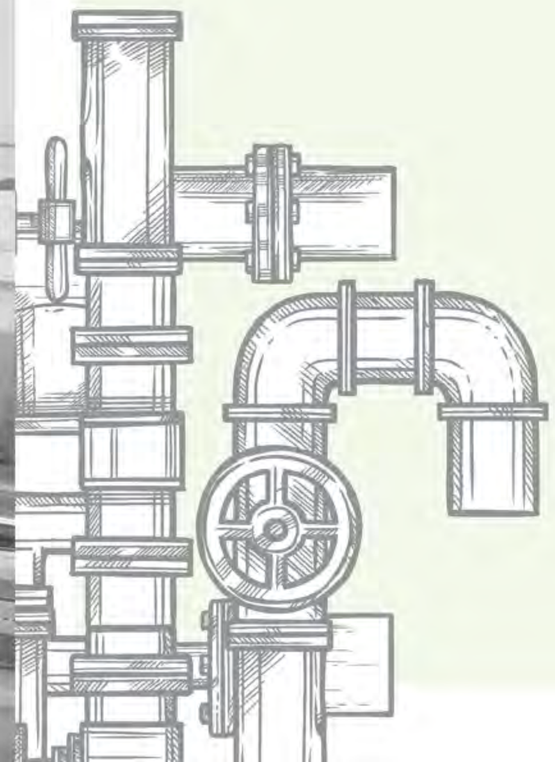
3 Use the same technique as before but only insert the spigot into the coupling sufficiently to leave one witness mark visible at the face of the coupling. This is necessary to allow for possible expansion of the pipe after installation.

If a joint is inserted too far, it may be withdrawn immediately, but once the lubricant is dry (which only takes a few minutes in hot weather) mechanical aids are required to pull the joint apart.

Ensure the coupling to be jointed is supported to prevent closing of preceding couplings.

Use of Other Brand Fittings

A variety of other cast/ductile iron, bronze, aluminium, steel ABS and UPVC fittings maybe used with MIGA PVC pipes. In most cases the fittings have sockets that are shorter than pipe sockets. When the socket is too short for the spigot to be inserted to the witness mark, the pipe should be fully homed and special precautions should be taken during construction to ensure that no contraction of the pipe will be taken up at these joints, i.e. it should be taken up at other joints.



Flanged **Joints**

The main functions of a flanged joint is to create a demountable joint, to connect valves and vessels where strength in tension is required, or to joint to other materials.

The three types of flanges available are:

1. Full-faced PVC socketed flanges.
2. PVC socketed stub flanges with loose PVC or metal backing rings.

Epoxy-coated aluminium or ductile iron flange adaptors are also available.

3. Tapered cores with either metal or PVC flanges. Flange joints require gaskets to seal them. In high stress situations, metal backing plates or flat washers are also required to spread the force and prevent damage to the flange. Bolts should not be over tightened.

Threaded **Joints**

or normal water supply purposes, the cutting of threads on PVC pipes is not an acceptable practice. A moulded threaded adaptor should be used.

When making threaded joints the following points should be observed :

1. A thread sealant is recommended and the only acceptable material is PTFE (TEFLON) tape. Hemp, grease or solvent cement should never be used.

Test the 'fit' of the joint, particularly when connecting to other materials or to other manufacturers' fittings. Judge the amount of tape accordingly. Under no circumstances should the thread bottom against a stop on either the male or female fitting.

2. Hand tighten initially. Usually a further two more turns are sufficient to effect a seal. Tighten only just enough to seal, plus half a turn more. Note. Over tightening will over stress the fitting. Avoid using serrated grip tools particularly on the plain barrel of fittings or pipes.
3. If a threaded connection is made to a metal fitting, it is preferable that the male thread be PVC. For female PVC fittings special care should be taken to avoid overstressing.

GOLDEN RULE **DO NOT OVERTIGHTEN**

Compression **Joints**

There are various types of compression joints available for use with PVC pipes. In principle all of these effect a seal by mechanical compression of a rubber ring by means of threaded caps or bolted end plates. Because immediate pressurisation is possible such joints are generally preferred for repair work.

They are also used frequently for final connections in difficult situations where slight mis alignment cannot be avoided.

Connection to Other **Materials**

A wide range of adaptors to joint PVC pipes and fittings to pipes and fittings of other materials is available.

See Product Data section for more details.

When making compression joints the manufacturers' recommendations should be followed. Over-tightening should be avoided. It may be found advantageous to use a lubricant on the rubber ring.

INTRODUCTION

HANDLING AND STORAGE

PVC pipe is very robust, but still can be damaged by rough handling. Pipes should not be thrown from trucks or dragged over rough surfaces. Plastic piping becomes more susceptible to damage in very cold weather so extra care should be taken when the temperature is low. Since the soundness of any pipe joint depends on the condition of the spigot and the socket, special care should be taken not to allow them to come into contact with sharp edges or protruding nails.

TRANSPORTATION OF PVC PIPES

While in transit pipes should be well secured and supported. Chains or wire ropes may be used only if suitably padded to protect the pipe from damage. Care should be taken that the pipes are firmly tied so that the sockets cannot rub together.

Pipes may be unloaded from vehicles by rolling them gently down timbers, care being taken to ensure that the pipes do not fall onto one another or onto any hard or uneven surface.

STORAGE OF PVC PIPES

Pipes should be given adequate support at all times. Pipes should be stacked in layers with sockets placed at alternate ends of the stack and with the sockets protruding.

Horizontal supports of about 75 mm wide should be spaced not more than 1.5 m centreto centre beneath the pipes to provide even support.

Crated pipes, however, may be stacked higher provided that the load bearing is not taken directly by the lower pipes.
In all cases, stacking should be such that pipes will not become distorted.

Vertical side supports should also be provided at intervals of 3 m along rectangular pipe stacks. For long term storage (longer than 3 months) the maximum free height should not exceed 1.5 m. The heaviest pipes should be on the bottom.

If it is planned to store pipes in direct sunlight for a period in excess of one year, then the pipes should be covered with material such as hessian, placed so as to not restrict the circulation of air in the pipes which has a cooling effect.

Coverings such as black plastic must not be used as these can greatly increase the temperatures within the stack.

Pipes should not be stored close to heat sources or hot objects, eg., heaters, boilers steam lines or engine exhaust, or against reflective metal fences which may concentrate heat.

BELOW-GROUND INSTALLATION

Preparing the Pipes

Before installation, each pipe and fitting should be inspected to see that its bore is free from foreign matter and that its outside surface has no large scores or any other damage. Pipe ends should be checked to ensure that the spigots and sockets are free from damage.

Pipes of the required diameter and class should be identified and matched with their respective fittings and placed ready for installation.

Preparing the Trench

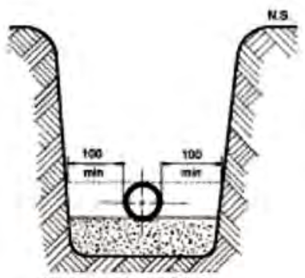
PVC pipe is likely to be damaged or deformed if its support by the ground on which it is laid is not made as uniform as possible. The trench bottom should be examined for irregularities and any hard projections removed.

Trench Widths

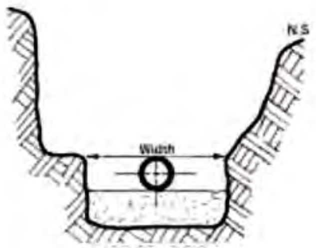
A trench should be as narrow as practical but adequate to allow space for working area and for tamping the side support. It should be not less than 200 mm wider than the outside diameter of the pipe irrespective of soil condition.

Wide Trenches

For deep trenches where significant soil loading may occur, the trench should not exceed the widths given in the Table 4.2 without further investigation.



Minimum Trench Width



Wide Condition

Size DN mm	Minimum mm	Maximum mm
100	320	800
125	340	825
150	360	825
200	425	900
225	450	925
250	480	950
300	515	1000
375	600	1200

Unstable Conditions

Where a trench, during or after excavation, tends to collapse or cave in, it is considered unstable. If the trench is located, for instance, in a street or a narrow pathway and it is therefore impractical to widen the trench, support should be provided for the trench walls in the form of timber planks or other suitable shoring. Alternatively the trench should be widened until stability is reached. At this point, a smaller trench may then be excavated in the bottom of the trench to accept the pipe.
In either case do not exceed the maximum trench width at the top of the pipe unless allowance has been made for the increased load.

Trench Depths

The recommended minimum trench depth is determined by the loads imposed on the pipe such as the mass of backfill material, the anticipated traffic loads and any other superimposed loads. The depth of the trench should be sufficient to prevent damage to the pipe when the anticipated loads are imposed upon it.

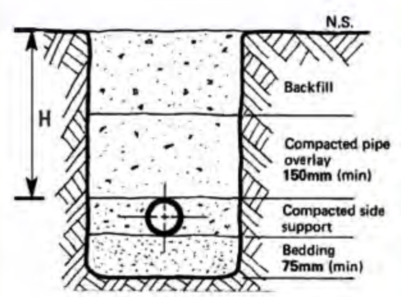
Minimum Cover

Trenches should be excavated to allow for the specified depth of bedding, the pipe diameter and the minimum recommended cover, overlay plus backfill, above the pipes. The table in the page provides recommendations for minimum cover.

The above cover requirements will provide adequate protection for all classes of pipe. Where it is necessary to use lower covers, several options are available.

Loading	Cover, H (mm)
No vehicle loading	300
Vehicular loading :	
not roadways	450
sealed roadways	600
unsealed roadways	750
Embankments	750
Construction equipment loading	750

1. Use a high quality granular backfill, eg crushed gravel or road base.
2. Use a higher class of pipe than required for normal pressure or other considerations.
3. Provide additional structural load bearing bridging over the trench. Temporary steel plates may be used in the case of construction loads.



Minimum Cover Requirement

Bedding Material

1. Suitable sand, free from rock or other hard or sharp objects that would be retained on a 13.2 mm sieve.

2. Crushed rock or gravel of approved grading up to a maximum size of 14 mm.

3. The excavated material may provide a suitable pipe underlay if it is free from rock or hard matter and broken up so that it contains no soil lumps having any dimension greater than 75 mm which would prevent adequate compaction of the bedding.

The suitability of a material depends on its compactability. Granular materials (gravel or sand) containing little or no fines, or specification graded materials, require little or no compaction, and are preferred.

Sands containing fines, and clays are difficult to compact and should only be used where it can be demonstrated that appropriate compaction can be achieved.

Variations in the hard bed should never exceed 20% of the bedding depth. Absolute minimum underlay should be 75 mm. It may be necessary to provide a groove under each socket to ensure that even support along the pipe barrel is achieved.

Pipe Side Support

Material selected for pipe side support should be adequately tamped in layers of not more than 150 mm. Care should be taken not to damage the exposed pipe and to tamp evenly on either side of the pipe to prevent pipe distortion. Unless otherwise specified, the pipe side support and pipe overlay material used should be identical with the pipe bedding material.

The pipe overlay material should be levelled and tamped in layers to a minimum height of 150 mm above the crown of the pipe. Care should be taken not to disturb the line or grade of the pipeline, where this is critical, by excessive tamping.

INSTALLATION

Backfill

Unless otherwise specified, excavated material from the site should constitute the backfill. Gravel and sand can be compacted by vibratory methods and clays by tamping. This is best achieved when the soils are wet. If water flooding is used and extra soil has to be added to the original backfill, this should be done only when the flooded backfill is firm enough to walk on. When flooding the trench, care should be taken not to float the pipe.

PVC Pipes Under Roads

PVC pipes can be installed under roads in either the longitudinal or transverse direction. The type of rock/granular materials specified for road subgrades have a very high soil modulus and offer excellent side support for flexible pipes as well as minimising the effects of dead and live loads. This represents an ideal structural environment for PVC pipes.

Consideration should be given at the time of installation to ensure:

1. Construction loadings are allowed
2. The pipes are buried at sufficient depth to ensure they are not disturbed during future realignments or regrading of the road
3. Minimum depths of cover and compaction techniques are observed.

Pipeline Buoyancy

Pipe, under wet conditions, can become buoyant in the trench. PVC pipe, being lighter than most pipe materials, should be covered with sufficient overlay and backfill material to prevent inadvertent flotation and movement. A depth of cover over the pipe of 1.5 times the diameter is usually adequate.

Expansion and Contraction

Pipe will expand or contract if it is installed during very hot or very cold weather, so it is recommended that the final pipe connections be made when the temperature of the pipe has stabilised at a temperature close to that of the backfilled trench.

When the pipe has to be laid in hot weather, precautions should be taken to allow for the contraction of the line which will occur when it cools to its normal working temperature.

For solvent cemented systems, the lines should be free to move until a strong bond has been developed (see Solvent Cement Jointing Procedures) and installation procedure should ensure that contraction does not impose strain on newly made joints.

For rubber ring jointed pipes, if contraction accumulates over several lengths, pull-out of a joint can occur. To avoid this possibility the preferred technique is to backfill each length, at least partially, as laying proceeds. (It may be required to leave joints exposed for test and inspection.)

It should be noted that rubber ring joint design allows for contraction to occur. Provided joints are made to the witness mark in the first instance, and contraction is taken up approximately evenly at each joint, there is no danger of loss of seal. A gap between witness mark and socket of up to 10 mm after contraction is quite acceptable.

Further contraction may be observed on pressurisation of the line (so-called Poisson contraction due to circumferential strain). Again this is anticipated in joint design and is quite in order.

Electrical Earthing

PVC piping is a non-conductive material and cannot be used for earthing electrical installations or for dissipating static charges. Local authorities, both water and electrical, should be consulted for their requirements.

INSTALLING PIPES ON A CURVE

When installing pipes on a curve, the pipe should be jointed straight and then laid to the curve. Bending of pipes is achieved in practice after each joint is made, by laterally loading the pipe by any convenient means, and fixing in place by compacted soil, or appropriate fixings above ground. The technique used depends on the size and class of pipe involved, as clearly the forces required to induce bending vary over a very large range.

For buried lines in good soil, the compaction process can be used to induce bending as illustrated below.

Bending aids, crowbars etc. must always be padded to prevent damage to pipes. Permanent point loads are not acceptable.

Size	Force applied at centre span			Forces applied at quarter points		
DN	Max. deification angle	Max. displacement angle	Max. end offset	Max. deification angle	Max. displacement angle	Max. end offset
mm	deg	mm	mm	deg	mm	mm
Minimum radius of curvature/diameter ratio					300	
Series 1, diameters						
15	23	470	1200	34	650	1800
20	18	380	950	27	520	1400
25	14	300	740	21	410	1100
32	11	240	580	17	330	900
40	9.9	210	520	15	290	790
50	7.9	170	410	12	230	630
65	6.3	130	330	9.5	180	500
80	5.4	110	280	8.1	160	420
100	4.2	88	220	6.3	120	330
125	3.4	71	180	5.1	98	270
150	3.0	63	160	4.5	86	240
175	2.4	50	130	3.6	69	190
200	2.1	44	110	3.2	61	170
Series 2, diameters						
100	3.9	82	200	5.9	110	310
150	2.7	56	140	4.0	78	210
200	2.1	43	110	3.1	59	160

iNSTALLATION

Thrust Blocks

Underground PVC pipelines jointed with rubber ring joints require concrete thrust blocks to prevent movement of the pipeline when a pressure load is applied. In some circumstances, thrust support may also be advisable in solvent cement jointed systems.

Uneven thrust will be present at most fittings. The thrust block transfers the load from the fitting, around which it is placed, to the larger bearing surface of the solid trench wall.

Construction of Thrust Blocks

Concrete should be placed around the fitting in a wedge shape with its widest part against the solid trench wall. Some forming may be necessary to achi eve an adequate bearing area with a minimum of concrete. The concrete mix should be allowed to cure for seven days before pressurisation.

A thrust block should bear firmly against the side of the trench and to achieve this, it may be necessary to hand trim the trench side or hand excavate the trench wall to form a recess. The thrust acts through the centre line of the fitting and the thrust block should be constructed symmetrically about this centre line. (See Thrust Support for design of thrust block size.)

PVC pipes and fittings should be covered with a protective membrane of PVC, polyethylene or felt when adjacent to concrete so that they can move without being damaged. (See Setting of pipes in concrete)

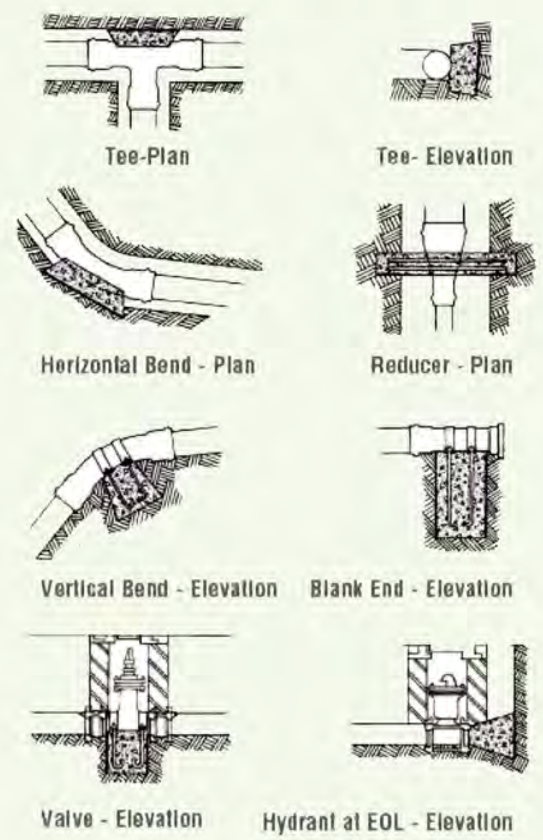
Pipelines on Steep Slopes

Two problems can occur when pipes are installed on steep slopes, i.e. slopes steeper than 20% (1:5).

1 The pipes may slide downhill so that the witness mark positioning is lost. It maybe necessary to support each pipe with some cover during construction to prevent the pipe slipping.

2 The generally coarse backfill around the pipe may be scoured out by water movement in the backfill. Clay stops or sandbags should be placed at appropriate intervals above and below the pipe to stop erosion of the backfill.

Where bulkheads are used, one restraint per pipe length, placed adjacent to the socket, is considered sufficient for all slopes.



ABOVE-GROUND INSTALLATION

General Considerations

In above ground installations, pipes should be laid on broad, smooth bearing surfaces wherever possible to minimise stress concentration and to prevent physical damage.

PVC pipe should not be laid on steam lines or in proximity to other high temperature surfaces.

Where a PVC pressure pipeline is used to supply cold water to a hot water cylinder, the last two metres of pipe should be made of copper and a nonreturn valve fitted between the PVC and copper line to prevent pipe failure.

Where connections are made to other sections or to fixtures such as pumps or motors, care should be taken to ensure that the sections are axially aligned. Any deviations will result in undue stress on the jointing fittings which could lead to premature failure.

If a pipeline is subjected to continuous vibration such as at the connection with a pump, it should be connected by a flexible joint or, if possible, the system should be redesigned to eliminate the vibration.

The pipe must be adequately supported in order to prevent sagging and excessive distortion. Clamp, saddle, angle, spring or other standard types of supports and hangers may be used where necessary.

Pipe hangers should not be overtightened. Metal surfaces should be insulated from the pipe by plastic coating, wrapping or other means.

SUPPORTS

Brackets and Clips

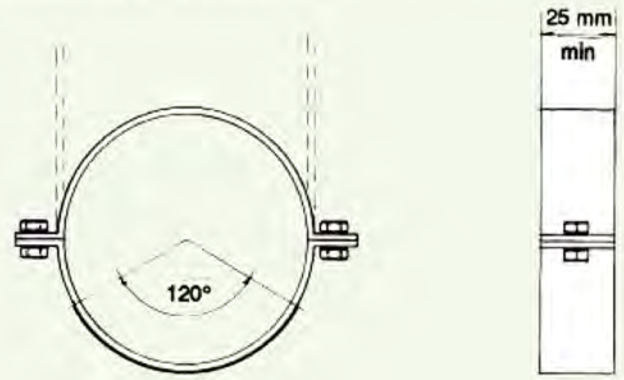
For either free or fixed pipeline supports using brackets or clips, the bearing surface should provide continuous support for at least 120° of the circumference.

Free Supports

A free support allows the pipe to move without restraint along its axis while still being supported. To prevent the support from scuffing or damaging the pipe as it expands and contracts, a 6 mm thick layer of felt or lagging material is wrapped around the support. Alternatively, a swinging type of support can be used and the support strap, protected with felt or lagging, must be securely fixed to the pipe.

Straps

Metal straps used as supports should be at least 25 mm wide, either plasticcoated or wrapped in a protective material such as nylon or PE sheet. If a strap is fastened around a pipe, it should not distort the pipe in any way.



Setting of Pipes in Concrete

When PVC pipes are encased in concrete, certain precautions should be taken :

1. Pipes should be fully wrapped with a compressible material, such as felt, with a minimum thickness of 5% of the pipe diameter, i.e. 5 mm for a 100mm diameter pipe.

2. Alternatively, flexible (rubber ring) joints should be provided at entry to and exit from the concrete as shown. This procedure also allows for possible differential movement between the pipeline and concrete structure. It must be borne in mind, however, that without a compressible membrane; stress transfer to the concrete will occur and may damage the concrete section.

3. Expansion joints coinciding with concrete expansion joints should be provided to accommodate movement due to thermal expansion or contraction in the concrete.

Placement of Supports

Careful consideration should be given to the layout of piping and its support system. Even for non pressure lines the effects of thermal expansion and contraction have to be taken into account. In particular, the layout should ensure that thermal and other movements do not induce significant bending moments at rigid connections to fixed equipment or at bends or tees.

For solvent-cement jointed pipe any expansion coupling must be securely clamped with a fixed support. Other pipe clamps should allow for movement due to expansion and contraction. Rubberring jointed pipe should have fixed supports behind each pipe socket.

Anchorage at Fittings

It is advisable to rigidly clamp at valves and other fittings located at or near sharp directional changes, particularly when the line is subjected to wide temperature variations. With the exception of solvent-cement jointed couplings, all PVC fittings should be supported individually and valves should be braced against operating torque.

Thrust Anchorage

A solvent-cement jointed PVC pipeline will not usually require thrust anchorage, but the designer should take into consideration any stress on the fittings. As pipe diameter or working pressure increases it is good practice to install thrust anchors where necessary. A rubberring jointed pressure pipeline requires anchorage at all joints, at changes in direction and at other positions where unbalanced pressure forces exist.

Expansion Joints

For above-ground installations with solvent cement joints provision should be made in the pipeline for expansion and contraction. If the ends are constrained and there is likely to be significant thermal variation, then a rubber ring joint should be installed at least every 12 m to allow for movement within the pipeline.

	Maximum Support Spacing	
Size DN	Horizontal	Vertical
mm	m	m
15	0.60	1.20
20	0.70	1.40
25	0.75	1.50
32	0.85	1.70
40	0.90	1.80
50	1.05	2.10
65	1.20	2.40
80	1.35	2.70
100	1.50	3.00
125	1.70	3.40
150	2.00	4.00
175	2.20	4.40
200	2.30	4.60
225	2.50	5.00
250	2.60	5.20
300	3.00	6.00

Protection from Solar Degradation

Although PVC pipe can be installed in direct sunlight, it will be affected by ultraviolet light which tends to discolour the pipe and can cause a loss of impact strength. No other properties are impaired. If the pipe is to be installed in continuous direct sunlight, it is advisable to paint the exterior with a white or light-coloured PVA paint.

Vertical Installation

Generally, vertical runs are supported by spring hangers and guided with rings or long U-bolts which restrict movement of the rise to one plane. It is sometimes helpful to support a long riser with a saddle at the bottom.

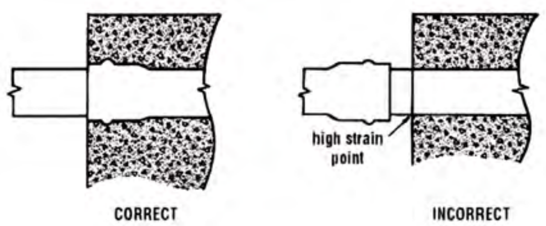
Where a PVC pipeline is to pass through or is to be built into a floor or wall of a building, allowance should be made for it to move without shearing against any hard surfaces or without causing damage to the pipe or fittings.

An annular space of not less than 6 mm should be left around the pipe or fitting.

This clearance should be maintained and sealed with a flexible sealant such as loosely packed felt, a rubber convolute sleeve or other suitable flexible sealing material.

If the pipeline has to pass through a fire-rated wall, appropriate fire stop collars should be installed.

When a fire breaks out, the fire stop collar will expand and seal off the pipe, thus preventing fire from spreading by means of the pipe access hole. Because fire stop collars seal off the pipe they must not be used on the water supply lines required for fire fighting.



INSTALLATION

TESTING AND COMMISSIONING

Protection from Solar Degradation

The pipeline may be tested as a whole or in sections, depending on the diameter and length of the pipe, the spacing between sectioning valves or blank ends and the availability of water.

Pipelines should be bedded and backfilled, but with the joints left uncovered for inspection before and after testing if possible.

All thrust supports for fittings and valves must be finished and the concrete properly cured (the minimum time is seven days). Blank ends installed temporarily should be adequately supported to take the pressure thrust.

Fill the pipeline with water and remove air from the system as far as possible. Allow the temperature to stabilise.

Pressurise the system. Selection of field test pressures is related to the system operating conditions. A maximum test pressure of 1.25 times the system design pressure, measured at the lowest point in the system, is specified although the test pressure should not exceed 1.25 times the PN of the lowest rated component in the system. Additional water will be required to bring the line up to pressure because the pipe expands slightly.

Original MATERIAL

PROPERTIES OF PVC

General properties of PVC compounds used in pipe manufacture are given in page 29 & 30. Unless otherwise noted, the values given are for standard unmodified formulations using K67 PVC resin. Some comparative values are shown for other pipe materials. Properties of thermoplastics are subject to significant changes with temperature, and the applicable range is noted where appropriate.

Mechanical properties are subject to duration of stress application, and are more properly defined by creep functions. More detailed data pertinent to pipe applications are given in the design section of this manual. For data outside of the range of conditions listed, users are advised to contact our Technical Department.

MATERIAL

ABBREVIATIONS

PE	Polyethylene	CI	Cast Iron
PP	Polypropylene	AC	Asbestos Cement
PA	Polyamide (nylon)	GRP	Glass Reinforced Pipe

Property	Value	Conditions and Remarks
Physical properties		
Molecular weight (resin)	140,000	cf: K57 PVC 70,000
Relative density	1.42 - 1.48	cf: PE 0.95 - 0.96, GRP 1.4 - 2.1, CI 7.20, Clay 1.8 - 2.6
Water absorption	0.12%	23°C, 24 hours cf: AC 18 - 20% AS1711
Hardness	80	Shore D Durometer, Brinell 15, Rockwell R 114, cf: PE Shore D 60
Impact strength - 20°C	20 kJ/m2	Charpy 250 μm notch tip radius
Impact strength - 0°C	8 kJ/m2	Charpy 250 μm notch tip radius
Coefficient of friction	0.4	PVC to PVC cf: PE 0.25, PA 0.3
Mechanical properties		
Ultimate tensile strength	52 MPa	AS 1175 Tensometer at constant strain rate cf: PE 30
Elongation at break	50 - 80%	AS 1175 Tensometer at constant strain rate cf: PE 600-900
Short term creep rupture	44 MPa	Constant load 1 hour value cf: PE 14, ABS 25
Long term creep rupture	28 MPa	Constant load extrapolated 50 year value cf: PE 8-12
Elastic tensile modulus	3.0 - 3.3 GPa	1% strain at 100 seconds cf: PE 0.9-1.2
Elastic flexural modulus	2.7 - 3.0 GPa	1% strain at 100 seconds cf: PE 0.7-0.9
Long term creep modulus	0.9 - 1.2 GPa	Constant load extrapolated 50 year secant value cf: PE 0.2 - 0.3
Shear modulus	1.0 GPa	1% strain at 100 seconds G=E/2/(1+μ) cf: PE 0.2
Bulk modulus	4.7 GPa	1% strain at 100 seconds K=E/3/(1-2μ) cf: PE 2.0
Poisson's ratio	0.4	Increases marginally with time under load. cf: PE 0.45
Electrical properties		
Dielectric strength (breakdown)	14 - 20 kV/mm	Short term, 3 mm specimen PE 70-85
Volume resistivity	2 x 1014Ω.m	AS 1255.1 PE > 1016
Surface resistivity	1013 - 1014 Ω	AS 1255.1 PE > 1013
Dielectric constant (permittivity)	3.9 (3.3)	50 Hz (106 Hz) AS 1255.4
Dissipation factor (power factor)	0.01 (0.02)	50 Hz (106 Hz) AS 1255.4
Thermal properties		
Softening point	80 - 84°C	Vicat method AS 1462.5 (min. 75°C for pipes)
Max. continuous service temp.	60°C	cf: PE 80*, PP 110*
Coefficient of thermal expansion	7 x 10-5/K	7 mm per 10 m per 10°C cf: PE 18 - 20 x 10-5, DI 1.2 x 10-5
Thermal conductivity	0.16 W/[m.K]	0 - 50°C PE 0.4
Specific heat	1,000 J/[kg.K]	0 - 50°C
Thermal diffusivity	1.1 x 10-7 m2/s	0 - 50°C
Fire performance		
Flammability (oxygen index)	45%	ASTM D2863 Fennimore Martin test, cf: PE 17.5, PP 17.5
Ignitability index	10 - 12 (/20)	cf: 9 - 10 when tested as pipe AS 1530 Early Fire Hazard Test
Smoke produced index	6 - 8 (/l0)	cf: 4 - 6 when tested as pipe AS 1530 Early Fire Hazard Test
Heat evolved index	0	
Spread of flame index	0	Will not support combustion. AS 1530 Early Fire Hazard Test

Conversion of Units 1 MPa = 10 bar = 9.81 kg/cm2 = 145 lbf/in2

The Chemical Performance of PVC

PVC is resistant to many alcohols, fats, oils and aromatic free petrol. It is also resistant to most common corroding agents including inorganic acids, alkalis and salts. However, PVC should not be used with esters, ketones, ethers and aromatic or chlorinated hydrocarbons. PVC will absorb these substances and this will lead to swelling and a reduction in tensile strength.

Chemical Attack

Chemicals that attack plastics do so at differing rates and in differing ways. There are two general types of chemical attack on plastic:

1. Swelling of the plastic occurs but the plastic returns to its original condition if the chemical is removed. However, if the plastic has a compounding ingredient that is soluble in the chemical, the plastic may be changed because of the removal of this ingredient and the chemical itself will be contaminated.

2. The base resin or polymer molecules are changed by crosslinking, oxidation, substitution reactions or chain scission. In these situations the plastic cannot be restored by the removal of the chemical. Examples of this type of attack on PVC are aqua regia at 20°C and wet chlorine gas.

Factors Affecting Chemical Resistance

A number of factors can affect the rate and type of chemical attack that may occur. These are:

Concentration. In general, the rate of attack increases with concentration, but in many cases there are threshold levels below which no significant chemical effect will be noted.

Temperature. As with all processes, the rate of attack increases as the temperature rises. Again, threshold temperatures may exist.

Period of Contact. n many cases rates of attack are slow and of significance only with sustained contact.

Stress. Some plastics under stress can undergo higher rates of attack. In general PVC is considered relatively insensitive to "stress corrosion".

A

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA A

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
ACETALDEHYDE	CH_3CHO	100	25	3	1
			60	3	
			100		
- AQUEOUS SOLUTION		40	25	3	1
			60	3	
			100		
ACETIC ACID	CH_3COOH	≤25	25	1	1
			60	2	3
			100		
		30	25	1	1
			60	2	3
			100		
		60	25	1	
			60	2	
			100		3
		80	25	1	2
			60	2	3
			100		3
- GLACIAL		100	25	2	3
			60	3	1
			100		3
ACETIC ANHYDRIDE	$(CH_3CO)_2O$	100	25	3	2
			60	3	
			100		
ACETONE	CH_3COCH_3	10	25	3	1
			60	3	3
			100		3
		100	25	33	1
			60		3
			100		3
ACETOPHENONE	CH_3COCH_3	nd	25		1
			60		
			100		
ACRYLONITRILE	CH_2CHCN	technically pure	25		2
			60	3	
			100		
ADIPIC ACID	$(CH_2CH_2CO_2H)_2$	sat.	25	1	1
- AQUEOUS SOLUTION			60	2	
			100		
ALLYL ALCOHOL	CH_2CHCH_2OH	96	25	2	
			60	3	
			100		
ALUM	$Al_2(SO_4)_3.K_2SO.nH_2O$	dil	25	1	
- AQUEOUS SOLUTION			60	2	
			100		
	$Al_2(SO_3)_3.K_2SO.nH_2O$	sat	25		
			60	2	
			100		
ALUMINIUM	$AlCl_3$	all	25	1	1
- CHLORIDE			60	1	
			100		
- FLUORIDE	AlF_3	100	25	1	
			60	1	
			100		
- HYDROXIDE	$Al(OH_4)_3$	all	25	1	1
			60	1	
			100		
- NITRATE	$Al(NO_2)_3$	nd	25	1	1
			60	1	
			100		
- SULPHATE	$Al(SO_4)_3$	deb	25	1	1
			60	1	
			100		
		sat	25	1	1
			60	1	
			100		

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
AMMONIA	NH_3	deb	25	1	1
- AQUEOUS SOLUTION			60	2	
			100		
		sat	25	1	1
			60	2	
			100		
- DRY GAS		100	25	1	1
			60	1	2
			100		
- LIQUID		100	25	2	1
			60	3	
			100		
AMMONIUM	CH_3COONH_4	sat	25		1
- ACETATE			60	2	
			100		
- CARBONATE	$(NH_4)_2CO_3$	all	25	1	1
			60	2	
			100		
- CHLORIDE	NH_4Cl	sat	25	1	1
			60	1	
			100		
- FLUORIDE	NH_4F	25	25	1	
			60	2	
			100		
- HYDROXIDE	NH_4OH	28	25		1
			60	2	
			100		
- NITRATE	NH_4NO_3	sat	25	1	
			60	1	
			100		
- PHOSPHATE DIBASIC	$NH_4(HPO_4)_2$	all	25	1	
			60	1	
			100		
- PHOSPHATE META	$(NH_4)_4P_4O_{12}$	all	25	1	1
			60	1	
			100		
- PHOSPHATE TRI	$(NH_4)_2HPO_4$	all	25	1	1
			60	1	
			100		
- PERSULPHATE	$(NH_4)_2S_2O_8$	all	25	1	1
			60	1	
			100		
- SULPHIDE	$(NH_4)_2S$	deb	25	1	1
			60	2	
			100		
		sat	25	1	1
			60	1	
			100		
- SULPHYDRATE	NH_4OHSO_4	dil	25	1	
			60	2	
			100		
		sat	25	1	
			60	1	
			100		
AMYLACETATE	$CH_3CO_2CH_2(CH_2)_3CH_3$	100	25	3	3
			60	3	3
			100		3
AMYLALCOHOL	$CH_3(CH_2)_3CH_2OH$	nd	25	1	1
			60	2	
			100		
ANILINE	$C_6H_5NH_2$	all	25	3	1
			60	3	
			100		
- CHLORHYDRATE	$C_6H_5NH_2HCl$	nd	25	2	
			60	3	
			100		

B

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA B

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
CARBON	CO²	100	25	1	1
- DIOXIDE			60	2	
AQUEOUS SOLUTION			100		
- GAS		100	25	1	1
			60	1	
			100		
- DISULPHIDE	CS_2	100	25	2	3
			60	3	3
			100		3
- MONOXIDE	CO	100	25	1	1
			60	1	
			100		
- TETRACHLORIDE	CCl_4	sat	25	2	3
			60	3	
			100		
CARBONIC ACID	H_2CO_3	100	25	1	
- AQUEOUS SOLUTION			60	1	
			100		
- DRY		all	25	1	
			60	1	
			100		
- WET		comm	25	1	
			60	2	
			100		
CARBON OIL		dil	25	1	1
			60	1	
			100		
CHLORAMINE		20	25	1	1
			60		
			100		
CHLORIC ACID	$HClO_3$	sat	25	1	1
			60	2	1
			100		1
CHLORINE	Cl_2	10	25	2	3
			60	3	
			100		
- DRY GAS		100	25	1	
			60	2	
			100		
		5g/m³	25	2	
			60	3	
			100		
- WET GAS		10g/m³	25	1	
			60	3	
			100		
		66g/m³	25	2	
			60	2	
			100		
		100	25	2	
			60	2	
			100		
- LIQUID		85	25	3	3
			60		
			100		
CHLOROACETIC ACID	$ClCH_2COH$	100	25	1	2
			60	2	
			100		3
		all	25	1	
			60	2	
			100		3
CHLOROBENZENE	C_6H_5Cl	all	25	3	3
			60	3	3
			100		
CHLOROFORM	$CHCl_3$		25	3	3
			60	3	3
			100	3	3

C

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA C

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
CHLOROSULPHONIC	$ClHSO_3$	100	25	2	3
ACID			60	3	3
			100		3
CHROME ALUM	$KCr(SO_4)_2$	nd	25	1	1
			60	2	
			100		
CHROMIC ACID	CrO_3+H_2O	10	25	1	1
			60	2	
			100		
		30	25	1	1
			60	2	3
			100		3
		50	25	1	2
			60	2	
			100		
CHROMIC SOLUTION	$CrO_3+H_2O+H_2SO_4$	50/35/15	25	1	
			60	2	
			100		
CITRIC ACID	$C_3H_4(OH)(CO_2H)_3$	50	25	1	1
AQ. SOL. min			60	1	
			100		
COPPER	$CuCl_2$	sat	25	1	1
- CHLORIDE			60	1	
			100		
- CYANIDE	$CuCN_2$	all	25	3	
			60	3	
			100		
- FLUORIDE	CuF_2	all	25	1	
			60	1	
			100		
- NITRATE	$Cu(NO_3)_2$	nd	25	1	1
			60	2	
			100		
- SULPHATE	$CuSO_4$	dil	25	1	1
			60	1	
			100		
		sat	25	1	1
			60	1	
			100		
COTTONSEED OIL		comm	25	1	2
			60	1	
			100		
CRESOL	$CH_3C_6H_4OH$	£90	25	2	3
			60	3	3
			100		
		>90	25	3	3
			60	3	3
			100		
CRESYLIC ACID	$CH_3C_6H_4COOH$	50	25	2	
			60	3	2
			100		
CYCLOHEXANE	C_6H_{12}	all	25	3	3
			60	3	3
			100		
CYCLOHEXANONE	$C_6H_{10}O$	all	25	3	3
			60	3	3
			100		3
DECAHYDRONAFTALENE	$C_{10}H_{18}$	nd	25	1	3
			60	1	3
			100		
DEMINERALIZED WATER		100	25	1	1
			60	1	1
			100		1
DEXTRINE	$C_6H_{12}OCH_2O$	nd	25	1	
			60	2	
			100		

D

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA D

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
DIBUTYLPHTALATE	$C_6H_4(CO_2C_4H9)_2$	100	25	3	1
			60	3	
	$Cl_2CHCOOH$		100		
DICHLOROACETIC		100	25	1	1
ACID			60	2	
			100		
DICHLOROETHANE	CH_2ClCH_2Cl	100	25	3	
			60	3	
			100		
DICHLOROETHYLENE	$ClCH_2Cl$	100	25	3	1
			60	3	
			100		
DIETHYL ETHER	$C_2H_5OC_2H_5$	100	25	3	
			60	3	
			100		
DIGLYCOLIC ACID	$(CH_2)_2O(CO_2H)_2$	18	25	1	1
			60	2	
			100		
DIMETHYLAMINE	$(CH_3)_2NH$	100	25	2	3
			60	3	
			100		
DIOCTYLPHTHALATE		all	25	3	2
			60	3	
			100		
DISTILLED WATER		100	25	1	1
			60	1	1
			100		1
DRINKING WATER		100	25	1	1
			60	1	1
			100		1
ETHERS		all	25	3	2
			60	3	3
			100		
ETHYL	$CH_3CO_2C_2H_5$	100	25	3	1
- ACETATE			60	3	3
			100		3
- ALCOHOL	CH_3CH_2OH	nd	25	1	1
			60	2	
			100		
- CHLORIDE	CH_3CH_2Cl	all	25	3	1
			60	3	
			100		
- ETHER	$CH_3CH_2OCH_2CH_3$	all	25	3	2
			60	3	3
			100		
ETHYLENE	$ClCH_2CH_2OH$	100	25	3	3
- CHLOROHYDRIN			60	3	3
			100		
- GLYCOL	$HOCH_2CH_2OH$	comm	25	1	1
			60	2	
			100		
FATTY	ACIDS	nd	25	1	
			60	1	
			100		
FERRIC	$FeCl_3$	10	25	1	1
- CHLORIDE			60	2	1
			100		
		sat	25	1	1
			60	1	1
			100		1
- NITRATE	$Fe(NO_3)_3$	nd	25	1	
			60	1	
			100		
- SULPHATE	$Fe(SO_4)_3$	nd	25	1	1
			60	1	
			100		

E

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA E

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
FERROUS	$FeCl_2$	sat	25	1	1
- CHLORIDE			60	1	
			100		
- SULPHATE	$FeSO_4$	nd	25	1	1
			60	1	
			100		
FERTILIZER		≤10	25	1	1
			60	1	
			100		
		sat	25	1	1
			60	1	
			100		
FLUORINE GAS - DRY	F_2	100	25	2	
			60	3	
			100		
FLUOROSILICIC ACID	H_2SiF_6	32	25	1	2
			60	1	
			100		
FORMALDEHYDE	HCOH		25	1	1
			60	2	
			100		
FORMIC ACID	HCOOH	50	25	1	1
			60	2	2
			100		
		100	25	1	2
			60	3	2
			100		
FRUIT PULP AND JUICE		comm	25	1	1
			60	1	
			100		
FUEL OIL		100	25	1	3
			60	1	
			100		
		comm	25	1	3
			60	1	
			100		
FURFUROLE ALCOHOL	$C_5H_3OCH_2OH$	nd	25	3	
			60	3	
			100		
GAS EXHAUST		all	25	1	1
- ACID			60	1	
			100		
- WITH NITROUS VAPOURS		traces	25	1	
			60	1	
			100		
GAS PHOSGENE	ClCOCl	100	25	1	
			60	2	
			100		
GELATINE		100	25	1	1
			60	1	
			100		
GLUCOSE	$C_6H_{12}O_6$	all	25	1	1
			60	2	
			100		
GLYCERINE	$HOCH_2CHOHCH_2OH$	all	25	1	1
AQ.SOL			60	1	
			100		
GLYCOGLUE		100	25	1	1
AQUEOUS			60	1	
			100		
GLYCOLIC ACID	$HOCH_2COOH$	37	25	1	
			60	1	
			100		
HEPTANE	C_7H_{16}	100	25	1	1
			60	2	1
			100		

F

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA F

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
FERROUS	$FeCl_2$	sat	25	1	1
- CHLORIDE			60	1	
			100		
- SULPHATE	$FeSO_4$	nd	25	1	1
			60	1	
			100		
FERTILIZER		≤10	25	1	1
			60	1	
			100		
		sat	25	1	1
			60	1	
			100		
FLUORINE GAS - DRY	F_2	100	25	2	
			60	3	
			100		
FLUOROSILICIC ACID	H_2SiF_6	32	25	1	2
			60	1	
			100		
FORMALDEHYDE	HCOH		25	1	1
			60	2	
			100		
FORMIC ACID	HCOOH	50	25	1	1
			60	2	2
			100		
		100	25	1	2
			60	3	2
			100		
FRUIT PULP AND JUICE		comm	25	1	1
			60	1	
			100		
FUEL OIL		100	25	1	3
			60	1	
			100		
		comm	25	1	3
			60	1	
			100		
FURFUROLE ALCOHOL	$C_5H_3OCH_2OH$	nd	25	3	
			60	3	
			100		
GAS EXHAUST		all	25	1	1
- ACID			60	1	
			100		
- WITH NITROUS VAPOURS		traces	25	1	
			60	1	
			100		
GAS PHOSGENE	ClCOCl	100	25	1	
			60	2	
			100		
GELATINE		100	25	1	1
			60	1	
			100		
GLUCOSE	$C_6H_{12}O_6$	all	25	1	1
			60	2	
			100		
GLYCERINE	$HOCH_2CHOHCH_2OH$	all	25	1	1
AQ.SOL			60	1	
			100		
GLYCOGLUE		10	25	1	1
AQUEOUS			60	1	
			100		
GLYCOLIC ACID	$HOCH_2COOH$	37	25	1	
			60	1	
			100		
HEPTANE	C_7H_{16}	100	25	1	1
			60	2	1
			100		

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
HEXANE	C_6H_{14}	100	25	1	3
			60	2	
			100		
HYDROBROMIC ACID	HBr	≤10	25	1	1
			60	2	
			100		3
		48	25	1	1
			60	2	
			100		3
HYDROCHLORIC ACID	HCl	≤25	25	1	1
			60	2	1
			100		3
		≤37	25	1	1
			60	1	2
			100		3
HYDROCYANIC ACID	HCN	deb	25	1	1
			60	1	3
			100		
HYDROFLUORIC ACID	HF	10	25	1	1
			60	2	
			100		
		60	25	2	2
			60	3	
			100		
HYDROGEN	H_2	all	25		
			60		
			100		
HYDROGEN	H_2O_2	30	25	1	1
- PEROXIDE			60	1	
			100		
		50	25	1	
			60	1	
			100		
		90	25	1	2
			60	1	
			100		
- SULPHIDE DRY		sat	25	1	1
			60	2	
			100		
- SULPHIDE WET		sat	25	1	1
			60	2	
			100		
HYDROSULPHITE		≤10	25	1	1
			60	2	
			100		
HYDROXYLAMINE	$(H_2NOH)_2H_2SO_4$	12	25	1	
SULPHATE			60	1	
			100		
ILLUMINATING GAS		100	25	1	1
			60		
			100		
IODINE	I_2	3	25	2	
- DRY AND WET			60	3	
			100		
- TINCTURE		>3	25	2	
			60	3	
			100		
ISOCTANE	C_8H_{18}	100	25	1	
			60		
			100		
ISOPROPYL	$(CH_3)_2CHOCH(CH_3)_2$	100	25	2	
- ETHER			60	3	
			100		
- ALCOHOL	$(CH_3)_2CHOH$	100	25		
			60	2	
			100		

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
LACTIC ACID	$CH_3CHOHCOOH$	≤28	25	1	1
			60	2	
			100		
LANOLINE		nd	25		
			60	2	
			100		
LEAD ACETATE	$Pb(CH_3COO)_2$	sat	25	1	1
			60	1	
			100		
LINSEED OIL		comm	25	1	1
			60	2	
			100		
LUBRICATING OILS		comm	25	1	3
			60	1	
			100		
MAGNESIUM	$MgCO_3$	all	25	1	1
- CARBONATE			60	1	
			100		
- CHLORIDE	$MgCl_2$	sat	25	1	1
			60	1	
			100		
- HYDROXIDE	$Mg(OH)_2$	all	25	1	1
			60	1	
			100		
- NITRATE	$MgNO_3$	nd	25	1	1
			60	1	
			100		
- SULPHATE	$MgSO_4$	dil	25	1	1
			60	1	
			100		
		sat	25	1	1
			60	1	
			100		
MALEIC ACID	COOHCHCHCOOH	nd	25	1	2
			60	1	
			100		
MALIC ACID	$CH_2CHOH(COOH)_2$	nd	25	1	3
			60		
			100		
MERCURIC	$HgCl_2$	sat	25	1	
- CHLORIDE			60	1	
			100		
- CYANIDE	$HgCN_2$	all	25	1	
			60	1	
			100		
MERCUROUS NITRATE	$HgNO_3$	nd	25	1	
			60	1	
			100		
MERCURY	Hg	100	25	1	1
			60	2	
			100		
METHYL	CH_3COOCH_3	100	25		2
- ACETATE			60		3
			100		
- ALCOHOL	CH_3OH	nd	25	1	1
			60	1	
			100		
- BROMIDE	CH_3Br	100	25	3	
			60		
			100		
- CHLORIDE	CH_3Cl	100	25	3	2
			60	3	
			100		
- ETHYLKETONE	$CH_3COCH_2CH_3$	all	25	3	1
			60	3	
			100		

I

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA I

MATERIAL

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
METHYLAMINE	CH_3NH_2	32	25	2	
			60	3	
			100		
METHYLENE	CH_2Cl_2	100	25	3	
CHLORIDE			60	3	
			100		
METHYL	CH_3COOSO_4	50	25	1	1
SULPHORIC ACID			60	2	
			100		3
		100	25	1	1
			60	2	
			100		3
MILK		100	25	1	1
			60	1	
			100		
MINERAL ACIDOULOUS		nd	25	1	1
WATER			60	1	1
			100		1
MOLASSES		comm	25	1	1
			60	2	
			100		
NAPHTA		100	25	2	3
			60	3	
			100		
NAPHTALINE		100	25	1	3
			60		
			100		
NICKEL	$NiCl_3$	all	25	1	1
- CHLORIDE			60	1	
			100		
- NITRATE	$Ni(NO_3)_2$	nd	25	1	1
			60	1	
			100		
- SULPHATE	$NiSO_4$	dil	25	1	1
			60	1	
			100		
		sat	25	1	1
			60	1	1
			100		
NITRIC ACID	$NiSO_4$	anhydrous	25	3	
			60	3	
			100		
		20	25	1	1
			60	2	
			100		2
		40	25	1	1
			60	1	
			100		3
		60	25	1	3
			60	2	3
			100		3
		98	25	3	3
			60	3	3
			100		3
NITROBENZENE	$C_6H_5NO_2$	all	25	3	3
			60	3	3
			100		
OLEIC ACID	$C_8H_{17}CHCH(CH_2)_7CO_2H$	comm	25	1	2
			60	1	
			100		

J

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA J

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
OLEUM		nd	25	3	3
			60	3	3
			100		
- VAPOURS		low	25	3	3
			60	3	3
			100		
		hight	25	3	3
			60	3	3
			100		
OLIVE OIL		comm	25		2
			60	2	
			100		
OXALIC ACID	HO_2CCO_2H	10	25	1	1
			60	2	1
			100		1
		sat	25	1	1
			60	1	
			100		
OXYGEN	O_2	all	25	1	1
			60	1	
			100		
OZONE	O_2	nd	25	1	1
			60	2	
			100		
PALMITIC ACID	$CH_3(CH_2)_{14}COOH$	10	25	1	2
			60	1	
			100		
		70	25	1	
			60	1	
			100		
PARAFFIN		nd	25		
			60	2	
			100		
- EMULSION		comm	25	1	
			60	1	
			100		
- OIL		nd	25	1	
			60	1	
			100		
PERCHLORIC ACID	$HClO_4$	100	25	1	2
			60	2	
			100		
		70	25	1	2
			60	2	
			100		
PETROL	C_2H_5OH	100	25	1	3
- REFINED			60		
			100		
- UNREFINED		100	25	1	3
			60	1	
			100		
PHENOL		1	25	1	1
- AQUEOUS SOLUTION			60		
			100		
		≤90	25	2	
			60	3	
			100		
PHENYL HYDRAZINE	$C_6H_5NHNH_2$	all	25	3	
			60	3	
			100		
- CHLORHYDRATE	$C_6H_5NHNH_3Cl$	sat	25	1	
			60	3	
			100		

K

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA K

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
PHOSPHORIC	H_3PO_4	≤25	25	1	1
- ACID			60	2	1
			100		1
		≤50	25	1	1
			60	1	1
			100		1
		≤85	25	1	1
			60	1	
			100		
- ANHYDRIDE	P_2O_5	nd	25	1	1
			60	2	
			100		
PHOSPHORUS	PCl_3	100	25	3	
TRICHLORIDE			60	3	
			100		
PHOTOGRAPHIC		comm	25	1	1
- DEVELOPER			60	1	
			100		
- EMULSION		comm	25	1	
			60	1	
			100		
PHTHALIC ACID	$C_6H_4(CO_2H)_2$	50	25		1
			60	3	1
			100		
PICRIC ACID	$HOC_6H_2(NO2)_3$	1	25	1	1
			60	1	
			100		
		>1	25	3	1
			60	3	2
			100		
POTASSIUM	K_2CrO_7	40	25	1	1
- BICHROMATE			60	1	
			100		
- BORATE	K_3BO_3	sat	25	1	
			60	2	
			100		
- BROMATE	$KBrO_3$	nd	25	1	1
			60	2	
			100		
- BROMIDE	KBr	sat	25	1	
			60	1	
			100		
- CARBONATE	K_2CO_3	sat	25	1	
			60	1	
			100		
- CHLORIDE	KCl	sat	25	1	2
			60	1	
			100		
- CHROMATE	$KCrO_4$	40	25	1	1
			60	1	
			100		
- CYANIDE	KCN	sat	25	1	
			60	1	
			100		
- FERROCYANIDE	$K_4Fe(CN)_6.3H_2O$	100	25	1	1
			60	1	
			100		
- FLUORIDE	KF	sat	25		
			60		
			100		
- HYDROXIDE	KOH	≤60	25	1	1
			60	2	
			100		
- NITRATE	KNO_3	sat	25	1	1
			60	1	
			100		

L

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA L

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
- PERBORATE	KBO_3	all	25	1	1
			60	1	
			100		
- PERMANGANATE	$KMnO_4$	10	25	1	1
			60	1	
			100		
- PERSULPHATE	$K_2S_2O_8$	nd	25	1	1
			60	2	
			100		
- SULPHATE	K_2SO_4	sat	25		2
			60	1	3
			100		
PROPANE	C_3H_8	100	25	1	1
- GAS			60		
			100		
- LIQUID		100	25	1	3
			60		
			100		
PROPYL ALCOHOL	C_3H_7OH	100	25	1	1
			60	2	
			100		
PYRIDINE	$CH(CHCH)_2N$	nd	25	3	3
			60	3	3
			100		
RAIN WATER		100	25	1	1
			60	1	1
			100		1
SEA WATER		100	25	1	1
			60	1	1
			100		1
SILICIC ACID	H_2SiO_3	all	25	1	1
			60	1	1
			100		
SILICONE OIL		nd	25	1	1
			60	3	
			100		
SILVER	AgCN	all	25	1	
- CYANIDE			60	1	
			100		
- NITRATE	$AgNO_3$	nd	25	1	1
			60	2	
			100		
- PLATING SOLUTION		comm	25	1	1
			60	1	
			100		
SOAP		high	25	1	1
- AQUEOUS SOLUTION			60	2	
			100		
SODIC LYE		£60	25	1	1
			60	1	
			100		
SODIUM	CH_3COONa	100	25	1	1
- ACETATE			60	1	
			100		
- BICARBONATE	$NaHCO_3$	nd	25	1	1
			60	1	
			100		
- BISULPHITE	$NaHSO_3$	100	25	1	1
			60	1	
			100		
- BROMIDE	NaBr	sat	25	1	1
			60	1	
			100		
- CARBONATE	Na_2CO_3	sat	25	1	1
			60	1	
			100		

M

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA M

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
- CHLORATE	$NaClO_3$	nd	25	1	1
			60	2	
			100		
- CHLORIDE	NaCl	dil	25	1	1
			60	2	
			100		
		sat	25	1	1
			60	1	
			100		
- CYANIDE	NaCN	all	25	1	1
			60	1	
			100		
- FERROCYANIDE	$Na_4Fe(CN)_6$	sat	25	1	3
			60	1	
			100		
- FLUORIDE	NaF	all	25	1	
			60	1	
			100		
- HYDROXIDE	NaOH	60	25	1	1
			60	1	
			100		
- HYPOCHLORITE	NaOCl	deb	25	1	1
			60	2	
			100		
- HYPOSULPHITE	$Na_2S_3O_3$	nd	25	1	
			60	1	
			100		
- NITRATE	$NaNO_3$	nd	25	1	1
			60	1	
			100		
- PERBORATE	$NaBO_2H_2O$	all	25	1	1
			60	1	
			100		
- PHOSPHATE di	Na_2HPO_4	all	25	1	1
			60	1	
			100		
- PHOSPHATE tri	Na_3PO_4	all	25	1	1
			60	1	
			100		
- SULPHATE	Na_2SO_4	dil	25	1	1
			60	1	
			100		
		sat	25	1	1
			60	1	
			100		
- SULPHIDE	Na_2S	dil	25	1	1
			60	1	
			100		
		sat	25	1	1
			60	1	
			100		
- SULPHITE	$NaSO_3$	sat	25	1	1
			60	1	
			100		
STANNIC CHLORIDE	$SnCl_4$	sat	25	1	
			60	1	
			100		
STANNOUS CHLORIDE	SnCl2	dil	25	1	1
			60	1	
			100		
STEARIC ACID	$CH_3(CH_2)_{16}CO_2H$	100	25	1	
			60	1	2
			100		
SUGAR SYRUP		high	25	1	1
			60	2	
			100		

N

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA N

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
SULPHUR	S	100	25	1	1
			60	2	
			100		
- DIOXIDE AQUEOUS	SO_2	sat	25	1	1
			60	2	
			100		
- DIOXIDE DRY		all	25	1	1
			60	1	
			100		
- DIOXIDE LIQUID		100	25	2	
			60	3	
			100		
- TRIOXIDE	SO_3	100	25	2	
			60	2	
			100		
SULPHURIC ACID	H_2SO_4	≤10	25	1	1
			60	1	1
			100		1
		≤75	25	1	1
			60	2	
			100		2
		≤90	25	1	1
			60	2	
			100		
		≤96	25	2	2
			60	3	3
			100		3
- FUMING		all	25	2	3
			60	3	3
			100		3
- NITRIC AQUEOUS	$H_2SO_4+HNO_3+H_20$	48/49/3	25	1	
SOLUTION			60	2	
			100		
		50/50/0	25	2	
			60	3	
			100		
		10/20/70	25	1	
			60	1	
			100		
TALLOW EMULSION		comm	25	1	1
			60	1	
			100		
TANNIC ACID	$C_{14}H_{10}O_9$	10	25	1	1
			60	1	
			100		
TARTARIC ACID	$HOOC(CHOH)_2COOH$	all	25	1	1
			60	2	2
			100		
TETRACHLORO	$CHCl_2CHCl_2$	nd	25	3	
- ETHANE			60	3	
			100		
- ETHYLENE	CCl_2CCl_2	nd	25	3	
			60	3	
			100		
TETRAETHYLLEAD	$Pb(C_2H_5)_4$	100	25	1	1
			60	2	
			100		
TETRAHYDROFURAN	C_4H_8O	all	25	3	3
			60	3	
			100		
THIONYL CHLORIDE	$SOCl_2$		25	3	3
			60		
			100		
THIOPHENE	C_4H_4S	100	25	3	
			60	3	
			100		

O

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA O

Chemical	Formula	Conc. (%)	Temp. (°C)	uPVC	EPM
TOLUENE	C6H5CH3	100	25	3	3
			60	3	3
			100		3
TRANSFORMER OIL		nd	25	1	3
			60	2	
			100		
TRICHLOROACETIC	CCl 3COOH	≤50	25	1	2
ACID			60	3	
			100		
TRICHLOROETHYLENE	Cl 2CCHCl	100	25	3	3
			60	3	3
			100		
TRIETHANOLAMINE	N(CH2CH2OH)2	100	25	2	2
			60	3	
			100		
TURPENTINE		100	25	2	
			60	2	
			100		
UREA	CO(NH2)2	^{2}10	25	1	
AQUEOUS SOLUTION			60	2	
			100		
		33	25	1	
			60	2	
			100		
URINE		nd	25	1	1
			60	2	
			100		
URIC ACID	C5H4N4O3	10	25	1	
			60	2	
			100		
VASELINE OIL		100	25	1	3
			60	3	3
			100		
VINYL ACETATE	CH3CO2CHCH2	100	25	3	2
			60	3	3
			100		3
WHISKY		comm	25	1	1
			60	1	
			100		
WINES		comm	25	1	1
			60	1	
			100	1	
WINE VINEGAR		comm	25	1	1
			60	2	1
			100		1
ZINC	ZnCl2	dil	25	1	1
- CHLORIDE			60	1	
			100		
		sat	25	1	1
			60	1	
			100		
- CHROMATE	ZnCrO4	nd	25	1	1
			60	1	
			100		
- CYANIDE	Zn(CN)2	all	25	1	1
			60	1	
			100		
- NITRATE	Zn(NO3)2	nd	25	1	1
			60	1	
			100		
- SULPHATE	ZnSO4	dil	25	1	1
			60	1	
			100		
		sat	25	1	1
			60	1	
			100		

P

TECHNICAL MANUAL

Standard and Reference Data

migagreen plast industry

BUSINESS DATA P

Miga Green provides many valves, connectors, fittings and solutions with various sizes and shapes. Moreover, it provides a variety of practical solution to different sectors; (Irrigation system, water treatment plant stations (in all its forms), infrastructure, swimming pools, foods, gas and petroleum).

MIGA **PRODUCTS**

everything you need

NEeD

Miga
plastic industries

www.migagreen.com