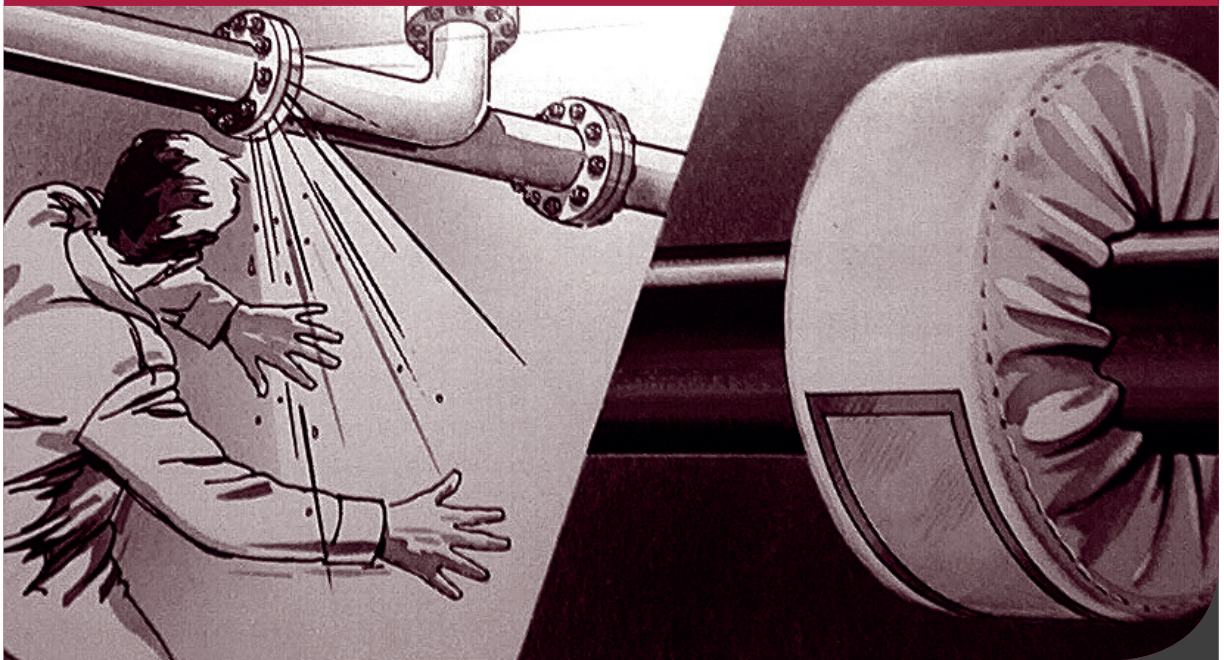


TOTAL SHIELD SOLUTIONS



Guidebook

INTRODUCTION

This guidebook summarises over 25 years’ safety shielding experience, and is designed to provide a start-to-finish guide to shielding projects and requirements.

Whilst safety shields & flange guards are relatively simple products, it is important to have a clear understanding of what is required (purpose & shield type) and exactly which plant areas and pipe runs need shields.

Consideration of a variety of issues is required to ensure success, otherwise shielding projects can run into problems, normally during the survey, installation phase, or later on when additional shields are required.

This guidebook can be used for information only, or, by completing the customer-entry sections, to create your own full specification of requirements. If you would like our recommendation on shield type & material, complete all sections and email or fax back to us. If you have already settled on the shield type, simply return the survey section.

For further information or clarification, please do not hesitate to contact us.

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DRIVER / REASON FOR SHIELDS

Many different motivations exist for the installation of safety shields. What is the driver behind your current requirements?

Recent incident or near-miss on site, or associated site

Very often, site incidents or near-misses will necessitate a safety review, at which time safety shields are considered as corrective or preventative action.

Industry regulations

Various regulations exist, some specifying safety shielding (SOLAS, marine industry) and others recommending shielding as a control measure (EP15 energy industry).

Insurance requirement

The cost of site fires, explosions and personal injury is significant. Industrial insurers now focus specifically on spray-out and oil mist prevention, and often insist on safety shielding.

Hazardous area zoning issue

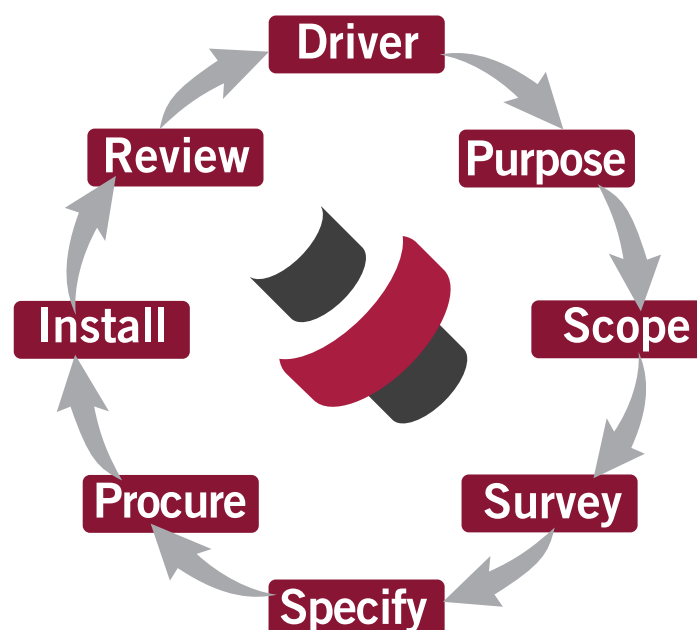
DSEAR reclassification can create technical and commercial complications. Many customers use safety shields as part of their case to reduce zoned areas.

Company-wide policy/philosophy & best practice

In an attempt to reach the goal of 'zero accidents', many large companies create and insist upon safety policies and requirements that often include safety shielding.

Other

There are a variety of other reasons to fit shields, including pollution control, general site cleanliness and protection of nearby electrical equipment.



PURPOSE

What are the main purposes of the shields? There may be more than one, and some might just be 'nice to have':

Prevent Spray-outs

Generally the most important requirement is to stop a leak from causing damage or injury. Even at low pressure, leakage can result in spray-out.

Avoid oil mist formation

For certain oil & fuel applications, oil mist formation is just as hazardous as a spray-out. Furthermore, ill-fitting safety shields can actually create mist formation.

Provide leak indication

It is important to identify leaks as quickly as possible, though the process will determine the urgency. For certain acid lines, some customers require that

flanges must not be concealed. This is achieved using transparent shielding. Alternatively leak-indicator patches can be used. For other process liquids, leaks will be self-evident.

Containment

Whilst standard safety shield designs generally do not provide secondary containment (indeed there should be a leak path to avoid pressure build-up), we can offer special design incorporating drain nipples and a system to channel liquid releases.

Other

The specific purpose of the shield may be unique to your site. We have a variety of shield types and materials, to solve practically any problem.

SCOPE

Which areas and plants on site require shielding? Consider the risk of leakage, the nature of the process and the local vicinity:-

Oil lines near hot surfaces

Do you need to install shielding for all oil lines, or only those in close proximity to hot surfaces?

Acid Lines near personnel or walkways

Is there a risk of injury through spray-out? Do you need immediate leak indication and identification of acids?

Reducing zoned hazardous areas

Some customers use the argument that safety shields around pipe fittings reduce the size of the local zoned area.

Concentration, temperature & pressure

Whilst we would suggest all hazardous process lines are shielded, perhaps the first priority should be those above a certain concentration, pressure or temperature.

Working at height

Pipelines at height can be as dangerous as any other. But once again, the logistics of gaining access might mean that first priority goes to pipework up to head-height.

Pipe Joint types

Which specific pipe joints present sufficient risk? Flanges, valves, expansion joints, couplings, hoses?

SURVEY

Safety shields are made to fit specific flange & fitting sizes. As such, for retrofits, the next step is to perform a site survey. This is not rocket science, but it is important to get right first time.

Measurement and dimensions

Please refer to the Survey Guide in the appendix, this provides a full explanation of exactly which measurements to be recorded, along with examples of past surveys.

For standard flanges and simple valves, we just require pipe size and class (eg 2", 150lb) and a note of the valve type (ball, butterfly).

Shield location & process line

Measuring a flange is easy enough but fitting a box full of shields is impossible if you don't know where they are supposed to go! We highly recommend recording specific areas and pipe-runs within the plant. If pipe-runs are complex, make additional notes (eg "caustic 2" line, running along floor from Tank No. CA10112)

Individual flange and shield identification?

Some customers create individual flange & shield ID tags. The ID schedule makes routine inspection and replacement orders much easier. We can supply individual tag numbers on the shield labels if requested.

Process information

For shield compatibility, it is critically important to note certain process information:

- Process liquid (eg. sulphuric, caustic, lube oil, fuel oil, steam, solvent etc)
- Concentration if applicable
- Maximum temperature
- Maximum pressure (unless you already state pipe class, eg. 150lb)

Surveying & Installing

If the surveyor knows he/she are also installing the shields, they will generally have a greater attention to detail, both in taking measurement and location information.

Drawings, photos and model/part numbers

We recommend that you take as much information as possible for non-standard items. Noting down model/part number can help us in identifying dimensions. Accompanying photographs or sketches are also very helpful.

Please refer to the Survey Guide in the appendix

SPECIFICATION & PROCUREMENT

With the information gained so far, we can now identify the right shielding solution for your application(s). Our comprehensive range of safety shield materials and designs means that we can provide solutions for almost any requirement, large or small, simple or complicated.

By completing the forms in the appendix, you are creating a comprehensive specification of requirements. If you have already chosen a specific shield type, simply return the survey forms and we will quote by return. If however, you would like us to make a recommendation on shield suitability, return all completed forms.

- Note: we recommend that the survey is performed before choosing a specific shield type. Steel shields cannot be fabricated to fit certain joint types, and elevated process temperature and pressure determines the suitability of some fabric shields.

- Note: Our growing service network enables us to perform survey and installation work on behalf of our clients. If you are interested in this, please contact either the local office nearest to you, or our head office in the UK.

We supply shielding solutions globally, either directly or through our growing network of local offices and partnerships.

INSTALLATION

The success of the install depends on the quality of the survey. Just dumping a large quantity of shields on your fitter's desk will inevitably have poor results. Worst case, shields will be installed incorrectly or not at all.

We recommend that the installer should be the same person(s) who performed the survey. This way, they take ownership of the project and ensure that all shields are installed correctly.

Whilst installation of our shield range is simple, it is important to follow these guidelines:-

Refer to survey notes to ensure that shields are installed on the correct process lines. If a mixture of shield materials are purchased, make sure each type is installed on the correct process (PVC is not suitable for high corrosion lines, PTFE is not suitable for high pressure steam, etc).

Install shields on the specific flange / joint sizes for which they were intended. Whilst a PTFE shield for a 2" flange will fit a 1 1/2", this will result in a shield for a 1 1/2" flange, that won't fit!

Tie fabric shields correctly (as per installation instructions) and secure with a square or reef knot. Otherwise, the shield may loosen and eventually fall off.

For standard steel shields, do not necessarily pull the quick-connection clamp as tight as it will possibly go. Select one of the four slots that ensure a snug fit.

REVIEW

Like any other part of the plant, safety shields should be routinely inspected.

Pipe maintenance work inevitably results in shields being removed. Our shield designs allow simple removal and re-fitting with no special tools – but if they are not included within maintenance schedules, they may not be re-fitted.

Additionally, if early leak detection is important, regular shield inspection should be included within your maintenance planning.

Our PTFE shields are designed for corrosive applications. We use multi-layered PTFE coated fibreglass with central strengthening scrim. Thread for the stitching and all pull-cords are also PTFE. However, if acid is left to soak into the shield indefinitely, the material will be damaged. Therefore in the event of a leak, remember to remove the shield, clean it and then return to service.

THE FLANGEGUARDS DIFFERENCE - NOT ALL SHIELDS ARE THE SAME!

Our product materials are very carefully selected, with only the highest quality fabrics and shield designs used.

QUALITY GUARANTEED

Our PTFE shields use multi-layered, permeable Teflon coated fibreglass body, additional central Teflon strengthened scrim, all-PTFE thread and pull-cords.

Our PTFE-Clear shield uses a transparent ECTFE central section. Other shield suppliers may use inferior, less expensive materials such as FEP, which tends to discolour and become cloudy in appearance.

Our STEEL shield comprises three-layer steel mesh inner and simple quick-connection latch. All materials are 316 grade.

BEST SERVICE

We pride ourselves on giving best possible customer service, whether your requirement is big or small. Our expert team will provide guidance and recommendations.

Largest Safety Shield stockholding in Europe, with a variety of designs and materials available for flange sizes from 15mm pipe size upwards.

Quick delivery turn around for non-standard shield sizes and shapes.

TESTED

When you specify FLANGEGUARDS, you know all shield types have been extensively pressure tested on our leak-simulation test facility – and chemically tested against a range of process media.

We recommend you check with your supplier, that the shield design being offered has been tested and is suitable for the process.

Tell us about your specific requirement. In the last 25 years we have supplied shield solutions for hundreds of different process applications.

FLEXIBLE

Our comprehensive product range enables us to make shields for virtually any shape or purpose. Typically, flanges are the first pipe joint to be considered, but we can make shields for;

valves (ball, butterfly, NRV, check, bonnet-style etc), couplings, elbows, tees, hose connections, expansion joints, pipe sections, pumps, heat exchanges, filters and the list goes on.

APPENDIX

i. SURVEY GUIDE	9
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iii. SELF SURVEY EXAMPLES	15
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SURVEY GUIDE

The information we need is simple, but it is important to take the correct measurements and other site/process information that will help to (a) identify most suitable shielding, and (b) enable the fitter to install the shields in the right place.

The following pages identify exactly what measurements and information is required. Our Self-Survey form is designed to be completed and returned to us for quotation or recommendation.

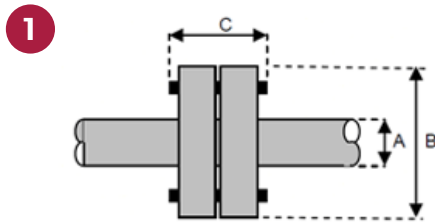
TIPS:

1. Pipelines will generally be made to standard sizes, according to process conditions. Knowing the pressure rating / class will make surveying quicker, but it is not a necessity.
2. For non-standard pipe joints/fittings, make a basic drawing or take a photo (if site conditions allow) and add dimensions.
3. For installation purposes, note the area you are in within the plant/site and the process (sulphuric, caustic, fuel oil etc). You can even note ID/tag numbers for specific tanks, pumps, valves. We can also tag the safety shields individually, if required.
4. If in doubt, ask us. We have over twenty five years' experience and are always happy to make recommendations and clarify specific dimensions required. We can also perform site surveys on your behalf, ask your local representative for details.
5. Have a tape measure and ideally a pair of callipers. These make outside diameter measurement simple, otherwise circumference can be measured.

Here is a list of common applications;

FLANGES

For standard flange sizes, we simply need to know outside flange diameter, but also ideally the pipe size and width. You can either (1) physically measure these dimensions or (2) simply tell us the pipe size and flange rating:-



2
PN16, DN40 / ANSI150lb, 2"

(for non-standard flange sizes, we prefer you to take manual measurement)

We can make shields for non-circular flanges such as SAE oval and square shapes. However, unless you advise us otherwise we will assume flanges are circular. Refer to the Joint-Types section of our website for further information.

VALVES

We can make shields for virtually any valve configuration. Typical valve types include;

Ball, butterfly, swing-check, wafer-check, non-return, plug, bonnet, diaphragm

So for standard flanged Ball, Butterfly and Non-Return valves we simply need to know:-

1. Valve Type
2. Pipe Size
3. Flange Class (or if screw connection)

Eg. Ball Valve, 50mm NB, PN25

Our shields will be made with cut-outs to accommodate valve handles and actuators. Unless you tell us otherwise, we will assume there's a handle, centrally placed (apart from non-return valves, where generally there is no handle).

Some actuator structures are larger than others, so please provide as much information as possible if the valve is actuated, or if the handle is offset. See our valve shield quick-reference guide, Appendix V.

OTHER JOINTS

For anything else, measure all the dimensions that you think will be pertinent – bearing in mind that we need to make the shield big enough to wrap around the areas that need protection. See survey-samples for further details.

ITEMS THAT WE CAN AND HAVE SHIELDED BEFORE:-

- Expansion Joints / Bellows
- Couplings, Unions, Hose Connections, Elbows, Tees
- Whole Pipe Sections and Hose Lengths
- Heat Exchangers
- Whole Filters and Filter Tops
- Whole Pump Sets
- Flanges; SAE, Oval, Square, Extra-Wide, Non-Even
- Sight Glasses
- Flow Indicators and Meters

SELF SURVEY

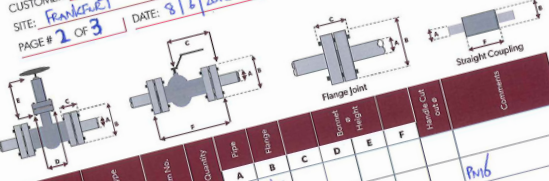
Please complete the 'Self Survey' sheets on the following pages and return them to us for a quotation. Examples of these pages can be found on pages 15 - 17 in this document.

SELF SURVEY

CUSTOMER: ABC CHEMICALS
 SITE: FRANKFURT
 PAGE # 2 OF 3 DATE: 8/6/2015

AREA: CHEMICAL STORAGE POWER PLANT

1 of 3



Location / Notes	Joint Type	Material	Quantity	A	B	C	D	E	F	Comments
CAUSTIC LINES FROM STORAGE TANK										
BOTTOM OF TANK 1.01	FLANGE	1.01	1	15	95	100				PN16
" " 1.02	FLANGE	1.02	1	15	95	100				PN16
" " 1.03	FLANGE	1.03	1	40	150	100				EXTRA WIDE INNER FLANGE
" " 1.04	BALL VALVE	1.04	1	40	150	100				2.5" SQUARE ACTUATOR
" " 1.05	BALL VALVE	1.05	1	25	115					PN16
TOP OF TANK 1.06	FLANGE	1.06	1	25	115					PN16
" " 1.07	BALL VALVE	1.07	1	80	200	75				
" " 1.08	BANK FLANGE	1.08	1							
FUEL LINES IN GENERATOR ROOM										
BURNER VALVE 2.01	FLANGE	2.01	1	150	300	100				100
FLANGE 2.02	FLANGE	2.02	1	150	300	100				SEE DRAWING
EXPANSION JOINTS 2.03	FLANGE	2.03	1	20	95					SEE DRAWING
SPECIAL VALVES 2.04	FLANGE	2.04	1							
HOSE 2.05	FLANGE	2.05	1							

Return your survey to us for quotation, www.flangeguards.com

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SELF SURVEY

COMPANY: ABC CHEMICALS
 TEL: 449 89 000001
 SITE: FRANKFURT

CONTACT NAME: FRED
 EMAIL: FRED@ABCHEM.COM

1 of 3

DRIVER / REASON FOR SHIELDS
 Briefly explain the reason why shields are being considered. Perhaps it is as a result of an accident/incident, insurance or regulatory requirement, corporate directive, hazardous area zoning. This information helps us to identify the correct solution for you.

CORPORATE DIRECTIVE FOLLOWING NGAR-MISS ON A DIFFERENT SITE.

PURPOSE:
 Tell us what you expect from the shield. Typically the main purpose is to prevent spray-out but not contain the leak. However, your requirement may be different. Perhaps oil mist is the main concern, or to provide visual leak indication. Alternatively you may need to contain the leak and divert through drains.

PREVENT SPRAY-OUT AND PROVIDE LEAK INDICATION

SCOPE:
 List specific process lines requiring shields, (eg. 98% sulphuric acid, lubrication oil) and where appropriate, tell us the process temperature and pressure (hydraulic oil at 100Bar pressure / Thermal oil at 250°C).

1) 47% CAUSTIC
2) FUEL OIL

The FlangeGuard

SELF SURVEY

CUSTOMER: ABC CHEMICALS
 SITE: FRANKFURT
 PAGE # 3 OF 3 DATE: 8/6/2015

AREA: POWER PLANT

3 of 3



2.04 BALL VALVE & NON-RETURN VALVE IN SERIES



2.05 HOSE & FLANGES

NOTE: NOT SURE IF SHIELDS REQUIRED FOR FLANGES - ONLY OR MESSAGED EVERYTHING

Return your survey to us for quotation, www.flangeguards.com

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SELF SURVEY

COMPANY: _____

CONTACT NAME: _____

TEL: _____

EMAIL: _____

SITE: _____

DRIVER / REASON FOR SHIELDS

Briefly explain the reason why shields are being considered. Perhaps it is as a result of an accident/incident, insurance or regulatory requirement, corporate directive, hazardous area zoning. This information helps us to identify the correct solution for you.

PURPOSE:

Tell us what you expect from the shield. Typically the main purpose is to prevent spray-out but not contain the leak. However, your requirement may be different. Perhaps oil mist is the main concern, or to provide visual leak indication. Alternatively you may need to contain the leak and divert through drains.

SCOPE:

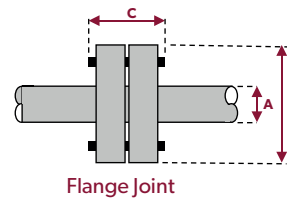
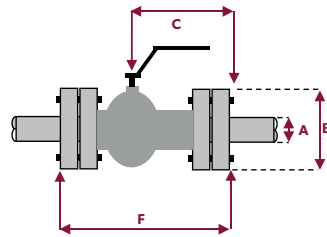
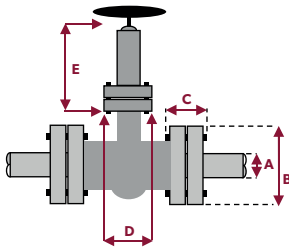
List specific process lines requiring shields, (eg. 98% sulphuric acid, lubrication oil) and where appropriate, tell us the process temperature and pressure (hydraulic oil at 100Bar pressure / Thermal oil at 250°C).

CUSTOMER: _____

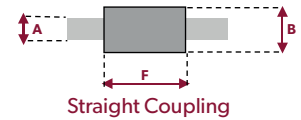
AREA: _____

SITE: _____

PAGE # OF DATE:



Flange Joint



Straight Coupling

[illegible]

Return your survey to us for quotation, www.flangeguards.com

*Dimensions measured in mm
(Unless otherwise stated)*

SELF SURVEY

CUSTOMER: _____		AREA: _____
SITE: _____		
PAGE # _____	OF _____	DATE: _____

Return your survey to us for quotation, www.flangeguards.com	<i>Dimensions measured in mm (Unless otherwise stated)</i>
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SELF SURVEY EXAMPLE 1

SELF SURVEY FLANGEGUARDS.com
1 of 3

COMPANY: ABC CHEMICALS CONTACT NAME: FRED
TEL: +49 69 000001 EMAIL: FGC@ABCCHM.COM
SITE: FRANKFURT

DRIVER / REASON FOR SHIELDS
Briefly explain the reason why shields are being considered. Perhaps it is as a result of an accident/incident, insurance or regulatory requirement, corporate directive, hazardous area zoning. This information helps us to identify the correct solution for you.

CORPORATE DIRECTIVE FOLLOWING NEAR-MISS ON A DIFFERENT SITE.

PURPOSE:
Tell us what you expect from the shield. Typically the main purpose is to prevent spray-out but not contain the leak. However, your requirement may be different. Perhaps oil mist is the main concern, or to provide visual leak indication. Alternatively you may need to contain the leak and divert through drains.

PREVENT SPRAY-OUT AND PROVIDE LEAK INDICATION

SCOPE:
List specific process lines requiring shields, (eg. 98% sulphuric acid, lubrication oil) and where appropriate, tell us the process temperature and pressure (hydraulic oil at 100Bar pressure / Thermal oil at 250°C).

1) 47% CAUSTIC AMBIENT
2) FUEL OIL

12

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SELF SURVEY EXAMPLE 2

SELF SURVEY

FLANGEGUARDS.com

2 of 3

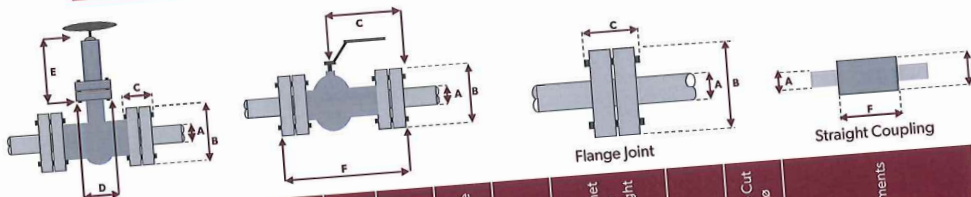
CUSTOMER: ABC CHEMICALS

AREA: 1 CHEMICAL STORES 2 BOWER PLANT

SITE: FRANKFURT

PAGE # 2 OF 3

DATE: 8/6/2015



Location / Notes	Joint Type	Item No.	Quantity	Pipe		Flange	C	Flange Joint			Handle Cut out	Comments	
				A	B			D	E	F			
<u>CAUSTIC LINES FROM STORAGE TANK</u>													
BOTTOM OF TANK I.D. 4701	FLANGE	1.01	1	40mm	150							PN16	
" "	FLANGE	1.02	1	15	95							PN25	
" "	FLANGE	1.03	1	15	95	100*						EXTRA WIDE WATER FLANGE	
" "	BALL VALVE	1.04	1	40	150	CENTRAL					15	PN16	
" "	BALL VALVE	1.05	1	40	150	CENTRAL					25x 25	SQUARE FOR ACTUATOR	
TOP OF TANK 4701 (FLOOR)	FLANGE	1.06	1	25	115							PN16	
" "	BUTTERFLY VALVE	1.07	1	25	115	CENTRE						PN16	
" "	Blank FLANGE	1.08	1	80	200	75							
<u>FUEL LINES IN GENERATOR ROOM</u>													
BONNET VALVE		2.01	1	150	300	100	200	250			40	PN40?	
FLANGE		2.02	1	150	300	100							
EXPANSION BOLLOWS		2.03	1	20	95						100		
SPECIAL VALVE		2.04	1									SEE DRAWING	
HOSE		2.05	1									SEE DRAWING	

flangeguards.com

Dimensions measured in mm
(Unless otherwise stated)

Dimensions measured in mm
(Unless otherwise stated)

Return your survey to us for quotation, www.flangeguards.com

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SELF SURVEY

FLANGE GUARDS.com

3 of 3

CUSTOMER: ABC CHEMICALS

AREA: POWER PLANT

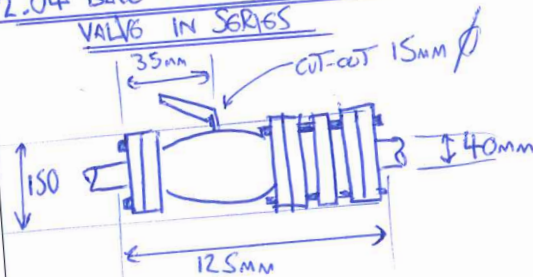
SITE: FRANKFURT

SITE: FRANKFURT
PAGE # 3 OF 3 DATE: 8/6/2015

PAGE # 3 OF 3

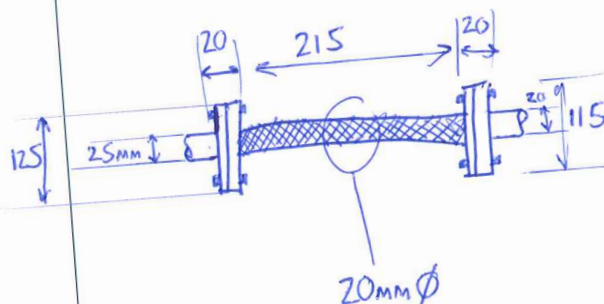
DATE: 8/6/2015

2.04 BALL VALVE & NON-RETURN VALVE IN SERIES



NOTE: ALL FLANGES ARE
SAME SIZE

2.05 HOSE & FLANGES



NOTE: NOT SURE IF
SAVINGS REQUIRED FOR
FRANCHISE - ONLY OR
ALSO HOSS, SO
MEASURED EVERYTHING

Return your survey to us for quotation, www.flangeguards.com Dimensions measured in mm (Unless otherwise stated)

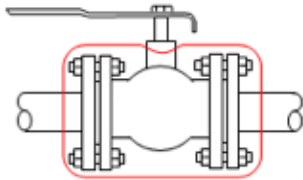
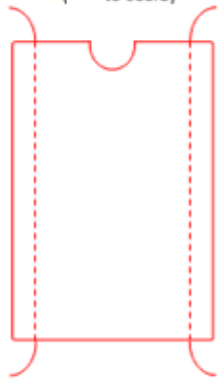
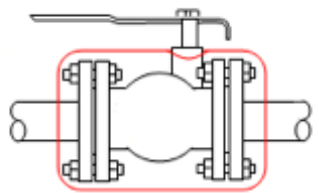
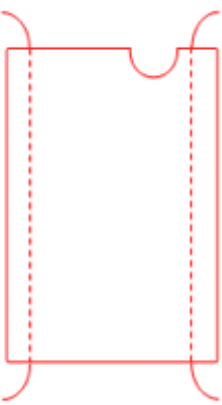
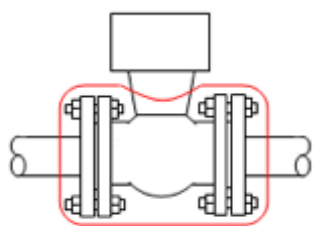
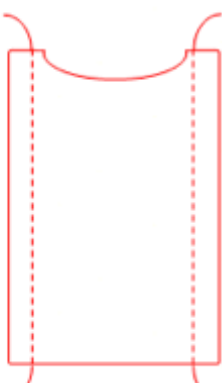
Dimensions measured in mm
(Unless otherwise stated)

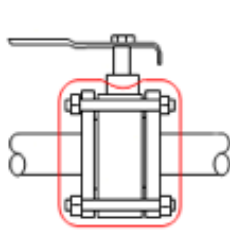
14

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VALVE SHIELDS - QUICK REFERENCE

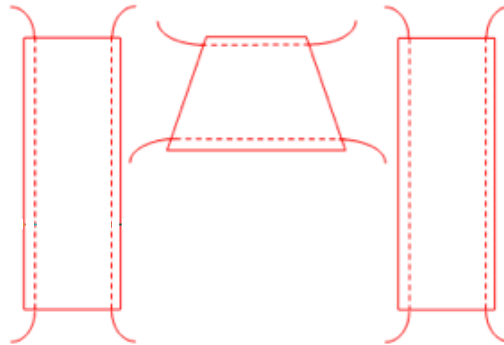
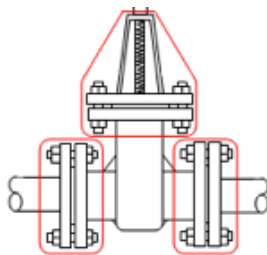
A wide variety of valve designs, sizes and configurations exist. We can tailor our shields to exactly fit any valve but common configurations are listed below, showing shield shape and fit. This information is useful during the survey, to identify the measurements required.

Valve with shield installed	shield shape & pull-cords uninstalled (not to scale)	Comments
		<u>BALL VALVE with central handle</u> One-piece shield, central cut-out
		<u>BALL VALVE with offset handle</u> One-piece shield, offset cut-out
		<u>BALL VALVE with actuator</u> One-piece shield, larger cut-out



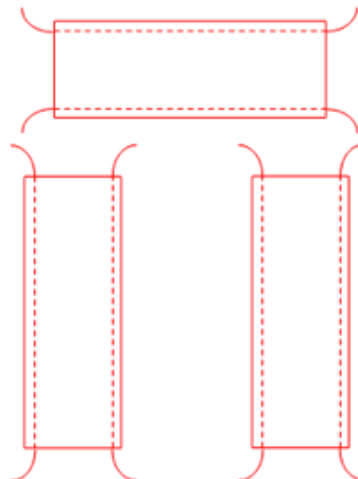
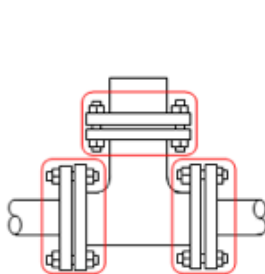
BUTTERFLY VALVE

One-piece shield,



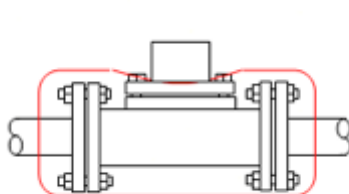
BONNET-STYLE VALVE

Three-piece shield, two standard flange shields and one tapered bonnet shield



GATE-STYLE VALVE

Three-piece shield, as top flange sits proud of bottom flanges



DIAPHRAGM VALVE

One-piece shield, as top flange sits within diameter of bottom flanges

FLANGE TABLES

The following tables are listed to assist with identification of flange dimensions. The first pair of tables (metric and imperial) express flange diameters for any given pipe size and pressure rating.

METRIC FLANGE DIAMETERS

	PN6	PN10	PN16	PN25	PN40	PN64	PN100	PN160	PN250
Pipe Dia.	flange dia.								
15	80	95	95	95	95	105	105	105	130
20	90	105	105	105	105	130	130	130	135
25	100	115	115	115	115	140	140	140	150
32	120	140	140	140	140	155	155	155	165
40	130	150	150	150	150	170	170	170	185
50	140	165	165	165	165	180	195	195	200
65	160	185	185	185	185	205	220	220	230
80	190	200	200	200	200	215	230	230	255
100	210	220	220	235	235	250	265	265	300
125	240	250	250	270	270	295	315	315	340
150	265	285	285	300	300	345	355	355	390
175	-	315	315	330	350	375	385	390	430
200	320	340	340	360	375	415	430	430	485
250	375	395	405	425	450	470	505	515	585
300	440	445	460	485	515	530	585	585	690
350	490	505	520	555	580	600	655	-	-
400	540	565	580	620	660	670	715	-	-
450	595	615	640	-	-	-	-	-	-
500	645	670	715	730	765	800	870	-	-
600	755	780	840	845	890	930	990	-	-

FLANGE TABLES

IMPERIAL FLANGE DIAMETERS

	150lb	300lb	600lb
Pipe Dia.	flange dia.		
1/2"	3 1/2"	3 3/4"	3 3/4"
3/4"	3 7/8"	4 5/8"	4 5/8"
1"	4 1/2"	4 7/8"	4 7/8"
1 1/4"	4 5/8"	5 1/4"	5 1/4"
1 1/2"	5"	6 1/8"	6 1/8"
2"	6"	6 1/2"	6 1/2"
2 1/2"	7"	7 1/2"	7 1/2"
3"	7 1/2"	8 1/4"	8 1/4"
4"	9"	10"	10 3/4"
5"	10"	11"	13"
6"	11"	12 1/2"	14"
8"	13 1/2"	15"	16 1/2"
10"	16"	17 1/2"	20"
12"	19"	20 1/2"	22"
14"	21"	23"	23 3/4"
16"	23 1/2"	25 1/2"	27"
18"	25"	28"	29 1/4"
20"	27 1/2"	30 1/2"	32"
24"	32"	36"	37"