Microsoft Ireland

DUB14-15

Engineering Planning Report

Issue 1 | P01

Job number 279225-00

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Document verification

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Job title	DUB14-15	**Job number**	279225-00
Document title	Engineering Planning Report	**File reference**	
Document ref			

Revision	**Date**	**Filename**	279225-00_DUB 14-15 Planning Engineering Report.docx		
Issue 1	25 Jun 2021	Description	Issued for Planning		
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		Filename			
		Description			
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		Name			
		Signature			
		Filename			
		Description			
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Issue Document verification with document ✓

Contents

1 Introduction/Summary

Arup were tasked by Microsoft Ireland to prepare the following documentation for a development on the existing Microsoft Data Centre Campus in Grange Castle Business Park, Kilmahuddrick, Co. Dublin. This Document should be read together with Arup engineering drawings and all other documents submitted in support of this application.

Microsoft Ireland is applying for permission to develop lands at Grange Castle Business Park, Kilmahuddrick, Dublin 22 on a site of c. 16.23 Ha.

The site is located immediately to the West of the existing Microsoft Data Centre Campus (SD16A/0088). The Proposed development will comprise site enabling works including the construction of a new bridge over the Griffeen River linking the site to the northern Grange Castle Business Park road, and modification works to previously approved (SD16A/0088) below ground attenuation features. The proposed bridge and works to the Grange Castle Business Park are as per the previously permitted development SD20A/0283.

The development will include the construction of the following proposed new buildings:

DUB14 Data Centre

- This will be a two-storey data centre and admin block to the north of the site.
- There are 8 flues associated with the building .C
- Ancillary works include landscaping, parking (35 no. spaces), bicycle parking and external plant area at ground level.
- The building will have associated drainage works including the modification of previously approved drainage works. (SD12A-0088).
- Underground attenuation and rainwater harvesting tanks

DUB15 Data Centre

- This will be a two-storey data centre and admin block to the South of the site.
- Ancillary works include landscaping, car parking (38 no. spaces), bicycle parking and external plant area at ground level.
- The building will have associated drainage works including the modification of previously approved drainage works. (SD12A-0088)
- Gas Generation compound for 24 No. gas generators, associated electrical rooms and 12 flues associated with the gas generation.

Central Administration Building

- This will be a four-storey building to the West of the site
- This building will comprise of office space, staff cafeteria, gym and reception area and will have associated drainage, carpark (92 no. spaces), bicycle parking, shuttle bus drop-off zone, and waste compound.

Water Treatment Plant

- This will be a single storey treatment plant and associated tanks to the North of the site.
- Ancillary works include landscaping and external plant area at ground level.
- 6 No. above ground tanks
- 1 No. underground surface water attenuation tank.

Ancillary site works for connection to infrastructural services, as well as fencing, landscaping and access road.

The overall proposed development location is indicated in red in Figure 1 below.

Figure 1 Site Layout (Google Maps)

2 Site Access

The proposed development will utilise the existing DUB 06 data centre entrance to the east of the development for access to the new DUB14 and DUB15 data centre buildings. This access accommodates 2-way traffic circulations for HGV's, emergency vehicles and passenger vehicles within the existing data centre campus. Access to the proposed Gas Networks Ireland compound will also be via the existing the DUB 06 entrance.

A separate entrance is proposed for the central administration/gateway building off the existing Grange Castle Business Park road network. This entrance will be staggered from the existing site entrance to Aryzta Bakeries on the north boundary of the site. The new entrance for the central administration building will require the construction of a new bridge structure over the River Griffeen.

The proposed road entrances and bridge are unchanged from the previously permitted scheme (S20A/0283). We can confirm that an OPW section 50 licence has been submitted by Arup and approved by the OPW for the proposed bridge over the Griffeen River.

3 Drainage General

Surface Water and Sanitary drainage systems have been designed to be completely separate systems and are in accordance with the GDSDS design principals. Drainage networks are primarily gravity based, with outfalls for the proposed foul and surface water located at the north west boundary of the site.

The overall drainage design philosophy in general is as per the previously permitted scheme (SD20A/0283).

3.1 Existing Drainage

3.1.1 Existing Surface Water Drainage

To facilitate the construction of the proposed development it will be necessary to undertake modifications to the existing surface water infrastructure on site and in particular the existing attenuation and rainwater harvesting tanks.

We can confirm that there will be no loss of existing attenuation or rainwater harvesting capacity for the existing campus as a result of the proposed development.

3.1.2 DUB 14 Modifications to the existing Surface Water / Rainwater Harvesting Infrastructure

In order to construct the DUB 14 building a portion of the existing Surface Water & Rainwater storge facilities which serves the existing DUB 9 and DUB 10 facilities will need to be relocated.

561m^3 of the existing Surface Water attenuation facility will be removed and replaced by a dedicated attenuation tank with the same capacity. This tank will be located under the proposed process water storage tanks at the Water Treatment Plant compound. This proposed attenuation facility will be connected back to the retained portion of the existing DUB09/10 attenuation facility.

Likewise, approximately 1400m^3 of the existing DUB 09/10 Rainwater Harvesting storage will need to be removed and relocated to a new 3,516m3 Rainwater Harvesting Tank located west of DUB 15. This new tank will also provide the Rainwater Harvesting capacity for the proposed DUB 14/15 facilities.

3.1.3 DUB 15 Modifications to the existing Surface Water / Rainwater Harvesting Infrastructure

In order to construct the proposed gas generator yard east of Dub 15, it is required to realign the existing Dub 12/13 Surface Water and Rainwater Harvesting tanks.

There are 4 No. existing tanks in this area as follows

- Dub12 Surface Water Attenuation Tank - 685m^3
- Dub12 Rainwater Harvesting Tank - 470m^3
- Dub13 Surface Water Attenuation Tank - 638m^3
- Dub13 Rainwater Harvesting Tank - 908m^3

In order to construct the proposed gas generation yard in this area it is proposed to combine both the existing attenuation volume of 1323m^3 into a single attenuation tank with a capacity of 1350m^3.

Likewise, it is proposed to combine both the existing rainwater harvesting tank volume of 1378m^3 into a single rainwater harvesting tank with a capacity of 1,400m^3.

The existing flow control devices will be retained so there will be no change to the existing discharge rates from DUB 12/13, The restricted discharge from these tanks will be connected to the proposed surface water network.

For further information on the relocated attenuation facilities, as well as the proposed attenuation facilities, please refer to Arup drawings DUB14-15_C-G-02, and DUB14-15_C-G-03.

3.2 Proposed Drainage

3.2.1 Proposed Surface Water Drainage

Design of the Storm Water drainage network is in accordance with the Greater Dublin Strategic Design System (GDSDS) and the design principals are un-changed from the permitted scheme SD20A/0283. It is proposed to provide two dedicated surface water drainage networks as follows:

- **Rainwater Harvesting Network** which collects runoff from the roof areas.
- **Surface Water Network** which collects runoff from the roads and yard areas.

3.2.1.1 Sustainable Surface Water Design Features

The overall surface water drainage design includes the following sustainable drainage features:

- Rainwater Harvesting for reuse as greywater.
- Rainwater Harvesting for reuse as cooling water.
- Rainwater Attenuation to limit the discharge rate to the Griffeen River.
- Porous Paving within the carparking areas to limit the runoff rates.
- Treatment in the form of Hydrocarbon Interceptors and separate suspended solids removal.
- Use of double contained fuel storage tanks

As a result of the above design features and continuous monitoring of the surface water discharge we are satisfied that only clean uncontaminated surface water will be discharged from this development.

3.2.1.2 Surface Water Design Criteria & Discharge Rates

Given the critical nature of the proposed development, both surface water drainage networks have been designed with a 25yr return period instead of the more frequently used 2yr return period. Both surface water networks have then been simulated for a range of return periods up to and including the 100yr rainfall event to ensure that no flooding takes place on site during the 100-year event.

The surface water discharge from the Dub 14/15 development will be limited to the following discharge rates, which are in line with the previously agreed and permitted discharge rate of 2.0L/Sec/Ha.

- 5yr Return Period – 26.10 L/Sec.
- 30yr Return Period – 27.20 L/Sec.
- 100yr Return Period – 27.20 L/Sec.

The surface water design criteria also include for a 20% increase in rainfall depth to cater for climate change.

3.2.1.3 Fuel Storage & Fuel Delivery Areas

The diesel fuel oil required for the backup power generators will be stored in double skinned "belly tanks" located within the generator yard, which consists of a concrete impermeable surface.

The fuel delivery hard standing area will be dished to contain any potential fuel spillage.

All roads and concrete impermeable areas have conventional positive drainage systems with longitudinal and horizontal falls incorporating gradients sufficient to allow any rainfall runoff to be collected using a combination of kerb drainage, channel drainage and road gullies.

Electrical Transformers which potentially contain hazardous liquids are located within bunded areas incorporating oil leak detection and alarm systems which control isolation valves to retain any hydrocarbon leaks.

All roads, fuel supply areas and hard standings will drain through Class 1 full retention fuel interceptors prior to discharging into the River Griffeen.

3.2.1.4 Surface Water Attenuation

In order to cater for the reduced surface water discharge rates identified above it is proposed to provide a dedicated surface water attenuation tank with a storage capacity of 4,400m^3 which will cater for all rainfall events up to and including the 100yr return period.

3.2.1.5 Firewater Retention

In the event of a fire scenario at the development, firewater that drains to the surface water networks will be retained in the primary attenuation tank located west of DUB 14. The water will be retained in the attenuation tank via automated lockdown of the sluice valve located at the discharge manhole which will be activated in the event of a fire alarm.

A manual override facility for the lockdown valve will be provided to allow control by firefighting attendees in an unlikely fire scenario at the development.

3.3 Rainwater Harvesting

As noted within the planning documentation, the Data Centre buildings use evaporative cooling during peak external temperatures in excess of circa 20 degrees. This cooling process involves the sprinkling of water across the air handling units to cool the buildings.

To minimise the demand on the public water supply it is proposed to harvest rainwater from the main roof areas of the data centre buildings. This harvested water will be stored temporarily in the underground rainwater harvesting tank before being pumped to the Water Treatment Facility where it will be treated and stored to be used when required.

A total rainwater storage capacity will be 1,160m^3 which is based on 2-hour storm event of 50mm/hour falling on clean roof areas. There is an overflow from the rainwater harvesting tank directly to the surface wate attenuation tank to cater for flows in excess of design volume. .

Surface water runoff collected in the attenuation tank is prevented from flowing back into the rainwater harvested tank by a non-return valve which prevents cross contamination of clean water with road and yard surface water runoff.

All treated water (industrial water) will be used within the development for evaporative cooling processes when required. If ambient air temperatures are low and adiabatic cooling is no longer required, above ground storage tanks containing treated industrial water will drain down back to the attenuation system. This water will then be mixed with harvested rainwater and can then be reused in the evaporative process if required or discharged to the River Griffeen. It is imperative to note that the cooling process does not involve the addition of any chemicals to the potable or industrial water. Existing minerals within the potable water will become slightly more concentrated by the evaporative process but no chemicals are added. It is therefore acceptable to discharge the water from the evaporative process to the storm water system.

As the water is clean water with only concentrates of minerals associated with potable water it is proposed to discharge any drain down from this system to the open watercourse of the River Griffeen. This harvesting system is currently in operation in the existing data centre campus facility and greatly reduces the demand on public water supply.

For further information on the surface water network please refer to Arup drawings DUB14-15_C-D-03, and DUB14-15_C-D-04.

4 Foul & Industrial Waste Drainage

4.1 Proposed Foul & Industrial Waste Drainage

It is proposed to connect the foul drainage to the existing Irish Water foul sewer located along the western boundary of the site.. An estimated total hydraulic loading of 19m^3 per day of foul effluent will be generated on completion of the development.

At full occupancy , circa 35 staff per building per shift will operate the new data centres on a twenty-four-hour basis. Approximately 120 people will operate within the Gateway building on an 8-hour working day. Referencing the Irish Water Code of Practice, Appendix D, the foul water generated by the proposed development will be as follows:

- Data Centres flowrates should be designed on the basis of an office development with no canteen - 50L/person/ shift
- The Gateway Building shall be designed as an office with canteen facilities - 100L/person/day.

The final effluent generate is based on a population of 140 staff (35 per datacentre for 2 shifts) at 50 litres/person/day and 120 staff at 100 litres/person/day, providing a total hydraulic foul effluent loading of 19,000 litres/day. This equates to an average flow of 0.5 L/sec (over a 24hr period) and a peak flow of 3l/s based on 6 x Dry Weather Flow (DWF) .

The final average daily BOD_5 loading would be 5.2 kg/day based on 20 grams of BOD_5/head/day.

The Foul drainage network has been designed to BSEN 752 and has a minimum self cleansing velocity of 0.75L/s. Foul waste will be generated from toilets, break rooms, showers and janitor stores rooms.

Low flow devices will be used throughout to minimise foul effluent and water demand. The proposed Foul & Industrial Wastewater drainage layout is indicated on Arup Drawing DUB14-15_C-D-01 and DUB14-15_C-D-02.

Discharge connections will be made to the existing foul sewer to the West of the site as referenced on Arup Drawing DUB14-15_C-D-01.

To facilitate monitoring of discharge volumes, an electromagnetic flow meters, type Watermaster F by ABB, will be installed at the discharge location. This meter will record all discharge flows from the development and will be linked back to the facility BMS control units.

5 Potable Water Supply

Grange Castle Business Park is served from South Dublin County Council's Belgard Reservoir. The Park is designed with a water supply capacity of 12 million litres per day available to service development within the park. Water supply to the surrounding areas is provided by Irish Water and SDCC through mains supply.

The potable water for the development will be supplied via a proposed 100mm diameter main which will connect to the existing sitewide 150mm diameter watermain, which is supplied from the Irish Water connection to the overall Microsoft campus.

The potable water demand for the overall development will be an average of 19m3/day and will be broken down as follows:

- Data Centres Staff based on 50L/Sec
- CAB Building Staff based on 100L/Sec.

Refer to Arup drawings DUB14-15_C-D-06 and DUB14-15_C-D-07 for the water main layout and hydrant locations.. The overall p

Hanley Pepper Consulting Engineers have submitted a pre connection enquiry to Irish Water and are in the process of agreeing the supply contract. The Irish Water Ref Number is CDS20004546.

6 Fire/Sprinkler Water Supply

The proposed fire/ sprinkler main will be supplied from a dedicated set of firewater storage tanks and associated pump house which will pressurise a separate firemain network as illustrated on drawings DUB14-15_C-D-06 and DUB14-15_C-D-07.

7 Flood Study Review

Various alterations to watercourses around the Grange Castle Business Park have been completed. The most recent involved the realignment of the Baldonnell Stream during the R134 realignment works Therefore, a detailed stage 3 flood risk assessment has been commissioned for the proposed development.

SLR Environmental Consulting have completed this study to determine the impact of three different flood zones (designated Zones A, B and C) in order to guide development at a particular site. The flood zones are:

Zone A High probability of flooding. This zone defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100) and the coast (i.e. more than 0.5°/» probability or more than 1 in 200).

Zone B Moderate probability of flooding. This zone defines areas with a moderate risk of flooding from rivers (i.e. 0.1% to 1% probability or between 1 in 100 and 1 in 1000) and the coast (i.e. 0.1'/o to 0.5°/o probability or between 1 in 200 and 1 in 1000).

Zone C Low probability of flooding. This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1°fo probability or less than 1 in 1000).

The findings of this report confirms the proposed site development is not within the 100- or 1000-year flood plains associated with the River Griffeen or the Baldonnell Stream and is not at risk from flooding. The 1:1000 event plus climate change design flood level is identified at 66.83 mOD. Allowing for a freeboard of at least 600 mm, the design flood level for the Highly Vulnerable parts of the development at the site should be 67.43. The lowest floor level associated with the proposed development is DUB 14 and the Central Administration Building with a finished floor level of 67.80m.

8 Ground Conditions and Groundwater

Two site specific ground investigations have been undertaken and are summarised in Table 1.

Table 1: Summary of site-specific ground investigations

Title	Contractor	Year	Scope
Dub14_15 – Ground Investigation	Causeway Geotech Ltd.	2021	• Fifteen cable percussion boreholes with rotary follow on. • Eighteen standalone rotary boreholes; • Eight groundwater monitoring installations; • Twenty-eight dynamic probes. • Twenty-four trial pits. • Twenty-two trial pits on spoil locations. • Four soakaway tests. • Six in-situ plate bearing tests. • Geotechnical and environmental laboratory testing
Grange castle Ground Investigation	Ground Investigation Ireland Ltd	2019	• Six trial pits • three cable percussion boreholes

The site is classified as brownfield due to both historical and current activities. A significant proportion of the site is currently used for construction activities for adjacent data centre construction including carparking, trafficking, storage, and construction.

The ground conditions on site, inferred from the aforementioned ground investigations, are typically a downward sequence of Topsoil/Made Ground, Silt, Glacial Tills (impersistent coarse grained layers) and bedrock which is typically shallow. The site stratigraphy is summarised in Table 2.

Table 2: Summary of the indicative stratigraphy on site

Strata type	Depth to top of strata (m BGL)	Thickness (m)
Topsoil – Soft slightly sandy gravelly CLAY with roots and rootlets	0	0 – 0.5
Made Ground – Soft to stiff gravelly silty CLAY and sandy fine to coarse GRAVEL	0 – 0.3	0 – 2.9
Silt – Firm to stiff slightly sandy slightly gravelly SILT	0.6 - 2	0 - 0.6

Strata type	Depth to top of strata (m BGL)	Thickness (m)
Glacial Deposits – Soft to very stiff brownish grey and brown sandy gravelly CLAY with cobbles and soft to very stiff greyish black to black slightly sandy gravelly CLAY with cobbles and boulders.	0 - 3	0.5 – 3.4
Gravel – Medium dense to stiff sandy, occasionally clayey, angular, occasionally subangular to subrounded, fine to coarse GRAVEL	0.6 – 3.5	0 - 1.1
Weathered Rock – Grey weathered LIMESTONE	1.5 – 1.8	0 – 0.5
Bedrock – Weak to medium strong thinly laminated argillaceous LIMESTONE, occasionally with medium spaced beds of weak thinly laminated calcareous MUDSTONE	1.4 – 4.9	-

A number of groundwater monitoring instruments were installed as part of the Causeway GI (2021) within both the bedrock and the overlying soils. Groundwater was measured between 1.3 and 2.9m below existing ground level over a nine-week period between April and May 2021. Installations from historical ground investigation in the adjacent sites to the east showed groundwater as shallow as 0.3m below existing ground level.

9 Earthworks

The geotechnical design will be undertaken in accordance with TII Specification for Roadworks – Series 600 Earthworks and Eurocode 7 (I.S. EN 1997-1:2005).

A number of existing stockpiles are located on the site and the nature and chemical composition of these has been investigated as part of the Causeway GI (2021). Geoenvironmental testing were undertaken which identified the material as predominantly inert with a smaller number of samples that classified as non-hazardous. This was typically as a result of naturally occurring minerals. It is envisaged that the majority of excavated material will be disposed offsite in accordance with relevant waste legislation due to the congested nature of the site.

The earthworks will involve:

1. Topsoil/Made Ground Strip.
2. Temporary surface and groundwater control (where required).
3. Site clearance (timed to avoid nesting season) including demolition of existing residential structure and removal of existing mounds located on the site.

4. Excavation for roads, attenuation and rainwater harvesting tanks, utilities, and services.
5. Excavation for foundations.
6. Filling and landscaping.

The contractor's earthworks methodology is to be developed with cognisance of the various environmental impacts and mitigation measures which have been outlined in the Environmental Impact Assessment Report (EIAR). This includes, but is not limited to, consideration of the Griffeen River that pass along the south west boundary and crosses the site, along with other areas of ecological importance, in addition to preserving the existing site wayleave and any associated services.

A1 Surface Water Networks

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	25	PIMP (%)	100
M5-60 (mm)	16.600	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.677	4-8	5.797	8-12	6.120	12-16	0.345

Total Area Contributing (ha) = 12.939

Total Pipe Volume (m³) = 569.403

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	50.419	0.252	200.1	0.024	4.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S4.000	20.122	0.101	200.0	0.041	4.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S4.001	13.044	0.065	200.0	0.036	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	4.76	66.700	0.024	0.0	0.0	0.7	1.11	78.3	4.0
S4.000	50.00	4.30	66.650	0.041	0.0	0.0	1.1	1.11	78.3	6.6
S4.001	50.00	4.50	66.549	0.077	0.0	0.0	2.1	1.11	78.3	12.5

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S5.000	19.920	0.100	200.0	0.036	4.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S4.002	19.603	0.098	200.0	0.030	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S6.000	19.997	0.100	200.0	0.040	4.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S4.003	10.224	0.051	200.5	0.035	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S3.001	90.000	0.300	300.0	0.143	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓
S3.002	55.000	0.138	400.0	0.216	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S3.003	90.000	0.225	400.0	0.183	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S3.004	41.228	0.103	400.0	0.129	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S3.005	74.801	0.187	400.0	0.038	0.00	0.0	0.600	o	525	Pipe/Conduit	🔓
S7.000	34.130	0.171	199.6	0.049	4.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S7.001	41.073	0.205	200.4	0.022	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S7.002	48.803	0.244	200.0	0.153	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S8.000	53.155	0.266	199.8	0.052	4.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S7.003	15.462	0.077	200.8	0.123	0.00	0.0	0.600	o	450	Pipe/Conduit	🔓

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S5.000	50.00	4.30	66.650	0.036	0.0	0.0	1.0	1.11	78.3	5.9
S4.002	50.00	4.79	66.484	0.143	0.0	0.0	3.9	1.11	78.3	23.2
S6.000	50.00	4.30	66.650	0.040	0.0	0.0	1.1	1.11	78.3	6.5
S4.003	50.00	4.95	66.386	0.218	0.0	0.0	5.9	1.11	78.2	35.3
S3.001	50.00	6.23	66.185	0.385	0.0	0.0	10.4	1.17	185.8	62.6
S3.002	50.00	7.05	65.810	0.601	0.0	0.0	16.3	1.11	241.1	97.7
S3.003	50.00	8.40	65.673	0.784	0.0	0.0	21.2	1.11	241.1	127.3
S3.004	50.00	9.02	65.448	0.913	0.0	0.0	24.7	1.11	241.1	148.3
S3.005	50.00	10.14	65.345	0.950	0.0	0.0	25.7	1.11	241.1	154.4
S7.000	50.00	4.51	66.300	0.049	0.0	0.0	1.3	1.11	78.4	7.9
S7.001	50.00	5.13	66.129	0.070	0.0	0.0	1.9	1.11	78.3	11.4
S7.002	50.00	5.87	65.924	0.224	0.0	0.0	6.1	1.11	78.3	36.3
S8.000	50.00	4.80	66.420	0.052	0.0	0.0	1.4	1.11	78.4	8.4
S7.003	50.00	6.05	65.530	0.398	0.0	0.0	10.8	1.43	227.6	64.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.006	9.903	0.026	375.0	0.062	0.00	0.0	0.600	o	525	Pipe/Conduit	
S9.000	51.000	0.510	100.0	0.054	4.00	0.0	0.600	o	300	Pipe/Conduit	
S9.001	16.898	0.169	100.0	0.035	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.007	13.347	0.030	450.0	0.005	0.00	0.0	0.600	o	600	Pipe/Conduit	
S10.000	16.527	0.075	220.4	0.037	4.00	0.0	0.600	o	225	Pipe/Conduit	
S10.001	10.553	0.075	140.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.008	13.347	0.030	450.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S3.009	11.093	0.025	450.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S11.000	44.155	0.088	501.8	5.502	4.00	11.0	0.600	o	975	Pipe/Conduit	
S11.001	51.736	0.103	500.0	0.000	0.00	0.0	0.600	o	975	Pipe/Conduit	
S11.002	27.456	0.055	499.2	0.043	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.000	25.349	0.056	449.4	0.068	4.00	0.0	0.600	o	300	Pipe/Conduit	
S12.001	11.647	0.056	206.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S13.000	25.522	0.128	199.4	0.034	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.006	50.00	10.28	65.158	1.410	0.0	0.0	38.2	1.15	249.1	229.1
S9.000	50.00	4.54	65.750	0.054	0.0	0.0	1.5	1.57	111.1	8.8
S9.001	50.00	4.72	65.240	0.090	0.0	0.0	2.4	1.57	111.1	14.6
S3.007	50.00	10.48	64.771	1.504	0.0	0.0	40.7	1.14	322.7	244.4
S10.000	50.00	4.31	65.500	0.037	0.0	0.0	1.0	0.88	34.9	6.0
S10.001	50.00	4.47	65.425	0.037	0.0	0.0	1.0	1.10	43.7	6.0
S3.008	50.00	10.67	64.741	1.541	0.0	0.0	41.7	1.14	322.7	250.4
S3.009	50.00	10.83	64.712	1.541	0.0	0.0	41.7	1.14	322.7	250.4
S11.000	50.00	4.50	65.600	5.502	11.0	0.0	151.2	1.46	1092.2	907.2
S11.001	50.00	5.09	65.512	5.502	11.0	0.0	151.2	1.47	1094.1	907.2
S11.002	50.00	5.75	65.408	5.545	11.0	0.0	152.4	0.70	49.3«	914.2
S12.000	50.00	4.57	66.050	0.068	0.0	0.0	1.9	0.74	52.0	11.1
S12.001	50.00	4.75	65.994	0.068	0.0	0.0	1.9	1.09	77.1	11.1
S13.000	50.00	4.38	66.050	0.034	0.0	0.0	0.9	1.11	78.4	5.5

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S12.002	19.496	0.222	87.8	0.031	0.00	0.0	0.600	o	450	Pipe/Conduit	
S14.000	21.407	0.100	214.1	0.045	4.00	0.0	0.600	o	300	Pipe/Conduit	
S12.003	17.058	0.057	300.0	0.039	0.00	0.0	0.600	o	450	Pipe/Conduit	
S11.003	89.982	0.300	299.9	0.134	0.00	0.0	0.600	o	450	Pipe/Conduit	
S11.004	80.000	0.267	299.6	0.350	0.00	0.0	0.600	o	450	Pipe/Conduit	
S11.005	25.437	0.085	299.3	0.614	0.00	0.0	0.600	o	450	Pipe/Conduit	
S15.000	19.744	0.100	197.4	0.037	4.00	0.0	0.600	o	225	Pipe/Conduit	
S11.006	17.927	0.051	351.5	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S11.007	25.003	0.071	352.2	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S3.010	26.692	0.027	988.6	0.053	0.00	0.0	0.600	o	900	Pipe/Conduit	
S16.000	90.000	0.360	250.0	0.129	4.00	0.0	0.600	o	300	Pipe/Conduit	
S16.001	41.701	0.180	231.7	0.189	0.00	0.0	0.600	o	450	Pipe/Conduit	
S17.000	33.052	0.233	141.7	0.099	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S12.002	50.00	4.90	65.772	0.133	0.0	0.0	3.6	2.17	345.2	21.6
S14.000	50.00	4.33	65.800	0.045	0.0	0.0	1.2	1.07	75.7	7.3
S12.003	50.00	5.15	65.550	0.216	0.0	0.0	5.9	1.17	185.8	35.1
S11.003	50.00	7.03	65.353	5.895	11.0	0.0	161.9	1.17	185.9«	971.1
S11.004	50.00	8.17	65.053	6.245	11.0	0.0	171.3	1.17	186.0«	1027.9
S11.005	50.00	8.53	64.786	6.859	11.0	0.0	188.0	1.17	186.1«	1127.8
S15.000	50.00	4.36	65.800	0.037	0.0	0.0	1.0	0.93	36.9	6.1
S11.006	50.00	8.79	64.801	6.897	11.0	0.0	189.0	1.19	257.4«	1133.8
S11.007	50.00	9.14	64.750	6.897	11.0	0.0	189.0	1.19	257.1«	1133.8
S3.010	50.00	11.28	64.440	8.490	11.0	0.0	232.1	0.99	628.6«	1392.9
S16.000	50.00	5.52	65.970	0.129	0.0	0.0	3.5	0.99	70.0	21.0
S16.001	50.00	6.04	65.460	0.319	0.0	0.0	8.6	1.33	211.8	51.8
S17.000	50.00	4.50	66.200	0.099	0.0	0.0	2.7	1.10	43.6	16.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S16.002	48.299	0.180	268.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S16.003	21.270	0.085	250.0	0.310	0.00	0.0	0.600	o	450	Pipe/Conduit	
S16.004	69.213	0.277	250.0	0.104	0.00	0.0	0.600	o	450	Pipe/Conduit	
S18.000	18.234	0.182	100.2	0.102	4.00	0.0	0.600	o	300	Pipe/Conduit	
S18.001	44.337	0.443	100.1	0.077	0.00	0.0	0.600	o	300	Pipe/Conduit	
S18.002	14.905	0.224	66.5	0.033	0.00	0.0	0.600	o	300	Pipe/Conduit	
S16.005	9.938	0.011	903.5	0.039	0.00	0.0	0.600	o	600	Pipe/Conduit	
S16.006	11.533	0.019	617.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S16.007	43.404	0.185	234.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S19.000	73.980	0.269	275.0	0.108	4.00	0.0	0.600	o	300	Pipe/Conduit	
S19.001	81.394	0.296	275.0	0.203	0.00	0.0	0.600	o	300	Pipe/Conduit	
S19.002	77.163	0.309	250.0	0.183	0.00	0.0	0.600	o	375	Pipe/Conduit	
S19.003	20.725	0.083	250.0	0.114	0.00	0.0	0.600	o	375	Pipe/Conduit	
S19.004	20.163	0.274	73.6	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S20.000	31.813	0.318	100.0	0.032	4.00	0.0	0.600	o	300	Pipe/Conduit	
S20.001	34.906	0.424	82.3	0.016	0.00	0.0	0.600	o	300	Pipe/Conduit	
S21.000	31.813	0.318	100.0	0.079	4.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S16.002	50.00	6.69	65.280	0.418	0.0	0.0	11.3	1.24	196.6	67.9
S16.003	50.00	6.97	65.100	0.728	0.0	0.0	19.7	1.28	203.8	118.3
S16.004	50.00	7.87	65.015	0.833	0.0	0.0	22.5	1.28	203.8	135.3
S18.000	50.00	4.19	65.750	0.102	0.0	0.0	2.8	1.57	111.0	16.6
S18.001	50.00	4.66	65.568	0.179	0.0	0.0	4.9	1.57	111.1	29.1
S18.002	50.00	4.79	65.125	0.213	0.0	0.0	5.8	1.93	136.4	34.5
S16.005	50.00	8.07	64.588	1.085	0.0	0.0	29.4	0.80	226.8	176.2
S16.006	50.00	8.27	64.577	1.085	0.0	0.0	29.4	0.97	275.0	176.2
S16.007	50.00	8.73	64.558	1.085	0.0	0.0	29.4	1.59	448.7	176.2
S19.000	50.00	5.31	66.150	0.108	0.0	0.0	2.9	0.94	66.7	17.5
S19.001	50.00	6.75	65.881	0.310	0.0	0.0	8.4	0.94	66.7	50.4
S19.002	50.00	7.87	65.510	0.493	0.0	0.0	13.4	1.14	126.1	80.1
S19.003	50.00	8.17	65.201	0.607	0.0	0.0	16.4	1.14	126.1	98.6
S19.004	50.00	8.33	65.118	0.607	0.0	0.0	16.4	2.11	233.5	98.6
S20.000	50.00	4.34	66.150	0.032	0.0	0.0	0.9	1.57	111.1	5.2
S20.001	50.00	4.67	65.832	0.048	0.0	0.0	1.3	1.73	122.6	7.8
S21.000	50.00	4.34	66.150	0.079	0.0	0.0	2.1	1.57	111.1	12.8

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S21.001	34.143	0.424	80.5	0.034	0.00	0.0	0.600	o	300	Pipe/Conduit	
S20.002	33.423	0.179	186.7	0.006	0.00	0.0	0.600	o	300	Pipe/Conduit	
S22.000	73.980	0.269	275.0	0.109	4.00	0.0	0.600	o	300	Pipe/Conduit	
S22.001	81.394	0.296	275.0	0.225	0.00	0.0	0.600	o	300	Pipe/Conduit	
S22.002	77.163	0.220	350.0	0.230	0.00	0.0	0.600	o	375	Pipe/Conduit	
S22.003	60.310	0.172	350.0	0.105	0.00	0.0	0.600	o	450	Pipe/Conduit	
S23.000	73.980	0.296	249.9	0.111	4.00	0.0	0.600	o	300	Pipe/Conduit	
S23.001	81.394	0.326	250.0	0.225	0.00	0.0	0.600	o	300	Pipe/Conduit	
S23.002	77.163	0.309	250.0	0.231	0.00	0.0	0.600	o	375	Pipe/Conduit	
S22.004	16.506	0.055	301.7	0.107	0.00	0.0	0.600	o	525	Pipe/Conduit	
S22.005	14.066	0.119	118.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S22.006	53.261	0.060	895.1	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S22.007	17.861	0.045	396.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S24.000	25.551	0.073	350.0	0.650	8.00	0.0	0.600	o	450	Pipe/Conduit	
S24.001	89.549	0.256	349.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S24.002	90.072	0.257	350.5	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S24.003	26.544	0.076	350.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S21.001	50.00	4.66	65.832	0.112	0.0	0.0	3.0	1.75	124.0	18.2
S20.002	50.00	5.16	65.408	0.166	0.0	0.0	4.5	1.15	81.1	27.0
S22.000	50.00	5.31	66.500	0.109	0.0	0.0	2.9	0.94	66.7	17.7
S22.001	50.00	6.75	66.231	0.334	0.0	0.0	9.0	0.94	66.7	54.2
S22.002	50.00	8.08	65.860	0.564	0.0	0.0	15.3	0.96	106.3	91.6
S22.003	50.00	9.01	65.565	0.669	0.0	0.0	18.1	1.08	171.9	108.6
S23.000	50.00	5.25	66.550	0.111	0.0	0.0	3.0	0.99	70.0	18.1
S23.001	50.00	6.62	66.254	0.337	0.0	0.0	9.1	0.99	70.0	54.7
S23.002	50.00	7.74	65.853	0.568	0.0	0.0	15.4	1.14	126.1	92.2
S22.004	50.00	9.23	65.317	1.343	0.0	0.0	36.4	1.28	278.0	218.3
S22.005	50.00	9.34	65.263	1.343	0.0	0.0	36.4	2.06	446.1	218.3
S22.006	50.00	10.44	65.068	1.343	0.0	0.0	36.4	0.81	227.8	218.3
S22.007	50.00	10.69	65.009	1.343	0.0	0.0	36.4	1.22	343.9	218.3
S24.000	50.00	8.39	65.900	0.650	0.0	0.0	17.6	1.08	171.9	105.6
S24.001	50.00	9.77	65.827	0.650	0.0	0.0	17.6	1.08	172.0	105.6
S24.002	50.00	11.16	65.571	0.650	0.0	0.0	17.6	1.08	171.8	105.6
S24.003	50.00	11.57	65.314	0.650	0.0	0.0	17.6	1.08	171.9	105.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S24.004	33.171	0.095	350.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S24.005	51.787	0.148	349.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S24.006	19.169	0.226	84.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S25.000	73.980	0.269	275.0	0.105	4.00	0.0	0.600	o	300	Pipe/Conduit	
S25.001	81.394	0.296	275.0	0.203	0.00	0.0	0.600	o	450	Pipe/Conduit	
S25.002	77.163	0.220	350.7	0.179	0.00	0.0	0.600	o	450	Pipe/Conduit	
S25.003	19.542	0.056	350.0	0.110	0.00	0.0	0.600	o	450	Pipe/Conduit	
S25.004	27.231	0.078	350.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S19.005	65.965	0.066	999.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S3.011	36.284	0.036	1000.0	0.000	0.00	0.0	0.600	o	975	Pipe/Conduit	
S3.012	18.865	0.063	299.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.013	13.777	0.046	299.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S24.004	50.00	12.08	65.238	0.650	0.0	0.0	17.6	1.08	171.9	105.6
S24.005	50.00	12.88	65.143	0.650	0.0	0.0	17.6	1.08	171.9	105.6
S24.006	50.00	13.03	64.995	0.650	0.0	0.0	17.6	2.21	351.1	105.6
S25.000	50.00	5.31	66.150	0.105	0.0	0.0	2.9	0.94	66.7	17.1
S25.001	50.00	6.42	65.731	0.308	0.0	0.0	8.3	1.22	194.2	50.1
S25.002	50.00	7.61	65.435	0.487	0.0	0.0	13.2	1.08	171.7	79.2
S25.003	50.00	7.91	65.215	0.598	0.0	0.0	16.2	1.08	171.9	97.1
S25.004	50.00	8.33	65.159	0.598	0.0	0.0	16.2	1.08	171.9	97.1
S19.005	50.00	14.47	64.800	3.364	0.0	0.0	91.1	0.76	215.4«	546.6
S3.011	50.00	15.06	64.413	12.939	11.0	0.0	352.6	1.03	771.0«	2115.8
S3.012	50.00	15.40	64.377	12.939	11.0	0.0	352.6	0.90	63.9«	2115.8
S3.013	50.00	15.66	64.314	12.939	11.0	0.0	352.6	0.90	63.9«	2115.8

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
3.000	User	-	100	0.024	0.024	0.024
4.000	User	-	90	0.045	0.041	0.041
4.001	User	-	90	0.040	0.036	0.036
5.000	User	-	90	0.040	0.036	0.036
4.002	User	-	90	0.033	0.030	0.030
6.000	User	-	90	0.044	0.040	0.040
4.003	User	-	90	0.039	0.035	0.035
3.001	User	-	100	0.143	0.143	0.143
3.002	User	-	100	0.055	0.055	0.055
	User	-	100	0.161	0.161	0.216
3.003	User	-	100	0.033	0.033	0.033
	User	-	100	0.150	0.150	0.183
3.004	User	-	100	0.054	0.054	0.054
	User	-	100	0.075	0.075	0.129
3.005	User	-	100	0.038	0.038	0.038
7.000	User	-	100	0.049	0.049	0.049
7.001	User	-	100	0.022	0.022	0.022
7.002	User	-	100	0.050	0.050	0.050
	User	-	100	0.103	0.103	0.153
8.000	User	-	100	0.052	0.052	0.052
7.003	User	-	100	0.073	0.073	0.073
	User	-	100	0.049	0.049	0.123
3.006	User	-	100	0.062	0.062	0.062
9.000	User	-	100	0.054	0.054	0.054
9.001	User	-	100	0.035	0.035	0.035
3.007	User	-	100	0.005	0.005	0.005
10.000	User	-	100	0.037	0.037	0.037
10.001	-	-	100	0.000	0.000	0.000
3.008	-	-	100	0.000	0.000	0.000
3.009	-	-	100	0.000	0.000	0.000
11.000	User	-	100	5.502	5.502	5.502
11.001	-	-	100	0.000	0.000	0.000
11.002	User	-	100	0.043	0.043	0.043
12.000	User	-	90	0.038	0.034	0.034
	User	-	90	0.038	0.035	0.068
12.001	-	-	100	0.000	0.000	0.000
13.000	User	-	90	0.037	0.034	0.034
12.002	User	-	90	0.034	0.031	0.031
14.000	User	-	90	0.050	0.045	0.045
12.003	User	-	90	0.043	0.039	0.039
11.003	User	-	100	0.022	0.022	0.022
	User	-	100	0.111	0.111	0.134
11.004	User	-	100	0.064	0.064	0.064
	User	-	100	0.141	0.141	0.205
	User	-	100	0.145	0.145	0.350
11.005	User	-	100	0.070	0.070	0.070
	User	-	100	0.022	0.022	0.091
	User	-	100	0.203	0.203	0.294
	User	-	100	0.064	0.064	0.357
	User	-	100	0.157	0.157	0.514
	User	-	100	0.100	0.100	0.614

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
15.000	User	-	100	0.037	0.037	0.037
11.006	-	-	100	0.000	0.000	0.000
11.007	-	-	100	0.000	0.000	0.000
3.010	User	-	100	0.053	0.053	0.053
16.000	User	-	100	0.129	0.129	0.129
16.001	User	-	100	0.189	0.189	0.189
17.000	User	-	100	0.099	0.099	0.099
16.002	-	-	100	0.000	0.000	0.000
16.003	User	-	100	0.310	0.310	0.310
16.004	User	-	100	0.104	0.104	0.104
18.000	User	-	100	0.102	0.102	0.102
18.001	User	-	100	0.077	0.077	0.077
18.002	User	-	100	0.033	0.033	0.033
16.005	User	-	100	0.039	0.039	0.039
16.006	-	-	100	0.000	0.000	0.000
16.007	-	-	100	0.000	0.000	0.000
19.000	User	-	90	0.120	0.108	0.108
19.001	User	-	90	0.225	0.203	0.203
19.002	User	-	90	0.203	0.183	0.183
19.003	User	-	90	0.126	0.114	0.114
19.004	-	-	100	0.000	0.000	0.000
20.000	User	-	90	0.035	0.032	0.032
20.001	User	-	90	0.018	0.016	0.016
21.000	User	-	90	0.049	0.044	0.044
	User	-	90	0.039	0.035	0.079
21.001	User	-	90	0.037	0.034	0.034
20.002	User	-	100	0.006	0.006	0.006
22.000	User	-	100	0.109	0.109	0.109
22.001	User	-	100	0.225	0.225	0.225
22.002	User	-	100	0.230	0.230	0.230
22.003	User	-	100	0.105	0.105	0.105
23.000	User	-	100	0.111	0.111	0.111
23.001	User	-	100	0.225	0.225	0.225
23.002	User	-	100	0.231	0.231	0.231
22.004	User	-	100	0.107	0.107	0.107
22.005	-	-	100	0.000	0.000	0.000
22.006	-	-	100	0.000	0.000	0.000
22.007	-	-	100	0.000	0.000	0.000
24.000	-	-	100	0.650	0.650	0.650
24.001	-	-	100	0.000	0.000	0.000
24.002	-	-	100	0.000	0.000	0.000
24.003	-	-	100	0.000	0.000	0.000
24.004	-	-	100	0.000	0.000	0.000
24.005	-	-	100	0.000	0.000	0.000
24.006	-	-	100	0.000	0.000	0.000
25.000	User	-	90	0.117	0.105	0.105
25.001	User	-	90	0.225	0.203	0.203
25.002	User	-	90	0.199	0.179	0.179
25.003	User	-	90	0.123	0.110	0.110
25.004	-	-	100	0.000	0.000	0.000
19.005	-	-	100	0.000	0.000	0.000

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
3.011	-	-	100	0.000	0.000	0.000
3.012	-	-	100	0.000	0.000	0.000
3.013	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				13.139	12.939	12.939

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S3.013	S-Outfall	67.000	64.268	64.300	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	7	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	25	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.600	Storm Duration (mins)	30
Ratio R	0.271		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SDummytank, DS/PN: S11.001, Volume (m³): 36.4

Unit Reference	MD-SHE-0145-1100-1500-1100
Design Head (m)	1.500
Design Flow (l/s)	11.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	145
Invert Level (m)	65.512
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	11.0
Flush-Flo™	0.442	11.0
Kick-Flo®	0.939	8.8
Mean Flow over Head Range	-	9.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.2	1.200	9.9	3.000	15.3	7.000	22.9
0.200	9.9	1.400	10.6	3.500	16.4	7.500	23.7
0.300	10.7	1.600	11.3	4.000	17.5	8.000	24.4
0.400	11.0	1.800	12.0	4.500	18.5	8.500	25.2
0.500	10.9	2.000	12.6	5.000	19.5	9.000	25.9
0.600	10.8	2.200	13.2	5.500	20.4	9.500	26.5
0.800	10.1	2.400	13.7	6.000	21.3		
1.000	9.1	2.600	14.3	6.500	22.1		

Non Return Valve Manhole: SRMHO, DS/PN: S19.004, Volume (m³): 5.3

Non Return Valve Manhole: S75, DS/PN: S22.007, Volume (m³): 19.3

Non Return Valve Manhole: S81, DS/PN: S24.006, Volume (m³): 11.8

Non Return Valve Manhole: S55, DS/PN: S25.004, Volume (m³): 6.0

Non Return Valve Manhole: S-RWH_TANK, DS/PN: S19.005, Volume (m³): 20.0

Hydro-Brake® Optimum Manhole: STANK, DS/PN: S3.011, Volume (m³): 53.8

Unit Reference	MD-SHE-0242-3830-2500-3830
Design Head (m)	2.500
Design Flow (l/s)	38.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	242
Invert Level (m)	64.413
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	2100

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	2.500	38.3
Flush-Flo™	0.728	38.3
Kick-Flo®	1.548	30.4
Mean Flow over Head Range	-	33.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	7.9	1.200	36.3	3.000	41.8	7.000	62.9
0.200	24.6	1.400	33.8	3.500	45.0	7.500	65.1
0.300	33.7	1.600	30.9	4.000	48.0	8.000	67.2
0.400	36.0	1.800	32.7	4.500	50.8	8.500	69.2
0.500	37.3	2.000	34.4	5.000	53.5	9.000	71.1
0.600	38.0	2.200	36.0	5.500	56.0	9.500	73.0
0.800	38.2	2.400	37.5	6.000	58.4		
1.000	37.6	2.600	39.0	6.500	60.7		

Storage Structures for Storm

Tank or Pond Manhole: SDummytank, DS/PN: S11.001

Allowance for upstream existing network/tanks

Invert Level (m) 65.612

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	5400.0	1.500	5400.0	1.501	0.0

Tank or Pond Manhole: S-RWH_TANK, DS/PN: S19.005

Allowance for capacity within RWH tank

Invert Level (m) 64.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1360.0	0.600	1360.0	0.601	0.0

Tank or Pond Manhole: STANK, DS/PN: S3.011

SW attenuation tank

Invert Level (m) 64.413

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	2500.0	1.600	2500.0	1.601	0.0

A2 5Yr Return Period Simulation

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 3
Number of Online Controls 7 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.271
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 16.600 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 5, 20, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S3.000	SWMH22	15 Winter	5	+0%					66.747
S4.000	SWMH23	15 Winter	5	+0%					66.716
S4.001	S3	15 Winter	5	+0%					66.643
S5.000	S3	15 Winter	5	+0%					66.712
S4.002	S3	15 Winter	5	+0%					66.606
S6.000	S6	15 Winter	5	+0%					66.715
S4.003	S4	15 Winter	5	+0%					66.547
S3.001	SWMH21	15 Winter	5	+0%					66.364
S3.002	SWMH20	15 Winter	5	+0%					66.034
S3.003	SWMH19	15 Winter	5	+0%					65.917
S3.004	SWMH18	30 Winter	5	+0%					65.722
S3.005	SWMH17	30 Winter	5	+0%					65.635
S7.000	SWMH34	15 Winter	5	+0%					66.369
S7.001	SWMH33	15 Winter	5	+0%					66.210
S7.002	SWMH32	15 Winter	5	+0%					66.065
S8.000	SWMH30	15 Winter	5	+0%					66.491
S7.003	SWMH31	15 Winter	5	+0%					65.714
S3.006	SWMH16	30 Winter	5	+0%	100/15 Summer				65.556
S9.000	SWMH28	15 Winter	5	+0%					65.812

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH22	-0.253	0.000	0.06			4.4	OK	
S4.000	SWMH23	-0.234	0.000	0.11			7.4	OK	
S4.001	S3	-0.206	0.000	0.19			12.3	OK	
S5.000	S3	-0.238	0.000	0.10			6.6	OK	
S4.002	S3	-0.178	0.000	0.34			22.8	OK	
S6.000	S6	-0.235	0.000	0.11			7.2	OK	
S4.003	S4	-0.139	0.000	0.56			34.6	OK	
S3.001	SWMH21	-0.271	0.000	0.31			55.2	OK	
S3.002	SWMH20	-0.301	0.000	0.37			80.1	OK	
S3.003	SWMH19	-0.280	0.000	0.42			95.4	OK	
S3.004	SWMH18	-0.250	0.000	0.47			99.7	OK	
S3.005	SWMH17	-0.234	0.000	0.45			100.4	OK	
S7.000	SWMH34	-0.231	0.000	0.12			8.7	OK	
S7.001	SWMH33	-0.219	0.000	0.16			11.6	OK	
S7.002	SWMH32	-0.159	0.000	0.45			32.8	OK	
S8.000	SWMH30	-0.229	0.000	0.13			9.4	OK	
S7.003	SWMH31	-0.266	0.000	0.35			58.9	OK	
S3.006	SWMH16	-0.127	0.000	0.93			136.5	OK	
S9.000	SWMH28	-0.238	0.000	0.09			9.7	OK	

Okay- No flooding

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S9.001	SWMH27	15 Winter	5	+0%	100/960 Winter		
S3.007	SWMH15	30 Winter	5	+0%	20/30 Winter		
S10.000	S26	15 Winter	5	+0%			
S10.001	S27	15 Winter	5	+0%			
S3.008	S22	30 Winter	5	+0%	100/15 Summer		
S3.009	SPI	30 Winter	5	+0%	100/15 Summer		
S11.000	SDUMMY	10080 Winter	5	+0%	5/7200 Winter		
S11.001	SDummytank	10080 Winter	5	+0%	5/5760 Winter		
S11.002	S33	15 Winter	5	+0%	100/15 Summer		
S12.000	SWMH14	15 Winter	5	+0%			
S12.001	S22	15 Winter	5	+0%			
S13.000	S22	15 Winter	5	+0%			
S12.002	S21	15 Winter	5	+0%			
S14.000	S25	15 Winter	5	+0%			
S12.003	S20	15 Winter	5	+0%			
S11.003	SWMH12	15 Winter	5	+0%	100/15 Summer		
S11.004	SWMH12	15 Winter	5	+0%	20/15 Winter		
S11.005	SWMH11	15 Winter	5	+0%	5/15 Winter		
S15.000	S40	15 Winter	5	+0%			
S11.006	S33	15 Winter	5	+0%	100/15 Summer		
S11.007	SPI	2160 Winter	5	+0%	20/1440 Winter		
S3.010	SWMH10	2160 Winter	5	+0%	100/360 Winter		
S16.000	SWMH9	15 Winter	5	+0%			
S16.001	SWMH8	15 Winter	5	+0%			
S17.000	S44	15 Winter	5	+0%			
S16.002	S44	15 Winter	5	+0%	100/15 Winter		
S16.003	SWMH7	15 Winter	5	+0%	100/15 Summer		
S16.004	SWMH6	15 Winter	5	+0%	100/15 Summer		
S18.000	S29	15 Winter	5	+0%			
S18.001	S30	15 Winter	5	+0%			
S18.002	S31	15 Winter	5	+0%	100/480 Winter		
S16.005	SWMH2	2160 Winter	5	+0%	20/15 Winter		
S16.006	SPI	2160 Winter	5	+0%	20/600 Winter		
S16.007	SWMH3	2160 Winter	5	+0%	20/480 Winter		
S19.000	SRMH14	15 Winter	5	+0%	100/15 Winter		
S19.001	SRMH13	15 Winter	5	+0%	100/15 Summer		
S19.002	SRMH12	15 Winter	5	+0%	100/15 Winter		
S19.003	SRMH1	15 Winter	5	+0%	100/15 Summer		
S19.004	SRMH0	15 Winter	5	+0%	100/720 Winter		
S20.000	SRMH24	15 Winter	5	+0%			
S20.001	SRMH23	15 Winter	5	+0%			
S21.000	SRMH20	15 Winter	5	+0%			
S21.001	SRMH21	15 Winter	5	+0%			
S20.002	SRMH22	15 Winter	5	+0%			
S22.000	SRMH7	15 Winter	5	+0%	100/15 Summer		
S22.001	SRMH6	15 Winter	5	+0%	20/15 Winter		
S22.002	SRMH5	15 Winter	5	+0%	100/15 Summer		
S22.003	SRMH4	15 Winter	5	+0%	100/15 Winter		

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S9.001	SWMH27		65.319	-0.221	0.000	0.16			14.7
S3.007	SWMH15		65.204	-0.167	0.000	0.79			142.1
S10.000	S26		65.571	-0.154	0.000	0.22			6.7
S10.001	S27		65.490	-0.160	0.000	0.18			6.6
S3.008	S22		65.168	-0.173	0.000	0.80			143.5
S3.009	SPI		65.131	-0.181	0.000	0.83			141.9
S11.000	SDUMMY		66.746	0.171	0.000	0.04			30.4
S11.001	SDummytank		66.746	0.259	0.000	0.01			11.0
S11.002	S33		65.550	-0.158	0.000	0.27			12.2
S12.000	SWMH14		66.155	-0.195	0.000	0.26			12.2
S12.001	S22		66.085	-0.209	0.000	0.20			12.1
S13.000	S22		66.109	-0.241	0.000	0.09			6.1
S12.002	S21		65.860	-0.362	0.000	0.08			22.5
S14.000	S25		65.869	-0.231	0.000	0.12			8.1
S12.003	S20		65.701	-0.299	0.000	0.25			36.2
S11.003	SWMH12		65.538	-0.265	0.000	0.33			58.0
S11.004	SWMH12		65.327	-0.176	0.000	0.52			91.4
S11.005	SWMH11		65.260	0.024	0.000	1.02			160.0
S15.000	S40		65.869	-0.156	0.000	0.20			6.8
S11.006	S33		65.166	-0.160	0.000	0.82			161.5
S11.007	SPI		65.132	-0.143	0.000	0.11			23.6
S3.010	SWMH10		65.113	-0.227	0.000	0.12			38.3
S16.000	SWMH9		66.092	-0.178	0.000	0.35			23.5
S16.001	SWMH8		65.618	-0.292	0.000	0.26			49.0
S17.000	S44		66.304	-0.121	0.000	0.44			18.0
S16.002	S44		65.469	-0.261	0.000	0.36			64.4
S16.003	SWMH7		65.358	-0.192	0.000	0.62			102.6
S16.004	SWMH6		65.270	-0.195	0.000	0.59			112.3
S18.000	S29		65.839	-0.211	0.000	0.19			18.6
S18.001	S30		65.677	-0.191	0.000	0.28			29.0
S18.002	S31		65.237	-0.188	0.000	0.30			34.1
S16.005	SWMH2		65.106	-0.082	0.000	0.07			10.4
S16.006	SPI		65.106	-0.071	0.000	0.07			9.8
S16.007	SWMH3		65.107	-0.051	0.000	0.03			9.8
S19.000	SRMH14		66.263	-0.187	0.000	0.28			17.9
S19.001	SRMH13		66.070	-0.111	0.000	0.66			42.3
S19.002	SRMH12		65.709	-0.176	0.000	0.53			63.4
S19.003	SRMH1		65.436	-0.141	0.000	0.71			75.1
S19.004	SRMH0		65.279	-0.214	0.000	0.38			75.2
S20.000	SRMH24		66.196	-0.254	0.000	0.06			5.8
S20.001	SRMH23		65.885	-0.247	0.000	0.07			7.9
S21.000	SRMH20		66.225	-0.225	0.000	0.14			14.3
S21.001	SRMH21		65.914	-0.218	0.000	0.17			18.8
S20.002	SRMH22		65.535	-0.173	0.000	0.37			27.8
S22.000	SRMH7		66.614	-0.186	0.000	0.28			18.1
S22.001	SRMH6		66.429	-0.102	0.000	0.71			45.4
S22.002	SRMH5		66.101	-0.134	0.000	0.70			70.7

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S22.003	SRMH4		65.794	-0.220	0.000	0.50			80.0

PN	US/MH Name	Status	Level Exceeded
S9.001	SWMH27	OK	
S3.007	SWMH15	OK	
S10.000	S26	OK	
S10.001	S27	OK	
S3.008	S22	OK	
S3.009	SPI	OK	
S11.000	SDUMMY	SURCHARGED	
S11.001	SDummytank	SURCHARGED	
S11.002	S33	OK	
S12.000	SWMH14	OK	
S12.001	S22	OK	
S13.000	S22	OK	
S12.002	S21	OK	
S14.000	S25	OK	
S12.003	S20	OK	
S11.003	SWMH12	OK	
S11.004	SWMH12	OK	
S11.005	SWMH11	SURCHARGED	
S15.000	S40	OK	
S11.006	S33	OK	
S11.007	SPI	OK	
S3.010	SWMH10	OK	
S16.000	SWMH9	OK	
S16.001	SWMH8	OK	
S17.000	S44	OK	
S16.002	S44	OK	
S16.003	SWMH7	OK	
S16.004	SWMH6	OK	
S18.000	S29	OK	
S18.001	S30	OK	
S18.002	S31	OK	
S16.005	SWMH2	OK	
S16.006	SPI	OK	
S16.007	SWMH3	OK	
S19.000	SRMH14	OK	
S19.001	SRMH13	OK	
S19.002	SRMH12	OK	
S19.003	SRMH1	OK	
S19.004	SRMH0	OK	
S20.000	SRMH24	OK	
S20.001	SRMH23	OK	

Okay- No flooding

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Status	Level Exceeded
S21.000	SRMH20	OK	
S21.001	SRMH21	OK	
S20.002	SRMH22	OK	
S22.000	SRMH7	OK	
S22.001	SRMH6	OK	
S22.002	SRMH5	OK	
S22.003	SRMH4	OK	

Okay- No flooding

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S23.000	SRMH10	15 Winter	5	+0%	100/15 Summer		
S23.001	SRMH9	15 Winter	5	+0%	100/15 Summer		
S23.002	SRMH8	15 Winter	5	+0%	100/15 Summer		
S22.004	SRMH3	15 Winter	5	+0%	100/15 Summer		
S22.005	SRMH2	15 Winter	5	+0%	100/15 Summer		
S22.006	SRMH14	15 Winter	5	+0%	100/15 Summer		
S22.007	S75	15 Winter	5	+0%			
S24.000	SEXRWMH14	15 Winter	5	+0%	100/15 Winter		
S24.001	SWMH05	15 Winter	5	+0%			
S24.002	SWMH06	15 Winter	5	+0%			
S24.003	SWMH07	15 Winter	5	+0%			
S24.004	S67	15 Winter	5	+0%			
S24.005	S80	15 Winter	5	+0%	100/2160 Winter		
S24.006	S81	15 Winter	5	+0%	100/600 Winter		
S25.000	SRMH18	15 Winter	5	+0%			
S25.001	SRMH17	15 Winter	5	+0%			
S25.002	SRMH16	15 Winter	5	+0%			
S25.003	SRMH15	15 Winter	5	+0%			
S25.004	S55	15 Winter	5	+0%			
S19.005	S-RWH_TANK	2160 Winter	5	+0%	100/480 Winter		
S3.011	STANK	2160 Winter	5	+0%	100/480 Winter		
S3.012	SWMH2	2160 Winter	5	+0%			
S3.013	SWMH1	2160 Winter	5	+0%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S23.000	SRMH10		66.662	-0.188	0.000	0.28			18.6
S23.001	SRMH9		66.448	-0.106	0.000	0.69			46.6
S23.002	SRMH8		66.071	-0.157	0.000	0.62			74.0
S22.004	SRMH3		65.665	-0.177	0.000	0.77			160.0
S22.005	SRMH2		65.558	-0.230	0.000	0.61			160.4
S22.006	SRMH14		65.479	-0.189	0.000	0.77			155.9
S22.007	S75		65.359	-0.250	0.000	0.64			154.0
S24.000	SEXRWMH14		66.152	-0.198	0.000	0.60			86.5
S24.001	SWMH05		66.061	-0.216	0.000	0.51			83.0
S24.002	SWMH06		65.796	-0.225	0.000	0.48			78.4
S24.003	SWMH07		65.549	-0.215	0.000	0.52			75.7
S24.004	S67		65.465	-0.223	0.000	0.50			75.2
S24.005	S80		65.363	-0.231	0.000	0.47			73.9
S24.006	S81		65.156	-0.290	0.000	0.28			74.1
S25.000	SRMH18		66.262	-0.188	0.000	0.30			19.2
S25.001	SRMH17		65.888	-0.293	0.000	0.25			45.4
S25.002	SRMH16		65.640	-0.245	0.000	0.41			65.3
S25.003	SRMH15		65.453	-0.212	0.000	0.55			75.5
S25.004	S55		65.388	-0.221	0.000	0.51			75.1

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S19.005	S-RWH_TANK		65.110	-0.290	0.000	0.13			24.8
S3.011	STANK		65.101	-0.287	0.000	0.08			37.5
S3.012	SWMH2		64.561	-0.116	0.000	0.68			37.5
S3.013	SWMH1		64.501	-0.113	0.000	0.71			37.5

PN	US/MH Name	Status	Level Exceeded
S23.000	SRMH10	OK	
S23.001	SRMH9	OK	
S23.002	SRMH8	OK	
S22.004	SRMH3	OK	
S22.005	SRMH2	OK	
S22.006	SRMH14	OK	
S22.007	S75	OK	
S24.000	SEXRWMH14	OK	
S24.001	SWMH05	OK	
S24.002	SWMH06	OK	
S24.003	SWMH07	OK	
S24.004	S67	OK	
S24.005	S80	OK	
S24.006	S81	OK	
S25.000	SRMH18	OK	
S25.001	SRMH17	OK	
S25.002	SRMH16	OK	
S25.003	SRMH15	OK	
S25.004	S55	OK	
S19.005	S-RWH_TANK	OK	
S3.011	STANK	OK	
S3.012	SWMH2	OK	
S3.013	SWMH1	OK	

Okay- No flooding

A3 25 Yr Return Period Simulation

25 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 3
Number of Online Controls 7 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.271
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 16.600 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 5, 20, 25, 30, 100
Climate Change (%) 0, 0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S3.000	SWMH22	15 Winter	25	+0%					66.759
S4.000	SWMH23	15 Winter	25	+0%					66.731
S4.001	S3	15 Winter	25	+0%					66.677
S5.000	S3	15 Winter	25	+0%					66.723
S4.002	S3	15 Winter	25	+0%					66.650
S6.000	S6	15 Winter	25	+0%					66.727
S4.003	S4	15 Winter	25	+0%					66.601
S3.001	SWMH21	15 Winter	25	+0%					66.420
S3.002	SWMH20	15 Winter	25	+0%					66.108
S3.003	SWMH19	15 Winter	25	+0%					65.995
S3.004	SWMH18	15 Winter	25	+0%					65.834
S3.005	SWMH17	30 Winter	25	+0%					65.765
S7.000	SWMH34	15 Winter	25	+0%					66.383
S7.001	SWMH33	15 Winter	25	+0%					66.230
S7.002	SWMH32	15 Winter	25	+0%					66.121
S8.000	SWMH30	15 Winter	25	+0%					66.505
S7.003	SWMH31	15 Winter	25	+0%					65.775
S3.006	SWMH16	30 Winter	25	+0%	25/15 Winter				65.685
S9.000	SWMH28	15 Winter	25	+0%					65.822

25 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH22	-0.241	0.000	0.09			6.3	OK	
S4.000	SWMH23	-0.219	0.000	0.15			10.4	OK	
S4.001	S3	-0.172	0.000	0.29			18.8	OK	
S5.000	S3	-0.227	0.000	0.14			9.3	OK	
S4.002	S3	-0.135	0.000	0.51			34.7	OK	
S6.000	S6	-0.223	0.000	0.15			10.2	OK	
S4.003	S4	-0.085	0.000	0.86			52.6	OK	
S3.001	SWMH21	-0.215	0.000	0.48			85.2	OK	
S3.002	SWMH20	-0.227	0.000	0.57			124.4	OK	
S3.003	SWMH19	-0.203	0.000	0.65			145.8	OK	
S3.004	SWMH18	-0.139	0.000	0.69			145.1	OK	
S3.005	SWMH17	-0.104	0.000	0.65			143.7	OK	
S7.000	SWMH34	-0.217	0.000	0.17			12.3	OK	
S7.001	SWMH33	-0.199	0.000	0.24			17.3	OK	
S7.002	SWMH32	-0.103	0.000	0.72			53.4	OK	
S8.000	SWMH30	-0.215	0.000	0.18			13.3	OK	
S7.003	SWMH31	-0.205	0.000	0.56			94.8	OK	
S3.006	SWMH16	0.003	0.000	1.34			196.1	SURCHARGED	
S9.000	SWMH28	-0.228	0.000	0.13			13.8	OK	

Okay - no flooding

25 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S9.001	SWMH27	30 Winter	25	+0%	100/960 Winter		
S3.007	SWMH15	30 Winter	25	+0%	20/30 Winter		
S10.000	S26	15 Winter	25	+0%			
S10.001	S27	15 Winter	25	+0%			
S3.008	S22	30 Winter	25	+0%	25/30 Winter		
S3.009	SPI	2160 Winter	25	+0%	25/1440 Winter		
S11.000	SDUMMY	10080 Winter	25	+0%	5/7200 Winter		
S11.001	SDummytank	10080 Winter	25	+0%	5/5760 Winter		
S11.002	S33	15 Winter	25	+0%	100/15 Summer		
S12.000	SWMH14	15 Winter	25	+0%			
S12.001	S22	15 Winter	25	+0%			
S13.000	S22	15 Winter	25	+0%			
S12.002	S21	15 Winter	25	+0%			
S14.000	S25	15 Winter	25	+0%			
S12.003	S20	15 Winter	25	+0%			
S11.003	SWMH12	15 Winter	25	+0%	100/15 Summer		
S11.004	SWMH12	15 Winter	25	+0%	20/15 Winter		
S11.005	SWMH11	15 Winter	25	+0%	5/15 Winter		
S15.000	S40	15 Winter	25	+0%			
S11.006	S33	2160 Winter	25	+0%	25/1440 Winter		
S11.007	SPI	2160 Winter	25	+0%	20/1440 Winter		
S3.010	SWMH10	2160 Winter	25	+0%	100/360 Winter		
S16.000	SWMH9	15 Winter	25	+0%			
S16.001	SWMH8	15 Winter	25	+0%			
S17.000	S44	15 Winter	25	+0%			
S16.002	S44	15 Winter	25	+0%	100/15 Winter		
S16.003	SWMH7	15 Winter	25	+0%	100/15 Summer		
S16.004	SWMH6	15 Winter	25	+0%	100/15 Summer		
S18.000	S29	15 Winter	25	+0%			
S18.001	S30	15 Summer	25	+0%			
S18.002	S31	2160 Winter	25	+0%	100/480 Winter		
S16.005	SWMH2	2160 Winter	25	+0%	20/15 Winter		
S16.006	SPI	2160 Winter	25	+0%	20/600 Winter		
S16.007	SWMH3	2160 Winter	25	+0%	20/480 Winter		
S19.000	SRMH14	15 Winter	25	+0%	100/15 Winter		
S19.001	SRMH13	15 Winter	25	+0%	30/15 Summer		
S19.002	SRMH12	15 Winter	25	+0%	100/15 Winter		
S19.003	SRMH1	15 Winter	25	+0%	100/15 Summer		
S19.004	SRMH0	2160 Winter	25	+0%	100/720 Winter		
S20.000	SRMH24	15 Winter	25	+0%			
S20.001	SRMH23	15 Winter	25	+0%			
S21.000	SRMH20	15 Winter	25	+0%			
S21.001	SRMH21	15 Winter	25	+0%			
S20.002	SRMH22	15 Winter	25	+0%			
S22.000	SRMH7	15 Winter	25	+0%	100/15 Summer		
S22.001	SRMH6	15 Winter	25	+0%	20/15 Winter		
S22.002	SRMH5	15 Winter	25	+0%	30/15 Winter		
S22.003	SRMH4	15 Winter	25	+0%	100/15 Winter		

25 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S9.001	SWMH27		65.386	-0.154	0.000	0.19			18.0
S3.007	SWMH15		65.376	0.005	0.000	1.15			207.8
S10.000	S26		65.585	-0.140	0.000	0.31			9.5
S10.001	S27		65.502	-0.148	0.000	0.26			9.4
S3.008	S22		65.344	0.002	0.000	1.17			210.7
S3.009	SPI		65.331	0.019	0.000	0.11			18.9
S11.000	SDUMMY		66.875	0.300	0.000	0.04			35.2
S11.001	SDummytank		66.875	0.388	0.000	0.01			11.0
S11.002	S33		65.652	-0.056	0.000	0.43			19.3
S12.000	SWMH14		66.178	-0.172	0.000	0.37			17.3
S12.001	S22		66.102	-0.191	0.000	0.28			17.2
S13.000	S22		66.120	-0.230	0.000	0.12			8.6
S12.002	S21		65.878	-0.344	0.000	0.12			32.8
S14.000	S25		65.883	-0.217	0.000	0.17			11.5
S12.003	S20		65.741	-0.259	0.000	0.37			53.5
S11.003	SWMH12		65.656	-0.147	0.000	0.47			81.8
S11.004	SWMH12		65.603	0.100	0.000	0.61			106.6
S11.005	SWMH11		65.482	0.246	0.000	1.33			207.5
S15.000	S40		65.882	-0.143	0.000	0.29			9.6
S11.006	S33		65.346	0.020	0.000	0.14			27.2
S11.007	SPI		65.342	0.067	0.000	0.13			26.4
S3.010	SWMH10		65.340	0.000	0.000	0.14			45.6
S16.000	SWMH9		66.119	-0.151	0.000	0.45			30.7
S16.001	SWMH8		65.663	-0.247	0.000	0.40			75.8
S17.000	S44		66.329	-0.096	0.000	0.62			25.5
S16.002	S44		65.536	-0.194	0.000	0.53			94.8
S16.003	SWMH7		65.465	-0.085	0.000	0.94			156.0
S16.004	SWMH6		65.402	-0.063	0.000	0.86			163.9
S18.000	S29		65.857	-0.193	0.000	0.28			26.3
S18.001	S30		65.708	-0.160	0.000	0.44			45.2
S18.002	S31		65.293	-0.132	0.000	0.02			2.7
S16.005	SWMH2		65.292	0.104	0.000	0.09			13.2
S16.006	SPI		65.292	0.115	0.000	0.09			12.6
S16.007	SWMH3		65.291	0.133	0.000	0.03			12.6
S19.000	SRMH14		66.288	-0.162	0.000	0.40			25.3
S19.001	SRMH13		66.178	-0.003	0.000	0.98			62.7
S19.002	SRMH12		65.773	-0.112	0.000	0.79			94.7
S19.003	SRMH1		65.536	-0.041	0.000	1.00			106.3
S19.004	SRMH0		65.318	-0.175	0.000	0.04			7.8
S20.000	SRMH24		66.207	-0.243	0.000	0.08			8.2
S20.001	SRMH23		65.898	-0.234	0.000	0.11			12.1
S21.000	SRMH20		66.241	-0.209	0.000	0.20			20.2
S21.001	SRMH21		65.934	-0.198	0.000	0.25			28.5
S20.002	SRMH22		65.571	-0.137	0.000	0.57			42.3
S22.000	SRMH7		66.638	-0.162	0.000	0.40			25.4
S22.001	SRMH6		66.566	0.035	0.000	1.01			65.1
S22.002	SRMH5		66.229	-0.006	0.000	0.99			100.2

25 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S22.003	SRMH4		65.893	-0.121	0.000	0.68			107.2

PN	US/MH Name	Status	Level Exceeded
S9.001	SWMH27	OK	
S3.007	SWMH15	SURCHARGED	
S10.000	S26	OK	
S10.001	S27	OK	
S3.008	S22	SURCHARGED	
S3.009	SPI	SURCHARGED	
S11.000	SDUMMY	SURCHARGED	
S11.001	SDummytank	SURCHARGED	
S11.002	S33	OK	
S12.000	SWMH14	OK	
S12.001	S22	OK	
S13.000	S22	OK	
S12.002	S21	OK	
S14.000	S25	OK	
S12.003	S20	OK	
S11.003	SWMH12	OK	
S11.004	SWMH12	SURCHARGED	
S11.005	SWMH11	SURCHARGED	
S15.000	S40	OK	
S11.006	S33	SURCHARGED	
S11.007	SPI	SURCHARGED	
S3.010	SWMH10	OK	
S16.000	SWMH9	OK	
S16.001	SWMH8	OK	
S17.000	S44	OK	
S16.002	S44	OK	
S16.003	SWMH7	OK	
S16.004	SWMH6	OK	
S18.000	S29	OK	
S18.001	S30	OK	
S18.002	S31	OK	
S16.005	SWMH2	SURCHARGED	
S16.006	SPI	SURCHARGED	
S16.007	SWMH3	SURCHARGED	
S19.000	SRMH14	OK	
S19.001	SRMH13	OK	
S19.002	SRMH12	OK	
S19.003	SRMH1	OK	
S19.004	SRMH0	OK	
S20.000	SRMH24	OK	
S20.001	SRMH23	OK	

Okay - no flooding

25 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Status	Level Exceeded
S21.000	SRMH20	OK	
S21.001	SRMH21	OK	
S20.002	SRMH22	OK	
S22.000	SRMH7	OK	
S22.001	SRMH6	SURCHARGED	
S22.002	SRMH5	OK	
S22.003	SRMH4	OK	

Okay - no flooding

25 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S23.000	SRMH10	15 Winter	25	+0%	100/15 Summer		
S23.001	SRMH9	15 Winter	25	+0%	25/15 Summer		
S23.002	SRMH8	15 Winter	25	+0%	100/15 Summer		
S22.004	SRMH3	15 Winter	25	+0%	100/15 Summer		
S22.005	SRMH2	30 Winter	25	+0%	100/15 Summer		
S22.006	SRMH14	30 Winter	25	+0%	100/15 Summer		
S22.007	S75	30 Winter	25	+0%			
S24.000	SEXRWMH14	15 Winter	25	+0%	100/15 Winter		
S24.001	SWMH05	15 Winter	25	+0%			
S24.002	SWMH06	15 Winter	25	+0%			
S24.003	SWMH07	15 Winter	25	+0%			
S24.004	S67	15 Winter	25	+0%			
S24.005	S80	15 Winter	25	+0%	100/2160 Winter		
S24.006	S81	2160 Winter	25	+0%	100/600 Winter		
S25.000	SRMH18	15 Winter	25	+0%			
S25.001	SRMH17	15 Winter	25	+0%			
S25.002	SRMH16	15 Winter	25	+0%			
S25.003	SRMH15	15 Winter	25	+0%			
S25.004	S55	15 Winter	25	+0%			
S19.005	S-RWH_TANK	2160 Winter	25	+0%	100/480 Winter		
S3.011	STANK	2160 Winter	25	+0%	100/480 Winter		
S3.012	SWMH2	2160 Winter	25	+0%			
S3.013	SWMH1	2160 Winter	25	+0%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S23.000	SRMH10		66.686	-0.164	0.000	0.39			26.3
S23.001	SRMH9		66.578	0.024	0.000	1.01			67.8
S23.002	SRMH8		66.149	-0.079	0.000	0.92			110.4
S22.004	SRMH3		65.816	-0.027	0.000	1.00			208.4
S22.005	SRMH2		65.720	-0.068	0.000	0.78			207.2
S22.006	SRMH14		65.668	0.000	0.000	1.01			203.6
S22.007	S75		65.434	-0.175	0.000	0.85			203.0
S24.000	SEXRWMH14		66.220	-0.130	0.000	0.85			122.4
S24.001	SWMH05		66.120	-0.157	0.000	0.72			117.6
S24.002	SWMH06		65.852	-0.169	0.000	0.68			110.5
S24.003	SWMH07		65.606	-0.158	0.000	0.73			106.7
S24.004	S67		65.520	-0.168	0.000	0.71			105.8
S24.005	S80		65.415	-0.179	0.000	0.67			104.2
S24.006	S81		65.318	-0.128	0.000	0.03			8.3
S25.000	SRMH18		66.286	-0.164	0.000	0.39			25.3
S25.001	SRMH17		65.935	-0.246	0.000	0.39			71.4
S25.002	SRMH16		65.709	-0.176	0.000	0.64			102.5
S25.003	SRMH15		65.533	-0.132	0.000	0.84			116.0
S25.004	S55		65.463	-0.146	0.000	0.79			115.1

25 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S19.005	S-RWH_TANK		65.317	-0.083	0.000	0.14			27.9
S3.011	STANK		65.290	-0.098	0.000	0.08			38.2
S3.012	SWMH2		64.563	-0.114	0.000	0.69			38.2
S3.013	SWMH1		64.504	-0.110	0.000	0.72			38.2

PN	US/MH Name	Status	Level Exceeded
S23.000	SRMH10	OK	
S23.001	SRMH9	SURCHARGED	
S23.002	SRMH8	OK	
S22.004	SRMH3	OK	
S22.005	SRMH2	OK	
S22.006	SRMH14	OK	
S22.007	S75	OK	
S24.000	SEXRWMH14	OK	
S24.001	SWMH05	OK	
S24.002	SWMH06	OK	
S24.003	SWMH07	OK	
S24.004	S67	OK	
S24.005	S80	OK	
S24.006	S81	OK	
S25.000	SRMH18	OK	
S25.001	SRMH17	OK	
S25.002	SRMH16	OK	
S25.003	SRMH15	OK	
S25.004	S55	OK	
S19.005	S-RWH_TANK	OK	
S3.011	STANK	OK	
S3.012	SWMH2	OK	
S3.013	SWMH1	OK	

Okay - no flooding

A4 30 Yr Return Period Simulation

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 3
Number of Online Controls 7 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.271
Region Scotland and Ireland Cv (Summer) 0.750
M5-60 (mm) 16.600 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 5, 20, 25, 30, 100
Climate Change (%) 0, 0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S3.000	SWMH22	15 Winter	30	+0%					66.760
S4.000	SWMH23	15 Winter	30	+0%					66.733
S4.001	S3	15 Winter	30	+0%					66.681
S5.000	S3	15 Winter	30	+0%					66.725
S4.002	S3	15 Winter	30	+0%					66.655
S6.000	S6	15 Winter	30	+0%					66.729
S4.003	S4	15 Winter	30	+0%					66.607
S3.001	SWMH21	15 Winter	30	+0%					66.426
S3.002	SWMH20	15 Winter	30	+0%					66.115
S3.003	SWMH19	15 Winter	30	+0%					66.003
S3.004	SWMH18	15 Winter	30	+0%					65.843
S3.005	SWMH17	15 Winter	30	+0%					65.773
S7.000	SWMH34	15 Winter	30	+0%					66.385
S7.001	SWMH33	15 Winter	30	+0%					66.232
S7.002	SWMH32	15 Winter	30	+0%					66.126
S8.000	SWMH30	15 Winter	30	+0%					66.507
S7.003	SWMH31	15 Winter	30	+0%					65.781
S3.006	SWMH16	30 Summer	30	+0%	25/15 Winter				65.686
S9.000	SWMH28	15 Winter	30	+0%					65.824

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH22	-0.240	0.000	0.09			6.5	OK	
S4.000	SWMH23	-0.217	0.000	0.16			10.8	OK	
S4.001	S3	-0.168	0.000	0.30			19.5	OK	
S5.000	S3	-0.225	0.000	0.14			9.7	OK	
S4.002	S3	-0.130	0.000	0.53			36.0	OK	
S6.000	S6	-0.221	0.000	0.16			10.6	OK	
S4.003	S4	-0.079	0.000	0.89			54.6	OK	
S3.001	SWMH21	-0.209	0.000	0.50			88.5	OK	
S3.002	SWMH20	-0.220	0.000	0.59			129.1	OK	
S3.003	SWMH19	-0.195	0.000	0.67			151.4	OK	
S3.004	SWMH18	-0.129	0.000	0.72			151.4	OK	
S3.005	SWMH17	-0.096	0.000	0.67			149.0	OK	
S7.000	SWMH34	-0.215	0.000	0.18			12.8	OK	
S7.001	SWMH33	-0.197	0.000	0.25			18.0	OK	
S7.002	SWMH32	-0.098	0.000	0.75			55.5	OK	
S8.000	SWMH30	-0.213	0.000	0.19			13.8	OK	
S7.003	SWMH31	-0.199	0.000	0.58			98.6	OK	
S3.006	SWMH16	0.004	0.000	1.28			187.8	SURCHARGED	
S9.000	SWMH28	-0.226	0.000	0.14			14.3	OK	

Okay - no flooding

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S9.001	SWMH27	30 Winter	30	+0%	100/960 Winter		
S3.007	SWMH15	30 Winter	30	+0%	20/30 Winter		
S10.000	S26	15 Winter	30	+0%			
S10.001	S27	15 Winter	30	+0%			
S3.008	S22	30 Winter	30	+0%	25/30 Winter		
S3.009	SPI	1440 Winter	30	+0%	25/1440 Winter		
S11.000	SDUMMY	10080 Winter	30	+0%	5/7200 Winter		
S11.001	SDummytank	10080 Winter	30	+0%	5/5760 Winter		
S11.002	S33	15 Winter	30	+0%	100/15 Summer		
S12.000	SWMH14	15 Winter	30	+0%			
S12.001	S22	15 Winter	30	+0%			
S13.000	S22	15 Winter	30	+0%			
S12.002	S21	15 Winter	30	+0%			
S14.000	S25	15 Winter	30	+0%			
S12.003	S20	15 Winter	30	+0%			
S11.003	SWMH12	15 Winter	30	+0%	100/15 Summer		
S11.004	SWMH12	15 Winter	30	+0%	20/15 Winter		
S11.005	SWMH11	15 Winter	30	+0%	5/15 Winter		
S15.000	S40	15 Winter	30	+0%			
S11.006	S33	1440 Winter	30	+0%	25/1440 Winter		
S11.007	SPI	1440 Winter	30	+0%	20/1440 Winter		
S3.010	SWMH10	2160 Winter	30	+0%	100/360 Winter		
S16.000	SWMH9	15 Winter	30	+0%			
S16.001	SWMH8	15 Winter	30	+0%			
S17.000	S44	15 Winter	30	+0%			
S16.002	S44	15 Winter	30	+0%	100/15 Winter		
S16.003	SWMH7	15 Winter	30	+0%	100/15 Summer		
S16.004	SWMH6	15 Winter	30	+0%	100/15 Summer		
S18.000	S29	15 Winter	30	+0%			
S18.001	S30	15 Summer	30	+0%			
S18.002	S31	2160 Winter	30	+0%	100/480 Winter		
S16.005	SWMH2	2160 Winter	30	+0%	20/15 Winter		
S16.006	SPI	2160 Winter	30	+0%	20/600 Winter		
S16.007	SWMH3	2160 Winter	30	+0%	20/480 Winter		
S19.000	SRMH14	15 Winter	30	+0%	100/15 Winter		
S19.001	SRMH13	15 Winter	30	+0%	30/15 Summer		
S19.002	SRMH12	15 Winter	30	+0%	100/15 Winter		
S19.003	SRMH1	15 Winter	30	+0%	100/15 Summer		
S19.004	SRMH0	2160 Winter	30	+0%	100/720 Winter		
S20.000	SRMH24	15 Winter	30	+0%			
S20.001	SRMH23	15 Winter	30	+0%			
S21.000	SRMH20	15 Winter	30	+0%			
S21.001	SRMH21	15 Winter	30	+0%			
S20.002	SRMH22	15 Winter	30	+0%			
S22.000	SRMH7	15 Winter	30	+0%	100/15 Summer		
S22.001	SRMH6	15 Winter	30	+0%	20/15 Winter		
S22.002	SRMH5	15 Winter	30	+0%	30/15 Winter		
S22.003	SRMH4	15 Winter	30	+0%	100/15 Winter		

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S9.001	SWMH27		65.394	-0.146	0.000	0.20			18.7
S3.007	SWMH15		65.384	0.013	0.000	1.21			217.8
S10.000	S26		65.587	-0.138	0.000	0.32			9.9
S10.001	S27		65.504	-0.146	0.000	0.27			9.8
S3.008	S22		65.348	0.006	0.000	1.24			223.0
S3.009	SPI		65.341	0.030	0.000	0.15			25.4
S11.000	SDUMMY		66.891	0.316	0.000	0.04			35.8
S11.001	SDummytank		66.891	0.404	0.000	0.01			11.0
S11.002	S33		65.673	-0.035	0.000	0.46			20.5
S12.000	SWMH14		66.180	-0.170	0.000	0.39			18.0
S12.001	S22		66.105	-0.189	0.000	0.29			17.9
S13.000	S22		66.121	-0.229	0.000	0.13			9.0
S12.002	S21		65.880	-0.342	0.000	0.13			34.1
S14.000	S25		65.885	-0.215	0.000	0.18			12.0
S12.003	S20		65.745	-0.255	0.000	0.38			55.6
S11.003	SWMH12		65.699	-0.104	0.000	0.47			83.4
S11.004	SWMH12		65.629	0.126	0.000	0.64			112.3
S11.005	SWMH11		65.503	0.267	0.000	1.39			217.1
S15.000	S40		65.884	-0.141	0.000	0.30			10.0
S11.006	S33		65.351	0.025	0.000	0.17			33.0
S11.007	SPI		65.346	0.071	0.000	0.15			31.8
S3.010	SWMH10		65.340	0.000	0.000	0.14			46.5
S16.000	SWMH9		66.122	-0.148	0.000	0.47			31.9
S16.001	SWMH8		65.668	-0.242	0.000	0.42			78.8
S17.000	S44		66.332	-0.093	0.000	0.65			26.6
S16.002	S44		65.551	-0.179	0.000	0.55			97.8
S16.003	SWMH7		65.491	-0.059	0.000	0.95			157.4
S16.004	SWMH6		65.421	-0.044	0.000	0.88			167.7
S18.000	S29		65.859	-0.191	0.000	0.29			27.4
S18.001	S30		65.711	-0.157	0.000	0.45			47.0
S18.002	S31		65.318	-0.107	0.000	0.02			2.8
S16.005	SWMH2		65.318	0.130	0.000	0.09			13.6
S16.006	SPI		65.317	0.140	0.000	0.10			13.4
S16.007	SWMH3		65.316	0.158	0.000	0.03			13.2
S19.000	SRMH14		66.291	-0.159	0.000	0.41			26.3
S19.001	SRMH13		66.198	0.017	0.000	1.00			64.1
S19.002	SRMH12		65.779	-0.106	0.000	0.81			97.5
S19.003	SRMH1		65.561	-0.015	0.000	1.00			106.3
S19.004	SRMH0		65.350	-0.143	0.000	0.04			8.0
S20.000	SRMH24		66.208	-0.242	0.000	0.08			8.5
S20.001	SRMH23		65.899	-0.233	0.000	0.11			12.6
S21.000	SRMH20		66.242	-0.208	0.000	0.21			21.0
S21.001	SRMH21		65.936	-0.196	0.000	0.26			29.7
S20.002	SRMH22		65.575	-0.133	0.000	0.59			44.0
S22.000	SRMH7		66.646	-0.154	0.000	0.41			26.3
S22.001	SRMH6		66.591	0.060	0.000	1.04			66.6
S22.002	SRMH5		66.247	0.012	0.000	1.02			102.6

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S22.003	SRMH4		65.921	-0.093	0.000	0.68			108.2

PN	US/MH Name	Status	Level Exceeded
S9.001	SWMH27	OK	
S3.007	SWMH15	SURCHARGED	
S10.000	S26	OK	
S10.001	S27	OK	
S3.008	S22	SURCHARGED	
S3.009	SPI	SURCHARGED	
S11.000	SDUMMY	SURCHARGED	
S11.001	SDummytank	SURCHARGED	
S11.002	S33	OK	
S12.000	SWMH14	OK	
S12.001	S22	OK	
S13.000	S22	OK	
S12.002	S21	OK	
S14.000	S25	OK	
S12.003	S20	OK	
S11.003	SWMH12	OK	
S11.004	SWMH12	SURCHARGED	
S11.005	SWMH11	SURCHARGED	
S15.000	S40	OK	
S11.006	S33	SURCHARGED	
S11.007	SPI	SURCHARGED	
S3.010	SWMH10	OK	
S16.000	SWMH9	OK	
S16.001	SWMH8	OK	
S17.000	S44	OK	
S16.002	S44	OK	
S16.003	SWMH7	OK	
S16.004	SWMH6	OK	
S18.000	S29	OK	
S18.001	S30	OK	
S18.002	S31	OK	
S16.005	SWMH2	SURCHARGED	
S16.006	SPI	SURCHARGED	
S16.007	SWMH3	SURCHARGED	
S19.000	SRMH14	OK	
S19.001	SRMH13	SURCHARGED	
S19.002	SRMH12	OK	
S19.003	SRMH1	OK	
S19.004	SRMH0	OK	
S20.000	SRMH24	OK	
S20.001	SRMH23	OK	

Okay - no flooding

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Status	Level Exceeded
S21.000	SRMH20	OK	
S21.001	SRMH21	OK	
S20.002	SRMH22	OK	
S22.000	SRMH7	OK	
S22.001	SRMH6	SURCHARGED	
S22.002	SRMH5	SURCHARGED	
S22.003	SRMH4	OK	

Okay - no flooding

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S23.000	SRMH10	15 Winter	30	+0%	100/15 Summer		
S23.001	SRMH9	15 Winter	30	+0%	25/15 Summer		
S23.002	SRMH8	15 Winter	30	+0%	100/15 Summer		
S22.004	SRMH3	15 Winter	30	+0%	100/15 Summer		
S22.005	SRMH2	15 Winter	30	+0%	100/15 Summer		
S22.006	SRMH14	15 Winter	30	+0%	100/15 Summer		
S22.007	S75	30 Winter	30	+0%			
S24.000	SEXRWMH14	15 Winter	30	+0%	100/15 Winter		
S24.001	SWMH05	15 Winter	30	+0%			
S24.002	SWMH06	15 Winter	30	+0%			
S24.003	SWMH07	15 Winter	30	+0%			
S24.004	S67	15 Winter	30	+0%			
S24.005	S80	15 Winter	30	+0%	100/2160 Winter		
S24.006	S81	2160 Winter	30	+0%	100/600 Winter		
S25.000	SRMH18	15 Winter	30	+0%			
S25.001	SRMH17	15 Winter	30	+0%			
S25.002	SRMH16	15 Winter	30	+0%			
S25.003	SRMH15	15 Winter	30	+0%			
S25.004	S55	15 Winter	30	+0%			
S19.005	S-RWH_TANK	2160 Winter	30	+0%	100/480 Winter		
S3.011	STANK	2160 Winter	30	+0%	100/480 Winter		
S3.012	SWMH2	2160 Winter	30	+0%			
S3.013	SWMH1	2160 Winter	30	+0%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S23.000	SRMH10		66.690	-0.160	0.000	0.41			27.4
S23.001	SRMH9		66.600	0.046	0.000	1.03			69.7
S23.002	SRMH8		66.156	-0.072	0.000	0.95			113.8
S22.004	SRMH3		65.842	0.000	0.000	1.01			209.8
S22.005	SRMH2		65.721	-0.066	0.000	0.79			208.7
S22.006	SRMH14		65.668	0.000	0.000	1.02			205.8
S22.007	S75		65.438	-0.171	0.000	0.86			205.6
S24.000	SEXRWMH14		66.230	-0.120	0.000	0.88			127.3
S24.001	SWMH05		66.128	-0.149	0.000	0.75			122.3
S24.002	SWMH06		65.860	-0.161	0.000	0.71			114.9
S24.003	SWMH07		65.614	-0.150	0.000	0.76			111.0
S24.004	S67		65.528	-0.160	0.000	0.73			110.0
S24.005	S80		65.422	-0.172	0.000	0.69			108.4
S24.006	S81		65.350	-0.096	0.000	0.03			8.5
S25.000	SRMH18		66.289	-0.161	0.000	0.41			26.2
S25.001	SRMH17		65.939	-0.242	0.000	0.41			74.1
S25.002	SRMH16		65.716	-0.169	0.000	0.66			106.5
S25.003	SRMH15		65.542	-0.123	0.000	0.87			120.5
S25.004	S55		65.471	-0.138	0.000	0.82			119.6

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S19.005	S-RWH_TANK		65.349	-0.051	0.000	0.14			28.1
S3.011	STANK		65.315	-0.073	0.000	0.08			38.2
S3.012	SWMH2		64.563	-0.114	0.000	0.69			38.2
S3.013	SWMH1		64.504	-0.110	0.000	0.72			38.2

PN	US/MH Name	Status	Level Exceeded
S23.000	SRMH10	OK	
S23.001	SRMH9	SURCHARGED	
S23.002	SRMH8	OK	
S22.004	SRMH3	OK	
S22.005	SRMH2	OK	
S22.006	SRMH14	OK	
S22.007	S75	OK	
S24.000	SEXRWMH14	OK	
S24.001	SWMH05	OK	
S24.002	SWMH06	OK	
S24.003	SWMH07	OK	
S24.004	S67	OK	
S24.005	S80	OK	
S24.006	S81	OK	
S25.000	SRMH18	OK	
S25.001	SRMH17	OK	
S25.002	SRMH16	OK	
S25.003	SRMH15	OK	
S25.004	S55	OK	
S19.005	S-RWH_TANK	OK	
S3.011	STANK	OK	
S3.012	SWMH2	OK	
S3.013	SWMH1	OK	

Okay - no flooding

A5 100 Yr Return Period Simulation

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	7	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.271
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.600	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	5, 20, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S3.000	SWMH22	15 Winter	100	+0%					66.767
S4.000	SWMH23	15 Winter	100	+0%					66.766
S4.001	S3	15 Winter	100	+0%					66.747
S5.000	S3	15 Winter	100	+0%					66.750
S4.002	S3	15 Winter	100	+0%					66.724
S6.000	S6	15 Winter	100	+0%					66.741
S4.003	S4	15 Winter	100	+0%					66.672
S3.001	SWMH21	15 Winter	100	+0%					66.458
S3.002	SWMH20	15 Winter	100	+0%					66.170
S3.003	SWMH19	30 Winter	100	+0%					66.072
S3.004	SWMH18	30 Winter	100	+0%					65.969
S3.005	SWMH17	30 Winter	100	+0%					65.869
S7.000	SWMH34	15 Winter	100	+0%					66.398
S7.001	SWMH33	15 Winter	100	+0%					66.248
S7.002	SWMH32	15 Winter	100	+0%					66.167
S8.000	SWMH30	15 Winter	100	+0%					66.520
S7.003	SWMH31	15 Winter	100	+0%					65.827
S3.006	SWMH16	30 Winter	100	+0%	100/15 Summer				65.748
S9.000	SWMH28	15 Winter	100	+0%					65.835

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S3.000	SWMH22	-0.233	0.000	0.12			8.5	OK	
S4.000	SWMH23	-0.184	0.000	0.20			13.8	OK	
S4.001	S3	-0.103	0.000	0.36			23.3	OK	
S5.000	S3	-0.200	0.000	0.18			12.3	OK	
S4.002	S3	-0.060	0.000	0.61			41.3	OK	
S6.000	S6	-0.209	0.000	0.20			13.8	OK	
S4.003	S4	-0.014	0.000	1.00			61.4	OK	
S3.001	SWMH21	-0.177	0.000	0.62			108.1	OK	
S3.002	SWMH20	-0.165	0.000	0.74			160.0	OK	
S3.003	SWMH19	-0.125	0.000	0.77			174.7	OK	
S3.004	SWMH18	-0.003	0.000	0.85			178.1	OK	
S3.005	SWMH17	-0.001	0.000	0.83			184.8	OK	
S7.000	SWMH34	-0.202	0.000	0.23			16.6	OK	
S7.001	SWMH33	-0.181	0.000	0.32			23.3	OK	
S7.002	SWMH32	-0.057	0.000	0.96			71.1	OK	
S8.000	SWMH30	-0.200	0.000	0.24			18.0	OK	
S7.003	SWMH31	-0.153	0.000	0.75			126.8	OK	
S3.006	SWMH16	0.065	0.000	1.77			260.5	SURCHARGED	
S9.000	SWMH28	-0.215	0.000	0.18			18.6	OK	

Okay- No flooding

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S9.001	SWMH27	2160 Winter	100	+0%	100/960 Winter		
S3.007	SWMH15	2160 Winter	100	+0%	20/30 Winter		
S10.000	S26	15 Winter	100	+0%			
S10.001	S27	2160 Winter	100	+0%			
S3.008	S22	2160 Winter	100	+0%	100/15 Summer		
S3.009	SPI	2160 Winter	100	+0%	100/15 Summer		
S11.000	SDUMMY	10080 Winter	100	+0%	5/7200 Winter		
S11.001	SDummytank	10080 Winter	100	+0%	5/5760 Winter		
S11.002	S33	30 Winter	100	+0%	100/15 Summer		
S12.000	SWMH14	15 Winter	100	+0%			
S12.001	S22	15 Winter	100	+0%			
S13.000	S22	15 Winter	100	+0%			
S12.002	S21	30 Winter	100	+0%			
S14.000	S25	30 Winter	100	+0%			
S12.003	S20	30 Winter	100	+0%			
S11.003	SWMH12	30 Winter	100	+0%	100/15 Summer		
S11.004	SWMH12	30 Winter	100	+0%	20/15 Winter		
S11.005	SWMH11	30 Winter	100	+0%	5/15 Winter		
S15.000	S40	15 Winter	100	+0%			
S11.006	S33	2160 Winter	100	+0%	100/15 Summer		
S11.007	SPI	2160 Winter	100	+0%	20/1440 Winter		
S3.010	SWMH10	2160 Winter	100	+0%	100/360 Winter		
S16.000	SWMH9	15 Winter	100	+0%			
S16.001	SWMH8	15 Winter	100	+0%			
S17.000	S44	15 Winter	100	+0%			
S16.002	S44	15 Winter	100	+0%	100/15 Winter		
S16.003	SWMH7	15 Winter	100	+0%	100/15 Summer		
S16.004	SWMH6	2160 Winter	100	+0%	100/15 Summer		
S18.000	S29	15 Winter	100	+0%			
S18.001	S30	15 Summer	100	+0%			
S18.002	S31	2160 Winter	100	+0%	100/480 Winter		
S16.005	SWMH2	2160 Winter	100	+0%	20/15 Winter		
S16.006	SPI	2160 Winter	100	+0%	20/600 Winter		
S16.007	SWMH3	2160 Winter	100	+0%	20/480 Winter		
S19.000	SRMH14	15 Winter	100	+0%	100/15 Winter		
S19.001	SRMH13	15 Winter	100	+0%	100/15 Summer		
S19.002	SRMH12	15 Winter	100	+0%	100/15 Winter		
S19.003	SRMH1	15 Winter	100	+0%	100/15 Summer		
S19.004	SRMH0	2160 Winter	100	+0%	100/720 Winter		
S20.000	SRMH24	15 Winter	100	+0%			
S20.001	SRMH23	15 Winter	100	+0%			
S21.000	SRMH20	15 Winter	100	+0%			
S21.001	SRMH21	15 Winter	100	+0%			
S20.002	SRMH22	15 Winter	100	+0%			
S22.000	SRMH7	15 Winter	100	+0%	100/15 Summer		
S22.001	SRMH6	15 Winter	100	+0%	20/15 Winter		
S22.002	SRMH5	15 Winter	100	+0%	100/15 Summer		
S22.003	SRMH4	15 Winter	100	+0%	100/15 Winter		

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S9.001	SWMH27		65.597	0.057	0.000	0.02			1.4
S3.007	SWMH15		65.597	0.226	0.000	0.13			24.1
S10.000	S26		65.601	-0.124	0.000	0.41			12.8
S10.001	S27		65.596	-0.054	0.000	0.02			0.6
S3.008	S22		65.596	0.255	0.000	0.14			24.5
S3.009	SPI		65.595	0.283	0.000	0.14			23.5
S11.000	SDUMMY		67.009	0.434	0.000	0.05			40.3
S11.001	SDummytank		67.009	0.522	0.000	0.01			11.0
S11.002	S33		65.900	0.192	0.000	0.62			27.4
S12.000	SWMH14		66.202	-0.148	0.000	0.50			23.3
S12.001	S22		66.122	-0.172	0.000	0.38			23.2
S13.000	S22		66.131	-0.219	0.000	0.17			11.7
S12.002	S21		66.003	-0.219	0.000	0.13			35.8
S14.000	S25		66.001	-0.099	0.000	0.18			12.2
S12.003	S20		65.995	-0.005	0.000	0.37			54.6
S11.003	SWMH12		65.927	0.124	0.000	0.43			75.9
S11.004	SWMH12		65.893	0.390	0.000	0.72			125.7
S11.005	SWMH11		65.791	0.555	0.000	1.69			263.8
S15.000	S40		65.897	-0.128	0.000	0.39			13.0
S11.006	S33		65.603	0.277	0.000	0.17			33.2
S11.007	SPI		65.599	0.324	0.000	0.16			33.2
S3.010	SWMH10		65.594	0.254	0.000	0.17			56.5
S16.000	SWMH9		66.149	-0.121	0.000	0.60			40.6
S16.001	SWMH8		65.836	-0.074	0.000	0.52			98.1
S17.000	S44		66.358	-0.067	0.000	0.84			34.4
S16.002	S44		65.757	0.027	0.000	0.59			104.3
S16.003	SWMH7		65.683	0.133	0.000	1.08			179.0
S16.004	SWMH6		65.596	0.132	0.000	0.07			13.5
S18.000	S29		65.876	-0.174	0.000	0.37			35.5
S18.001	S30		65.736	-0.132	0.000	0.59			61.0
S18.002	S31		65.595	0.170	0.000	0.03			3.4
S16.005	SWMH2		65.595	0.406	0.000	0.12			17.5
S16.006	SPI		65.594	0.417	0.000	0.13			17.5
S16.007	SWMH3		65.593	0.435	0.000	0.05			17.5
S19.000	SRMH14		66.466	0.016	0.000	0.49			31.6
S19.001	SRMH13		66.384	0.203	0.000	1.21			77.7
S19.002	SRMH12		65.893	0.008	0.000	0.94			112.4
S19.003	SRMH1		65.611	0.035	0.000	1.27			134.6
S19.004	SRMH0		65.597	0.104	0.000	0.05			9.8
S20.000	SRMH24		66.216	-0.234	0.000	0.11			11.0
S20.001	SRMH23		65.908	-0.224	0.000	0.15			16.4
S21.000	SRMH20		66.255	-0.195	0.000	0.27			27.2
S21.001	SRMH21		65.953	-0.179	0.000	0.34			38.4
S20.002	SRMH22		65.606	-0.102	0.000	0.76			56.9
S22.000	SRMH7		66.997	0.197	0.000	0.47			29.9
S22.001	SRMH6		66.925	0.394	0.000	1.23			79.2
S22.002	SRMH5		66.378	0.143	0.000	1.24			125.3

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S22.003	SRMH4		66.032	0.018	0.000	0.81			128.7

PN	US/MH Name	Status	Level Exceeded
S9.001	SWMH27	SURCHARGED	
S3.007	SWMH15	SURCHARGED	
S10.000	S26	OK	
S10.001	S27	OK	
S3.008	S22	SURCHARGED	
S3.009	SPI	SURCHARGED	
S11.000	SDUMMY	SURCHARGED	
S11.001	SDummytank	FLOOD RISK	
S11.002	S33	SURCHARGED	
S12.000	SWMH14	OK	
S12.001	S22	OK	
S13.000	S22	OK	
S12.002	S21	OK	
S14.000	S25	OK	
S12.003	S20	OK	
S11.003	SWMH12	SURCHARGED	
S11.004	SWMH12	SURCHARGED	
S11.005	SWMH11	SURCHARGED	
S15.000	S40	OK	
S11.006	S33	SURCHARGED	
S11.007	SPI	SURCHARGED	
S3.010	SWMH10	SURCHARGED	
S16.000	SWMH9	OK	
S16.001	SWMH8	OK	
S17.000	S44	OK	
S16.002	S44	SURCHARGED	
S16.003	SWMH7	SURCHARGED	
S16.004	SWMH6	SURCHARGED	
S18.000	S29	OK	
S18.001	S30	OK	
S18.002	S31	SURCHARGED	
S16.005	SWMH2	SURCHARGED	
S16.006	SPI	SURCHARGED	
S16.007	SWMH3	SURCHARGED	
S19.000	SRMH14	SURCHARGED	
S19.001	SRMH13	SURCHARGED	
S19.002	SRMH12	SURCHARGED	
S19.003	SRMH1	SURCHARGED	
S19.004	SRMH0	SURCHARGED	
S20.000	SRMH24	OK	
S20.001	SRMH23	OK	

Okay- No flooding

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Status	Level Exceeded
S21.000	SRMH20	OK	
S21.001	SRMH21	OK	
S20.002	SRMH22	OK	
S22.000	SRMH7	SURCHARGED	
S22.001	SRMH6	SURCHARGED	
S22.002	SRMH5	SURCHARGED	
S22.003	SRMH4	SURCHARGED	

Okay- No flooding

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
S23.000	SRMH10	15 Winter	100	+0%	100/15 Summer		
S23.001	SRMH9	15 Winter	100	+0%	100/15 Summer		
S23.002	SRMH8	15 Winter	100	+0%	100/15 Summer		
S22.004	SRMH3	15 Winter	100	+0%	100/15 Summer		
S22.005	SRMH2	30 Winter	100	+0%	100/15 Summer		
S22.006	SRMH14	30 Winter	100	+0%	100/15 Summer		
S22.007	S75	30 Winter	100	+0%			
S24.000	SEXRWMH14	15 Winter	100	+0%	100/15 Winter		
S24.001	SWMH05	15 Winter	100	+0%			
S24.002	SWMH06	15 Winter	100	+0%			
S24.003	SWMH07	15 Winter	100	+0%			
S24.004	S67	2160 Winter	100	+0%			
S24.005	S80	2160 Winter	100	+0%	100/2160 Winter		
S24.006	S81	2160 Winter	100	+0%	100/600 Winter		
S25.000	SRMH18	15 Winter	100	+0%			
S25.001	SRMH17	15 Winter	100	+0%			
S25.002	SRMH16	15 Winter	100	+0%			
S25.003	SRMH15	15 Winter	100	+0%			
S25.004	S55	2160 Winter	100	+0%			
S19.005	S-RWH_TANK	2160 Winter	100	+0%	100/480 Winter		
S3.011	STANK	2160 Winter	100	+0%	100/480 Winter		
S3.012	SWMH2	4320 Summer	100	+0%			
S3.013	SWMH1	4320 Summer	100	+0%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S23.000	SRMH10		66.939	0.089	0.000	0.48			32.3
S23.001	SRMH9		66.864	0.310	0.000	1.22			82.4
S23.002	SRMH8		66.304	0.075	0.000	1.10			131.8
S22.004	SRMH3		65.917	0.075	0.000	1.26			262.2
S22.005	SRMH2		65.813	0.025	0.000	0.99			261.9
S22.006	SRMH14		65.698	0.030	0.000	1.29			258.6
S22.007	S75		65.609	0.000	0.000	1.03			247.8
S24.000	SEXRWMH14		66.353	0.003	0.000	1.14			165.3
S24.001	SWMH05		66.199	-0.078	0.000	0.96			156.2
S24.002	SWMH06		65.914	-0.107	0.000	0.90			147.0
S24.003	SWMH07		65.671	-0.093	0.000	0.98			142.5
S24.004	S67		65.599	-0.089	0.000	0.07			10.5
S24.005	S80		65.598	0.005	0.000	0.07			10.5
S24.006	S81		65.597	0.152	0.000	0.04			10.1
S25.000	SRMH18		66.313	-0.137	0.000	0.53			33.7
S25.001	SRMH17		65.974	-0.207	0.000	0.52			95.6
S25.002	SRMH16		65.771	-0.114	0.000	0.84			134.5
S25.003	SRMH15		65.648	-0.017	0.000	1.00			138.5
S25.004	S55		65.602	-0.007	0.000	0.07			9.6

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S19.005	S-RWH_TANK		65.596	0.196	0.000	0.20			39.5
S3.011	STANK		65.592	0.204	0.000	0.08			38.2
S3.012	SWMH2		64.563	-0.114	0.000	0.69			38.2
S3.013	SWMH1		64.504	-0.110	0.000	0.72			38.2

PN	US/MH Name	Status	Level Exceeded
S23.000	SRMH10	SURCHARGED	
S23.001	SRMH9	SURCHARGED	
S23.002	SRMH8	SURCHARGED	
S22.004	SRMH3	SURCHARGED	
S22.005	SRMH2	SURCHARGED	
S22.006	SRMH14	SURCHARGED	
S22.007	S75	OK	
S24.000	SEXRWMH14	SURCHARGED	
S24.001	SWMH05	OK	
S24.002	SWMH06	OK	
S24.003	SWMH07	OK	
S24.004	S67	OK	
S24.005	S80	SURCHARGED	
S24.006	S81	SURCHARGED	
S25.000	SRMH18	OK	
S25.001	SRMH17	OK	
S25.002	SRMH16	OK	
S25.003	SRMH15	OK	
S25.004	S55	OK	
S19.005	S-RWH_TANK	SURCHARGED	
S3.011	STANK	SURCHARGED	
S3.012	SWMH2	OK	
S3.013	SWMH1	OK	

Okay- No flooding

Appendix B

Watermeter Details

Data Sheet D184S024U02 Rev. 02.3

FXP4000 (PARTI-MAG II)
Electromagnetic Flowmeter
Model DP41F and DP46F

Measurement made easy

For full and partially full pipelines (free and surface pipelines)

Precise measurement of the flowrate of liquids and slurries with electrical conductivities of at least 50 mS/cm up to 10.000 mS/cm
— High accuracy also with partially for full pipes

Especially suitable for flow metering in partially full pipelines (e.g. for rain retention basins, clarifier in- and outflow)
— In the partially full flow regime it is unaffected by backflow
— Short in- and outlet straight sections: 5 x DN upstream and 3 x DN downstream of the meter
— Minimum required fill level 10 % of the flowmeter diameter

Meter size range from DN 150 to DN 2000

User friendly parameter entry directly at the converter

Factory calibrated

Automatic system monitoring with error diagnostics in clear text plus an output alarm signal

Absolute zero stability

Maximum measuring error
— With partially for full pipes: 3 % or 5 % of rate
— With full pipe: 1 % of rate

Power and productivity
for a better world™

Accuracy, Reference Conditions and Functional Description

Reference Conditions Based on EN 29104

Fluid Temperature
20 °C (68 °F) ± 2 K

Ambient Temperature
20 °C (68 °F) ± 2 K

Supply Power
Line voltage per Instrument Tag U_N ± 1 %

Straight Pipe Installation Requirements
Upstream >10 x DN
Downstream > 5 x DN,
DN = Flowmeter primary diameter

Warm Up Time
30 min

Accuracy: (Pulse Output)

- **Full Pipe**
  - $Q > 0.04\ Q_{maxDN}$ 1 % of rate
  - $Q < 0.04\ Q_{maxDN}$ $0.0004\ Q_{maxDN}$
- **Partially Full Pipe**
  (v > 0.2 m/s); (h > 0.1 x DN)
  (for DN 150 only: h > 0.15 x DN)
  - $Q > Q_u$ 3 % of rate
  - $Q_{min} < Q < Q_u$ 5 % of rate

  where $Q_u = 0.02\ Q_{maxDN}$ and $Q_{min} = 0.001\ Q_{maxDN}$
  (For values of Q_{maxDN} see Table Page 3)

Current Output Effects
Same as pulse output plus ± 0.1 % of rate

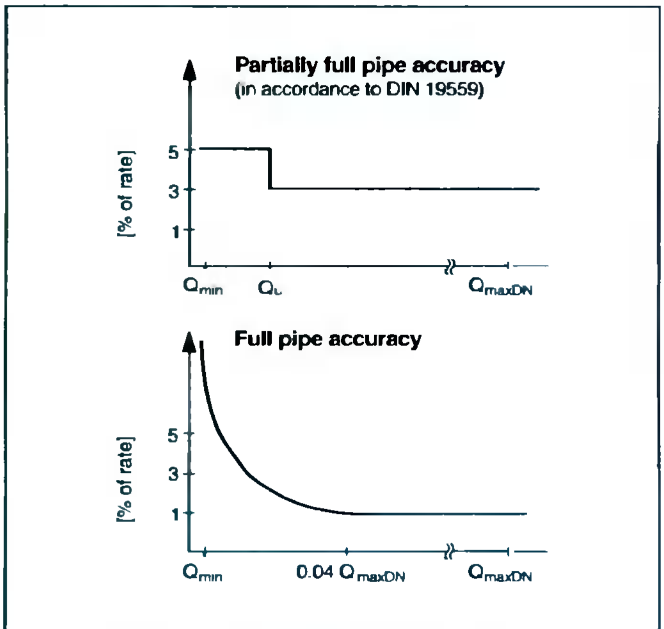


Fig. 1 Accuracy of the FXP4000 (PARTI-MAG II)

Functional Description

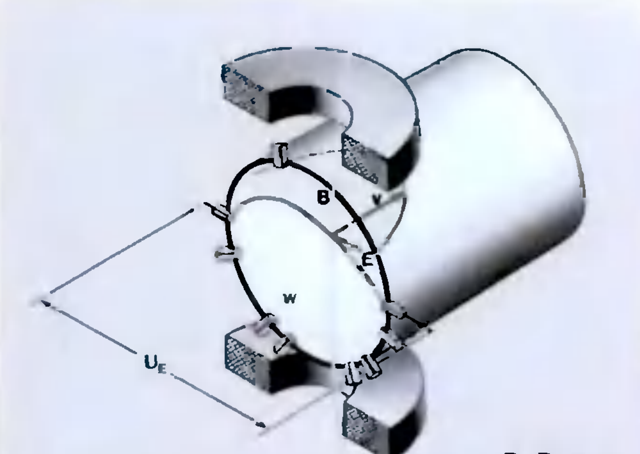
The basis for the electromagnetic flowmeter is Faraday's law of induction. A conductive fluid flows through a pipe perpendicular to the direction of a magnetic field (see Fig. 2).

$$U_E \sim B \cdot D \cdot v$$

The voltages generated in the fluid are measured by a number of electrodes pairs. They are arranged in the meter tube in such a manner that for each cross sectional flow area (full or partially full) the electrode pair with the optimal weighting factor is utilized for the measurements. One additional electrode is integrated for full pipe detection.

In addition to the optimized measurement of the average flow velocity the four electrode pairs are also utilized for determining the fill level through utilization of a superimposed ac field.

The signal voltage U_E is corrected using the partially full characteristic curves stored in the converter and converted into a flowrate proportional output signal.



U_E = Signal voltage
B = Magnetic induction
D = Electrode spacing
v = Average flow velocity
qv = Volume flowrate
k = Correction factor

$$U_E \sim B \cdot D \cdot v$$

$$qv = \frac{D^2 \pi}{4} \cdot v \cdot k$$

$$U_E \cdot k \sim qv$$

Fig. 2 Measurement Principle

Technical Data: Flowmeter Primary

Fig. 3 Flowmeter Primary

Meter Size, Pressure Rating and Flow Ranges

Meter Size DN	Standard Pressure rating PN	Min. Range Setting	Max. Range Setting Q_{maxDN}
150	10/16	0 to 8.33 l/s	0 to 166.7 l/s
200	10/16	0 to 15.0 l/s	0 to 300 l/s
250	10/16	0 to 25.0 l/s	0 to 500 l/s
300	10/16	0 to 33.33 l/s	0 to 667 l/s
350	10/16	0 to 45.83 l/s	0 to 917 l/s
400	10/16	0 to 62.50 l/s	0 to 1250 l/s
500	10	0 to 91.67 l/s	0 to 1833 l/s
600	10	0 to 133.33 l/s	0 to 2667 l/s
700	10	0 to 183.33 l/s	0 to 3667 l/s
800	10	0 to 272.20 l/s	0 to 5000 l/s
900	10	0 to 333.33 l/s	0 to 6667 l/s
1000	10	0 to 375 l/s	0 to 7500 l/s
1200	6	0 to 590 l/s	0 to 11600 l/s
1400	6	0 to 750 l/s	0 to 15000 l/s
1600	6	0 to 1000 l/s	0 to 20000 l/s
1800	6	0 to 1250 l/s	0 to 25000 l/s
2000	6	0 to 1590 l/s	0 to 31700 l/s

Sizing Information

For the selection of the nominal sizes, observe that the meter tube for minimum flow must be at least 10 % filled. Otherwise the nominal size is to be reduced. The filling height at max. flow should be well above 50 %. The filling height at normal flow which occurs most of the time should be above 30 % at minimum. The conductivity must lie in a range from 50 µS/cm to 10 mS/cm.

For selecting the optimum flowmeter size for your application a sizing program is available on a 3 1/2" disc for IBM compatible PC's. All required calculation values are integrated in the program.

Notice

When the level drops below the minimum allowable value of 10 % of the flowmeter primary diameter, (15 % only for DN 150), an automatic shut off of the output signals occurs.

Flowrate Nomograph for Full Pipelines

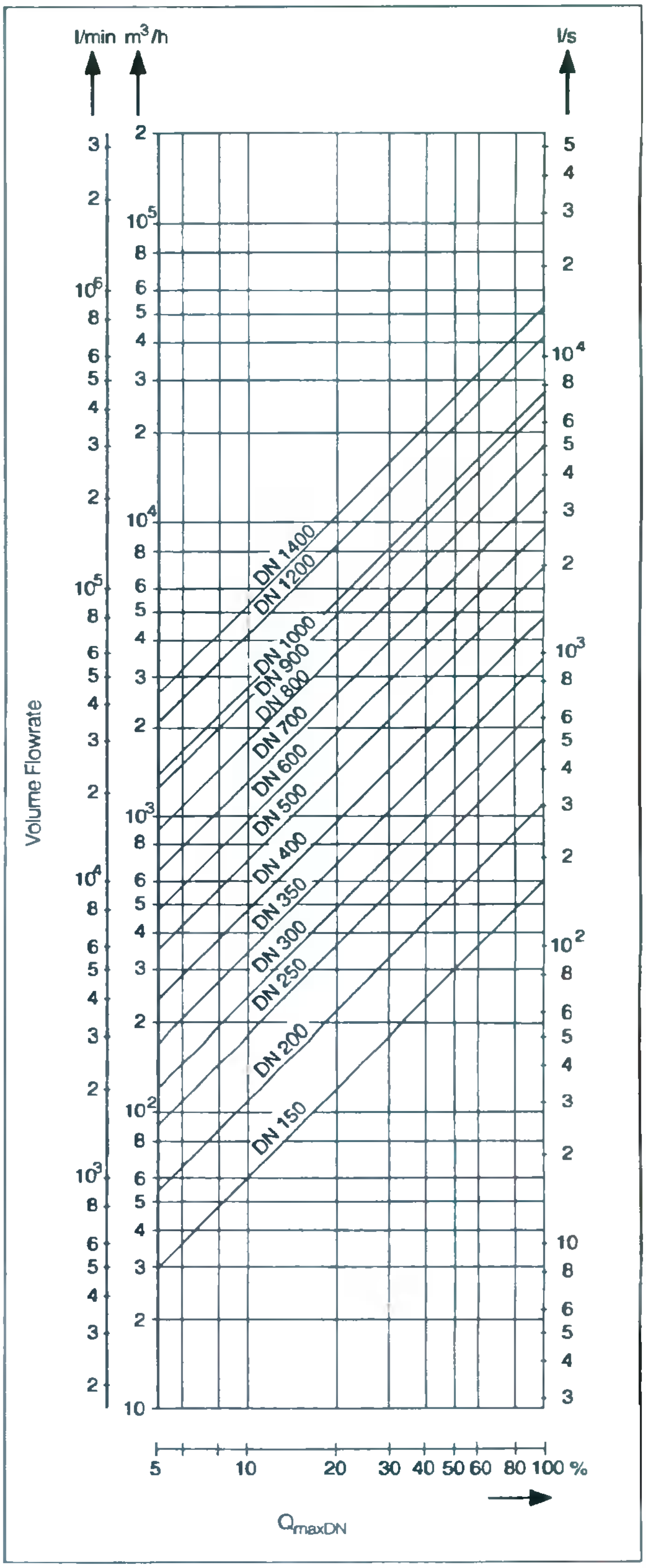


Fig. 4 Flowrate Nomograph for DN 150 to DN 2000

Technical Data Model DP41F, DP46F

Min. allow. Pressure as a function of Fluid Temperature

Liner	Meter Size	$P_{Operation}$ mbar abs	at $T_{Operation}$
Hard rubber	150 ... 250 (6 ... 10")	0	< 80 °C (176 °F)
	300 ... 1000 (12 ... 40")	0	< 80 °C (176 °F)
Soft rubber	150 ... 250 (6 ... 10")	0	< 60 °C (140 °F)
	300 ... 1000 (12 ... 40")	0	< 60 °C (140 °F)
PTFE KTW approved	150 ... 600 (6 ...24")	270 400 500	< 20 °C (68 °F) < 80 °C (176 °F) < 80 °C (176 °F)

Max. Allowable Ambient Temperature as a function of Fluid Temperature

For flowmeters with carbon steel flangers

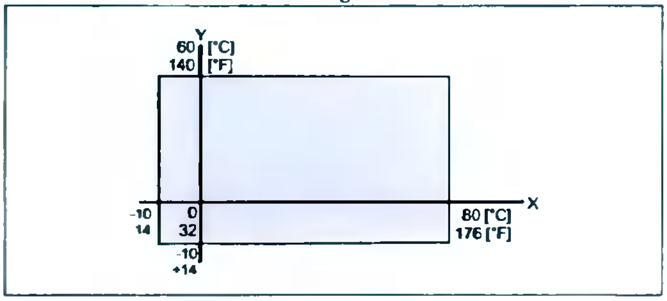


Fig. 5

For flowmeter with stainless steel flangers

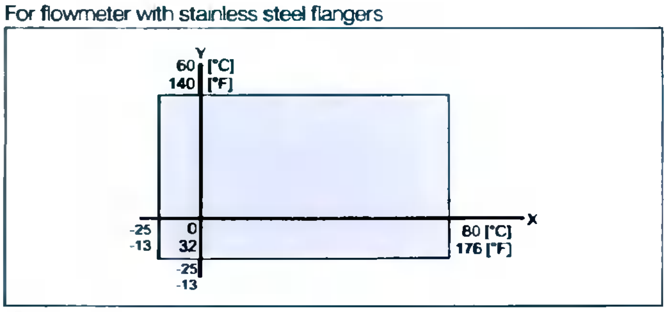


Fig. 6

Y = Ambient temperature °C/°F
X = Fluid temperature °C/°F

Notes regarding min./max. measuring temperature

Liner	Flange material	Min. Temp	Max. Temp.
Hard rubber	Steel	-10 °C (14 °F)	80 °C (176 °F)
	stainless steel 1.4571	-15 °C (5 °F)	80 °C (176 °F)
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)
	stainless steel 1.4571	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14 °F)	80 °C (176 °F)
	stainless steel 1.4571	-25 °C (-13 °F)	80 °C (176 °F)

Materials, Flowmeter Primary

Parts	Standard	Options
Liner	PTFE, PFA, hard rubber, soft rubber	–
Signal and ground electrodes for – Hard rubber – Soft rubber	SS 1.4571 [316Ti]	Hast. B-3 (2.4600), Hast. C-4 (2.4610), Titanium, Tantalum, Platinum-Iridium, 1.4539 [904L]
– PTFE	Hast. C-4 (2.4610)	SS1.4571[316Ti] Hast. B-3 (2.4600) Titanium, Tantalum, Platinum-Iridium, 1.4539 [904L]
Ground plate	SS 1.4571 [316Ti]	Upon request
Protection plate	SS 1.4571 [316Ti]	Upon request

Process Connection Materials

Parts	Standard	Options
Flange DN 150 ... DN 300 (6 ... 12")	Steel (galvanized)	SS1.4571[316Ti]
DN 350 ... DN 1000 (14 ... 40")	Steel (painted)	SS1.4571[316Ti]

Parts	Standard	Options
Housing DN 150 ... DN 300 (6 ... 12")	Two-piece cast aluminum housing, painted, paint coat 60 µm thick, RAL 9002	–
DN 350 ... DN 1000 (14 ... 40")	Welded steel construction, painted, paint coat 60 µm thick, RAL 9002	–
Connection box	Cast aluminium, painted, 60 µm thick, frame: dark gray, RAL7012, cover: light gray, RAL 9002	–
Meter tube	SS 1.4301 [304]	–
PG-Connector	Polyamide	–

Storage Temperature

-20 ... 70 °C (-4 ... 158 °F)

Protection Class per EN 60529

IP 67
IP 68 (optional, max. immersion depth: 5 m)

Pipeline Vibration Following EN 60068-2-6

Converter
- In the range of 10 - 55 Hz max. 0.15 mm deflection

Flowmeter primary
- In the range of 10 - 55 Hz max. 0.15 mm deflection
- In the range of 55 -150 Hz max. 2 g acceleration

Designs

The flanged flowmeters comply with the installation lengths defined in VDI/VDE 2641, ISO 13359 or DVGW (W420, Design WP, ISO 4064 short).

Electrical connection

Screw terminals
Cable gland DN 150 ... DN 2000
Excitation cable PG13.5
Signal cable PG21

Explosion protection

Sensor DP46F
II 2 G EEx em [ib] IIC T4,
EC-type Examination Certificate TÜV 97 ATEX 1219X

Ex-Data for model DP46F

The maximum allowable fluid temperatures °C (°F) are listed in the following table as a function of the maximum allowable ambient temperature and the flowmeter size.

Flowmeter size DN	Temperature class	Max. allowable ambient temperature °C (°F)	Max. allowable fluid temperature °C (°F)
150 - 250	T4	60 (140 °F)	80 (176 °F)
150 - 250	T4	50 (122 °F)	80 (176 °F)
150 - 250	T4	40 (104 °F)	80 (176 °F)
300 - 900	T4	60 (140 °F)	80 (176 °F)
300 - 900	T4	50 (122 °F)	80 (176 °F)
300 - 900	T4	40 (104 °F)	80 (176 °F)
1000 - 3000	T4	60 (140 °F)	80 (176 °F)
1000 - 3000	T4	50 (122 °F)	80 (176 °F)

The max. allowable fluid temperature 80 °C (176 °F) is determined by the thermal fuse for the coils.

Allowable ambient temperature primary -20 ... 60 °C (-4 ... 140 °F)

Material load for flanged design model DP41F / DP46F

Limits for the allowable fluid temperature (TS) and allowable pressure (PS) are a function of the liner and flange materials of the flowmeter (see instrument name plate).

Temperature limits

Liner	Flange material	Min. Temp.	Max. Temp.
Hard rubber	Steel	-10 °C (14 °F)	80 °C (176 °F)
	Stainless steel 1.4571	-15 °C (5 °F)	80 °C (176 °F)
Soft rubber	Steel	-10 °C (14 °F)	60 °C (140 °F)
	Stainless steel 1.4571	-15 °C (5 °F)	60 °C (140 °F)
PTFE	Steel	-10 °C (14 °F)	80 °C (176 °F)
	Stainless steel 1.4571	-25 °C (-13 °F)	80 °C (176 °F)

DIN-Flange SS 1.4571 [316Ti] to DN 600 (24")

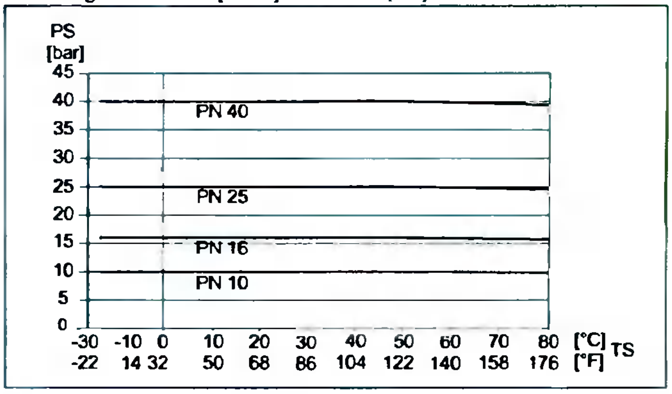


Fig. 7

ASME Flange SS1.4571[316TI] to DN 300 (12") (CL150/300) to DN 1000 (40") (CL150)

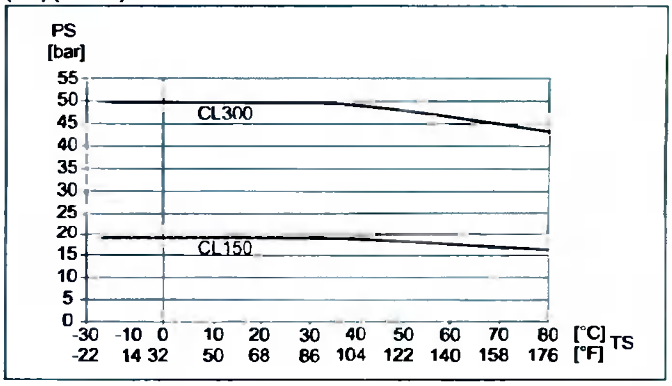


Fig. 8

DIN-Flange Steel to DN 600 (24")

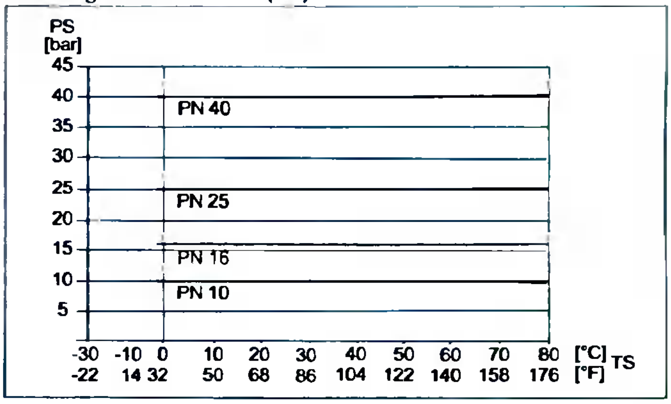


Fig. 9

ASME flange carbon steel to DN 300 (12") (CL150/300) to DN 1000 (40") (CL150)

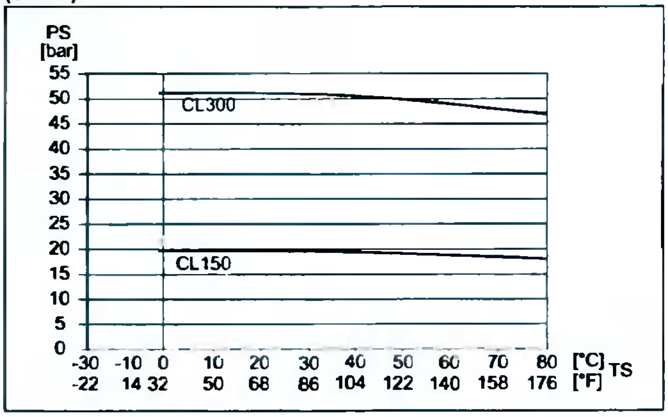


Fig. 10

DIN-Flange SS 1.4571 DN 700 (28") to DN 1000 (40")

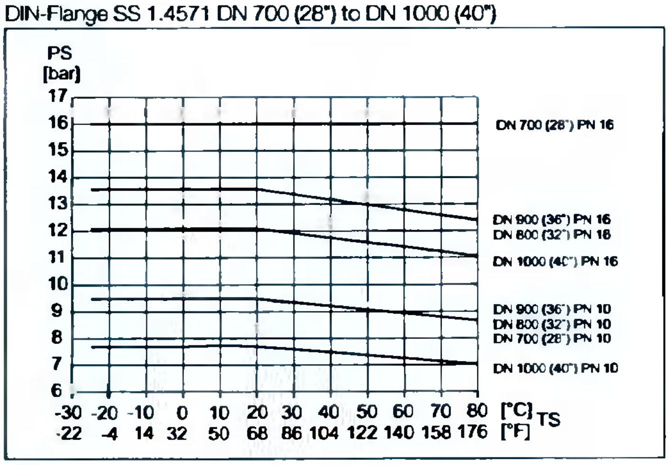


Fig. 11

DIN-Flange carbon steel DN 700 (28") to DN 1000 (40")

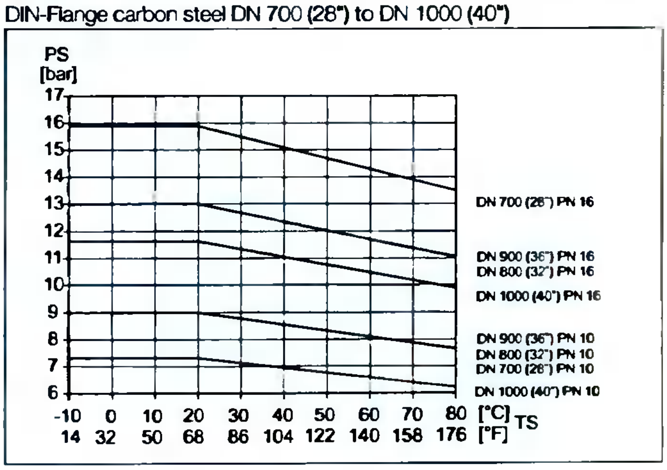
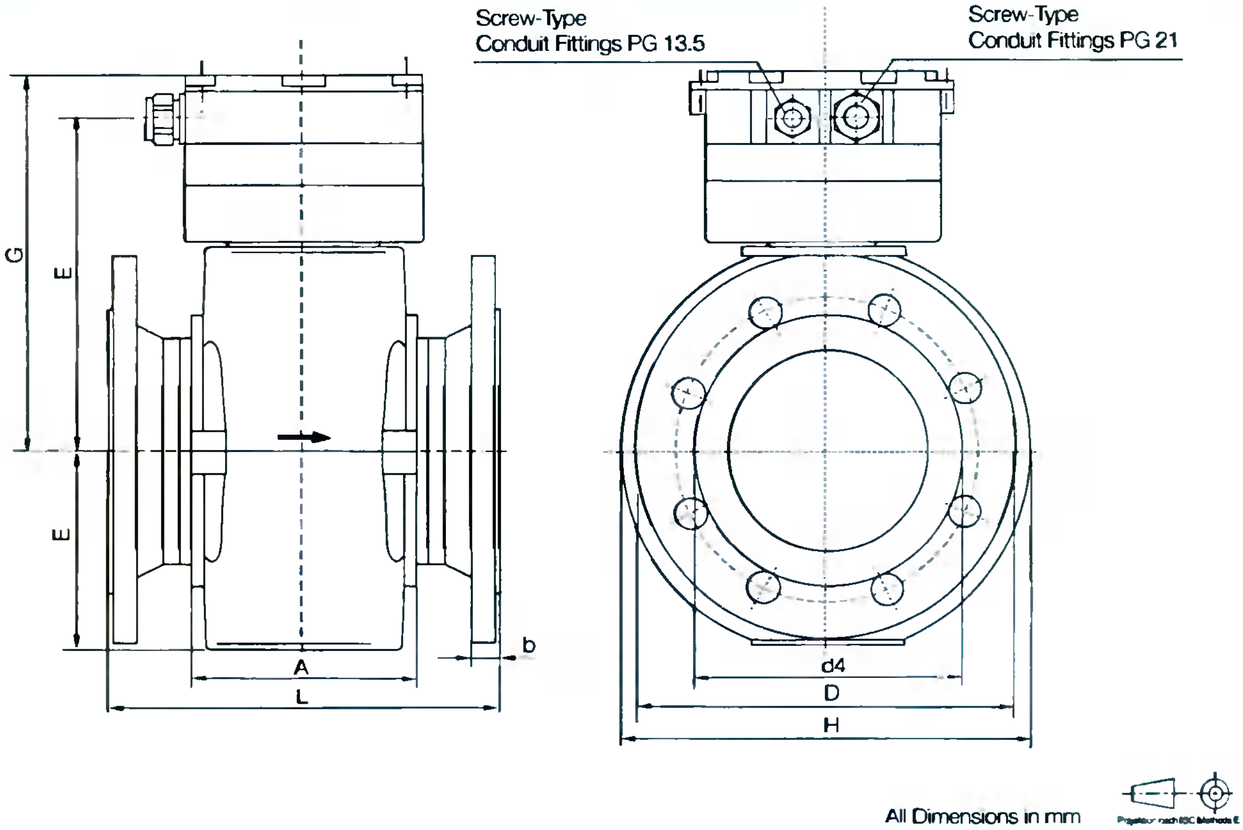


Fig. 12

Dimensional Drawing Flowmeter Primary, DN 150 to DN 250, DIN-flanges

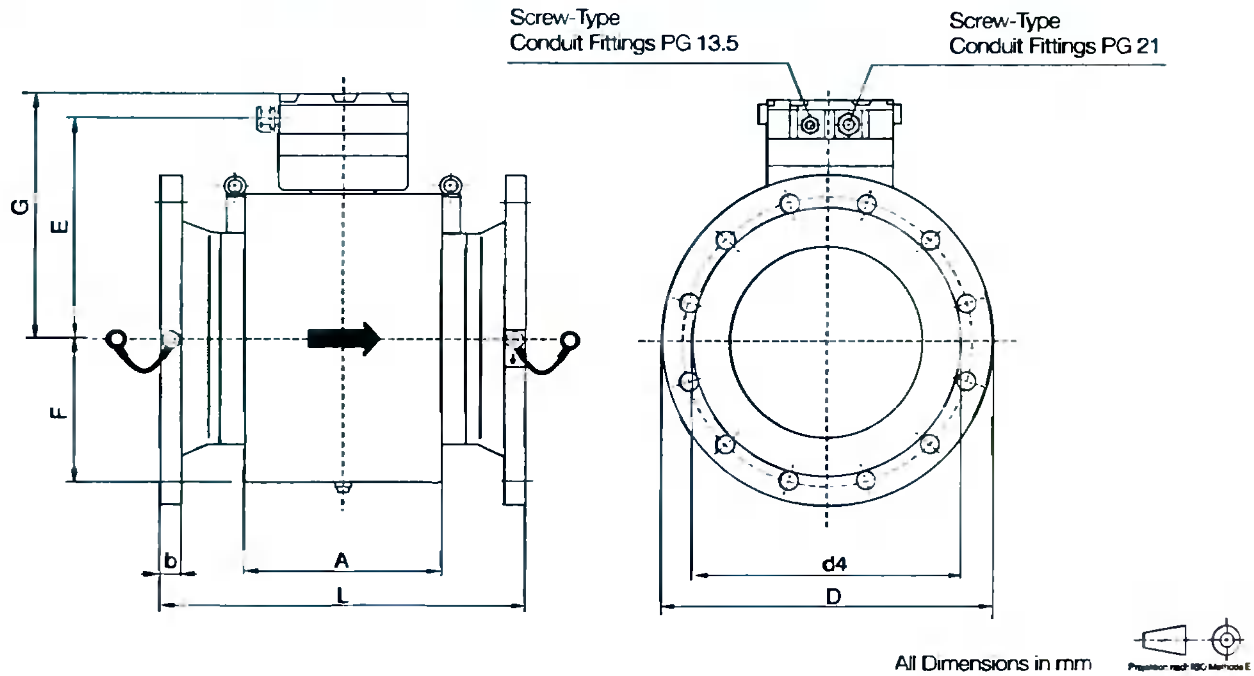


Flange Dimensions					Instrument Dimensions								Weight approx. kg
DN	PN	D	d4	b	A	L	L 1)	L 2)	G	E	F	H	
150	10 16	285 285	212 212	25 25	170 170	300 300	305 305	310 310	275 275	242 242	148 148	310 310	29 29
200	10 16	340 340	268 268	28 28	195 195	350 350	355 355	360 360	315 315	274 274	179 179	340 340	56 56
250	10 16	395 405	320 320	30 30	250 250	450 450	455 455	460 460	344 344	301 301	207 207	395 405	82 82

1) Standard with one grounding plate SS No.1.4571. Other materials and DN 300 and up upon request. See Note section 9.1 and Footnote Ordering Information Primary.
For hard rubber liners + 2 mm for gasket.
2) With protection flange: Protection flanges provide the ground function, grounding plate not required
For hard rubber liners + 4 mm for gasket.

Fig. 13 Flowmeter Primary DN 150 to DN 250, DIN-flanges

Dimensional Drawing Flowmeter Primary, DN 300 to DN 1000, DIN-flanges

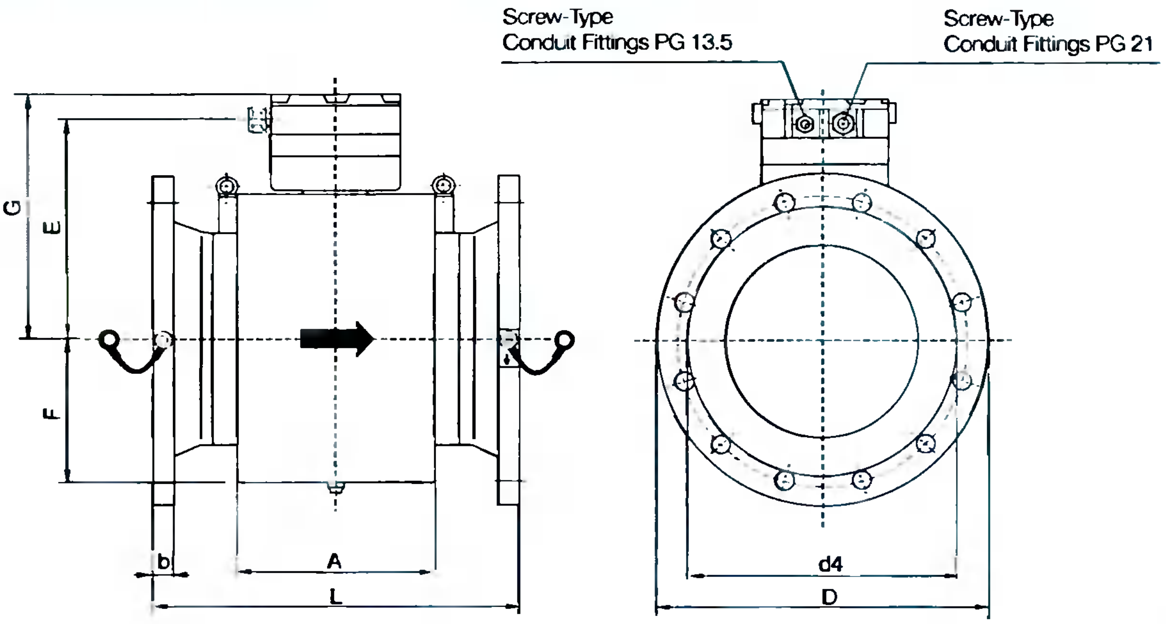


Flange Dimensions					Instrument Dimensions	Protection Flange without[2)]	Protection Flange with[3)]				Weight approx. kg
DN	PN	D	d4	b	A	L	L	G	E	F	
300	10	445	370	31	279	500	Upon request	362	329	224	112
300	16	465	378	33	279	500		362	329	224	117
350	10	505	430	31	300	550		387	354	249	153
350	16	520	438	35	300	550		387	354	249	162
400	10	565	482	31	333	600		412	380	275	166
400	16	580	490	37	333	600		412	380	275	173
500	10	670	585	33	407	650		448	415	311	232
500	16	715	610	39	407	650		448	415	311	277
600	10	780	685	33	469	780		500	466	361	283
600	16	840	725	41	469	780		500	466	361	313
700	10	895	800	35	537	910		543	510	405	394
700	16	910	795	41	537	910		543	510	405	408
800	10	1015	905	37	605	1040		593	560	455	441
800	16	1025	900	43	605	1040		593	560	455	458
900	10	1115	1005	39	671	1170		643	610	505	757
900	16	1125	1000	45	671	1170		643	610	505	772
1000	6	1175	1080	31	739	1300		693	660	555	907
1000	10	1230	1110	39	739	1300		693	660	555	960
1000	16	1255	1115	47	739	1300		693	660	555	1007

1) > DN 1000 upon request
2) Grounding plate DN 300 and up upon request. See Note "Grounding" section 9.1 and Footnote Ordering Information Flowmeter Primary
3) Protection flanges for PTFE-Liners provide the ground function, grounding plate not required

Fig. 14 Flowmeter Primary DN 300 to DN 1000, DIN-flanges

Dimensional Drawing Flowmeter Primary, DN 150 to DN 900, ASME-flanges



All Dimensions in mm

Meter Size		Instrument Dimensions						Flange Dimensions ASME CL 150			Weight approx. kg.
DN	Inch	A	L [1) 2)]		E	F	G	D	d4	b	
			ISO 13359	Old inst. lenght							
150	6	170	300	450	242	139	275	279	216	29	39
200	8	195	350	500	273	179	306	343	270	34	68
250	10	250	450	550	301	207	334	406	324	35	98
300	12	279	500	620	330	224	362	483	381	37	112
350	14	322	550	650	354	249	387	534	413	40	144
400	16	370	600	700	350	275	412	597	470	42	174
500	20	407	762	780	416	311	443	699	584	48	217
600	24	469	914	850	466	361	500	813	692	53	371
700	28	537	–	910	510	405	543	837	762	50	343
800	32	605	–	1040	560	455	593	942	864	51	355
900	36	671	–	1170	610	505	643	1057	972	58	680

1) If a grounding disk is installed (attached by one side to the flange), the dimension L is increased by 5 mm
See Note Grounding section 9.1 and Footnote Ordering Information Primary
2) If protective plates are installed (attached on both sides of the flange), the dimension L is increased by 10 mm.

Comments
Drawings < DN 250 upon request

Fig. 15 Flowmeter Primary DN 150 to DN 900, ASME-flanges

Installation Requirements and Grounding Flowmeter Primary

Electrode Axis

The electromagnetic flowmeter for metering in partially full pipelines is to be installed axisymmetrically so that the upper electrode pair is exactly horizontal. An ideal installation with horizontal electrodes is shown in Fig. 16.

A level has been installed in the customer connection box on the flowmeter primary. It is an additional aid in assuring that the flowmeter primary is correctly leveled.

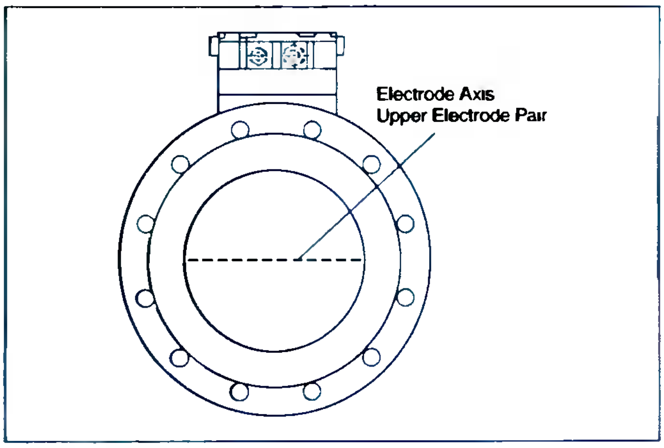


Fig. 16 Electrode Axis

In- and Outlet Sections

The flow profile within the meter must be axisymmetric when the pipe is full. The flow stream must be free of swirl and pulsations. No standing eddies should exist within the meter, such as may occur after elbows or tangential entries.

A hydraulic jump is to be avoided in the metering section. The max. allowable pipeline slope is 5 %. Slope changes within the in- and outlet sections are to be avoided. The optimal gradient lies in a range between 0.8 to 1.5 %.

Note

The following installation requirements are to be observed: A straight section with the same diameter as the flowmeter and a length of at least 5 times the diameter is to be installed upstream and one 3 times the diameter downstream (Fig. 17). Sharp edges in the vicinity of the flowmeter are to be avoided. No additional inlets or outlets are to exist in the inlet section.
For cleaning and examination purposes a inspection opening is recommended (see Fig. 17).

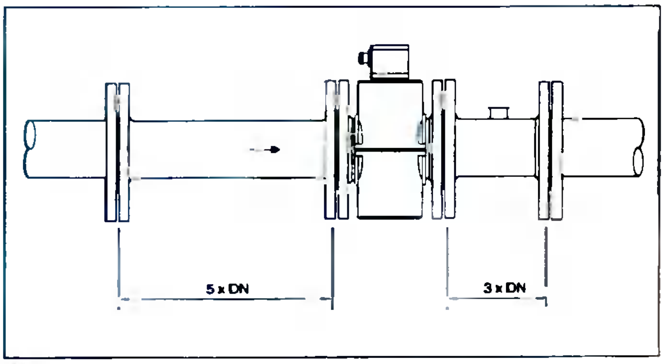


Fig. 17 In- and Outlet Sections

Pipeline Transitions

Transitions from other pipeline sizes or geometries should be made so that the in- and outlet section requirements mentioned previously are maintained. Steps in the bottom of the pipeline are to be avoided.

Grounding

For satisfactory operation of an electromagnetic flowmeter grounding is essential. The ground screws on the flowmeter primary are to connected to the protection ground in accordance with VDE 0100, Part 540. For technical reasons this potential should be identical to that of the fluid.

For plastic pipes or pipes with electrically insulating liners the ground connection is made using grounding rings or ground electrodes. **Flowmeters with hard or soft rubber liners include in the flange area a conductive element for grounding. Therefore additional grounding rings or grounding electrodes are not required** (see Note: Ordering Information Page 11). When stray currents are present in the fluid and a PTFE or PFA lined flowmeter primary is installed grounding rings or grounding electrodes at the in- and outlet ends of the meter are recommended.

With model DP46 (Ex-design), grounding terminals and primary flanges have to be connected to Potential Equalization.

Sizing Information

For selecting the optimum meter size a sizing program is available on a 3 1/2" disc. All required calculation values are integrated in the program.

It is recommended that a plan of the installation site be provided to ABB Automation Products during the planning phase for evaluation.

Ordering information: Flowmeter Primary, Model DP41F and DP46F

In addition to the Ordering Number please supply the following information: Fluid, fluid temperature, operating pressure, pipeline type, (grounding ring, grounding electrode). Installation sketch with slopes.

Standard-design	**DP41F**
Ex-design	**DP46F**
Liner material	
Hard rubber	H
Soft rubber	S
PTFE (up to DN 600)	T
Meter size	
DN 150	1F
DN 200	2H
DN 250	2F
DN 300	3H
DN 350	3F
DN 400	4H
DN 500	5H
DN 600	6H
DN 700	7H
DN 800	8H
DN 900	9H
DN 1000	1T
DN 1200	12
DN 1400	14
DN 1600	16
DN 1800	18
DN 2000	2T
Measuring electrodes[1]	
SST 1.4571 (316 Ti)	S
Hastelloy B-3 (upon request)	B
Hastelloy C-4 (upon request)	H
Titanium	M
Tantalum	T
Platinum-Iridium	P
Others	Z
Pressure rating	
DIN PN 10	C
DIN PN 16	D
DIN PN 25	E
DIN PN 40	F
ANSI CL 150 ISO laid length	R
ANSI CL 300 ISO laid length	S
Flange material	
Steel	1
SST 1.4571	3
Others	9
Flange accessories	
Without	A
Protection flange 1.4571 (both sides)	B
Grounding ring 1.4571 (fastened on one side)	C
Others	Z
Temperature range	
Standard design (max. 80 °C)	S

Continuation next page

1) Grounding electrodes for hard rubber and soft rubber are Standard.
With PTFE liner a grounding ring is required in case of plastic pipeline.

Please complete details for ordering: Remote signal converter 50XP2000

Continue Ordering information: Flowmeter Primary, Model DP41F and DP46F

Standard-design		**DP41F**
Ex-design		**DP46F**
Certificates		
PED Standard		A
Material certificate per EN 10204 3.1 + pressure test per AD 2000		D
Pressure test per AD 2000		G
Inspection certificate per EN 10204 3.1		F
Type of protection		
IP 67		2
IP 68	Thread for screw-type conduit fitting M20 x 1.5	7
IP 68	Cable connected and connection box potted[1]	8
Name plate		
German		G
English		E
Design level (specified by ABB)		*
Additional Options		
Without		A
Cable glands 3/4 in. NPT		N
Electrode Design		
Round head		7
Laid Length		
Short, acc. to ISO 13359		A
Excitation Frequency		
6,25 Hz		1
7,50 Hz		3

[1] Sealing compound (optional) 5 pieces, part no. D141B038U01

Technical Data Converter 50XP2000

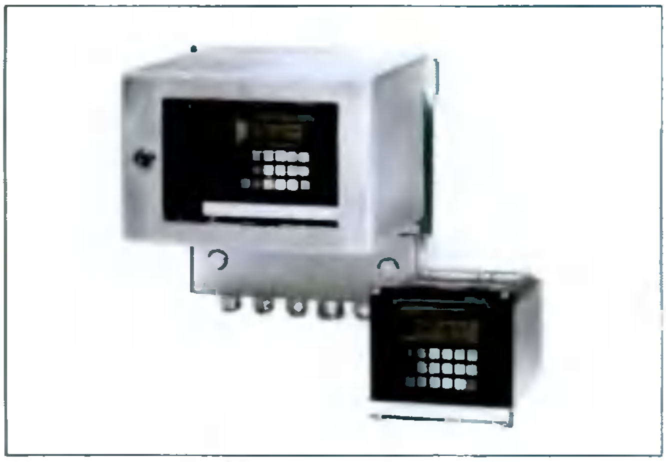


Fig. 18 Converter Field Mount Housing and 19"-Rack Mount Housing

Flow Range
Continuous, 0.5 m/s to 10 m/s

Conductivity
≥ 50 µS/cm

Response Time
0 - 99 % Step function (equiv. to 5 τ) >10 s

Damping
Settings to 200 s

Supply Power
115/230 V AC ±10 %
24 V AC ±10 %
50/60 Hz ±6 %
Ripple < 1.5 Vp

Magnetic Field Excitation
6 1/4 Hz, 7 1/2 Hz (50/60 Hz Power supply)

Power Consumption
DN 150 to DN 2000 (6 ... 80")
< 60 VA (primary including converter)

Ambient Temperature
-20 ... 50 °C (-4 ... 122 °F)

Protection Class per EN 60529
IP 65 for field mount housing
IP 00 for 19" rack mount design

Design
Stainless steel wall mount housing
19"-Insert, 167 mm deep, 28 TE, 3 HE

Electrical Connections
Screw terminals
5 x Cable connectors Pg 13.5
1 x Cable connector Pg 16/21 for signal cable

Weight
Field mount housing approx. 9.3 kg
19"-Insert cassette approx. 2.8 kg

Signal Cable/Excitation Cable
The max. cable length between the flowmeter primary and the converter is 50 m. Signal and excitation cable are preassembled and connected to the converter prior to shipment (field mount housing). Ordering Number see Page 16.

Display
2 x 16 character dot-matrix display in Super-twisted technology with LED background lighting. The flow direction is indicated in the 1st line and the instantaneous flowrate in % of the selected flow range or in engineering units. In the 2nd line the value of the integrated flow is displayed in engineering units. Separate totalizer values for each flow direction, 7 digit plus overflow counter.

Parameter Settings
Entry is made from the keypad, menu controlled in clear text dialog All parameter settings, including totalizer values are stored for a 10 year period in EEPROMs. The meter location parameters can be uploaded by pressing a button after a converter exchange.

Forward/Reverse Metering
The direction is indicated in the display by arrows and over a contact output, optocoupler design, for an external alarm.

Input Signals

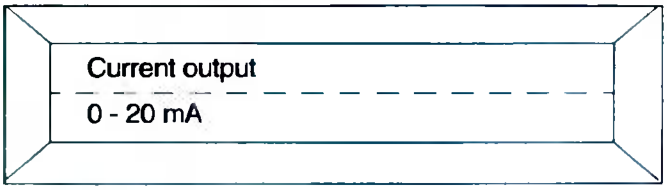
External Zero Return
Passive or active over operating contact (closer).
When the pipeline empties all output signals can be turned off.

External Totalizer Reset
Passive or active over operating contact (closer).
The internal totalizer values can be reset.
Optocoupler. 16 V ≤ U_{CE} ≤ 30 V DC, R_i = 2000 Ohm.

Output Signals

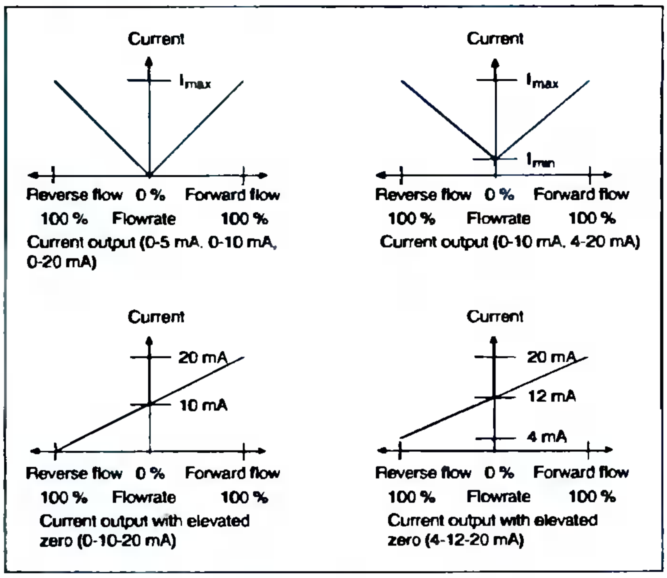
Isolation In/Output

All in- and outputs are isolated from the signal circuit and each other.



Current Output

0/4-20 mA, load < 1000 Ω
0/2-10 mA, load < 2000 Ω
Can be switched by the software



Scaled Pulse Output

Scaled pulse output, separate for each flow direction, max. count frequency 5 kHz. The pulse factor can be set between 0.001 and 1000. Pulse width can be set between 0.1 and 2000 ms.

Active

Voltage pulses 24 V rectangular, load > 150 Ω.

Option

Passive, optocoupler:
5 V < U_{CE} < 30 V DC
2 mA < I_{CE} < 220 mA, f_{max} 5 kHz

Contact Output for System Monitoring

During an error condition the internal system monitor displays a clear text error message and activates a contact output.
Select optocoupler or relay (opens for alarm).
Errors encountered are stored in an error register.

Optocoupler: 16 V < U_{CEH} < 30 V; 0 V < U_{CEL} < 3.5 V
0 mA < I_{CEH} < 0.2 mA; 2 mA < I_{CEL} < 15 mA

Relay: max. 3 W, max. 250 mA,
max. 30 V DC

Configurable Contact Outputs

The following functions can be software selected for the contact outputs:
No function,
Empty pipe,
Forward/reverse flow direction signal
Max. alarm or min. alarm for flowrate

Optocoupler: 16 V < U_{CEH} < 30 V; 0 V < U_{CEL} < 3.5 V
0 mA < I_{CEH} < 0.2 mA; 2 mA < I_{CEL} < 15 mA

Serial Interface

The serial interface is available in Rs 485 configuration.

RS 485

V_{pp} = 5 V, input impedance: ≥ 12 kΩ,
max. cable length ≤ 1200 m.
Baudrate 1200-9600 Baud.
Max. 32 instruments in parallel on a single bus. A shielded data cable with individually twisted pairs is recommended.
Terminals: V1, V2, V3, V4; Function T-, T+, R-, R+.

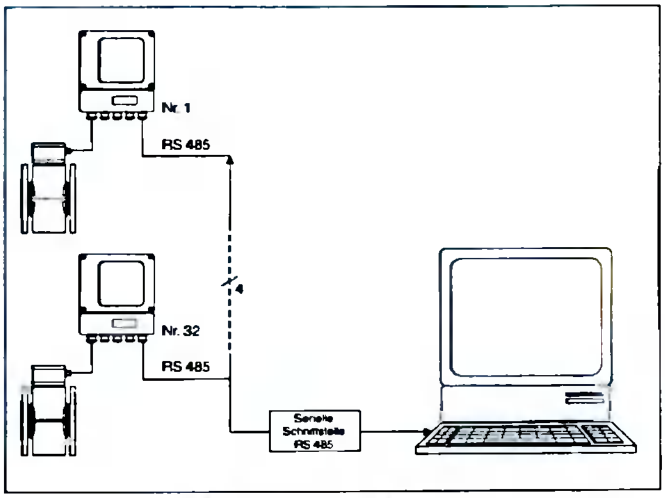
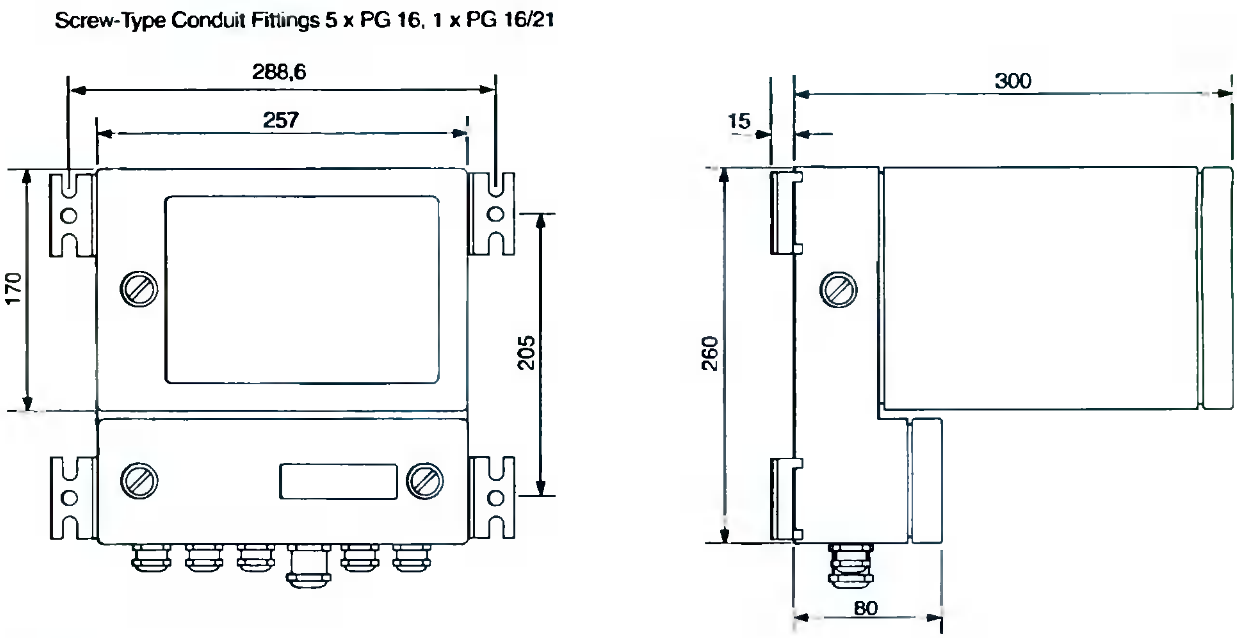


Fig. 19 Communication with RS 485 interface

Communication via Modem

If the converter is equipped with a serial data link it can be connected to a standard modem (Hayes compatibel). All parameters of the converter can be interrogged resp. changed.

Dimensional Drawing Converter, Modell 50XP2000

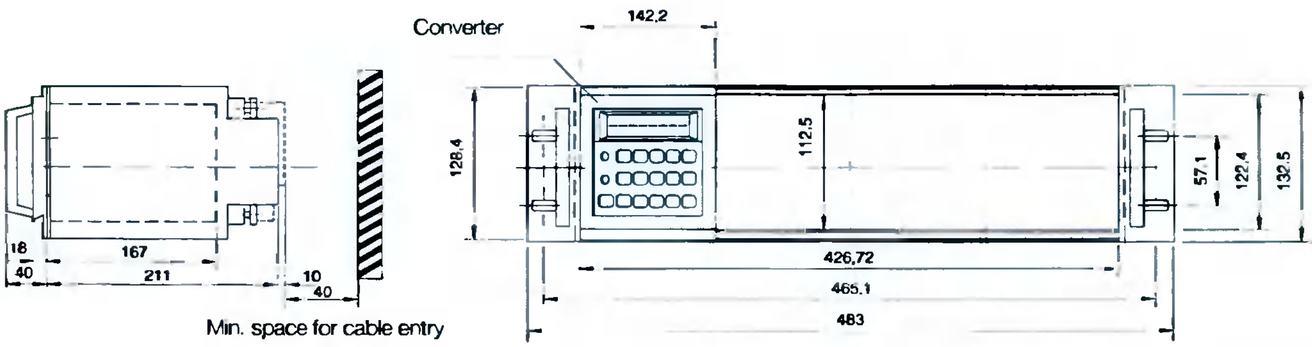


Note

The upper section of the converter housing hinges open to the right. The latching screw for the upper section is located on the left side of the housing. Therefore space of at least 50 mm must be provided on the left side and 250 mm on the right side of the housing.

All dimensions in mm

Fig. 20 Field Mount Housing



All dimensions in mm

Fig. 21 19" Rack Mount

Odering Information Converter, Model 50XP2000

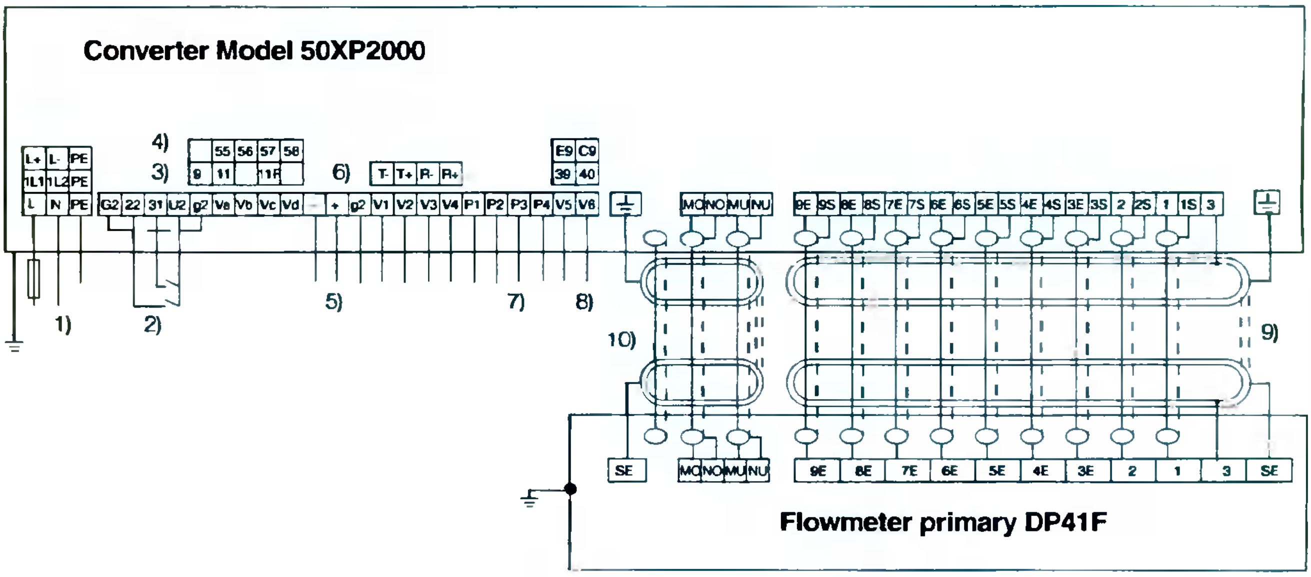
In addition to the Ordering Number please supply the following information: Flow range

Catalog Number	50XP2											
Remote signal converter												
Excitation frequency												
6 1/4 Hz (50 Hz)		1										
7 1/2 Hz (60 Hz)		3										
Certifications												
Without			0									
Alarm output												
Passive optocoupler				0								
Passive relay				1								
Design level (specified by ABB)					*							
Software level (specified by ABB)						*						
Housing												
Field housing with window							G					
19"-plug-in unit							M					
Pulse output / **Interface**												
Active (Standard) / Without								0				
Passive optocoupler / Without								1				
Without / RS 485								2				
Passive optocoupler / RS 485								5				
Operating mode												
Continuous flow measurement									0			
Additional option												
Without										A		
Power supply												
230 V 50/60 Hz											A	
115 V 50/60 Hz											B	
24 V 50/60 Hz											C	
Name plate												
German												1
English												2

Signal- and excitation cable length	
0 m (if converter electronic is required for spare part for example)	00
5 m	05
10 m	10
15 m	15
20 m	20
25 m	25
30 m	30
35 m	35
40 m	40
45 m	45
50 m	50

Shielded signal/excitation cable, pre-configured connected to remote converter (field housing version) when shipped.

Interconnection Diagram for standard design, Primary DP41F with converter 50XP2000



1) Supply Power, see Instrument Tag
2) Contact Input (Optocoupler), 16 V < U < 30 V, R_i = 2000 Ω, Function software selectable for:
   a) External zero return
   b) External totalizer reset
   Optocoupler contact input control:
   – passive, over operating contact (closer). Install jumper G2/g2 for this mode
   – active, over terminals G2/22 or G2/31. Jumper is not to be installed.
3) Scaled Pulse Output, active 24 V DC, load > 150 Ω, f_{max} < 5 kHz
   Terminals g2 and Va, Function 9 and 11 forward
   Terminals g2 and Vc, Function 9 and 11R reverse
4) Scaled Pulse Output, passive, Optocoupler
   5 V < U_{CE} ≤ 25 V DC, 5 mA < I_{CE} < 200 mA; f_{max} 5 kHz
   Terminals Va and Vb, Function 55 and 56 forward
   Terminals Vc and Vd, Function 57 and 58 reverse
5) Current Output, Terminals +/-, selectable
   a) 0/4-20 mA, load < 1000 Ω or
   b) 0/2-10 mA, load < 2000 Ω
6) Interface RS 485[1], Terminals: g2, V1, V2, V3, V4;
   Function: Shield, T-, T+, R-, R+
7) Two Contact Outputs (optocoupler), Function software selectable:
   Forward/reverse direction signal, min./max. alarm for flowrate,
   Optocoupler: 16 V < U_{CEH} < 30 V; 0 V < U_{CEL} < 3.5 V
   0 mA < I_{CEH} < 0.2 mA; 2 mA < I_{CEL} < 15 mA
   Terminals: P1, P2, P3, P4; P1/P3 = emitter, P2/P4 = collector
8) Alarm Output, relay contact < 3 W; < 250 mA; < 30 V DC, opens at alarm,
   Terminals V5, V6, Function 39/40 or
   Alarm output, optocoupler, same specifications as 8), opens at alarm,
   Terminals V5, V6, Function E9/C9
9) Shielded signal cable, connected to converter when shipped
10) Shielded excitation cable, connected to converter when shipped

Note

1) When using data link RS 485 a shielded data cable with individually twisted pairs is recommended.

Colour-Code of signal and excitation cable

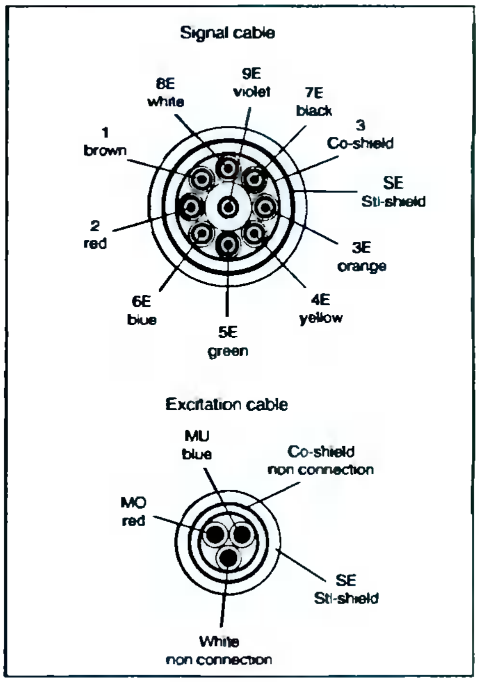
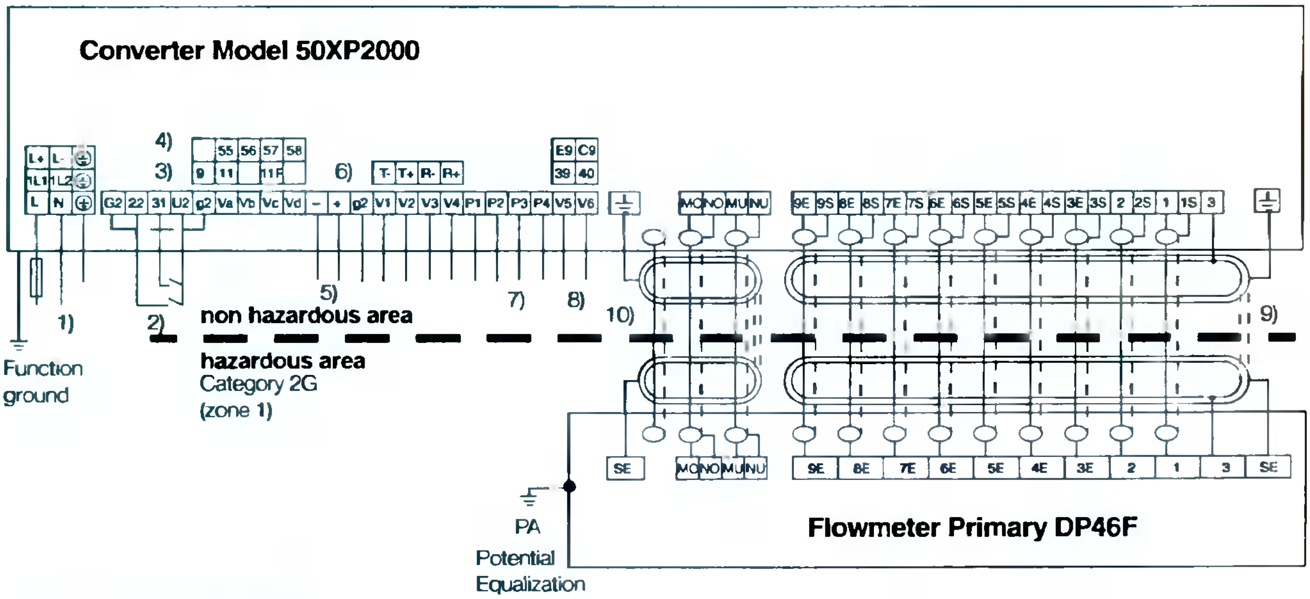


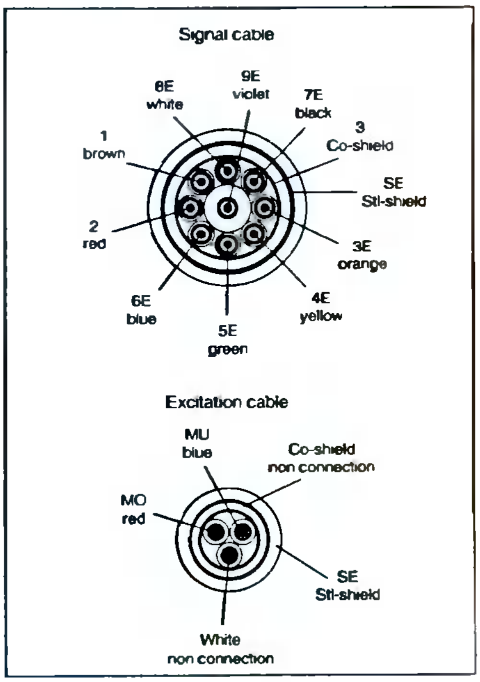
Fig. 22 Converter 50XP2000

Interconnection Diagram for ex-design, Primary DP46F with converter 50XP2000



1) Supply Power, see Instrument Tag
2) Contact Input (Optocoupler), 16 V < U < 30 V. R_i = 2000 Ω, Function software selectable for:
   a) External zero return
   b) External totalizer reset
   Optocoupler contact input control:
   – passive, over operating contact (closer). Install jumper G2/g2 for this mode
   – active, over terminals G2/22 or G2/31. Jumper is not to be installed.
3) Scaled Pulse Output, active 24 V DC, load > 150 Ω, f_{max} < 5 kHz
   Terminals g2 and Va, Function 9 and 11 forward
   Terminals g2 and Vc, Function 9 and 11R reverse
4) Scaled Pulse Output, passive, Optocoupler
   5 V < U_{CE} ≤ 25 V DC, 5 mA < I_{CE} < 200 mA; f_{max} 5 kHz
   Terminals Va and Vb, Function 55 and 56 forward
   Terminals Vc and Vd, Function 57 and 58 reverse
5) Current Output, Terminals +/-, selectable
   a) 0/4-20 mA, load < 1000 Ω or
   b) 0/2-10 mA, load < 2000 Ω
6) Interface RS 485[1], Terminals: g2, V1, V2, V3, V4:
   Function: Shield, T-, T+, R-, R+
7) Two Contact Outputs (optocoupler), Function software selectable:
   Forward/reverse direction signal, min./max. alarm for flowrate,
   Optocoupler: 16 V < U_{CEH} < 30 V; 0 V < U_{CEL} < 3.5 V
   0 mA < I_{CEH} < 0.2 mA; 2 mA < I_{CEL} < 15 mA
   Terminals: P1, P2, P3, P4; P1/P3 = emitter, P2/P4 = collector
8) Alarm Output, relay contact < 3 W; < 250 mA; < 30 V DC, opens at alarm,
   Terminals V5, V6, Function 39/40 or
   Alarm output, optocoupler, same specifications as 8), opens at alarm,
   Terminals V5, V6, Function E9/C9
9) Shielded signal cable, connected to converter when shipped
10) Shielded excitation cable, connected to converter when shipped

Colour-Code of signal and excitation cable



Note

1) When using data link RS 485 a shielded data cable with individually twisted pairs is recommended.

⚠ The rated voltage U_M for the in- and outputs is ≤ 60 V

Fig. 23 Converter 50XP2000

Interconnection Examples for Peripherals

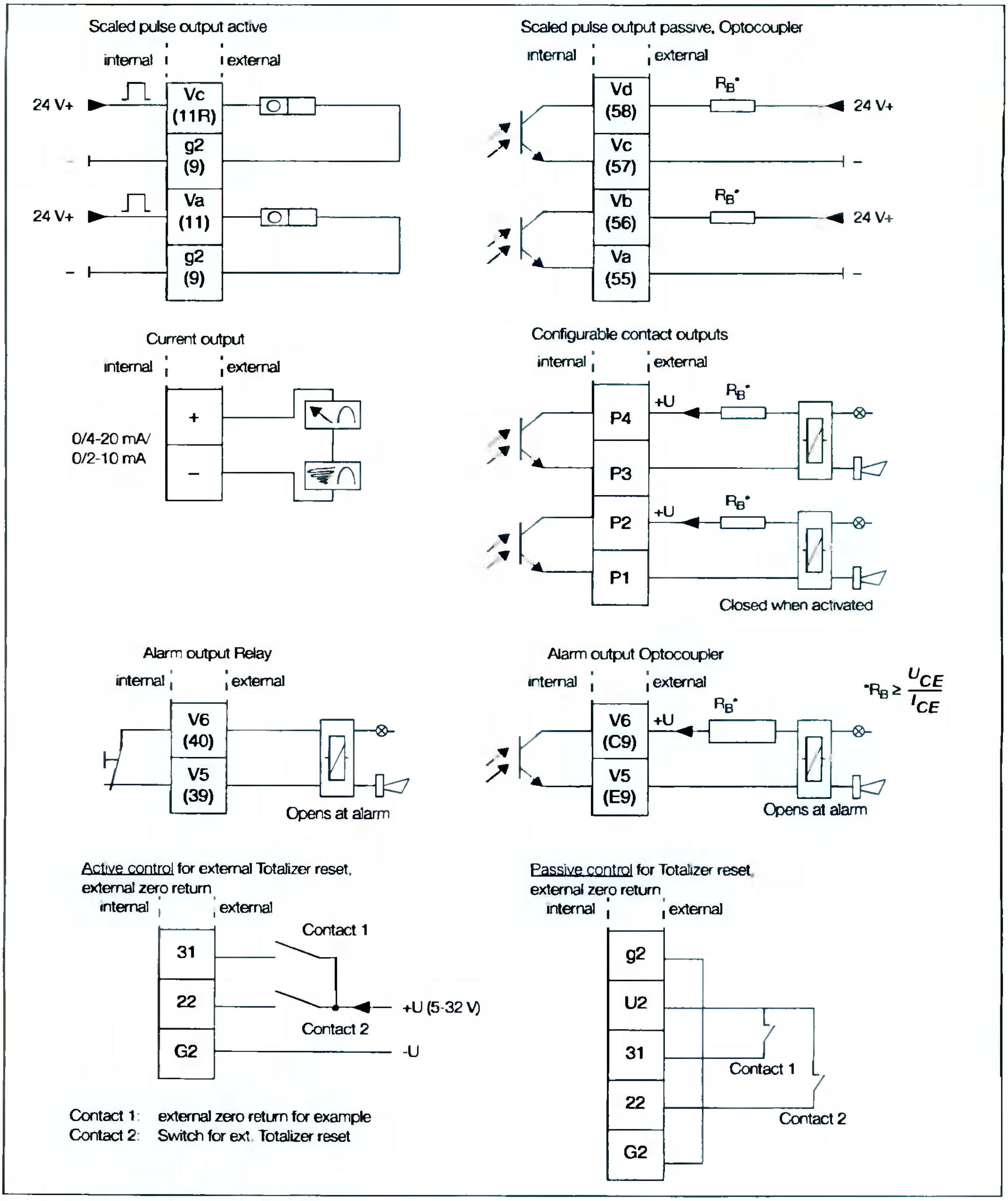


Fig. 24 Interconnection Examples for Peripherals

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D184S024U02 Rev. 02.3 09.2013

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Appendix C

Hydrocarbon Interceptor

SEPARATORS

A RANGE OF FUEL/OIL SEPARATORS
FOR PEACE OF MIND

Kingspan

Klargester

60 YEARS OF
Expertise &
Innovation
1955–2015

Separators

A RANGE OF FUEL/OIL SEPARATORS FOR PEACE OF MIND

Surface water drains normally discharge to a watercourse or indirectly into underground waters (groundwater) via a soakaway. Contamination of surface water by oil, chemicals or suspended solids can cause these discharges to have a serious impact on the receiving water.

The Environment Regulators, Environment Agency, England and Wales, SEPA, Scottish Environmental Protection Agency in Scotland and Department of Environment & Heritage in Northern Ireland, have published guidance on surface water disposal, which offers a range of means of dealing with pollution both at source and at the point of discharge from site (so called 'end of pipe' treatment). These techniques are known as 'Sustainable Drainage Systems' (SuDS).

Where run-off is draining from relatively low risk areas such as car-parks and non-operational areas, a source control approach, such as permeable surfaces or infiltration trenches, may offer a suitable means of treatment, removing the need for a separator.

Oil separators are installed on surface water drainage systems to protect receiving waters from pollution by oil, which may be present due to minor leaks from vehicles and plant, from accidental spillage.

Effluent from industrial processes and vehicle washing should normally be discharged to the foul sewer (subject to the approval of the sewerage undertaker) for further treatment at a municipal treatment works.

SEPARATOR STANDARDS AND TYPES

A British (and European) standard (EN 858-1 and 858-2) for the design and use of prefabricated oil separators has been adopted. New prefabricated separators should comply with the standard.

SEPARATOR CLASSES

The standard refers to two 'classes' of separator, based on performance under standard test conditions.

CLASS I

Designed to achieve a concentration of less than 5mg/l of oil under standard test conditions, should be used when the separator is required to remove very small oil droplets.

CLASS II

Designed to achieve a concentration of less than 100mg/l oil under standard test conditions and are suitable for dealing with discharges where a lower quality requirement applies (for example where the effluent passes to foul sewer).

Both classes can be produced as full retention separators. The oil concentration limits of 5 mg/l and 100 mg/l are only applicable under standard test conditions. It should not be expected that separators will comply with these limits when operating under field conditions.

FULL RETENTION SEPARATORS

Full retention separators treat the full flow that can be delivered by the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 65mm/hr.

On large sites, some short term flooding may be an acceptable means of limiting the flow rate and hence the size of full retention systems.

Get in touch for a **FREE** professional site visit and a representative will contact you within 5 working days to arrange a visit.
helpingyou@klargester.com to make the right decision or call **028 302 66799**

BYPASS SEPARATORS

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small.

FORECOURT SEPARATORS

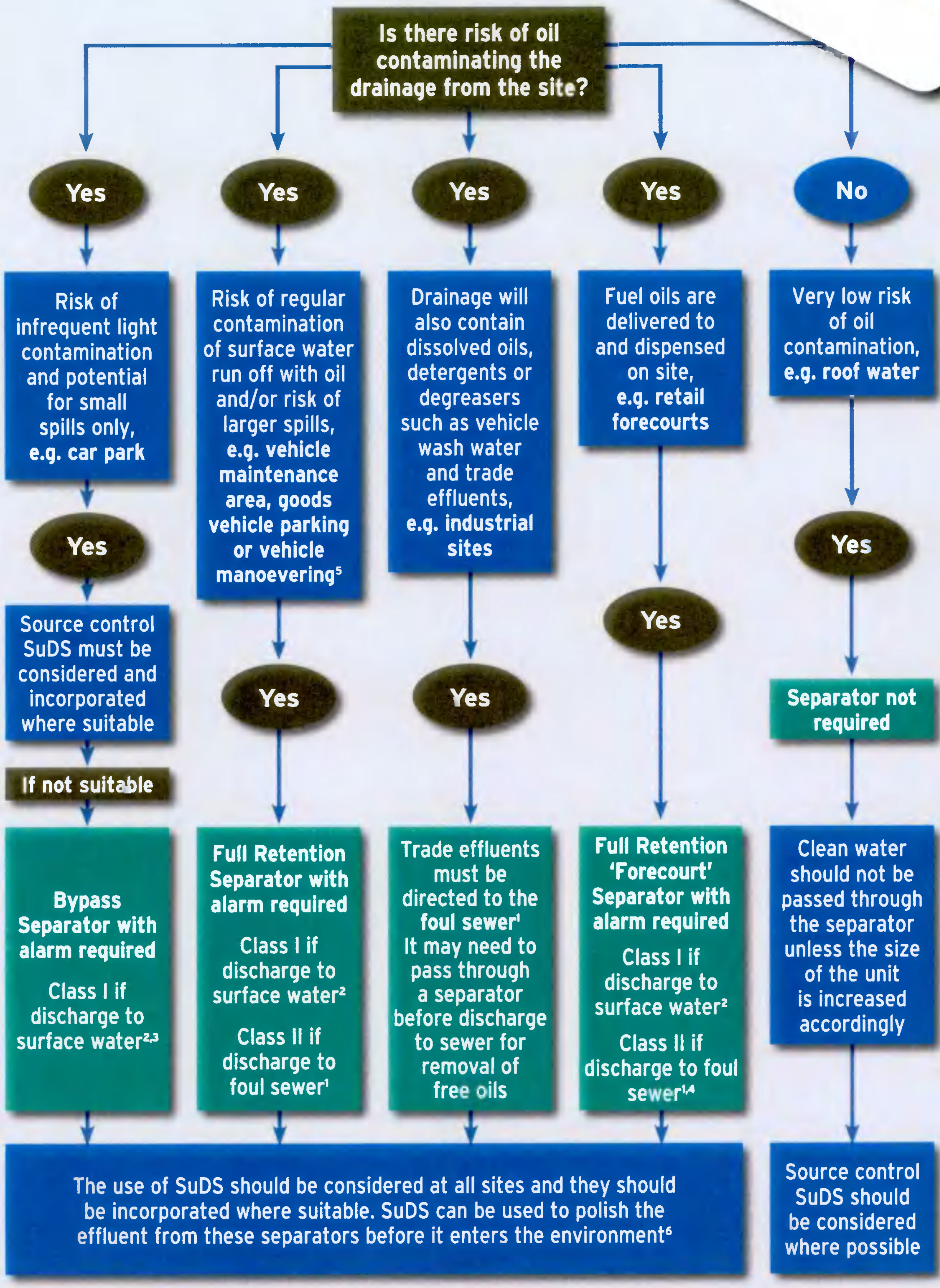
Forecourt separators are full retention separators specified to retain on site the maximum spillage likely to occur on a petrol filling station. They are required for both safety and environmental reasons and will treat spillages occurring during vehicle refuelling and road tanker delivery. The size of the separator is increased in order to retain the possible loss of the contents of one compartment of a road tanker, which may be up to 7,600 litres.

SELECTING THE RIGHT SEPARATOR

The chart on the following page gives guidance to aid selection of the appropriate type of fuel/oil separator for use in surface water drainage systems which discharge into rivers and soakaways.

For further detailed information, please consult the Environment Agency Pollution Prevention Guideline 03 (PPG 3) 'Use and design of oil separators in surface water drainage systems' available from their website.

Kingspan Klargester has a specialist team who provide technical assistance in selecting the appropriate separator for your application.



1 You must seek prior permission from your local sewer provider before you decide which separator to install and before you make any discharge.
2 You must seek prior permission from the relevant environmental body before you decide which separator to install.
3 In this case, if it is considered that there is a low risk of pollution a source control SuDS scheme may be appropriate.
4 In certain circumstances, the sewer provider may require a Class 1 separator for discharges to sewer to prevent explosive atmospheres from being generated.
5 Drainage from higher risk areas such as vehicle maintenance yards and goods vehicle parking areas should be connected to foul sewer in preference to surface water.
6 In certain circumstances, a separator may be one of the devices used in the SuDS scheme. Ask us for advice.

Bypass NSB RANGE

APPLICATION

Bypass separators are used when it is considered an acceptable risk not to provide full treatment, for very high flows, and are used, for example, where the risk of a large spillage and heavy rainfall occurring at the same time is small, e.g.

- Surface car parks.
- Roadways.
- Lightly contaminated commercial areas.

PERFORMANCE

Klargester were one of the first UK manufacturers to have separators tested to EN 858-1. Klargester have now added the NSB bypass range to their portfolio of certified and tested models. The NSB number denotes the maximum flow at which the separator treats liquids. The British Standards Institute (BSI) tested the required range of Kingspan Klargester Bypass separators and certified their performance in relation to their flow and process performance assessing the effluent qualities to the requirements of EN 858-1. Klargester bypass separator designs follow the parameters determined during the testing of the required range of bypass separators.

Each bypass separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Silt storage capacity.
- Oil storage volume.
- Coalescer.

The unit is designed to treat 10% of peak flow. The calculated drainage areas served by each separator are indicated according to the formula given by PPG3 NSB = 0.0018A(m2). Flows generated by higher rainfall rates will pass through part of the separator and bypass the main separation chamber.

Class I separators are designed to achieve a concentration of 5mg/litre of oil under standard test conditions.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Oil alarm system available (required by EN 858-1 and PPG3).
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size bypass separator, the following information is needed:-

- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the flow is not pumped.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	PEAK FLOW RATE (l/s)	DRAINAGE AREA (m²)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	STANDARD FALL ACROSS (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA.
NSBP003	3	30	1670	300	45	1700	1350	600	1420	1320	100	500	160
NSBP004	4.5	45	2500	450	60	1700	1350	600	1420	1320	100	500	160
NSBP006	6	60	3335	600	90	1700	1350	600	1420	1320	100	500	160
NSBE010	10	100	5560	1000	150	2069	1220	750	1450	1350	100	700	315
NSBE015	15	150	8335	1500	225	2947	1220	750	1450	1350	100	700	315
NSBE020	20	200	11111	2000	300	3893	1220	750	1450	1350	100	700	375
NSBE025	25	250	13890	2500	375	3575	1420	750	1680	1580	100	700	375
NSBE030	30	300	16670	3000	450	4265	1420	750	1680	1580	100	700	450
NSBE040	40	400	22222	4000	600	3230	1920	600	2185	2035	150	1000	500
NSBE050	50	500	27778	5000	750	3960	1920	600	2185	2035	150	1000	600
NSBE075	75	750	41667	7500	1125	5841	1920	600	2235	2035	200	950	675
NSBE100	100	1000	55556	10000	1500	7661	1920	600	2235	2035	200	950	750
NSBE125	125	1250	69444	12500	1875	9548	1920	600	2235	2035	200	950	750

Rotomoulded chamber construction   GRP chamber construction   * Some units have more than one access shaft – diameter of largest shown.

Full Retention NSF RANGE

Kingspan Klargester

APPLICATION

Full retention separators are used in high risk spillage areas such as:

- Fuel distribution depots.
- Vehicle workshops.
- Scrap Yards

PERFORMANCE

Kingspan Klargester were the first UK manufacturer to have the required range (3-30 l/sec) certified to EN 858-1 in the UK. The NSF number denotes the flow at which the separator operates.

The British Standards Institute (BSI) have witnessed the performance tests of the required range of separators and have certified their performance, in relation to their flow and process performance to ensure that they met the effluent quality requirements of EN 858-1. Larger separator designs have been determined using the formulas extrapolated from the test range.

Each full retention separator design includes the necessary volume requirements for:

- Oil separation capacity.
- Oil storage volume.
- Silt storage capacity.
- Coalescer (Class I units only).
- Automatic closure device.

Klargester full retention separators treat the whole of the specified flow.

FEATURES

- Light and easy to install.
- Class I and Class II designs.
- 3-30 l/sec range independently tested and performance sampled, certified by the BSI.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.

- Oil alarm system available.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- GRP or rotomoulded construction (subject to model).

To specify a nominal size full retention separator, the following information is needed:-

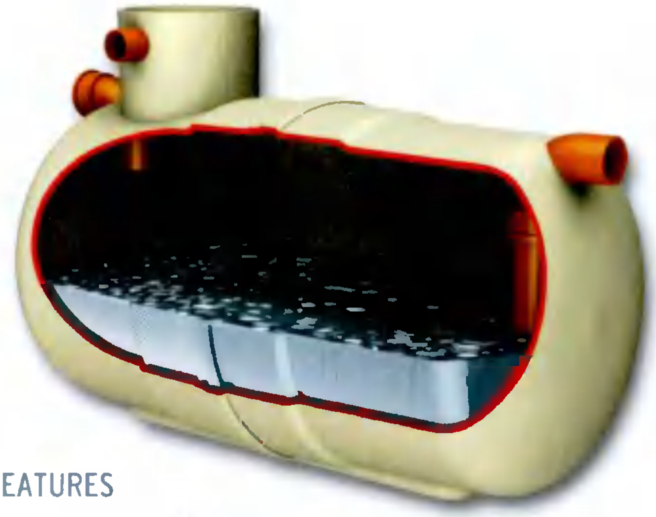
- The calculated flow rate for the drainage area served. Our designs are based on the assumption that any interconnecting pipework fitted elsewhere on site does not impede flow into or out of the separator and that the influent is not pumped.
- The required discharge standard. This will decide whether a Class I or Class II unit is required.
- The drain invert inlet depth.
- Pipework type, size and orientation.

SIZES AND SPECIFICATIONS

UNIT NOMINAL SIZE	FLOW (l/s)	DRAINAGE AREA (m^2) PPG-3 (0.018)	STORAGE CAPACITY (litres) SILT	OIL	UNIT LENGTH (mm)	UNIT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT	MIN. INLET INLET (mm)	STANDARD PIPEWORK DIA. (mm)
NSFP003	3	170	300	30	1700	1350	1420	1345	500	160
NSFP006	6	335	600	60	1700	1350	1420	1345	500	160
NSFA010	10	555	1000	100	2610	1225	1050	1000	500	200
NSFA015	15	835	1500	150	3910	1225	1050	1000	500	200
NSFA020	20	1115	2000	200	3200	2010	1810	1760	1000	315
NSFA030	30	1670	3000	300	3915	2010	1810	1760	1000	315
NSFA040	40	2225	4000	400	4640	2010	1810	1760	1000	315
NSFA050	50	2780	5000	500	5425	2010	1810	1760	1000	315
NSFA065	65	3610	6500	650	6850	2010	1810	1760	1000	315
NSFA080	80	4445	8000	800	5744	2820	2500	2450	1000	300
NSFA100	100	5560	10000	1000	6200	2820	2500	2450	1000	400
NSFA125	125	6945	12500	1250	7365	2820	2500	2450	1000	450
NSFA150	150	8335	15000	1500	8675	2820	2550	2450	1000	525
NSFA175	175	9725	17500	1750	9975	2820	2550	2450	1000	525
NSFA200	200	11110	20000	2000	11280	2820	2550	2450	1000	600

Rotomoulded chamber construction   GRP chamber construction

Washdown & Silt



APPLICATION

This unit can be used in areas such as car wash and other cleaning facilities that discharge directly into a foul drain, which feeds to a municipal treatment facility.

If emulsifiers are present the discharge must not be allowed to enter an NS Class I or Class II unit.

- Car wash.
- Tool hire depots.
- Truck cleansing.
- Construction compounds cleansing points.

PERFORMANCE

Such wash down facilities must not be allowed to discharge directly into surface water but must be directed to a foul connection leading to a municipal treatment works as they utilise emulsifiers, soaps and detergents, which can dissolve and disperse the oils.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.

SIZES AND SPECIFICATIONS

REF.	TOTAL CAPACITY (litres)	MAX. REC. SILT	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STANDARD FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STANDARD PIPEWORK DIA. (mm)	APPROX EMPTY (kg)
W1/010	1000	500	3	1123	1225	460	1150	1100	50	500	160	60
W1/020	2000	1000	5	2074	1225	460	1150	1100	50	500	160	120
W1/030	3000	1500	8	2952	1225	460	1150	1100	50	500	160	150
W1/040	4000	2000	11	3898	1225	460	1150	1100	50	500	160	180
W1/060	6000	3000	16	4530	1440	600	1360	1310	50	500	160	320
W1/080	8000	4000	22	3200	2020	600	2005	1955	50	500	160	585
W1/100	10000	5000	27	3915	2020	600	2005	1955	50	500	160	680
W1/120	12000	6000	33	4640	2020	600	2005	1955	50	500	160	770
W1/150	15000	7500	41	5435	2075	600	1940	1890	50	500	160	965
W1/190	19000	9500	52	6865	2075	600	1940	1890	50	500	160	1200

Car Wash Silt Trap

APPLICATION

Car Wash silt trap is designed for use before a separator in car wash applications to ensure effective silt removal.

FEATURES

- FACTA Class B covers.
- Light and easy to install.
- Maintenance from ground level.

Forecourt

APPLICATION

The forecourt separator is designed for installation in petrol filling station forecourts and similar applications. The function of the separator is to intercept hydrocarbon pollutants such as petroleum and oil and prevent their entry to the drainage system, thus protecting the environment against hydrocarbon contaminated surface water run-off and gross spillage.

PERFORMANCE

Operation ensures that the flow cannot exit the unit without first passing through the coalescer assembly.

In normal operation, the forecourt separator has sufficient capacity to provide storage for separated pollutants within the main chamber, but is also able to contain up to 7,600 litres of pollutant arising from the spillage of a fuel delivery tanker compartment on the petrol forecourt. The separator has been designed to ensure that oil cannot exit the separator in the event of a major spillage, subsequently the separator should be emptied immediately.

FEATURES

- Light and easy to install.
- Inclusive of silt storage volume.
- Fitted inlet/outlet connectors.
- Vent points within necks.
- Extension access shafts for deep inverts.
- Maintenance from ground level.
- Class I and Class II design.
- Oil storage volume.
- Coalescer (Class I unit only).
- Automatic closure device.
- Oil alarm system available.

INSTALLATION

The unit should be installed on a suitable concrete base slab and surrounded with concrete or pea gravel backfill. See sales drawing for installation.

If the separator is to be installed within a trafficked area, then a suitable cover slab must be designed to ensure that loads are not transmitted to the unit.

The separator should be installed and vented in accordance with Health and Safety Guidance Note HS(G)41 for filling stations, subject to Local Authority requirements.

SIZES AND SPECIFICATIONS

ENVIROCEPTOR CLASS	TOTAL CAP. (litres)	DRAINAGE AREA (m^2)	MAX. FLOW RATE (l/s)	LENGTH (mm)	DIAMETER (mm)	ACCESS SHAFT DIA. (mm)	BASE TO INLET INVERT (mm)	BASE TO OUTLET INVERT (mm)	STD. FALL ACROSS UNIT (mm)	MIN. INLET INVERT (mm)	STD. PIPEWORK (mm)	EMPTY WEIGHT (kg)
I	10000	555	10	3963	1920	600	2110	2060	50	400	160	500
II	10000	555	10	3963	1920	600	2110	2060	50	400	160	500
I	10000	1110	20	3963	1920	600	2110	2060	50	400	200	500
II	10000	1110	20	3963	1920	600	2110	2060	50	400	200	500

Alarm Systems

British European Standard EN 858-1 and Environment Agency Pollution Prevention Guideline PPG3 requires that all separators are to be fitted with an oil level alarm system and that it should be installed and calibrated by a suitably qualified technician so that it will respond to an alarm condition when the separator requires emptying.

- Easily fitted to existing tanks.
- Excellent operational range.
- Visual and audible alarm.
- Additional telemetry option.

PROFESSIONAL INSTALLERS

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Experience shows that correct installation is a prerequisite for the long-lasting and successful operation of any wastewater treatment product. This is why using an installer with the experience and expertise to install your product is highly recommended.

Services include :

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- Advice on system design and product selection
- Assistance on gaining environmental consents and building approvals
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- Connection to discharge point and electrical networks
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Factory trained engineers are available for site visits as part of a planned maintenance contract or on a one-off call out basis.

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  HIGH PERFORMANCE SEWAGE TREATMENT SYSTEMS
- PACKAGE PUMP STATIONS
- **PUMPSTOR24** PUMPING SYSTEMS
- OIL/WATER SEPARATORS
- BELOW GROUND STORAGE TANKS
- GREASE & SILT TRAPS

RAINWATER SOLUTIONS

- BELOW GROUND RAINWATER HARVESTING SYSTEMS
- ABOVE GROUND RAINWATER HARVESTING SYSTEMS

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Issue No. 21: September 2015

Appendix D

Rainfall Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 302972, Northing: 231557,

DURATION	Interval 6months,	1year,	Years 2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3,	3.4,	4.1,	5.0,	5.6,	6.1,	7.8,	9.8,	11.1,	13.0,	14.7,	16.0,	18.1,	19.8,	21.1,	N/A ,
10 mins	3.3,	4.8,	5.6,	6.9,	7.8,	8.6,	10.9,	13.6,	15.5,	18.1,	20.5,	22.4,	25.3,	27.5,	29.5,	N/A ,
15 mins	3.8,	5.6,	6.6,	8.2,	9.2,	10.1,	12.8,	16.0,	18.2,	21.3,	24.1,	26.3,	29.7,	32.4,	34.7,	N/A ,
30 mins	5.0,	7.3,	8.6,	10.5,	11.9,	12.9,	16.4,	20.4,	23.1,	26.9,	30.3,	33.0,	37.2,	40.5,	43.3,	N/A ,
1 hours	6.6,	9.6,	11.2,	13.6,	15.3,	16.6,	20.9,	25.9,	29.2,	33.9,	38.2,	41.5,	46.6,	50.6,	54.0,	N/A ,
2 hours	9.7,	12.4,	14.5,	17.6,	19.7,	21.3,	26.7,	32.9,	37.0,	42.8,	48.1,	52.1,	58.4,	63.3,	67.4,	N/A ,
3 hours	10.2,	14.5,	16.9,	20.4,	22.8,	24.7,	30.8,	37.9,	42.5,	49.1,	55.0,	59.6,	66.6,	72.2,	76.7,	N/A ,
4 hours	11.4,	16.2,	18.8,	22.7,	25.3,	27.4,	34.1,	41.8,	46.9,	54.1,	60.5,	65.5,	73.2,	79.2,	84.1,	N/A ,
6 hours	13.4,	18.9,	21.9,	26.3,	29.3,	31.7,	39.4,	48.1,	53.9,	62.0,	69.2,	74.8,	83.5,	90.2,	95.8,	N/A ,
9 hours	15.7,	22.1,	25.5,	30.6,	34.0,	36.7,	45.4,	55.3,	61.9,	71.0,	79.2,	85.5,	95.2,	102.8,	109.0,	N/A ,
12 hours	17.6,	24.6,	28.4,	34.0,	37.8,	40.7,	50.3,	61.1,	68.2,	78.2,	87.1,	94.0,	104.6,	112.8,	119.5,	N/A ,
18 hours	20.6,	28.7,	33.0,	39.5,	43.8,	47.1,	58.0,	70.3,	78.4,	89.7,	99.7,	107.4,	119.3,	128.5,	136.1,	N/A ,
24 hours	23.1,	32.0,	36.8,	43.9,	48.6,	52.3,	64.2,	77.7,	86.5,	98.8,	109.7,	118.1,	131.0,	141.0,	149.2,	178.0,
2 days	29.0,	39.1,	44.4,	52.1,	57.2,	61.2,	73.8,	87.8,	96.8,	109.3,	120.3,	128.7,	141.5,	151.3,	159.4,	187.3,
3 days	33.8,	44.8,	50.5,	58.7,	64.2,	68.4,	81.7,	96.2,	105.5,	118.4,	129.5,	138.1,	151.0,	160.9,	169.0,	196.8,
4 days	38.0,	49.8,	55.8,	64.5,	70.3,	74.6,	88.5,	103.5,	113.1,	126.3,	137.7,	146.4,	159.5,	169.5,	177.7,	205.6,
6 days	45.3,	58.4,	65.1,	74.6,	80.8,	85.5,	100.3,	116.2,	126.4,	140.1,	152.0,	160.9,	174.5,	184.7,	193.0,	221.4,
8 days	51.9,	66.1,	73.2,	83.4,	90.0,	95.0,	110.6,	127.3,	137.9,	152.2,	164.4,	173.7,	187.5,	198.0,	206.5,	235.4,
10 days	57.9,	73.1,	80.6,	91.4,	98.3,	103.6,	120.0,	137.3,	148.3,	163.0,	175.6,	185.1,	199.4,	210.1,	218.8,	248.1,
12 days	63.5,	79.6,	87.5,	98.8,	106.1,	111.6,	128.6,	146.6,	157.8,	173.0,	186.0,	195.7,	210.3,	221.2,	230.0,	259.8,
16 days	73.9,	91.5,	100.2,	112.4,	120.3,	126.1,	144.3,	163.4,	175.3,	191.2,	204.8,	214.9,	230.0,	241.4,	250.5,	281.2,
20 days	83.6,	102.6,	111.9,	124.9,	133.2,	139.5,	158.6,	178.7,	191.1,	207.7,	221.8,	232.3,	247.9,	259.5,	269.0,	300.4,
25 days	95.0,	115.5,	125.4,	139.4,	148.2,	154.8,	175.1,	196.2,	209.2,	226.6,	241.2,	252.1,	268.3,	280.3,	290.1,	322.4,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

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0.2712