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ACO Water Management: Civils + Infrastructure

ACO Qmax®



ACO Qmax® - High capacity slot drainage system

Technical data



Introduction to the ACO Group

Throughout the world ACO branded drainage and surface water management systems are recognised for their innovative design, high quality manufacture, environmental excellence and industry leading performance.

Today the ACO Group has a research and production base that reaches across four continents. This unmatched resource pioneers the development of solutions that are tailored to individual applications, meeting the need for high performance, sustainable products that deliver optimum value throughout their operational life.

ACO Technologies plc

ACO operates as ACO Technologies plc in the United Kingdom. Founded over 30 years ago, the company has grown quickly on a reputation for design innovation and customer service.

There are now 4 divisions within ACO Technologies that serve every sector of the construction industry, providing solutions for applications as diverse as rail, highways, airports, landscaping, retail, distribution centres and environmentally sensitive projects.



To help architects, designers and contractors meet the legal requirements that now tightly control the way surface water is managed, ACO has created its unique 'Surface Water Management Cycle' – Collect, Clean, Hold, Release – the four core processes now required for the complete and sustainable management of surface water drainage.



The ACO group / www.aco.com

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The ACO Qmax® channel system is protected by patent and registered design rights. All intellectual rights are the property of ACO Technologies plc.

Introduction to ACO Qmax®

The ACO Qmax® system provides optimum surface water drainage and attenuation for a wide range of infrastructure, industrial, hard landscaped and other SuDS applications.

What is ACO Qmax®

ACO Qmax® satisfies the demand for a versatile, high capacity slot drainage system for applications involving small to large catchment areas. For economical system design and installation, ACO Qmax® can cater for a wide range of applications to any load class.

ACO Qmax® is specifically designed to form an integral part of any modern, sustainable surface water management solution. The system maximises the hydraulic capacity available providing effective storage, attenuation, and eliminating carry over in stormwater conditions.

The ACO Qmax® system has six channel sizes ensuring greater system flexibility for engineers and designers to optimise scheme hydraulics.

In recognition of its innovative design, ACO Qmax® has received many accolades including Construction Product of the Year 2006 and The Queen's Award for Enterprise: Innovation in 2006.



ACO Qmax® channels

The ACO Qmax® system

System features

- ▶ Available in these sizes: 150, 225, 350, 550, 700 and 900
- ▶ The ACO Qmax® channel unit is 2m in length
- ▶ Simple connection between each channel run is provided by step and channel connectors
- ▶ Range of access chambers available
- ▶ Manufactured from recycled Polyethylene (PE)
- ▶ ACO Qmax® is easy to handle and quick to install
- ▶ Unique patented inlet design provides a continuous pavement beam feature over the line of the channel
- ▶ Each size within the ACO Qmax® range is CE marked and certified to BS EN1433:2002
- ▶ Supports all Load Classes up to and including F 900
- ▶ ATec coating on all the ductile iron edge rails

System benefits

- ▶ Unobtrusive continuous slot drainage system
- ▶ Eliminates stormwater carry over
- ▶ Sealed system
- ▶ Effective silt management
- ▶ Meets environmental construction targets
- ▶ Improves onsite handling and installation rates
- ▶ Strengthening the pavement installation and minimising the need for reinforcement
- ▶ Proven performance and durability
- ▶ Safe and secure installation
- ▶ Long service life in excess of 25 years

Why choose ACO Qmax®

SuDS



ACO Qmax® provides many solutions as part of a SuDS system allowing engineers and designers to combine the benefits of both “Hard” and “Soft” SuDS in order to achieve the key elements of quality, quantity and amenity.

When combined with the ACO Q-Brake Vortex flow control, it can regulate and control stormwater before it discharges into the ongoing watercourses or drainage network.

Discrete finish



To satisfy surface finishes and application requirements, ACO Qmax® is available with a range of discreet edge rail designs and materials.

ACO Qmax® channels come complete with either high quality ATec coated ductile iron or hot dipped galvanised edge rails, which are suitable for all load classes in asphalt or concrete pavements

The edge rails are available in three different inlet slot designs: ACO Q-Flow, ACO Q-Guard, and for landscaped areas with block pavements or flags, the ACO Q-Slot galvanised steel edge rail provides a discreet, unobtrusive finish.



ACO Hydraulic Design Software

Register online for our free, secure online design software:

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- ▶ Data always up-to-date
- ▶ Proven calculation methodology - more accurate and efficient designs
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- ▶ Integrated rainfall data
- ▶ Automated product optimisation
- ▶ PDF summary documents



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ACO Qmax® system layout

The layout diagram below illustrates a selection of channels and components available within the ACO Qmax® range.

Key

- | | | |
|--|--|--|
| 1 Edge rail protector for ductile iron edge rails | 5 ACO Qmax® 550 to 700 step connector | 9 ACO Qmax® 350 with ACO Q-Guard galvanised steel edge rail |
| 2 ACO Qmax® access / silt chamber with solid cover and frame | 6 Qmax® 550 with ACO Q-Guard ductile iron edge rail | 10 ACO Qmax® access chamber with ACO Q-Slot recessed cover and frame |
| 3 ACO Qmax® 700 chamber connector | 7 ACO Qmax® 550 chamber connector | 11 ACO Qmax® 225 with ACO Q-Slot galvanised steel edge rail |
| 4 ACO Qmax® 700 with ACO Q-Flow ductile iron edge rail | 8 ACO Qmax® access / silt chamber with slotted cover and frame | 12 End cap |



Reusable magnetic edge protector for ductile iron edge rails, prevents concrete and pavement materials entering the system during installation

Patented 'Pavement beam' feature permits continuous flow of concrete through the product, strengthening installation

High level services easily accommodated



Only high capacity system with an integrated seal as standard

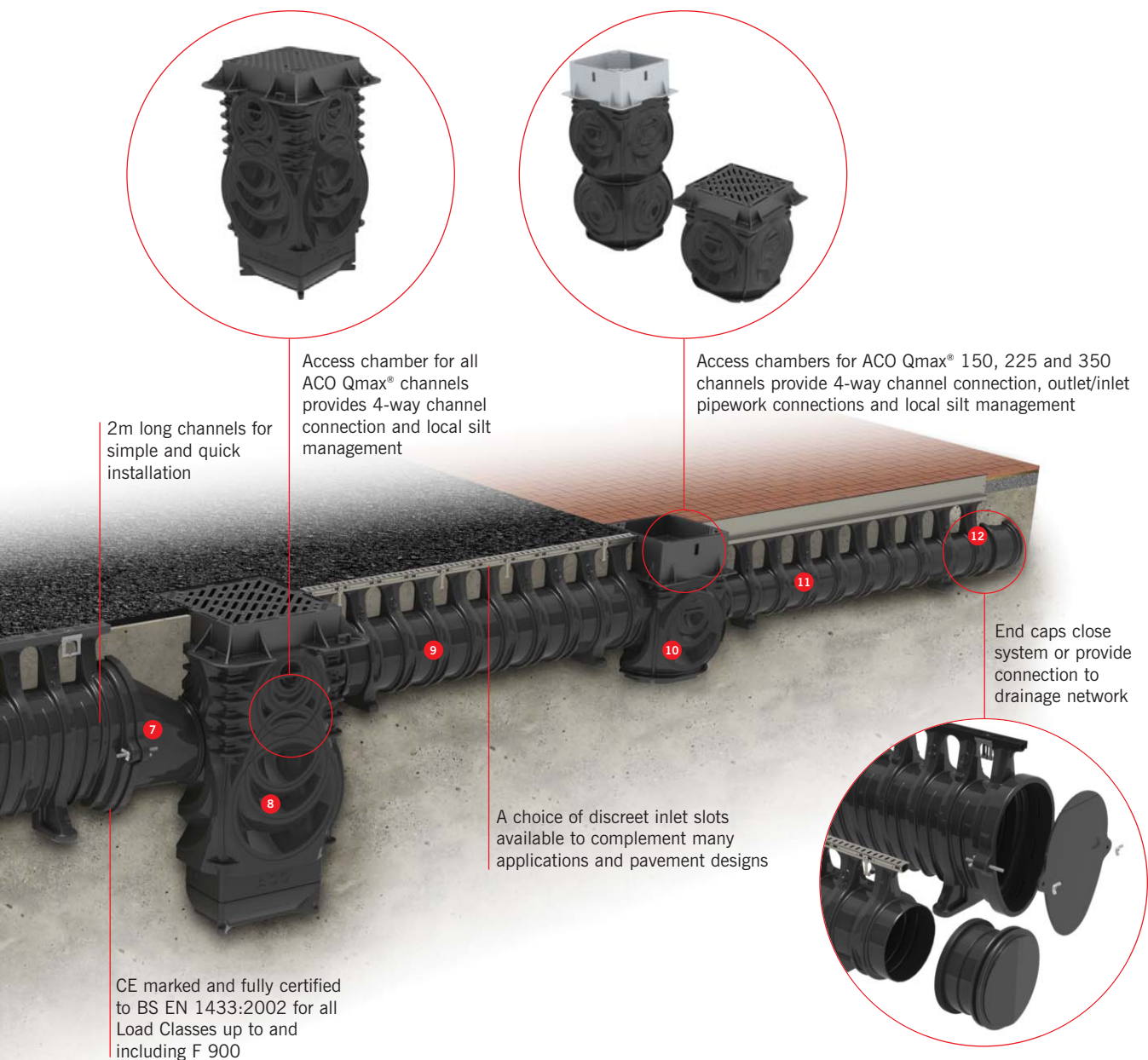
Six channel sizes available for optimum drainage design: 150, 225, 350, 550, 700, 900

PE step connectors optimise system design and provide uninterrupted slot finish



PE chamber connectors for simple connection between channels and chambers and pipework



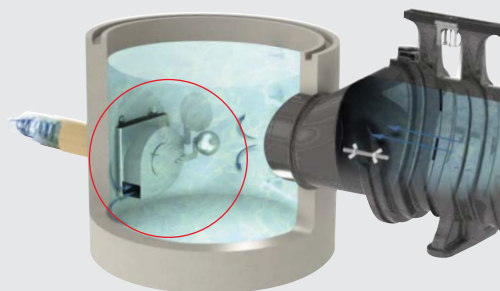


Controlling stormwater discharge

If a controlled rate discharge is required, ACO Qmax® can be used in conjunction with the ACO Q-Brake Vortex flow control unit to regulate stormwater flows.

ACO Q-Brake Vortex provides superior hydraulic performance in comparison to traditional flow control systems and permits more flow at lower heads, reducing storage volume requirements and lowering cost.

For more information on ACO Q-Brake Vortex, see page 54.



ACO QMAX® CHANNEL FEATURES OVERVIEW

Patented 'Pavement beam' feature permits continuous flow of concrete through the product, for strong and cost effective installation

Simple push fit channel connection detail for easy edge rail alignment

ACO Qmax® 550, 700 and 900 channels are provided with wingnut connection

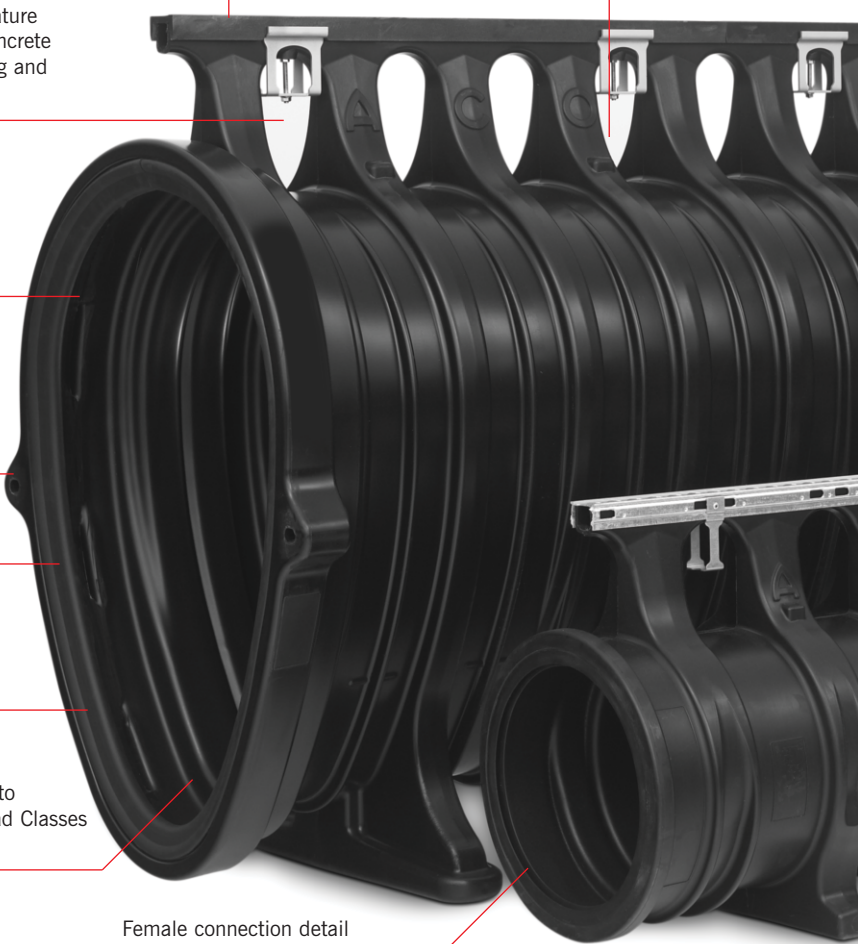
Female connection detail

Integrated channel seal for quick and easy watertight connections*

CE marked and fully certified to BS EN 1433:2002 for all Load Classes up to and including F 900

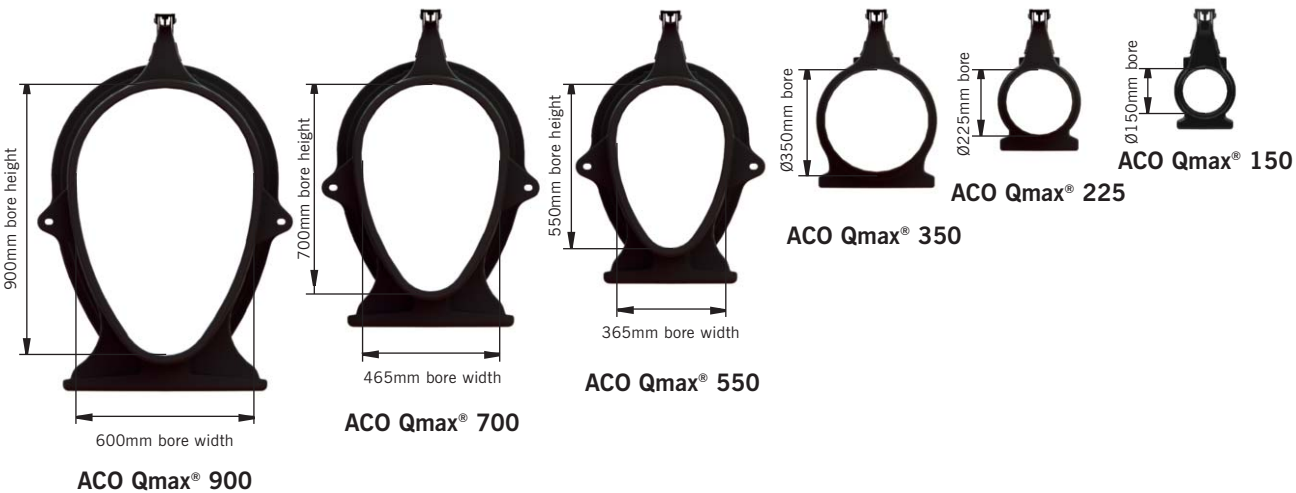
ACO Qmax® channels are available as standard with three different edge rail details for specific applications

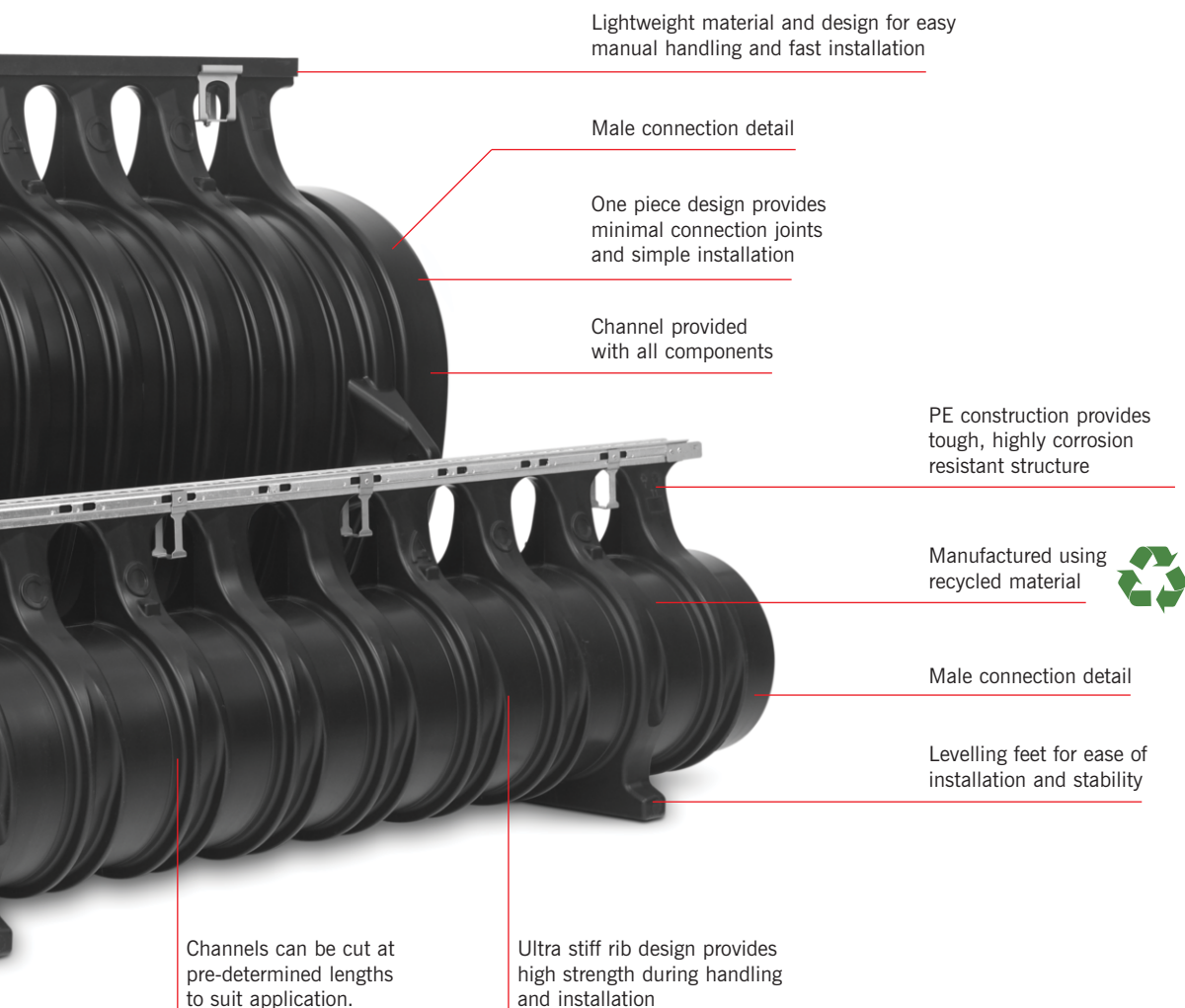
Reinforcement support aids installation



Female connection detail

Available channel sizes:





LOAD CLASSES



A 15
Pedestrian, cycleways,
minimally trafficked areas
(light domestic vehicles only).



B 125
Pedestrian precincts, light vehicles,
private car parks and drives.



C 250
Parking areas, service stations
(cars) and slow-moving light
commercial vehicles.



D 400
Public highways, parking areas
for all types of vehicles,
distribution yards.



E 600
Industrial areas, heavy wheel loads,
slow-moving HGV's and forklifts,
service stations.



F 900
Airport runways, very heavy
industrial and military
installations, service yards and
lorry parks.

*ACO Qmax® channels are tested to confirm compliance with the watertightness requirements of BS EN 1433 when filled with water to the top of the channel bore. See watertightness note on page 58 for more information.

ACO Qmax® edge rails

Making the right edge rail selection

ACO Qmax® edge rails are available in five different finishes, and are suitable for all channel sizes.

To summarise the available options, the product selector below displays key features for each of the different profiles and finishes available.

AVAILABILITY



AVAILABLE



NOT AVAILABLE

	Q-Flow Ductile Iron	Q-Guard Ductile Iron
		
FINISH	Ductile iron	Ductile iron
ATEC COATED*	✓	✓
LOAD CLASS	A 15 to F 900	A 15 to F 900
TYPICAL APPLICATIONS	Commercial, industrial, highways, docks and airports	Car parking, petrol forecourts, retail, commercial and airports
PAVEMENT TYPE	Concrete and asphalt	Concrete and asphalt
SLOT WIDTH	26mm	8mm twin slot
INTAKE AREA	18800mm ² /m	10900mm ² /m
CHEMICAL RESISTANT	Effluents, oils, petrol, diesel, road salts and de-icing agents	Effluents, oils, petrol, diesel, road salts and de-icing agents
RAIL PROTECTOR	Edge protectors available	Edge protectors available

	Q-Flow Steel	Q-Guard Steel	Q-Slot Steel
			
FINISH	Hot dipped galvanised steel	Hot dipped galvanised steel	Hot dipped galvanised steel
ATEC COATED*	✗	✗	✗
LOAD CLASS	A 15 to F 900	A 15 to F 900	A 15 to D 400
TYPICAL APPLICATIONS	Commercial, industrial, highways, docks and airports	Car parking, petrol forecourts, retail, commercial and airports	Landscaping, town centres, car parking, retail and commercial applications
PAVEMENT TYPE	Concrete	Concrete and asphalt	Block, slab and natural stone (designed for paving material up to 100mm thick)
SLOT WIDTH	26mm	10mm	10mm discreet slot
INTAKE AREA	18106mm ² /m	8356mm ² /m	10000mm ² /m
CHEMICAL RESISTANT	Effluents, oils, petrol, diesel and road salts	Effluents, oils, petrol, diesel and road salts	Effluents, oils, petrol, diesel, road salts and de-icing agents
RAIL PROTECTOR	Supplied with channel	Supplied with channel	N/A

*Long lasting corrosion protection

ACO Qmax® components

End caps

Three types of end caps are available:

1. A multifunctional (closing/outlet/inlet) end cap for ACO Qmax® 150, 225 and 350 systems
2. A closing end cap for ACO Qmax® 550, 700 and 900 systems
3. A blanking end cap to suit cut channel for ACO Qmax® 550, 700 and 900 systems

Functions and features are included in the relevant product chapters.



Multifunctional end cap for 150, 225 and 350 systems



Step connector for 150 to 225 & 225 to 350 systems



Chamber connector for 550, 700 & 900 systems



Closing end cap for 550, 700 and 900 systems



Step connector for 500 to 700 & 700 to 900 systems



Blanking end cap for 550, 700 and 900 systems

Step connectors

Four step connectors are available to provide connection between:

1. ACO Qmax® 150 to 225 systems
2. ACO Qmax® 225 to 350 systems
3. ACO Qmax® 550 to 700 systems
4. ACO Qmax® 700 to 900 systems

Functions and features are included in the relevant product chapters.

Chamber connectors

Three chamber connectors are available for:

1. ACO Qmax® 550 system
2. ACO Qmax® 700 system
3. ACO Qmax® 900 system

Functions and features are included in the relevant product chapters.



Access chambers providing outlet/inlet connections and silt management are available for each size in the ACO Qmax® system. For more information see: ACO Qmax® 150, 225 & 350 chambers – page 32 and ACO Qmax® 550, 700 & 900 chambers – page 53.

ACO Qmax® project case studies

Since its launch, the many benefits of ACO Qmax® have helped architects, engineers and contractors realise some of the country's most ambitious, groundbreaking and high profile projects.

In differing applications with widely varying objectives, the ACO Water Management Design Services Team has played a key partnering role, ensuring each finished system not only met those objectives but added wider value.

The next two pages demonstrate how ACO Qmax® has provided efficient and cost effective high capacity drainage and attenuation across a diverse range of applications.



For more ACO Water Management case studies visit www.aco.co.uk.

Project requirement: Minimal disruption **Belfast International Airport Refurbishment**

Client:

Abertis Airports

Design engineer:

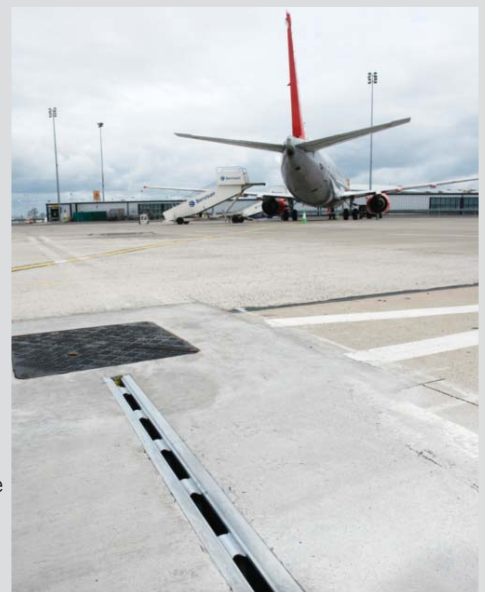
Doran Consulting

Contractor:

Whitemountain



Keeping disruption to a minimum was essential as Belfast International Airport undertook a major extension and refurbishment of its aircraft handling aprons. ACO Water Management's Design Services conducted trials that proved to the Belfast team that ACO Qmax® set in a polycarbonate fibre reinforced concrete mix would not only meet the specified cure time but also deliver Load Class F900 performance. All four sizes of ACO Qmax® have been installed across the project forming the principal part of a wider SuDS system handling surface water from all the areas of hardstanding.



Project requirement: Value and Versatility **ProLogis Distribution Warehouse, North Kettering Business Park**

Architect:

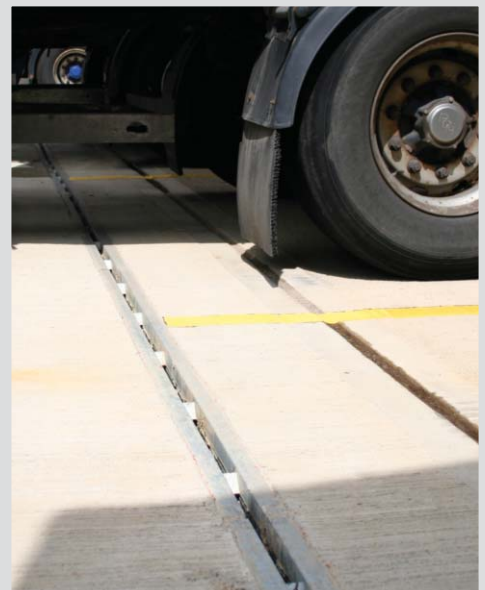
Stephen George & Partners

Contractor:

Winvic



The transformation of the former quarry site into five state-of-the-art logistics centres ranging from 50,000 to 700,000 sq ft required extensive earthworks and remediation before superstructure works could commence. By exploiting the handling and Value Engineering benefits of Qmax, Winvic were able to complete the critical groundworks phases within extremely tight schedules, using the Load Class versatility of Qmax® to provide surface water management in all the trafficked areas including trailer handling yards, access roads and car parks.



Designing the scheme

ACO has been a pioneer of 'Value Engineering' – a revolutionary approach to design and construction.

Through ACO Water Management's Design Services Team, any proposal can be Value Engineered to identify how its performance can be optimised with minimal use of materials. Powerful CAD systems produce full hydraulic calculations and installation schedules that enable all on-site work to be

completed efficiently. It is a unique, comprehensive service that is provided free of charge.

ACO Qmax® has played a key role in realising the benefits of Value Engineering. Its high carrying capacity, ability to attenuate stormwater flows, ease of installation, and design versatility allow extensive conventional drainage networks to be greatly simplified, significantly reducing installation and whole lifetime costs.

ACO Water Management Design Services Team

Telephone: 01462 816666
Fax: 01462 851081
e-mail: technical@aco.co.uk

Project requirement: Total SuDS solution Newcastle Recycling Centre

Client:

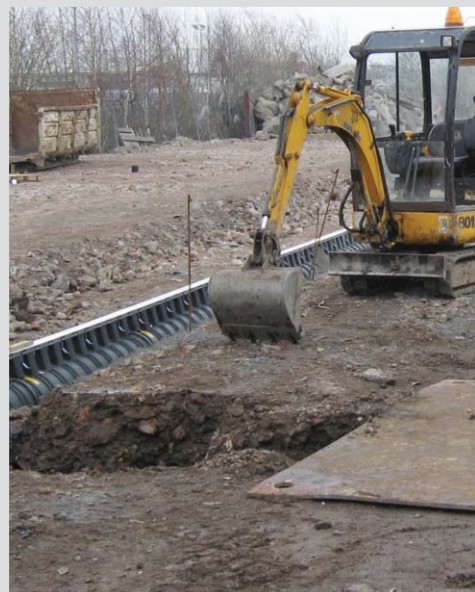
J & J Stanley Ltd

Engineer:

G & B Civil Engineering



The refurbishment of J & J Stanley's recycling centre has benefited from a SuDS scheme created using products from every process within ACO's System Chain - Collect, Clean, Hold, Release. By integrating the high attenuating capacity of ACO Qmax® with an ACO Q-Ceptor, StormTank and a Q-Brake Vortex, the scheme's overall performance has been designed to balance the operating conditions of the facility with the discharge limits for the site – a Value Engineering exercise that has reduced total cost and installation time and minimised ongoing maintenance requirements.



Project requirement: Self contained SuDS Mansfield Brick Manufacturing Facility

Client:

Mansfield Brick

Engineer:

MHI Fellows Hallat

Contractor:

RG Carter



All run-off generated from the new eight acres of hardstanding created for Mansfield Brick's new manufacturing facility is collected, cleaned and returned safely to ground within the curtilage of the site. Meeting the project planning requirements, no connection to the main sewer network has been made. By utilising the high attenuating capacity of over 1000 metres of ACO Qmax®, consulting engineers MHI were able to avoid having to provide additional underground stormwater storage – a benefit that greatly simplified the overall design and significantly reduced installation time and costs.



ACO Qmax® system overview

Making the right product selection

ACO Qmax® is available in six channel sizes: 150, 225, 350, 550, 700 and 900.

To summarise the available options, the product selector below displays key features for each of the profiles and unit depths available.

Once product selection has been made based on the features required, the table will direct you to the appropriate page.

ACO Qmax® is:

- ▶ Available in six channel sizes
- ▶ Supplied in 2m lengths
- ▶ Manufactured from tough, highly corrosion resistant PE
- ▶ CE marked and fully certified to BS EN 1433:2002, A 15 – F 900



	ACO Qmax® 150	ACO Qmax® 225	ACO Qmax® 350
	See page 15	See page 21	See page 27
UNIT SIZE	150	225	350
HYDRAULIC CAPACITY			
CATCHMENT AREA	390m ² *	1500m ² *	5200m ² *
ATTENUATION CAPACITY	0.0177m ³ /m	0.0398m ³ /m	0.0962m ³ /m
ACCESS/OUTLET/INLET/ SILT CHAMBERS	✓	✓	✓
Q-SLOT ACCESS CHAMBER, COVER AND FRAME	✓	✓	✓
	ACO Qmax® 550	ACO Qmax® 700	ACO Qmax® 900
	See page 35	See page 41	See page 47
UNIT SIZE	550	700	900
HYDRAULIC CAPACITY			
CATCHMENT AREA	8400m ² *	16600m ² *	31700m ² *
ATTENUATION CAPACITY	0.1544m ³ /m	0.2501m ³ /m	0.4135m ³ /m
ACCESS/SILT CHAMBER	✓	✓	✓
Q-SLOT COVER AND FRAME	✗	✗	✗
CATCHMENT AREA *EXAMPLE RUN BASED ON 100m LENGTH LAID LEVEL AT 50mm/hr RAINFALL AVAILABILITY AVAILABLE NOT AVAILABLE HYDRAULIC CAPACITY LOW MEDIUM HIGH			

ACO Qmax® 150



ACO Qmax® 150

ACO Qmax® 150



The ACO Qmax® 150 channel is manufactured from recycled PE which is lightweight, chemically resistant and extremely robust. Its circular bore, sealed push fit channel connections and unique patented inlet design ensure drainage inverts are kept to a minimum, installation rates are maximised and the product is fully integrated within the pavement detail providing long term dependable performance.

ACO Qmax® 150 channels are available with the following components:

- Outlet and closing end cap
- Qmax® 150-225 step connector
- Access, outlet / inlet and silt chambers
- Installation edge rail protectors
- Q-Brake Vortex flow controls

150

Unit size



Hydraulic capacity

390m²*

Catchment area

0.0177m³/m

Attenuation capacity



Access/outlet/inlet/
silt chambers



Q-Slot access
chamber, cover
and frame

*Example run based on 100m length
laid level at 50mm/hr

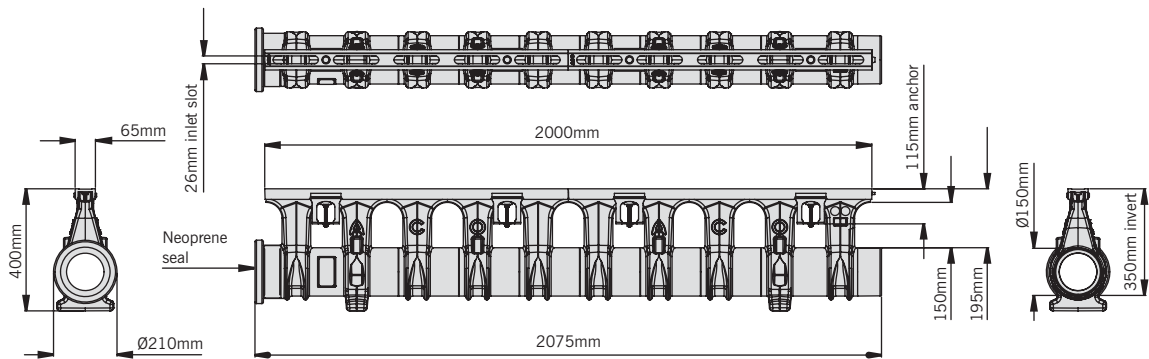
15



ACO Qmax® 150

ACO Qmax® 150 with ACO Q-Flow ductile iron edge rail

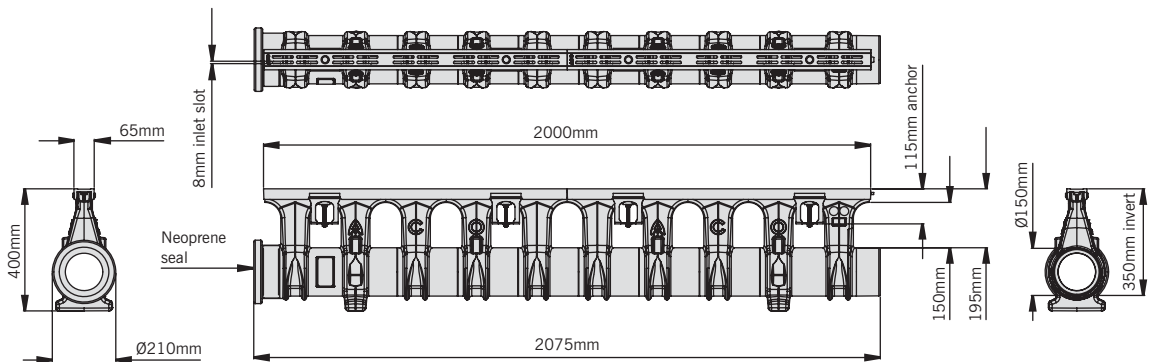
Product code	Description	Length (mm)	Width overall (mm)	Depth overall (mm)	Slot width (mm)	Weight (kg)
32990	ACO Qmax® 150 channel assembly complete with ACO Q-Flow ductile iron edge rail	2000	Ø210	400	26	22



ACO Qmax® 150 with ACO Q-Flow ductile iron edge rail

ACO Qmax® 150 with ACO Q-Guard ductile iron edge rail

Product code	Description	Length (mm)	Width overall (mm)	Depth overall (mm)	Slot width (mm)	Weight (kg)
32991	ACO Qmax® 150 channel assembly complete with ACO Q-Guard ductile iron edge rail	2000	Ø210	400	2 x 8	23



ACO Qmax® 150 with ACO Q-Guard ductile iron edge rail

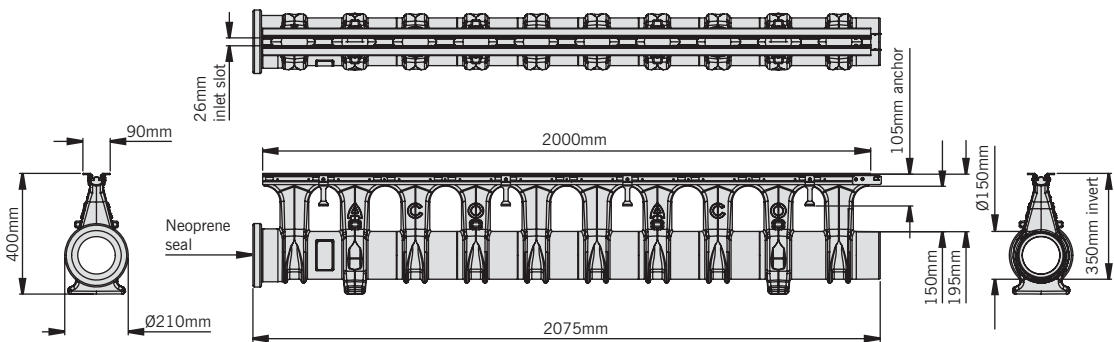
Note: For details regarding the access/outlet/inlet/silt chambers for use with this system please refer to page 32.

These products are subject to weight and dimensional tolerances. The dimensions shown on this page are for guidance purposes only.

ACO Qmax® 150

ACO Qmax® 150 with ACO Q-Flow galvanised steel edge rail

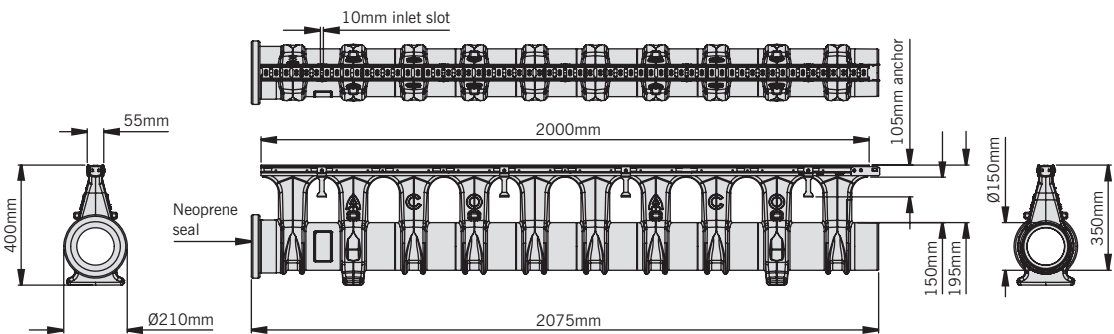
Product code	Description	Length (mm)	Width overall (mm)	Depth overall (mm)	Slot width (mm)	Weight (kg)
32992	ACO Qmax® 150 channel assembly complete with ACO Q-Flow galvanised steel edge rail	2000	Ø210	400	26	12



ACO Qmax® 150 with ACO Q-Flow galvanised steel edge rail

ACO Qmax® 150 with ACO Q-Guard galvanised steel edge rail

Product code	Description	Length (mm)	Width overall (mm)	Depth overall (mm)	Slot width (mm)	Weight (kg)
32993	ACO Qmax® 150 channel assembly complete with ACO Q-Guard galvanised steel edge rail	2000	Ø210	400	10	12



ACO Qmax® 150 with ACO Q-Guard galvanised steel edge rail

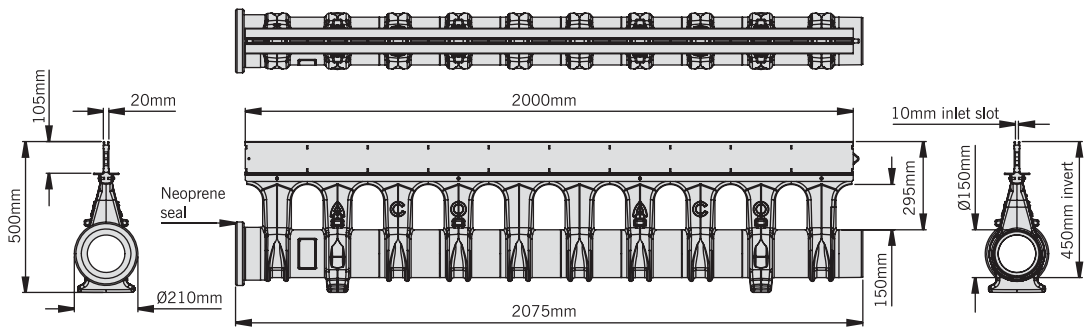
Note: For details regarding the access/outlet/inlet/silt chambers for use with this system please refer to page 32.

These products are subject to weight and dimensional tolerances. The dimensions shown on this page are for guidance purposes only.

ACO Qmax® 150

ACO Qmax® 150 with ACO Q-Slot galvanised steel edge rail

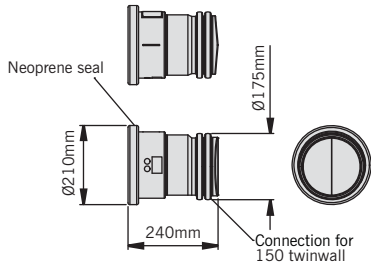
Product code	Description	Length (mm)	Width overall (mm)	Depth overall (mm)	Slot width (mm)	Weight (kg)
32994	ACO Qmax® 150 channel assembly complete with ACO Q-Slot galvanised steel edge rail	2000	Ø210	500	10	20.5



ACO Qmax® 150 with ACO Q-Slot galvanised steel edge rail

ACO Qmax® 150 multifunctional end cap (closing/outlet/inlet)

Product code	Description	Length (mm)	Width overall (mm)	Depth overall (mm)	Slot width (mm)	Weight (kg)
32997	ACO Qmax® 150 universal endcap assembly	240	Ø210	-	-	1



ACO Qmax® 150 universal endcap

ACO Qmax® 150 multifunctional end cap has the following functions:

- ▶ Male and female closing end cap
- ▶ Male and female inlet/outlet end cap for connection to Ø150mm twinwall pipe
- ▶ Simple fitting

Installation instructions supplied

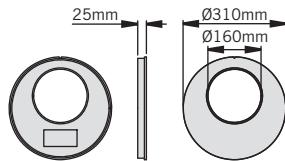
Note: For details regarding the access/outlet/inlet/silt chambers for use with this system please refer to page 32.

These products are subject to weight and dimensional tolerances. The dimensions shown on this page are for guidance purposes only.

ACO Qmax® 150

ACO Qmax® 150 to 225 step connector

Product code	Description	Length (mm)	Width overall (mm)	Depth overall (mm)	Slot width (mm)	Weight (kg)
32995	ACO Qmax® 150 to 225 step connector (M to F)	-	Ø310	25	-	0.4



ACO Qmax® 150 to 225 step connector

ACO Qmax® 150 to 225 step connector has the following functions:

- ▶ Enables step fall installations of ACO Qmax® 150 and ACO Qmax® 225 channels
- ▶ For use between ACO Qmax® 150 male and ACO Qmax® 225 female channel connections
- ▶ Simple fitting

Installation instructions supplied

ACO Qmax® ductile iron edge rail protector

Product code	Description	Length (m)	Width overall (mm)	Depth overall (mm)	Weight (kg)
32854	ACO Qmax® ductile iron edge rail protector 15.25m roll	15.25	65	1.5	5.0

ACO Qmax® ductile iron edge rail protector has the following functions:

- ▶ Used to cover and protect rails from debris during installation
- ▶ Simple fitting
- ▶ Can be reused

Note: For details regarding the access/outlet/inlet/silt chambers for use with this system please refer to page 32.

These products are subject to weight and dimensional tolerances. The dimensions shown on this page are for guidance purposes only.

ACO Qmax® 150 hydraulic performance tables

Hydraulic capacities

The table opposite shows the maximum capacity of the unit, assuming uniform lateral inflow. The capacity will depend on the length of unit to the outlet and on any slope along the unit.

Q (l/s) is the maximum total flow that the channel can carry.

q (l/s/m) is the maximum possible lateral inflow.

A (m²) is the maximum area that can be drained and will depend on the design rainfall intensity chosen. The tabulated areas are for a rainfall intensity of 50mm/h (0.014 l/s/m²).

At other rainfall intensities, the area can be determined by proportion, e.g. at 75mm/h, the maximum area drained will be the tabulated area x 50/75.

ACO Qmax® 150 channels

Slope	0%			0.5%			1%		
Length to Outlet (m)	Q (l/s)	q (l/s/m)	A (m ²)	Q (l/s)	q (l/s/m)	A (m ²)	Q (l/s)	q (l/s/m)	A (m ²)
10	8.1	0.81	580	11.3	1.13	813	13.5	1.35	970
25	7.3	0.29	526	12.9	0.52	927	16.2	0.65	1166
50	6.5	0.13	467	14.1	0.28	1014	18.2	0.36	1309
100	5.5	0.05	393	15.0	0.15	1080	19.0	0.19	1370
150	4.8	0.03	346	15.4	0.10	1109	19.0	0.13	1370
200	4.3	0.02	313	15.6	0.08	1124	19.0	0.10	1370

ACO Water Management Design Services Team

Please contact the ACO Water Management Design Services Team on 01462 816666 for advice on channels with non-uniform inflow, or channels receiving point inflows at the end or at intermediate locations. The ACO Water Management Design Services Team will be pleased to assist with any technical queries, scheme designs or parts schedules.

Designing a drainage system

An example design method is provided on page 56 to help determine your drainage requirements.

This example will enable you to use the hydraulic performance tables on this page.