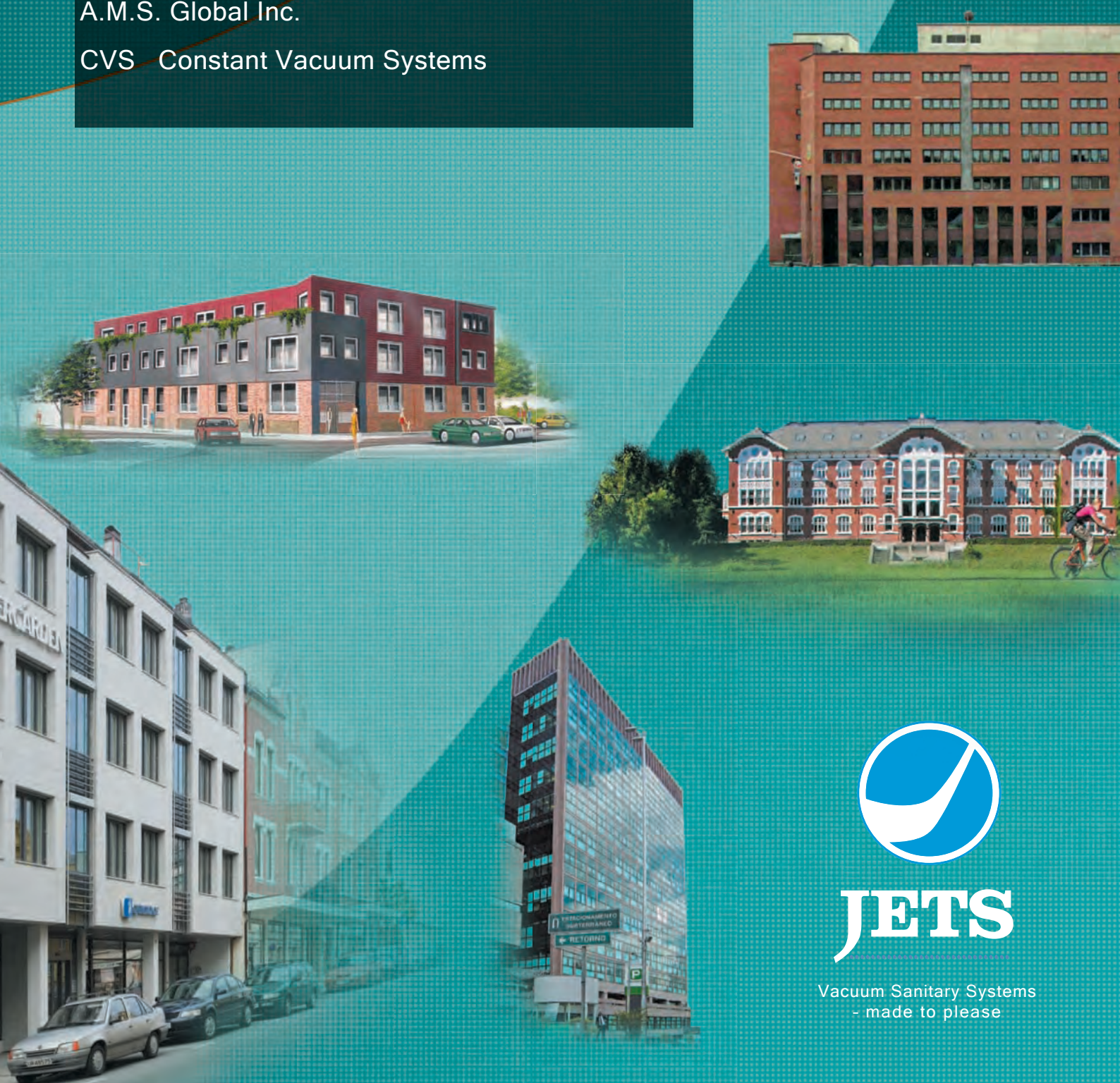
# Instruction Manual

## Jets Vacuum Sanitary System

A.M.S. Global Inc.

CVS Constant Vacuum Systems



JETS

Vacuum Sanitary Systems
- made to please

# Content

## INSTALLATION

# Content

# Storage & Maintenance Instruction





## For Jets vacuumarators, vacuum units, toilets and related equipment

### Storage:

a) Storage before installation:

Goods to be stored in a tempered and dry place.

b) From installation, up to setting to work:

Goods to be protected against dust, grinding, welding and moisture.

c) From setting to work up to customer:

As for b), especially to be protected against moisture.

### Maintenance Instruction during storage:

Environmental conditions: Goods to be stored indoor at a dry place.

Visual inspections: Check for visual damage.

Inspection intervals: Upon arrival and before installation.

Maintenance: Not required.

Maintenance Intervals: Not required.

Tools: Not required.

Note: Changes without prior notice



Myravegen 1, N-6060 Hareid, Norway. Tel. + 47 70 03 91 00. Fax + 47 70 03 91 01. E-mail: post@jets.no

# Installation Jets™ Vacuumarator™ pump





## Vacuum unit

When designing the installation of the vacuum unit, it is important to provide sufficient space for inspection and maintenance. Install shut-off valves (included in Jets™ supply) according to piping diagram. Each pump is supplied with vibration dampers. Flexible joints (included in Jets™ supply) must be used when connecting the pump`s suction and pressure side.

The pump must be located to avoid head loss on outlet pipe. Height of outlet pipe should be kept at a minimum, preferably less than 2 meters, because increased height of outlet pipe will reduce vacuum capacity of pump.
If increased height is needed, please contact Jets™ Vacuum Technical Department.

**Please notice:**
For pump Jets™15M/15MB and Jets™15MB-D:
To keep sufficient priming of the pump, outlet pipe should be at least 1 m long in vertical direction.

## Rotation of the Jets™ Vacuumarator™ pump

The correct rotation is indicated with an arrow on the pump housing. The rotation of the pump is always clockwise seen from the motor fan end.
Prior to checking the rotation, make sure that the pump is filled with liquid.
Starting up the pumps without liquid will damage the shaft seals.

## Sewage treatment plant

If connected to a sewage treatment plant, the discharge pipe(s) from the pump(s) is connected to the plant. See SewageTreatment Plant Instruction Manual.

## Integrated holding tank

Connected to an integrated holding tank, connections for pumps must be made according to Technical Manual.
Level switches for control of discharge pump(s) must be installed according to drawing in Technical Manual.

## Fresh water supply

Fresh water supply may be connected to the suction chamber on each pump to flush and clean when neccessary and to fill the pump with water after service.

How to fill water into the pump:
Unscrew plug* on side of suction chamber**, one of the plugs. Fill fresh water through the plug hole up to plug hole level. Level may be controlled by looking through the suction chamber cover ***. Refit plug.

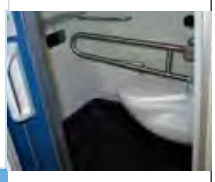
| Jets™ Vacuumarator™ | Dwg** | Plug No* | Cover No*** |
|---|---|---|---|
| Jets 15MB-D | 31739-029 | 020202900 | 029150310 |
| Jets 25MBA | 31781-023 | 020202900 | 023280000 |
| Jets 65MBA | 32020-02A | 020202900 | 023280050 |
| | 33126-02D | 020202900 | 02D220010 |

**A Jets™ Vacuumarator™ pump must never be started or operated without sufficient pre-filling of water in Suction Chamber**

Note: Changes without prior notice

# VTS - controller

## CVS



STANDARD

JETS®

JETS STANDARD AS

# VTS - controller



## VTS-controller

*The VTS-controller is the controller in the vacuum system with function as:*
Automatic start / stop Vacuumarator
Manual start / stop Vacuumarator
Vacuumlevel monitoring
Stop max runtime
Level sensor in collecting tank
Automatic stop when discharging collecting tank
Alarm signal with system failure

It is possible to connect level switch from the collecting tank for high and low level to the VTS-controller.
It is possible to connect a external alarm to the VTS-controller.

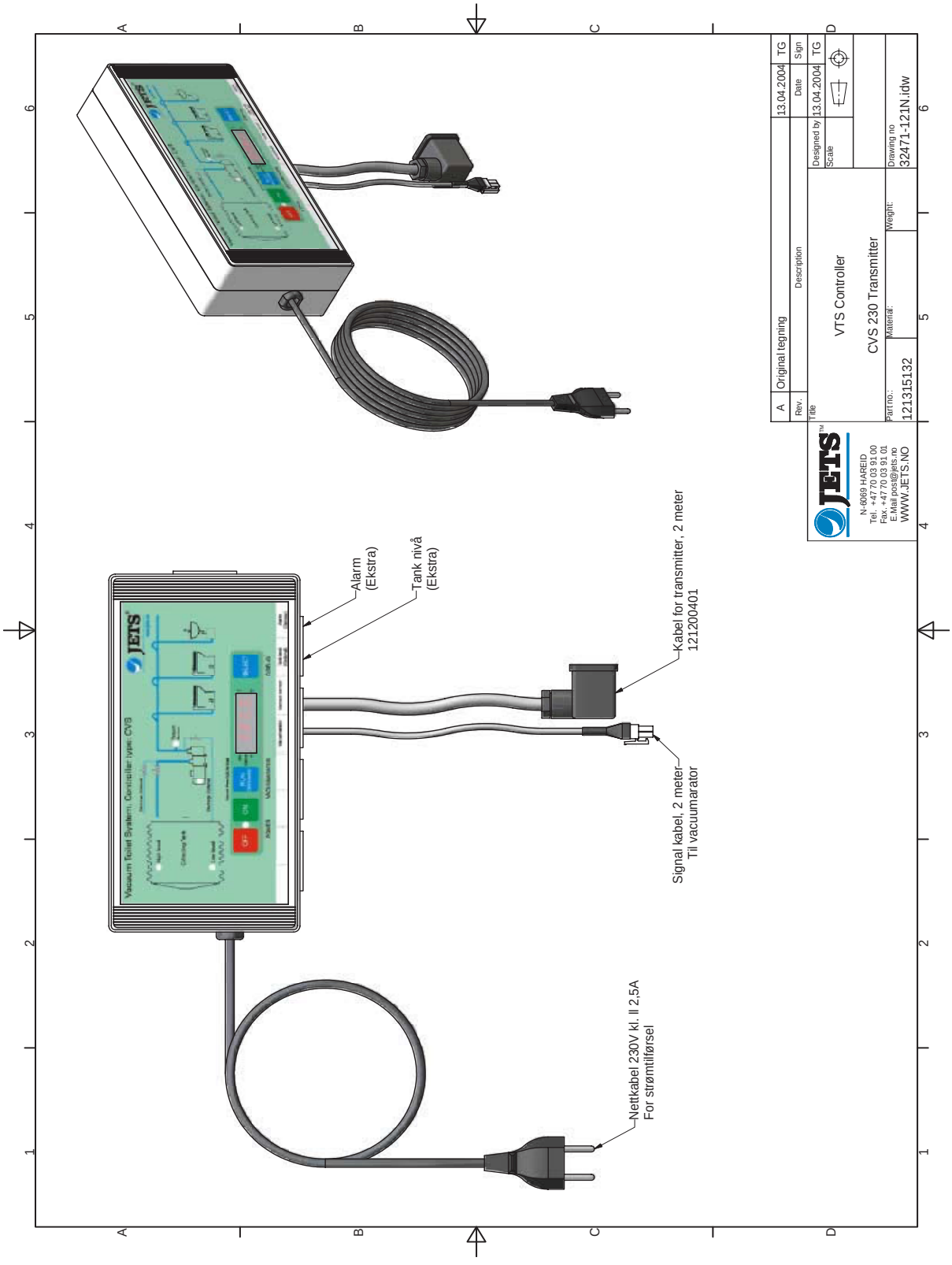
The VTS-controller is factory-programmed with standard setting (see setting)

Part no. 230 VAC: 121 3151 32
Overall dimensions: 240 x 120 x 60 m m (l x w x h)

## Content

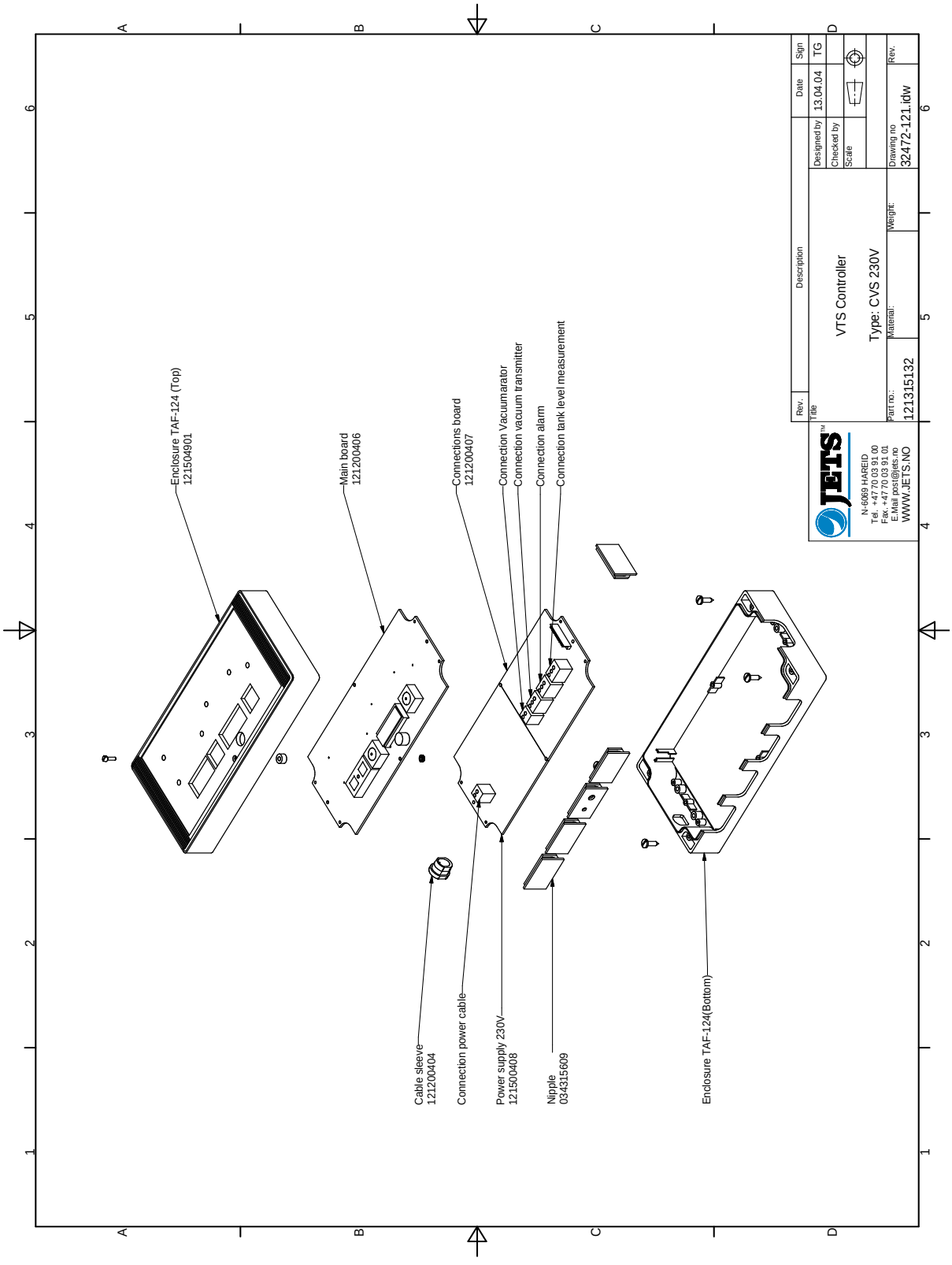
# VTS - controller





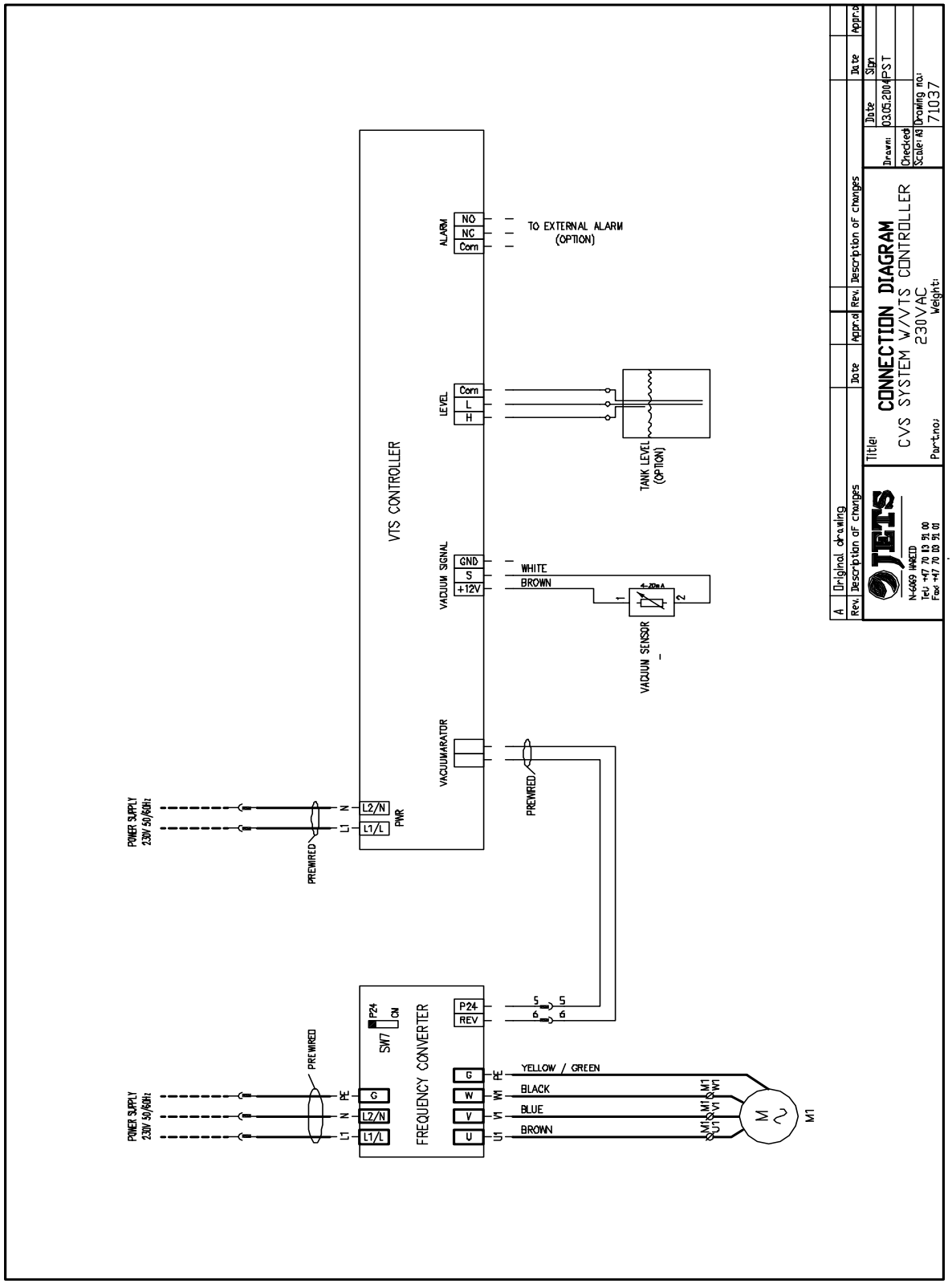
# Component overview





# Connection diagram

5

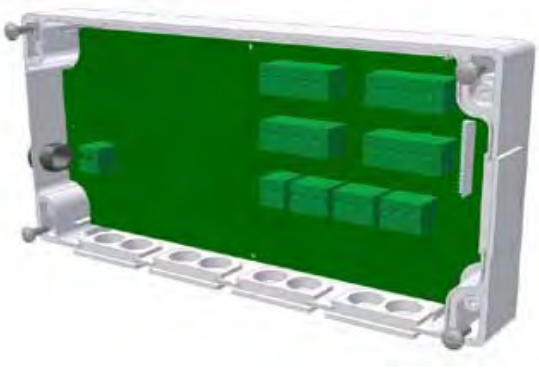


# Mounting - VTS-controller

6

PS!
In order to avoid electric shock, pull out the electric contact. Do not reconnect it until the VTS- controller is assembled!

Use a screwdriver to remove the two small strips on the top of the panel to get accsess to the four lock screws. Remove these.

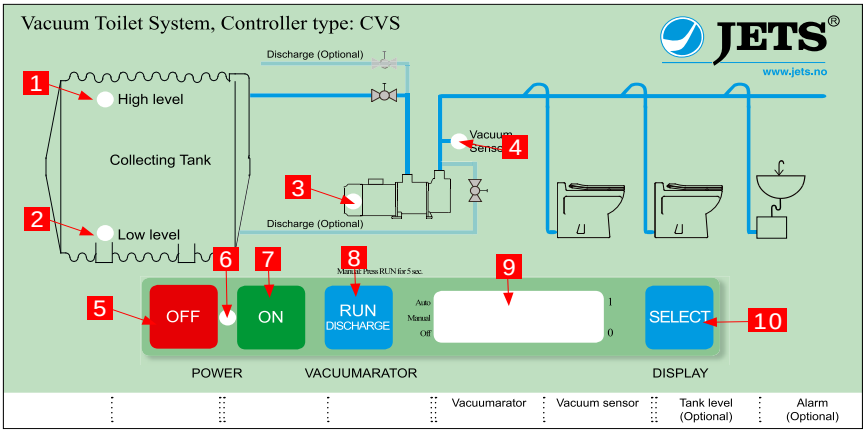


Lift off the lid to accsess the holes in the bottom of the panel. Screw the panel securely to the wall, replace the lid and tighten the screws.

# Electronic control



When a vacuum transmitter is connected to the VTS-controller, the transmitter will be automatic detected when the controller is switched on. The function and menu will then be for CVS 1.
If no transmitter is connected to the controller the function and menu will be for CVS 2:




1. Indicator high level
2. Indicator low level
3. Indicator Vacuumarator
4. Indicator Vacuum level
5. Off button
6. Indicator Power on
7. On button
8. Manual operation Vacuumarator
9. Display
10. Display selector

*The automatic start and stop of the Vacuumarator is controlled by the VTS-controller.*

**If the default setting can be used, the system is ready for immediate use.**

*Default setting is based on:*
*a. The Vacuumarator is set to start at 40% vacuum, and stop at 60% vacuum*
*b. Max runtime for the Vacuumarator is 40min.*

## Use and operation:

Press 

to switch on the controller.
All indicator lights will light up for 3 sec.
In the display the information *JETS will appear, follow up by CVS1, and then the software version (ex. v1.1)*
*Simultaneously the alarm will run for 2 sec.*
*The system is now ready for use. The Vacuumarator will start in auto mode, and the display will show the current vacuum level*

Press 

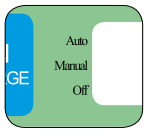
to switch off the controller.
This must always be done before installation, maintenance or repair.

To run the Vacuumarator manually, press 

for 5 sec.
The Vacuumarator vill then run continuously

To stop the Vacuumarator, press 

once more
To the left in the display a sign will indicate in which mode the controller is.



# Electronic control



## Settings menu:

Press SELECT and RUN DISCHARGE simultaneously to activate or deactivate the menu. New settings can be saved by going to the next menu, press SELECT to exit the menu.

Press SELECT

Display: P 60 LED: Vacuum Sensor

Adjustment of vacuum level for stop Vacuumarator (10-95%)
Default setting: 60%
Values can be changed by pressing "RUN".

Press SELECT

Display: P 40 LED: Vacuum Sensor, High level, Collecting Tank, Low level

Adjustment of vacuum level for start Vacuumarator (5-30% below stop level)
Default setting: 20%
Values can be changed by pressing "RUN".

Press SELECT

## Mode select (Off / Manual / Auto):

Press ON to switch on the controller. The Vacuumarator will start running in Auto mode.

Press SELECT

Display: 42 LED: Vacuum Sensor

Auto mode (normal)
The Vacuumarator starts and stops based on set point.
To the left in the display an indicator will indicate Auto mode.
To the right in the display a status indicator will indicate "1" when the Vacuumarator runs.

Press SELECT

Display: 42 LED: Vacuum Sensor

Auto mode (normal)
The Vacuumarator starts and stops based on set point.
To the left in the display an indicator will indicate Auto mode.
To the right in the display a status indicator will indicate "0" when the Vacuumarator stops.

Press SELECT

Display: 42 LED: Vacuum Sensor

Off
The Vacuumarator can be stopped by pressing "RUN" once.
To the left in the display an indicator will indicate Off mode.
To the right in the display a status indicator will indicate "0" when the Vacuumarator stops.

Press SELECT

Display: 42 LED: Vacuum Sensor

Manual
The Vacuumarator will run continuously
To the left in the display an indicator will indicate Manual.
To the right in the display a status indicator will indicate "1" mode. Press "RUN" once to switch off Manual mode.

Press SELECT

# Electronc control - user menu



## History:

To display information on performance, press SELECT

*Display:* 34 *LED:*

The value in the display will show the total run time for the Vacuumarator
The example to the left shows that the Vacuumarator has run for 34 hours

*Press* SELECT

*Display:* 25 *LED:* High level, Collecting Tank

The value in the display shows the number of collection tank max. level warnings.NB! This value will only change if a level indicator is installed.
The example to the left shows that there has been 25 warnings in the system.

*Press* SELECT

## Operation failure (stop max runtime):

*Display:* _ 00 _ *LED:*

**Stop Vacuumarator**
The Vacuumarator has stopped.
Press "SELECT" to show the information in the display

*Press* SELECT

*Display:* ERR *LED:*

**Stop Vacuumarator (Max runtime)**
The Vacuumarator has stopped because "max runtime" (see setting)
The error may be leakage in the pipes/piping system
Switch OFF and turn ON the controller for Reset

*Press* SELECT

The history information will automatically switch off after one min.

# Electronic control - supervisor menu

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In supervisor menu it's possible to activate special function.

Press SELECT and RUN DISCHARGE simultaneously as the power is switched on to activate the menu.

New settings will automatically be saved by selecting next menu, or exit supervisor menu.

Switch OFF the controller to exit the supervisor menu.

*Press* SELECT

*Display:* S 4 0 *LED:*

Adjustment of max runtime, Vacuumarator (5 - 60 min.)
Default setting: 40 min.
Values can be changed by pressing "RUN".

*Press* SELECT

*Display:* S _ *LED:*

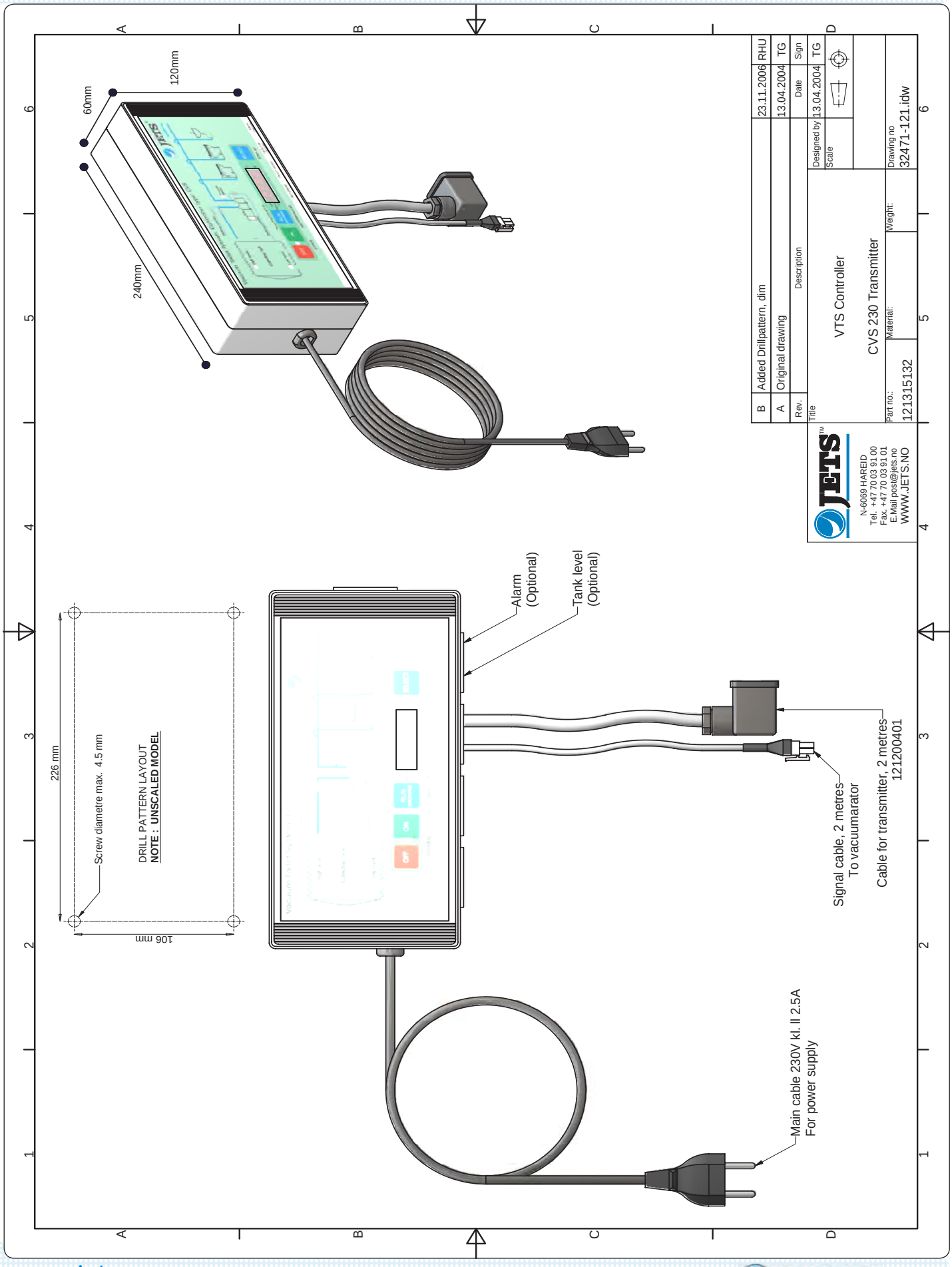
Change function for the manual run switch
Press the "RUN/DISCHARGE" to alter between impulse or on/off function with discharge mode.
(To use discharge mode, the low level switch must be activated).

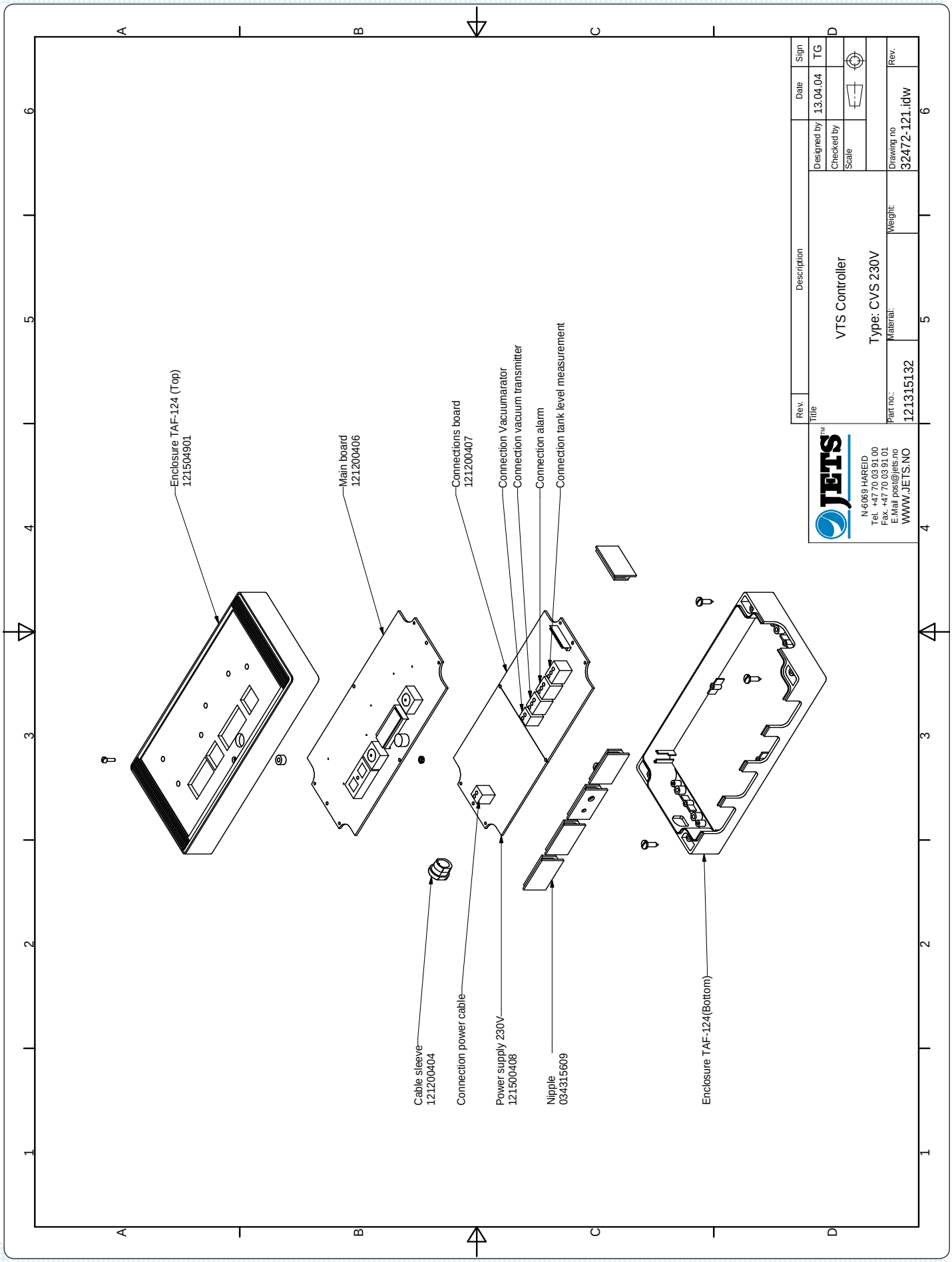
*Press* SELECT

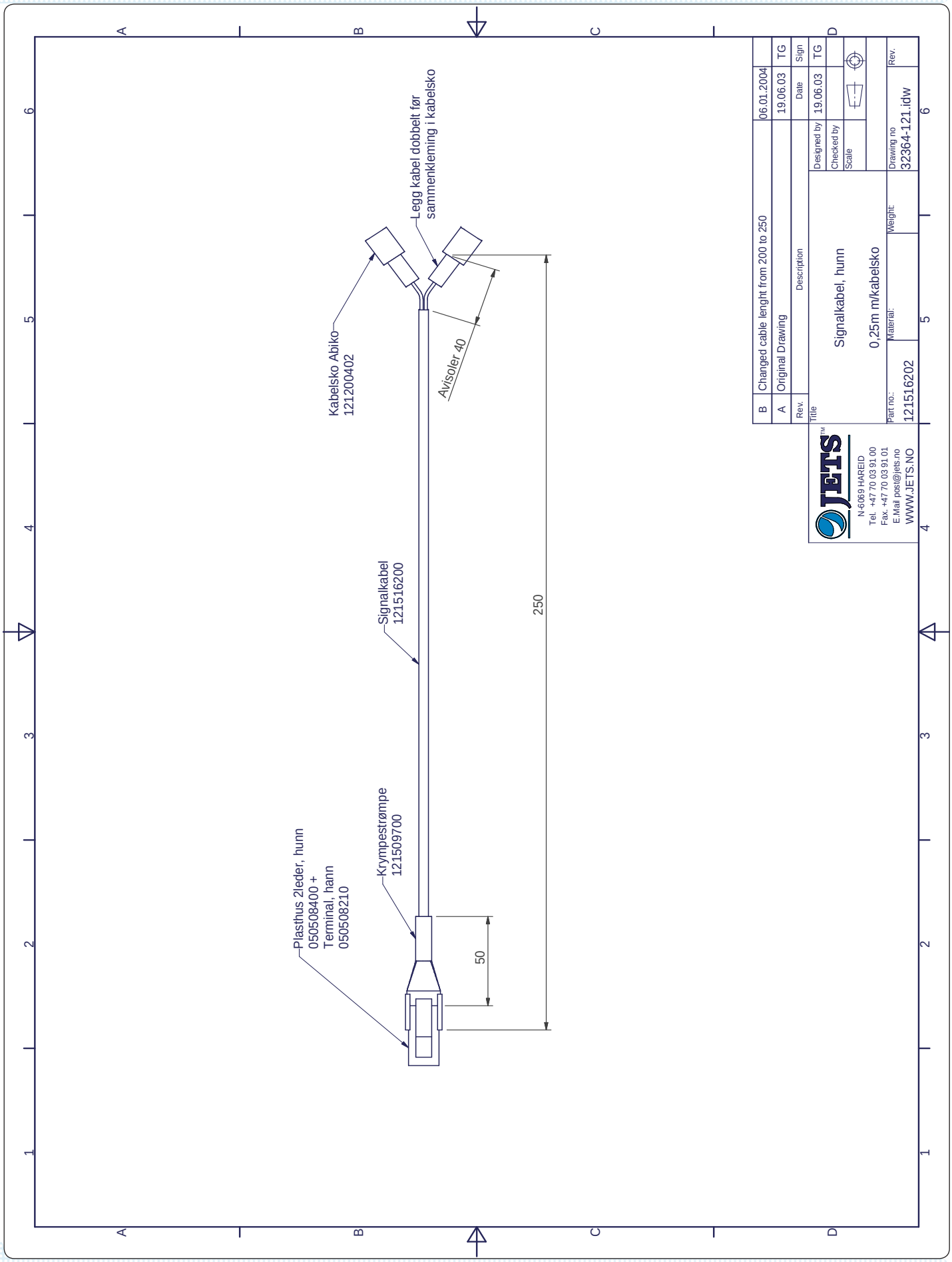
*Display:* S _ *LED:* Low level

Activate discharge mode (low level switch):
Press "RUN/DISCHARGE" to switch on/off the level switch

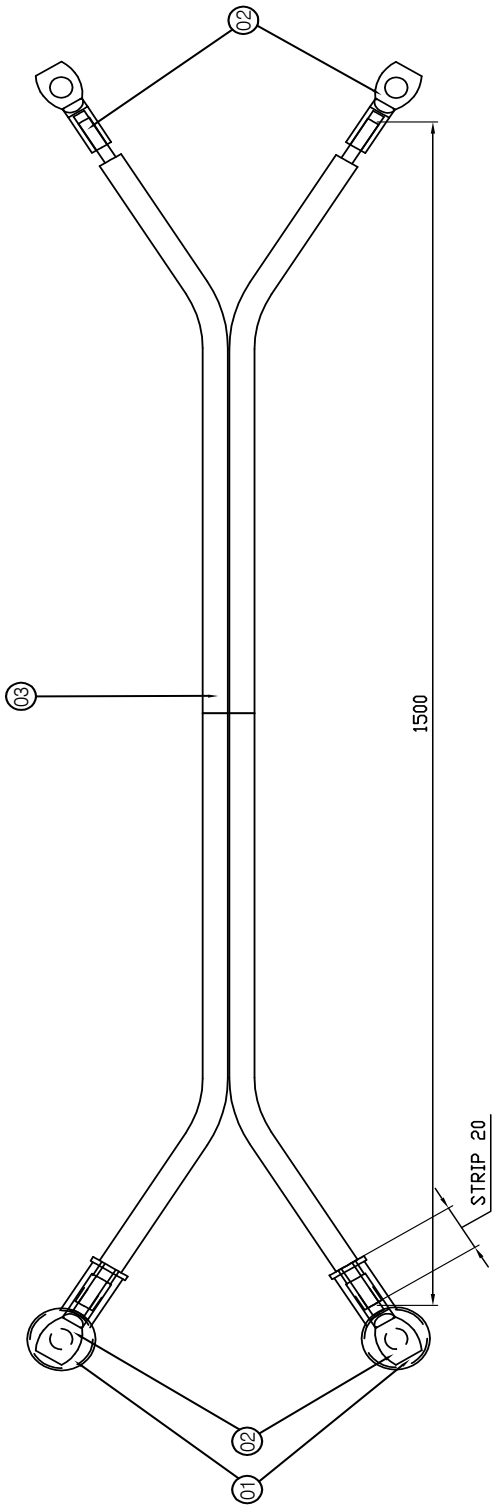
*Press* SELECT


60mm
120mm
240mm
B Added Drillpattern, dim 23.11.2006 RHU
A Original drawing 13.04.2004 TG
Rev. Description Date Sign
Designed by 13.04.2004 TG
Scale
Title
VTS Controller
CVS 230 Transmitter
Part no.: 121315132
Material:
Weight:
Drawing no 32471-121.idw
JETS
N-6069 HAREID
Tel. +47 70 03 91 00
Fax. +47 70 03 91 01
E.Mail post@jets.no
WWW.JETS.NO
DRILL PATTERN LAYOUT
NOTE : UNSCALED MODEL
226 mm
Screw diametre max. 4.5 mm
106 mm
Alarm (Optional)
Tank level (Optional)
Signal cable, 2 metres
To vacuumarator
Cable for transmitter, 2 metres
121200401
Main cable 230V kl. II 2.5A
For power supply


Enclosure TAF-124 (Top)
121504901
Main board
121200406
Connections board
121200407
Connection Vacuumarator
Connection vacuum transmitter
Connection alarm
Connection tank level measurement
Cable sleeve
121200404
Connection power cable
Power supply 230V
121500408
Nipple
034315609
Enclosure TAF-124(Bottom)
Rev.
Description
Date
Sign
Designed by
13.04.04
TG
Checked by
Scale
Title
VTS Controller
Type: CVS 230V
Part no.:
121315132
Material:
Weight:
Drawing no
32472-121.idw
Rev.
JETS
N-6069 HAREID
Tel. +47 70 03 91 00
Fax. +47 70 03 91 01
E.Mail post@jets.no
WWW.JETS.NO


Legg kabel dobbelt før sammenkleming i kabelsko
Kabelsko Abiko
121200402
Avisoler 40
Signalkabel
121516200
250
Krympestrømpe
12150970
Plasthus 2leder, hunn
050508400 +
Terminal, hann
050508210
50
B
Changed cable lenght from 200 to 250
06.01.2004
TG
A
Original Drawing
19.06.03
TG
Rev.
Description
Date
Sign
Designed by
19.06.03
TG
Checked by
Scale
Title
Signalkabel, hunn
0,25m m/kabelsko
Part no.:
121516202
Material:
Weight:
Drawing no
32364-121.idw
Rev.
JETS
N-6069 HAREID
Tel. +47 70 03 91 00
Fax. +47 70 03 91 01
E.Mail post@jets.no
WWW.JETS.NO

| POS | OBJECT | DESCRIPTION | PART NO. | QUA. |
|---|---|---|---|---|
| 01 | CABLE COVER | | 121516398 | 2 |
| 02 | CABLE EYE | 16mm2/8mm | 121200344 | 4 |
| 03 | POWER CABLE | 2x16mm2 | 121516400 | 1.5 |



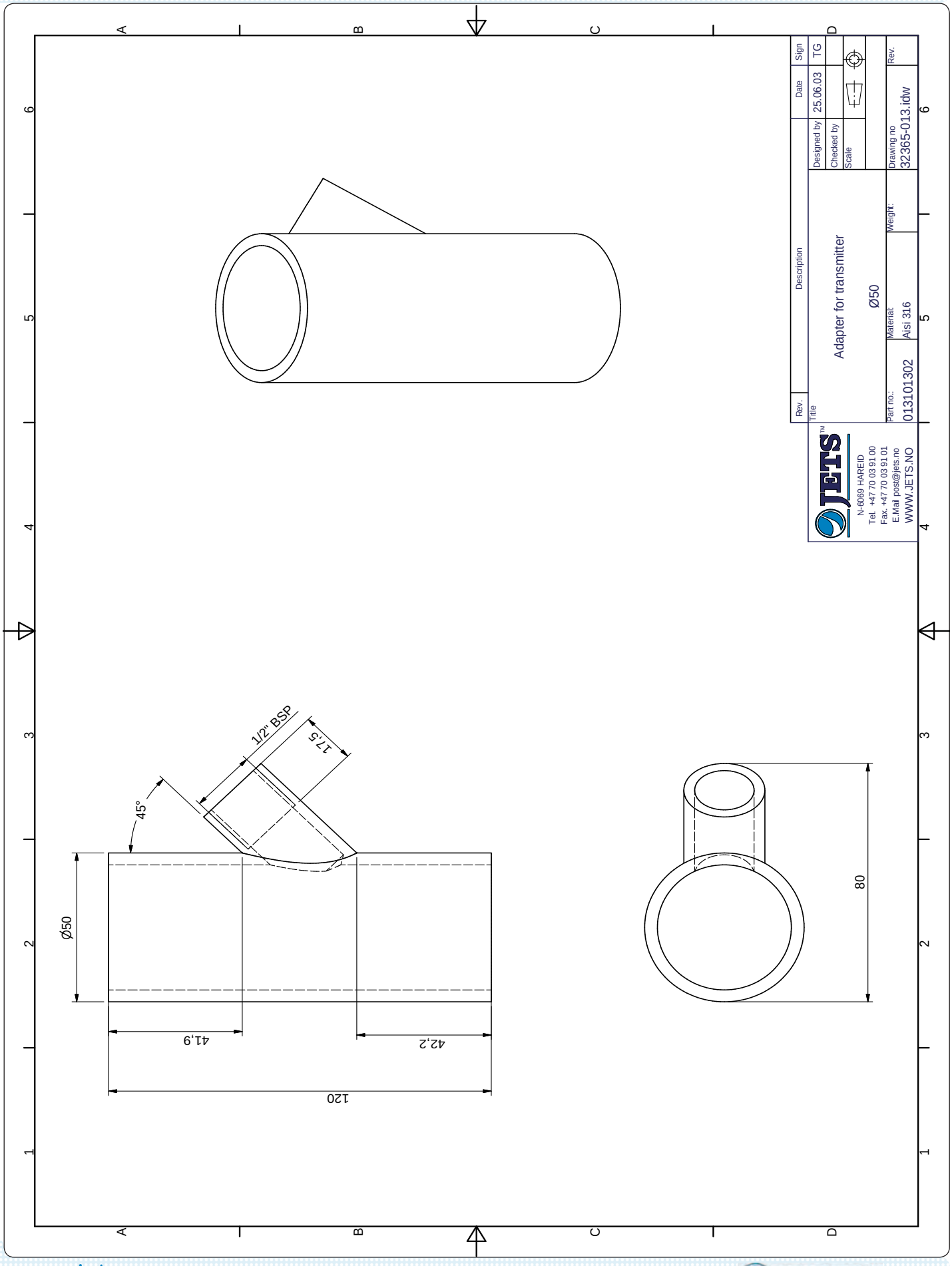

| Rev. | Description of changes | Date | Appr.d |
|---|---|---|---|
| A | Original drawing | 13.12.2001 | T.G. |
| C | REMOVED FUSE | 05.06.2003 | T.G. |
| B | ADDED FUSE | 21.06.2004 | T.G. |

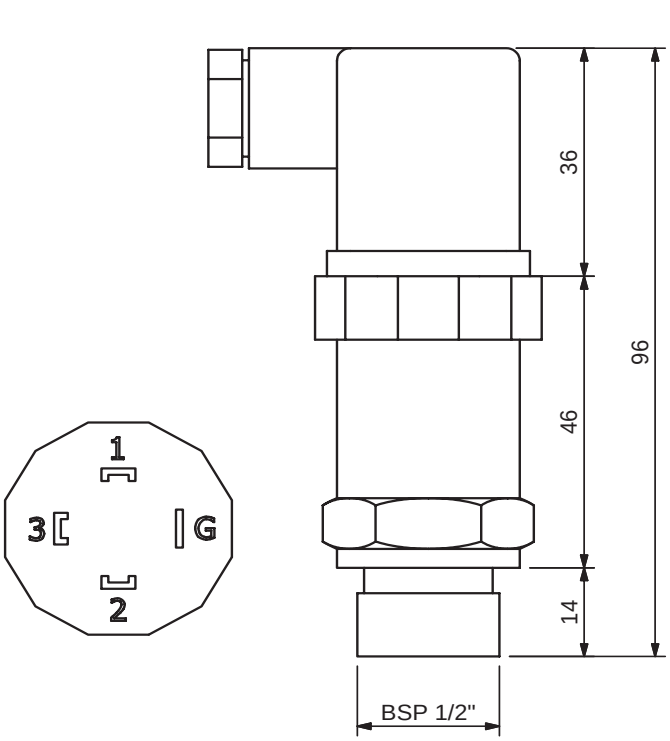
JETS
N-6069 HAREID
Tel.: +47 70 03 91 00
Fax: +47 70 03 91 01

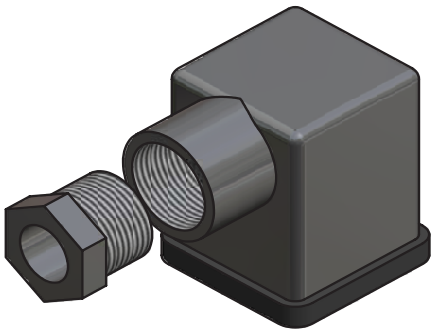
Title: POWER CABLE 1,5m

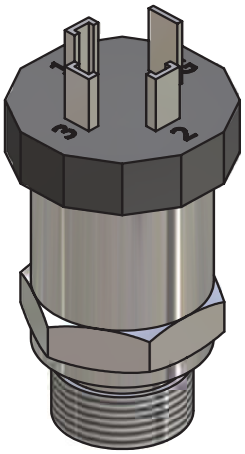
Part.no.: 121516401 Weight:

| Description of changes | Date | Sign |
|---|---|---|
| Drawn | 13.12.2001 | T.G. |
| Checked | | |
| Scale: A3 | Drawing no.: | 32080-121 |

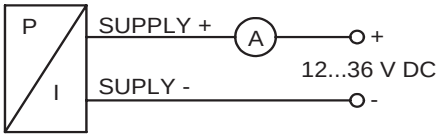

Description
Rev.
Sign
Date
Designed by
Checked by
Scale
TG
25.06.03
Rev.
Drawing no
32365-013.idw
Adapter for transmitter
Ø50
Weight:
Material:
Aisi 316
Part no.:
013101302
Title
JETS
N-6069 HAREID
Tel. +47 70 03 91 00
Fax. +47 70 03 91 01
E.Mail post@jets.no
WWW.JETS.NO
1/2" BSP
17,5
45°
Ø50
41,9
42,2
120
80



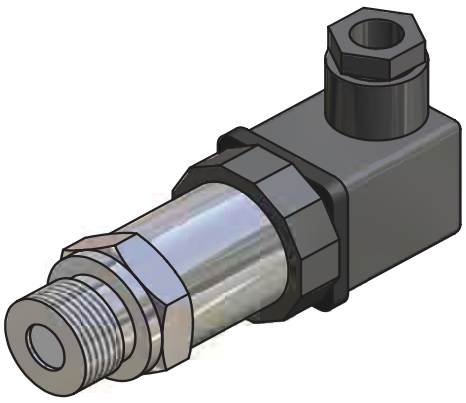






2 - Wire: 4-20mA




| | DIN 43650 | CABLE COLOR |
|---|---|---|
| SUPPLY+ | 1 | BROWN |
| SUPPLY- | 2 | WHITE |
| GROUND | GROUND PIN | YELLOW/GREEN |



| Rev. | Description | Date | Sign |
|---|---|---|---|
| B | Updated | 09.02.2005 | ER |
| A | Original drawing | 19.01.2004 | TG |

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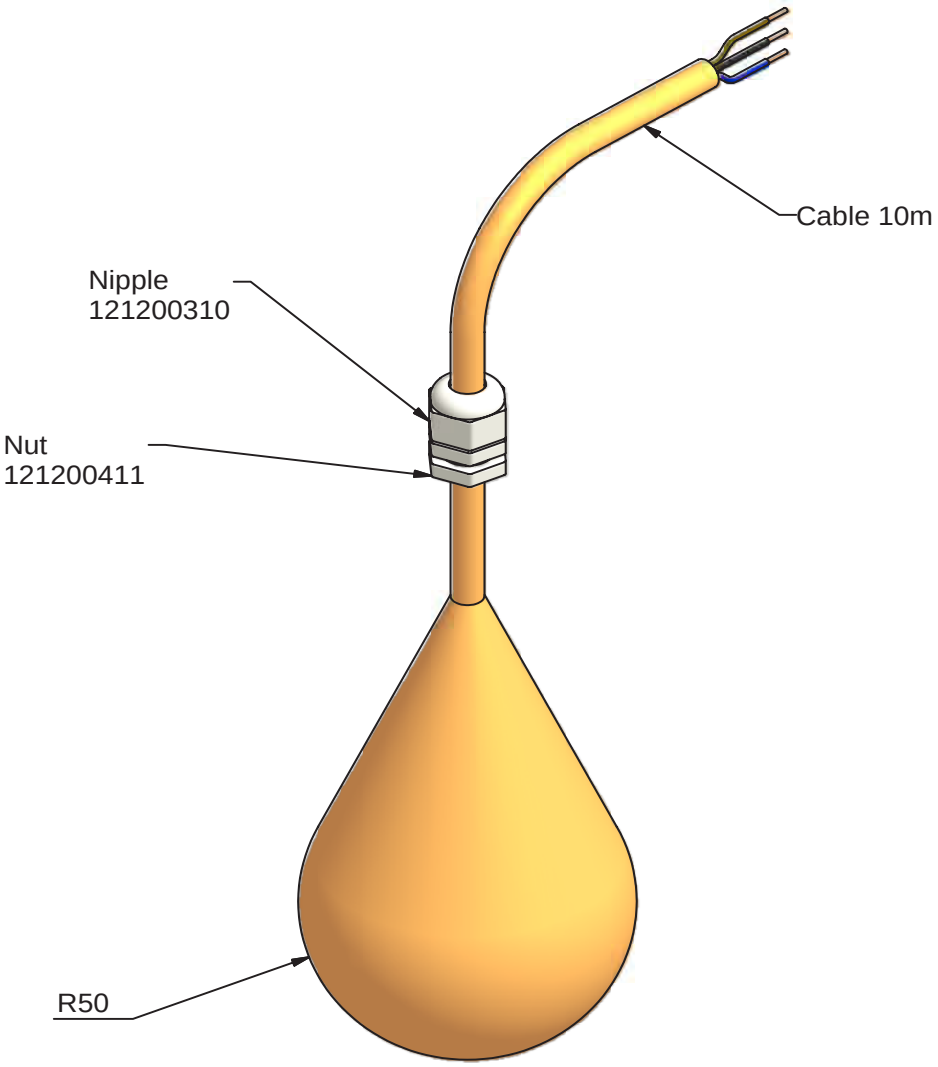
| | | | |
|---|---|---|---|
| Title: Vacuumtransmitter DMK 331<br>2 - Wire: 4-20mA CVS | | | Designed by: 19.01.2004 TG<br>Scale: |
| Part no.: 032318571 | Material: | Weight: | Drawing no: 41824-032.idw |




| Rev. | Description | Date | Sign |
|---|---|---|---|
| A | Original Drawing | 03.02.2004 | TG |

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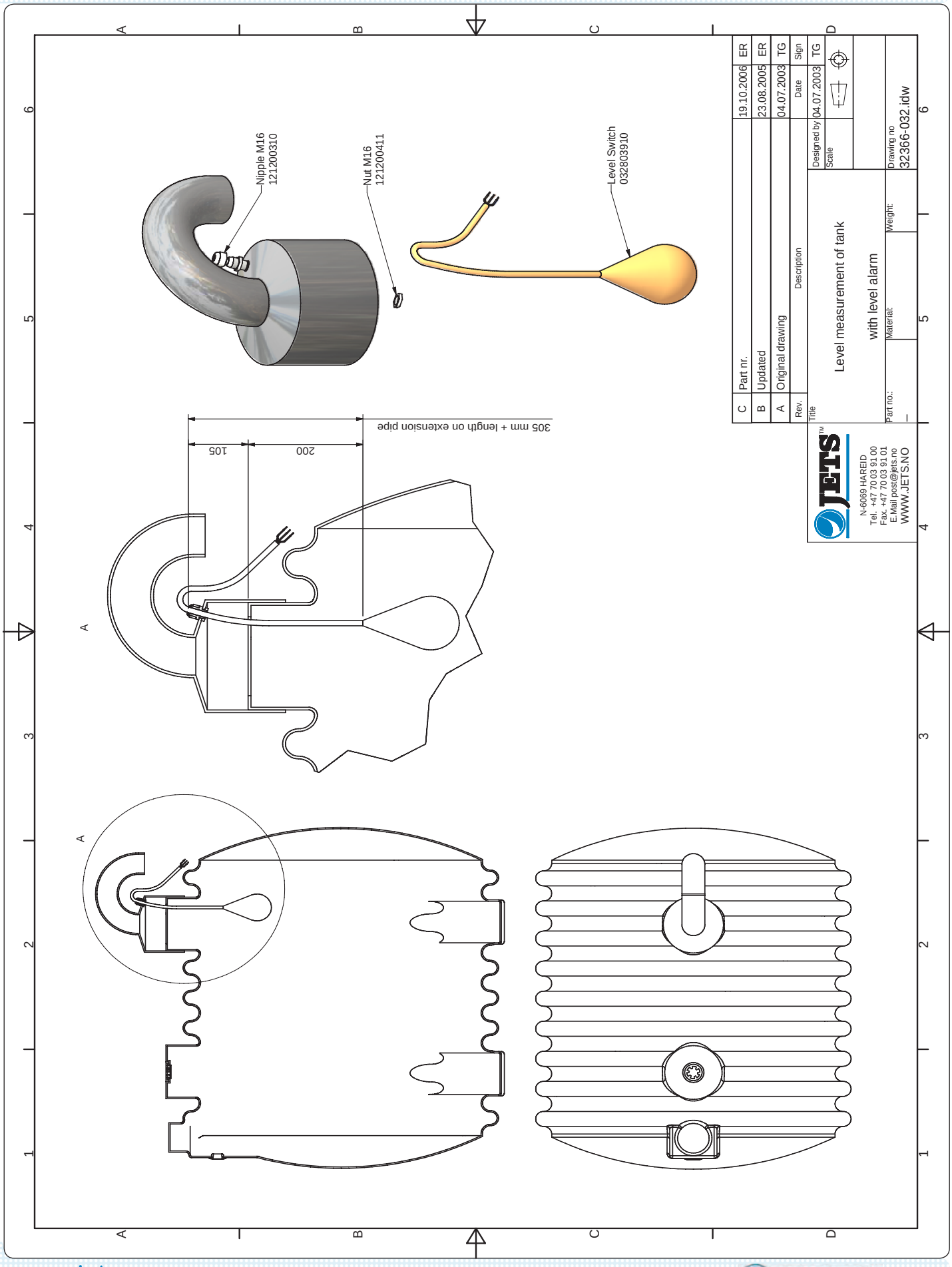
E.Mail post@jets.no
WWW.JETS.NO

| | | | | |
|---|---|---|---|---|
| Title: Level Switch - | | | Designed by | 03.02.2004 TG |
| | | | Checked by | |
| | | | Scale | |
| Part no.: 032803905 | Material: | Weight: | Drawing no 41826-032.idw | Rev. A |


Nipple M16
121200310
Nut M16
121200411
Level Switch
032803910
305 mm + length on extension pipe
200
105
A
A
A
Level measurement of tank
with level alarm
Description
Rev.
Part nr.
Updated
Original drawing
19.10.2006
23.08.2005
04.07.2003
ER
ER
TG
Date
Sign
Designed by
Scale
Drawing no
32366-032.idw
Material:
Weight:
Part no.:
JETS
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Tel. +47 70 03 91 00
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E.Mail post@jets.no
WWW.JETS.NO

# Toilet Jets™ Charm

Technical Data



** Illustration photo only.*

Jets™ Charm toilet is a wall model vacuum toilet in a porcelain design.
Jets™ Charm toilet features low water consumption, reliable flushing and discharge.

## Toilet Jets™ Charm (wall mounted)

Part No.: ..... TO611PO
Total Weight: ..... Approx. 22.5 kg
Water Connection: ..... BSP ½" male ball valve
Discharge Outlet: ..... Outside diameter Ø 50 mm

## Toilet Bowl Jets™ 611:

Part No.: ..... 066607100
Outside Dimensions: ..... 540x370x400 mm (LxWxH)
Bowl Material: ..... Porcelain
Bowl Weight: ..... Approx. 19 kg

## Seat & Cover:

Jets™ Soft Line QR: ..... 069608840

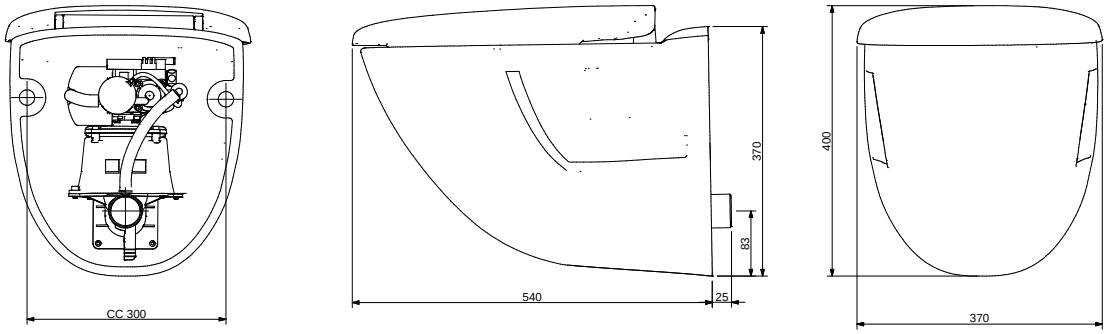
Note: Changes without prior notice.

# Toilet Jets™ Charm

Technical Data



## Design Dimensions




## Operating Data:

Flushing Time: .....Approx. 5 seconds (adjustable)
Discharge Time:..... Approx. 2 seconds
Water Pressure:.....2-7 bar (200-700kPa)
Operating Vacuum:.....30-50% vacuum
Water Consumption:..... Adjustable (1,2 litres)
Air Consumption:..... Approx. 60 liters at 50% vacuum

## Toilet Valve Systems and Accessories

### Constant Vacuum Systems (CVS™):

VFD ..... Vacuum operated flush/discharge

### Accessories:

Vacuum Breaker Kit.....034507320
Rubber Elbow with Clamp .....034505450
Rubber Sleeve with Clamp .....034505550
Rag hook w/support.....034102902
Bracket, retrofit toilet.....069000300

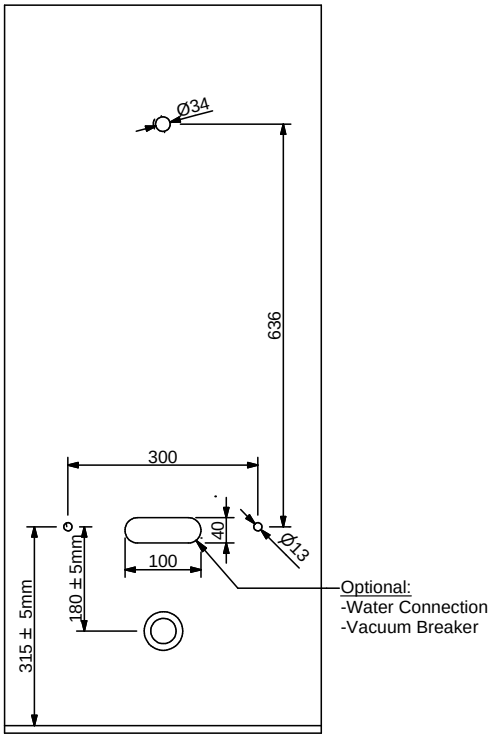
### Available Parts:

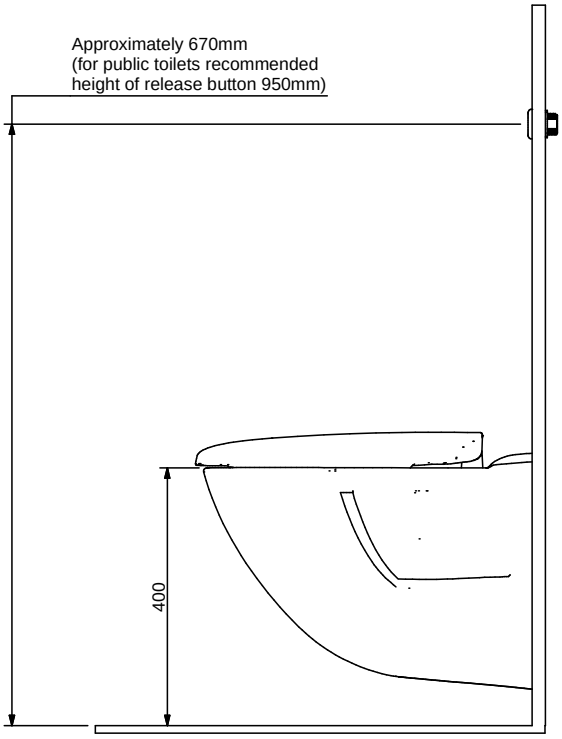
Flushing Nozzle Kit.....069503151
Fastening Kit, wall .....069606400
Label, ‘’Don’t throw’’.....814200206

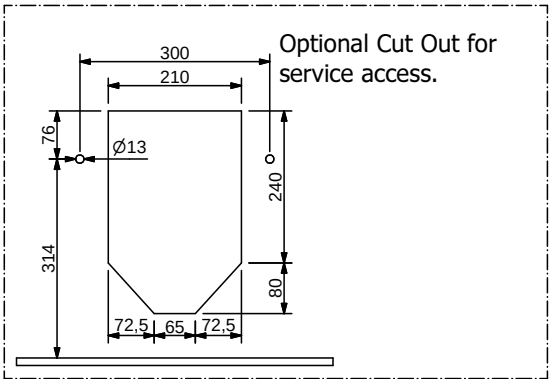
# Toilet Jets™ Charm



## Mounting



# Toilet Jets™ Charm



## Toilet Connections

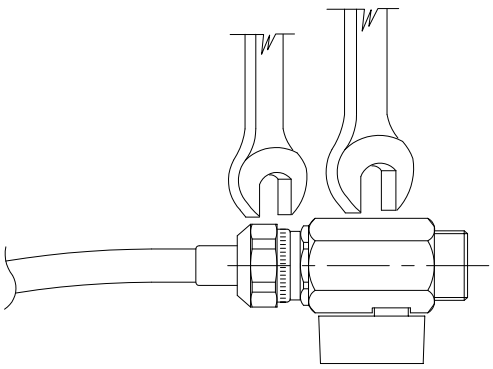
### Connection to the Toilet Valve

To avoid leakage between the toilet valve and the toilet bowl, it is important that the pipe is properly aligned. The rubber sleeve and the elbow are to be secured with hose clamps.

## Mounting of the Flexible Hose

1. Disconnect the ball valve.
2. Connect the ball valve to the water main.
3. Connect the flexible hose to the ball valve (filter must be fitted).

   Note: Do not tighten too hard.



## Regulation of Water in the Toilet Bowl

The water level in the toilet is controlled by the diameter of the orifice on the VPC-V controller. See datasheet VFD Valve, Complete for information.

# Toilet Jets™ Charm



## Storage and Maintenance Instruction

### a) Storage:

Goods to be stored in a dry environment between -30°C and +40°C, Storage location to be dust free, low humidity (≤ 95%) and free from moisture. Keep clear of foreign objects.

### b) During transport/prior to installation:

Goods to be protected against shock, dust, grinding, welding, humidity and moisture. Suitable, adequately dimensioned transporting equipment is to be used during transportation and delivery. Note that the equipment contains components that are easily damaged as a result of inappropriate handling.

### c) Installation to end use:

Site to be a dry environment between -30°C and +40°C. Instructions per item b). Note: Special attention to protection against moisture.

Environmental conditions: Goods to be stored indoor as per conditions stated above.

Visual inspections: Check for visual damage. Any damage detected after dispatch should be reported immediately to Jets AS and commissioning must be postponed until equipment has been inspected.

Inspection intervals: Upon arrival and prior to installation.

Maintenance: Not required.

Maintenance intervals: Not required.

Tools: Not required.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# Release Button





** Illustration photo only.*

## Release Button

Part No.: ..... 100100030

This release button can only be used on a VPC-V Controller.

## Principle & Function

The vacuum operated flush release button is designed to provide a softer operation for flushing. Vacuum from the vacuum pipe is fed to the start valve piston. When the flush release button is pressed, air is sucked through the 4 mm hose and the piston in the start valve moves to operate the flap in the start valve.

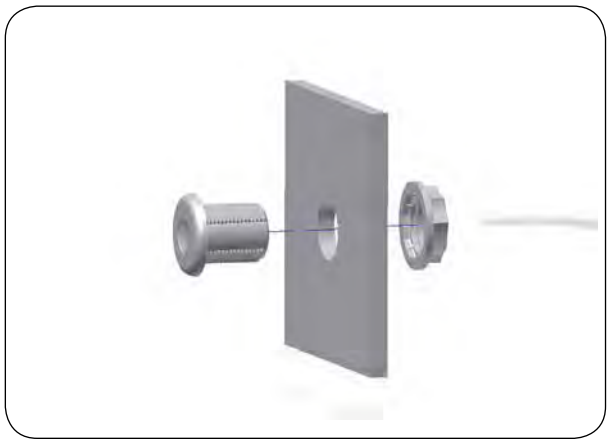
Note: Changes without prior notice.

# Release Button

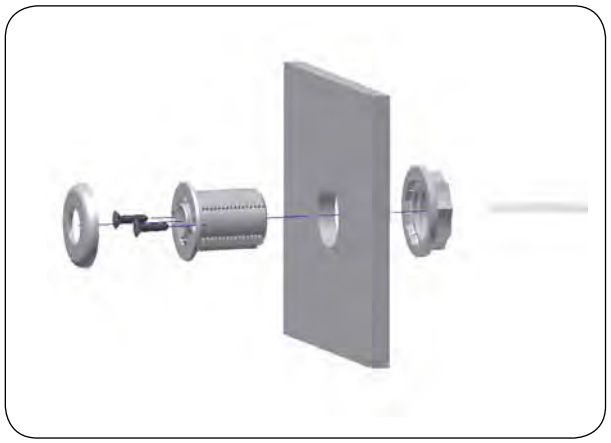


## Installation

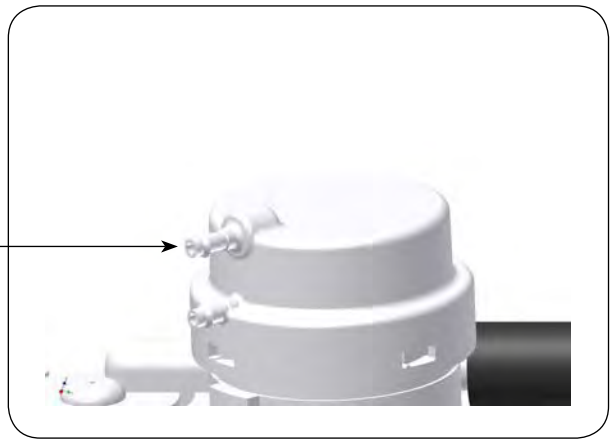
1. Place the release button in the wall and mount the nut on the back. The diameter of the hole should be Ø35.



2. If unable to fit the nut from behind the wall, use screws as shown in the illustration to the right.



3. Attach the hose to the start cylinder.



The approximate height for the release button is 670mm.
For public toilets recommended the height of the release button is 950mm.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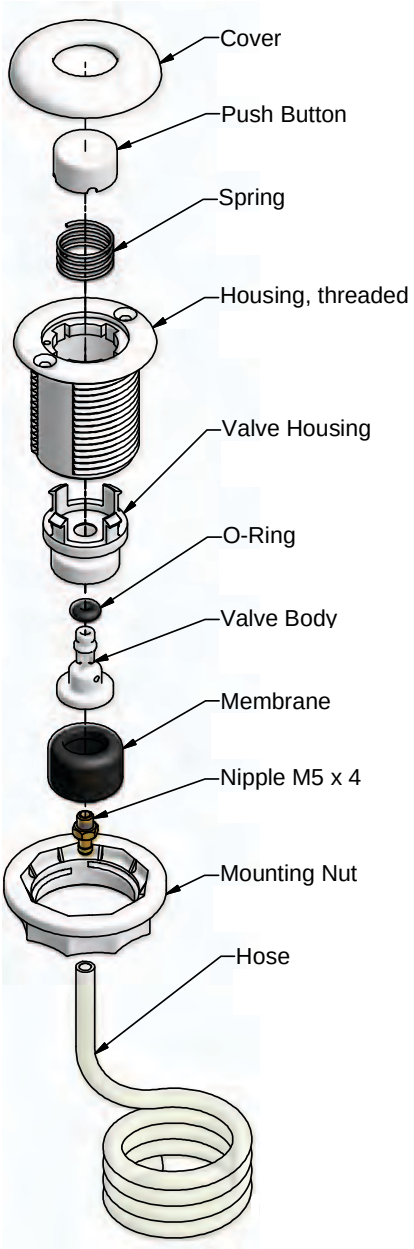
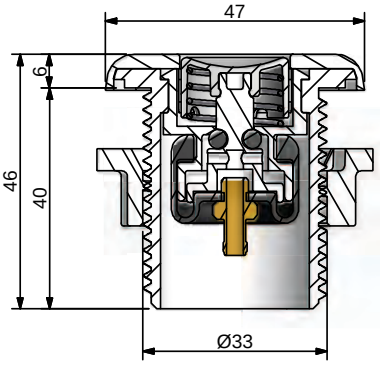
# Release Button



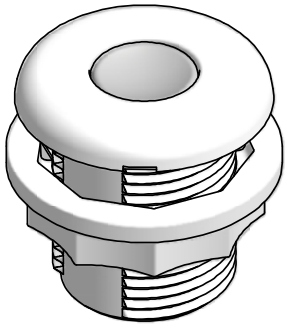





Section View




Isometric View



Note: Items listed in the drawing are only available as a complete Release Button.

## Troubleshooting

| PROBLEM | CAUSE | ACTION |
|---|---|---|
| No reaction or insufficient flushing when pressing the release button. | No vacuum in the discharge pipe line. | Check the vacuum. |
| | The release button does not open. | Replace the release button. |
| | Dirt in the NR-Valve. | Clean the NR-Valve and related hoses. |
| Flushing and discharge do not stop. | The valve in the release button does not close. | Replace the release button. |
| | The signal hose between the release button and the start cylinder is leaking. | Check the signal hose and connections for air leakages. |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# VFD Valve, Complete

Technical Data



** Illustration photo only.*

Jets™ VFD Valve, Complete features a total vacuum operated flush and discharge valve optimized for easy maintenance.

## VFD Valve, Complete:

Part No.: ..... 054100960
Outside Dimensions: ..... 235x195x300 mm (LxWxH)
Total Weight: ..... Approx. 1.9 kg
Water Connection: ..... BSP ½" male ball valve
Discharge Valve Inlet: ..... Inside diameter Ø 63,5 mm
Discharge Valve Outlet: ..... Outside diameter Ø 50 mm

## Operating Data:

Flushing Time: ..... Approx. 5 seconds (adjustable on some models)
Discharge Time: ..... Approx. 2 seconds
Water Pressure: ..... 2-7 bar (200-700kPa)
Operating Vacuum: ..... 25-50% vacuum
Water Consumption: ..... Adjustable (1.2 liters)
Air Consumption: ..... Approx. 60 liters at 50% vacuum

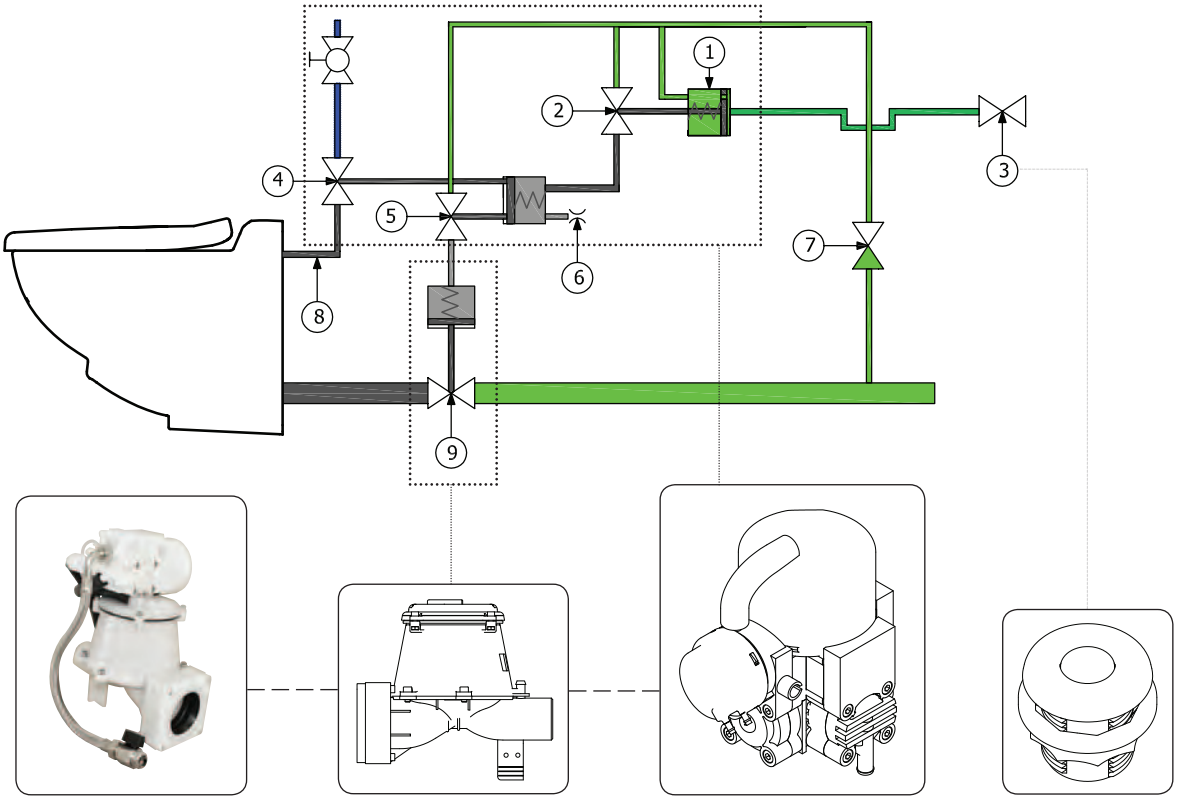
Note: Changes without prior notice.

# VFD Valve, Complete





## Explanation of VFD Valve Function (Vacuum powered release mechanism)




Vacuum in piping as indicated ( ).

Water in piping as indicated ( ).

### D Valve with VPC-V Controller Components:

① Start cylinder
② Start valve
③ Release button
④ Water valve
⑤ Control valve for the D valve
⑥ Air orifice, main cylinder
⑦ Non-return Valve
⑧ Flushing ring hose
⑨ D valve

### Normal Position/Closed Valve

- Start valve ② - CLOSED
- Control valve for D valve ⑤ - CLOSED
- D valve ⑨ - CLOSED
- Water valve ④ - CLOSED



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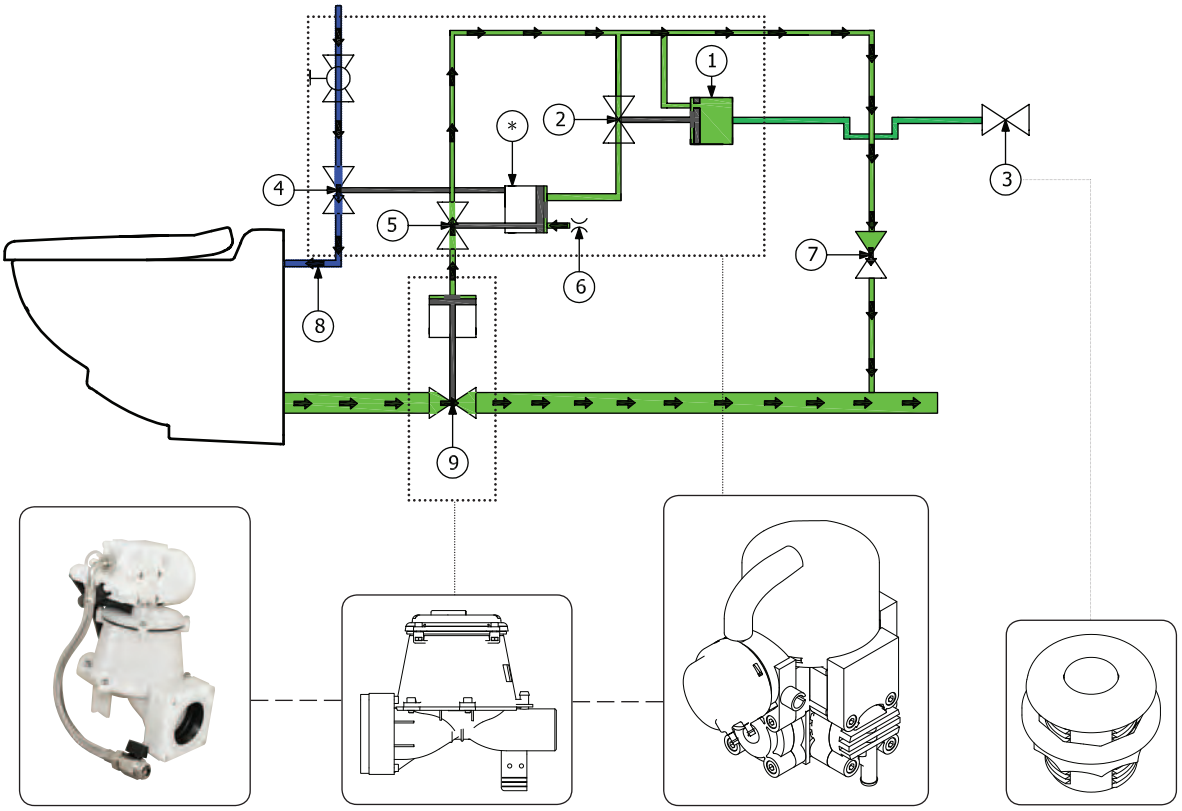
# VFD Valve, Complete








Vacuum in piping as indicated ( ).

Water in piping as indicated ( ).

## Emptying Sequence

1. Release button ③ - OPEN.
2. Air is sucked into the start cylinder ①.
3. Piston in start cylinder ① under vacuum to LOW position.
4. Start valve ② - OPEN.
5. Piston in VPC-V controller under vacuum to TOP position.
6. Control valve for D valve ⑤ - OPEN.
7. Water valve ④ - OPEN.
8. D valve ⑨ - OPEN.

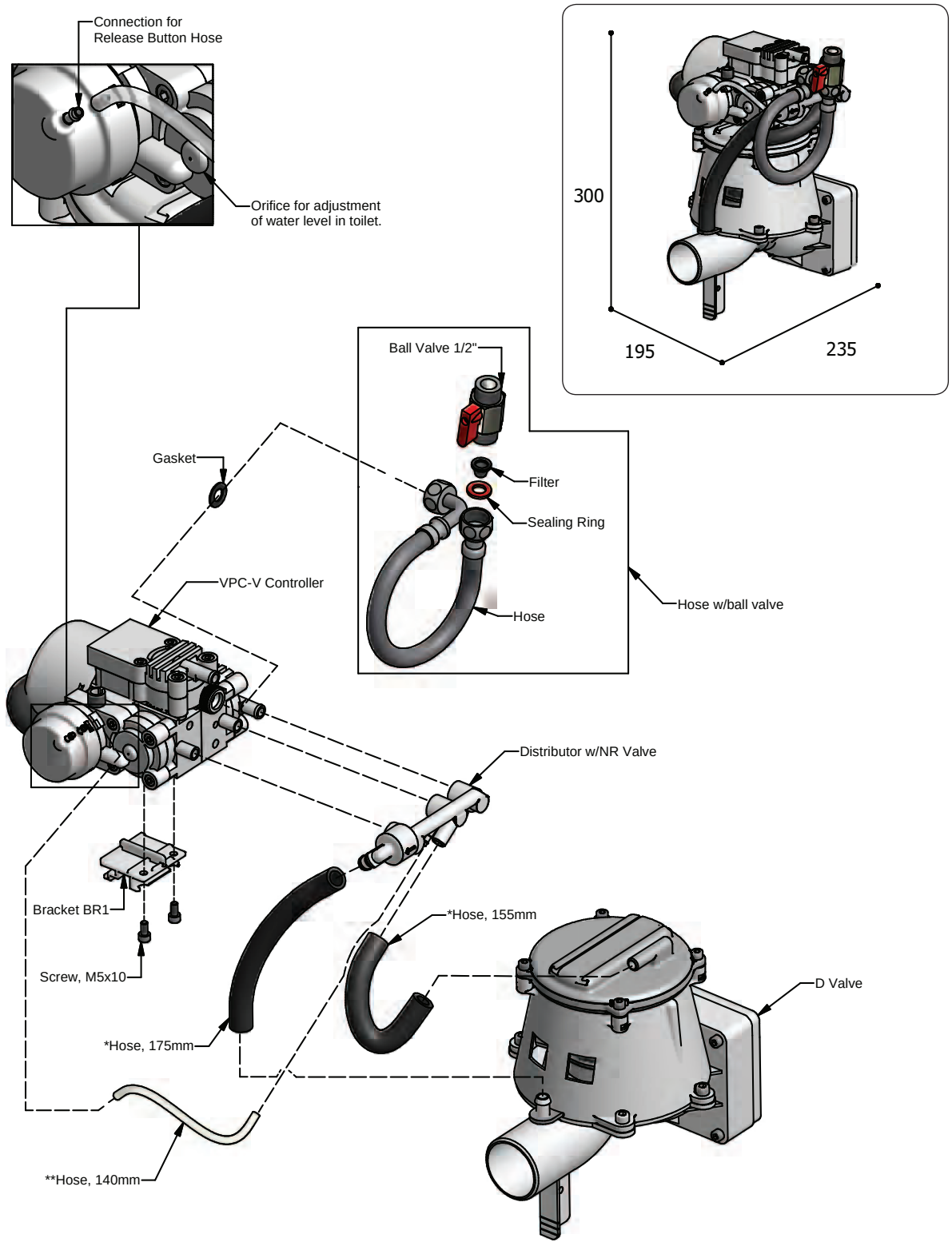
Result: Effluent is sucked by vacuum from the toilet. Water flows into the toilet bowl.

## Closing Sequence

1. Release button ③ - CLOSED.
2. Piston in start cylinder in RESTING position.
3. Start valve ② - CLOSED.
4. Piston in VPC-V controller pushed to LOW position by the spring. Air orifice ⑥ controls the speed.
5. Control valve for D valve ⑤ and water valve ④ - CLOSED.
6. D Valve ⑨ - CLOSED.

# VFD Valve, Complete

## Disassembly of the VPC-V Controller from the VFD Valve

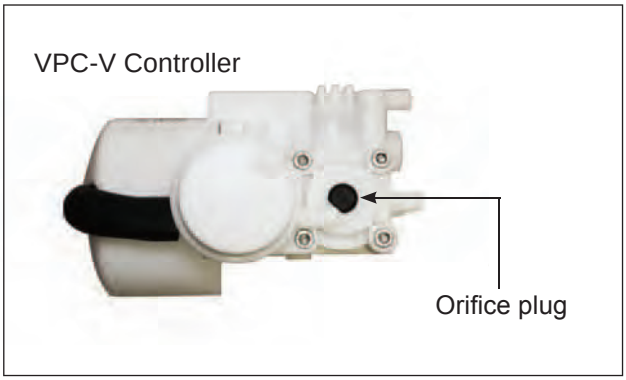


# VFD Valve, Complete



## Regulation of Water in the Toilet Bowl

The water level in the toilet is controlled by the diameter of the orifice. The orifice plug is made of rubber and placed as shown in the picture. If there is too much water in the toilet bowl after flushing, change to a plug with a bigger orifice. If there is too little water in the toilet bowl after flushing, change to a plug with a smaller orifice. A total of 6 orifice plugs of various diameters are attached to the VPC-V controller upon delivery of the toilet.




### Disassembly of the VFD Valve from the Toilet Bowl

1. Close the ball valve for the water supply to the toilet valve.
2. Disconnect the flexible water supply hose from the ball valve.
3. For wall mounted toilets:
   Release the spring which is connected to the lower housing of the valve and the toilet bowl.
4. Pull off the release button hose from the VPC-V controller.
5. Pull the complete VFD Valve unit from the toilet bowl.

### Disassembly of the VPC-V Controller from the VFD Valve

1. Remove the distributor w/NR valve.
2. Remove hoses connected to the VPC-V controller.
3. Pull the VPC-V controller backwards to release it from the D-valve.

See diagram on page 4.

## Storage and Maintenance Instruction

### a) Storage:

Goods to be stored in a dry environment between -30°C and +40°C, Storage location to be dust free, low humidity (≤ 95%) and free from moisture. Keep clear of foreign objects.

### b) During transport/prior to installation:

Goods to be protected against shock, dust, grinding, welding, humidity and moisture. Suitable, adequately dimensioned transporting equipment is to be used during transportation and delivery. Note that the equipment contains components that are easily damaged as a result of inappropriate handling.

### c) Installation to end use:

Site to be a dry environment between -30°C and +40°C. Instructions per item b). Note: Special attention to protection against moisture.

Environmental conditions: Goods to be stored indoor as per conditions stated above.

Visual inspections: Check for visual damage. Any damage detected after dispatch should be reported immediately to Jets AS and commissioning must be postponed until equipment has been inspected.

Inspection intervals: Upon arrival and prior to installation.

Maintenance: Not required.

Maintenance intervals: Not required.

Tools: Not required.

## Available Parts

| | |
|---|---|
| D Valve | 050513000 |
| VPC-V Controller | 101100010 |
| Distributor w NR/Valve | 101100116 |
| Bracket BR1 | 054110030 |
| Screw, M5x10 | 036531600 |
| Hose w/ball valve | 034509620 |
| Gasket | 037504200 |
| **Hose | 034501002 |
| *Hose | 034509000 |

## Troubleshooting

| PROBLEM | CAUSE | ACTION |
|---|---|---|
| No reaction or insufficient flushing when pressing the release button. | No vacuum in the discharge pipe line. | Check the vacuum. |
| | The release button does not open. | Replace the release button. |
| | Dirt in the Distributor w/NR Valve. | Clean the Distributor w/NR Valve and related hoses. |
| Only flushing and no discharge is taking place. | Vacuum is below 25%. | Check the vacuum level and take action to increase the vacuum. |
| | Leakage in the lifting membrane. | Replace the lifting membrane. |
| Flushing and discharge do not stop. | Valve in the release button does not close. | Replace the release button. |
| | Signal hose between the release button and the start cylinder is leaking. | Check the signal hose and connections for air leakage. |
| Toilet bowl slowly fills up with water. | Water valve is leaking. | Replace the valve sealing flap. |
| The normal water level in the toilet bowl is reducing. | Impurities prevent the shut-off membrane from closing. | Shut-off membrane to be cleaned. |
| | | Press the release button for new discharge. |
| | Shut-off membrane is damaged. | Replace the shut-off membrane. |
| Flushing and discharge cycles are incorrect. | The air orifice is dirty. | Clean the orifice. |
| | The sealing flap is leaking. | Replace the sealing flap. |

# Fastening Kit, wall





** Illustration photo only.*

## Fastening Kit, wall

Part No.: ..... 069606400

## Principle & Function

Jets™ Fastening Kit, wall is designed to secure selected Jets™ toilets to a wall surface.

Note: Changes without prior notice.

# Rubber Elbow w/hose clip

Technical Data



** Illustration photo only.*

## Rubber Elbow w/hose clip:

Part No.: ..... 034505450
Total Weight: ..... Approx. 0.35 kg
Connection Diameter: ..... Ø 50 mm / Ø 50 mm
Material: ..... EPDM
Material Hose Clip: ..... Aisi316L

## Available Parts

Rubber Elbow Ø 50: ..... 034505400
Hose Clip: ..... 034506900

Note: Changes without prior notice.

# Seat & Cover, Soft Line QR

Technical Data



** Illustration photo only.*

## Seat & Cover, Soft Line QR:

Part No.: ..... 069608840
Material: ..... ABS
Total Weight: ..... Approx. 2.9 kg

## Product Description and Spare Parts

### Product Description:

Seat & Cover Soft Line QR: ..... 069608840

### Spare Parts:

Fastening, Soft Line QR ..... 069608607

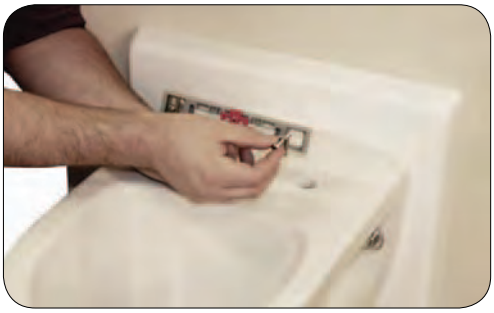
Note: Changes without prior notice.

# Seat & Cover, Soft Line QR



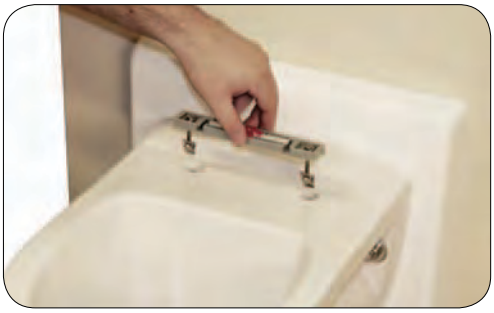


## Installation



1. Insert the screws into the bracket.

2. Affix the nut on the back side of the screws.



3. Place the bracket into the holes on the toilet.

4. Tighten the screws.

5. Slide the toilet seat into place on the bracket.

6. Complete.

# Flushing Nozzle Kit





** Illustration photo only.*

## Flushing Nozzle Kit

Part No.: ..... 069503151

## Principle & Function

Jets™ Flushing Nozzle Kit is connected to the toilet bowl and the valve and is designed to provide a flushing solution for Jets™ toilet systems.

Note: Changes without prior notice.

# Rubber Sleeve w/hose clip

Technical Data



** Illustration photo only.*

## Rubber Sleeve w/hose clip:

Part No.: ..... 034505550
Total Weight: ..... Approx. 0.17 kg
Connection Diameter: ..... Ø 50 mm / Ø 50 mm
Material: ..... EPDM
Material Hose Clip: ..... Aisi316L

## Available Parts

Rubber Sleeve Ø 50: ..... 034505500
Hose Clip: ..... 034506900

Note: Changes without prior notice.

# Vacuum Piping Guide
# Jets Standard

JETS
Sanitary Systems
– made to please

# Table of Contents

# 1. Introduction

This manual is dealing with piping for vacuum sewage systems as well as waste water pipes connected to such systems. The vacuum piping must be in accordance with vacuum sewage system transportation principles:

The transport proceeds in slugs as a result of difference in pressure in front of and behind this slug.


During the transport through the piping system, the slug is affected by the gravity and will flatten out after a time. For this reason it is necessary to have low points in the piping system where the slug can form again, so that the pressure difference can be re-established.

Pipes are to be secured by clamps, and cleanouts to be made where convenient.

## 1.1 Standards and regulations

See also building standards for Vacuum Toilet System:

- NS EN 12109 Internal vacuum systems

## 1.2 Terms and Conditions

This manual is considered as guidelines only, and is intended to help pipeline designers to avoid common mistakes. It is not to be used as complete instructions. Pipelines are the customer's responsibility, and Jets can not be held responsible for malfunction of the system due to incorrect pipeline design or construction.

## 1.3 Safety Annotations


This manual is to be considered as guidelines only, and is intended to help pipeline designers avoid common mistakes. It is not to be used as complete instructions. Pipelines are the customer's responsibility, and Jets can not be held responsible for malfunction of the system due to incorrect pipeline design or construction.


Indicates possibilities for hazards or unsafe practices, which COULD result in minor personnel injuries and/or property damage, if the required precautions are not taken.


Draws attention to specific information of technical significance which might not be obvious to specialist personnel, or points at important remarks in the procedures to follow.

## 1.4 Support

Please contact Jets Standard Service.

# 2. System Description

A vacuum sewage system uses difference in air pressure for transport of sewage. This difference is created by the Vacuumarator. By means of pressure switches controlling start and stop of the Vacuumarator, a constant vacuum of 40%-55% (-0,40 - -0,55 bar) is maintained in the vacuum pipes.

When flushing the toilet, its contents are sucked into the piping system. Consequently transport will continue as long as the toilet valve is open. When the valve closes (after 1.5 -seconds) transport will stop. During the discharge period, the distance of transport will vary from 5 to 15 meters, depending on vacuum, dimension of pipe, direction of flow, the number of bends on pipe etc.

When transport stops, the water in the pipes will flow by gravity to the nearest low point. The pipes must consequently be installed with a water lock or “transport pocket” at this point. At the next discharging of the toilet, or other toilets connected at the same side of the “transport pocket”, the contents of the “transport pocket” will be sucked further along in the pipes. In longer lines of piping there will be a simultaneous transport from several “transport pockets” until the sewage reaches the Vacuumarator. Between each “transport pocket” the pipes should be installed with a slope along the direction of transport to secure that water will also flow in this direction.

# 3. Designing Pipe System

## 3.1 Vacuum Sewage System Layout

### 3.1.1 Choice of piping Layout

For installations in buildings, the choice of piping layout design will have to be adjusted to many considerations.

NOTE

If possible the outlet pipe from toilets should point downwards, i.e. collecting pipes and branches should be on a lower level than the toilets.

In this way you avoid the risk of “backflow”, and sufficient vacuum for operation of toilets will always be present. Our experience has shown that in this way you obtain maximum operation reliability.

However, when using a vacuum toilet system, collecting pipes and branches may be installed in the ceiling.
In this case it is vital that the piping layout is designed to avoid “backflow”, un-intended collection of water in the pipe system and securing safe transport of sewage.

### 3.1.2 Location of vacuum unit in different types of buildings

As a main rule the vacuum generating unit should always be located at the absolutely lowest point of the vacuum system. In addition it should be located in a way that main pipes and branches could be as short as possible. Branch pipes from toilets should be routed in a downward direction towards the vacuum generating unit.

### 3.1.3 Vacuum reservoir: Calculation and build-up

Usually the total volume of pipes creates the vacuum reservoir. When a toilet is flushed, 60 - 100 litres of air is let into the system. At a decrease in vacuum level, the vacuum generating unit will start and vacuum level is rebuilt.
However, this takes some time (e.g. from a few seconds to several minutes, depending on pipe volume and capacity of vacuumarators). In cases of possible simultaneous flushing of many toilets ( e.g. in larger installation) the total piping volume must be big enough to make the system function. In buildings with a total pipe volume less than 160 litres, we recommend increase of vacuum reservoir by installing an accumulating tank.

### 3.1.4 Choice of branches

An optimally constructed piping system is designed to contain as little water as possible during ordinary operation. This is obtained by making horizontal pipes as short as possible and with as few bends as possible. Horizontal collecting pipes/main pipes should be located in a way that branches will be as short as possible.

### 3.1.5 Sectioning/shut-off of pipes for service

When deciding the number of main pipes from vacuum generating unit to branch points, the number of toilets, number of floors and the need for shutting-off for service should be considered. Each main pipe should be installed with a shut-off valve towards manifold of vacuum generating unit.

## 3.2 Challenges regarding different types of buildings.

### 3.2.1 Large buildings

These buildings have long corridors and consequently one may be tempted to connect many toilets to each horizontal branch of pipe. These horizontal pipes will then contain more water than what is desirable, and this will increase the risk of “backflow”. In addition, many “transport pockets”/waterlocks will reduce the level of vacuum at the end of each branch.

In certain periods public toilets will have a high frequency of flushing. This must also be considered when choosing branches.

The risk of clogging of pipes is high, and the location of rodding points is important. Shut-off valves have to be installed at branches to secure as few toilets as possible out of operation in cases of operation breaks or servicing.

### 3.2.2 N/A

### 3.2.3 N/A

### 3.2.4 Small buildings

In such building, with a high number of people in periods and a relatively low number of toilets, all the toilets will frequently be flushed simultaneously. In these cases it is vital to calculate vacuum generating capacity as well as vacuum reservoir according to simultaneous flushing of toilets. If necessary, an extra vacuum accumulating tank has to be installed to increase the vacuum reservoir.

Due to risk of low vacuum level during high load of operation, pipes from the toilets should have a downward direction, and horizontal branches should be installed lower than toilet level.

## 3.3 Pipetables

### 3.3.1 Table 1 - Materials

| Material: | PEH | PVC | Steel | Stainless steel |
|---|---|---|---|---|
| Use: | Accomodation up to 75 mm (DN 65) | Accomodation up to 75 mm (DN 65) | In engine room or other heat producing areas. Sizes above DN 65/80 to be used* | In accomodation and engine room |
| Minimum Pressure Rating: | PN 10 | PN 10 | PN 10 | PN 10 |

PEH = High Density Polyethylene. PVC = Polyvinylchlorine, e.g. DIN 86013.

**NOTE**

- Plastic pipes do not resist temperatures above 60° C under vacuum conditions
- Steel pipes to be galvanized
- Rules of National Authorities and Classification Societies to be followed.

### 3.3.2 Table 2 – Number of vacuum toilets

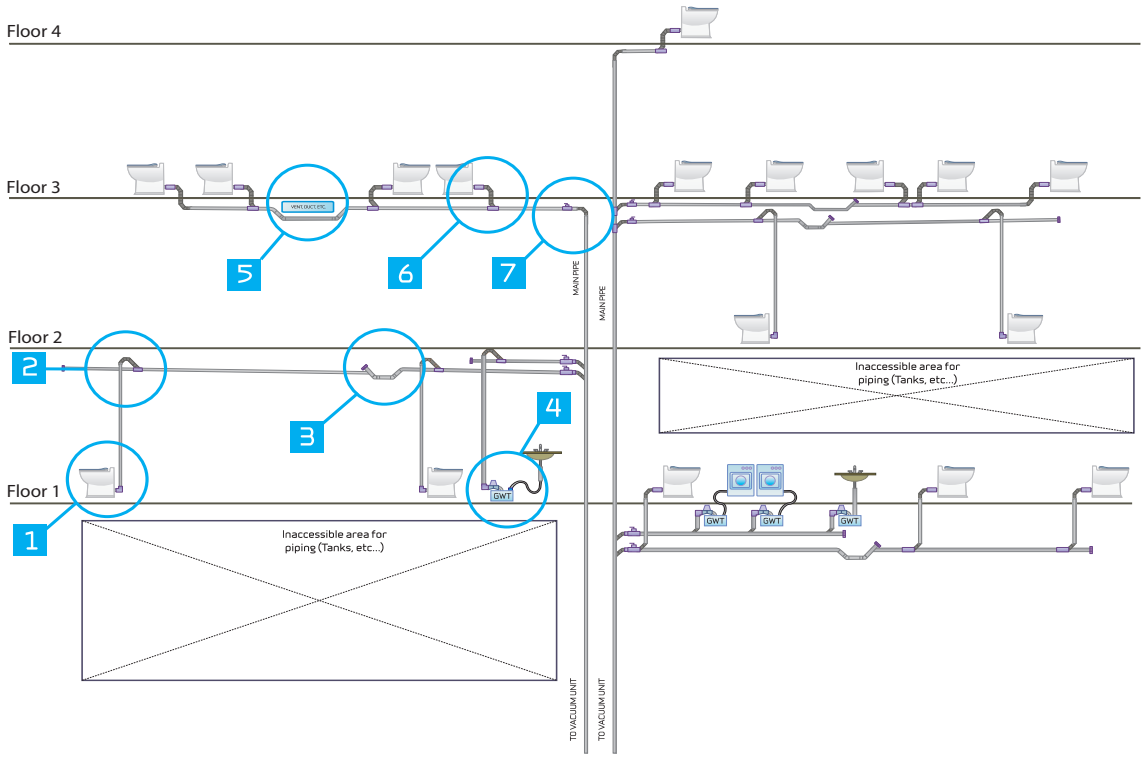
| Number of vacuum toilets | Min. pipe size | | | | |
|---|---|---|---|---|---|
| | Connection DN | PEH d x s (mm) | PVC d x s (mm) | Steel d x s (mm) | Stainless steel d x s (mm) |
| 3 | 40 | 50 x 3.0 | 50 x 2.4 | 48.3 x 2.6 | 50 x 1.0 |
| 25 | 50 | 63 x 5.8 | 63 x 3.0 | 60.3 x 2.9 | 50 x 1.0 |
| 100 | 65 | 75 x 6.9 | 75 x 3.6 | 76.1 x 2.9** | 75 x 1 |

d = outside diameter. s = wall thickness.

| | |
|---|---|
| * | Supplier to be contacted. |
| ** | Steel pipes for more than 100 toilets; supplier to be contacted. |
| *** | For higher number of toilets, Jets Standard to be contacted. |

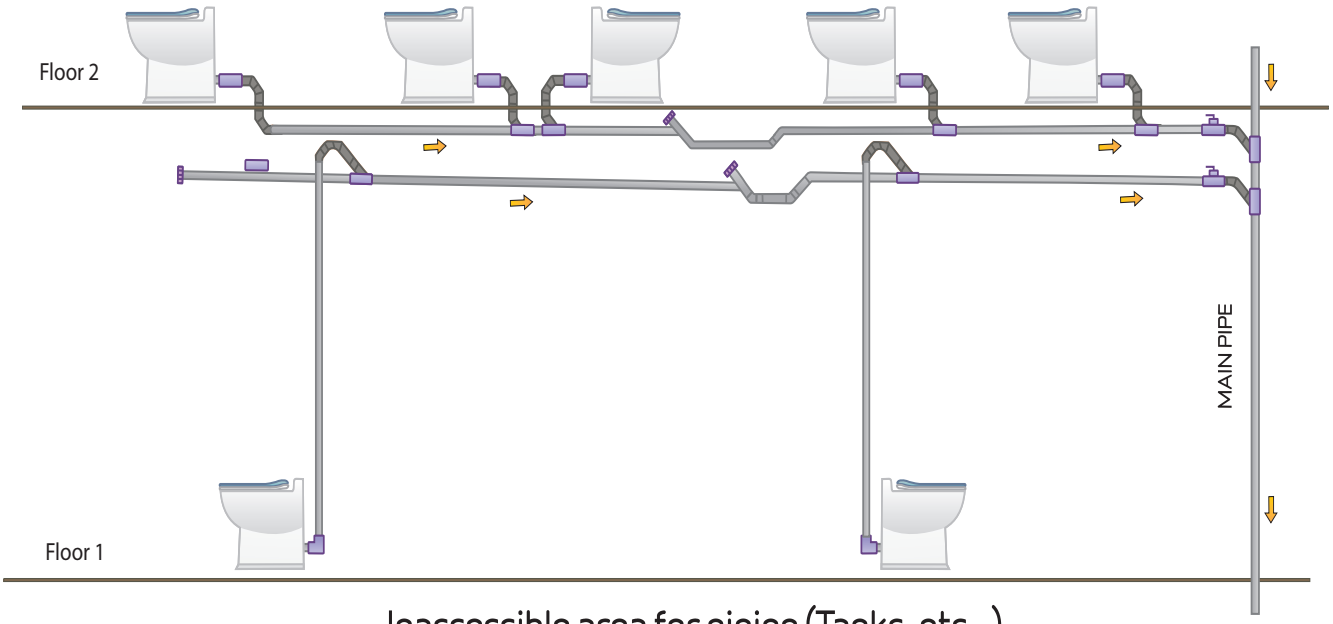
# 4. Installation Guidelines

## 4.1 Vacuum System Layout




| Reference | Name | Page |
|---|---|---|
| 1 | Toilet connection | 24 |
| 2 | Gooseneck | 22 |
| 3 | Transport pocket | 17 |
| 4 | Grey water | 26 |
| 5 | Pipelines passing obstructions | 17 |
| 6 | Downward directed outlet pipes from toilets | 17 |
| 7 | Bends | 21 |

# 4.2 Pipe connections for two floors



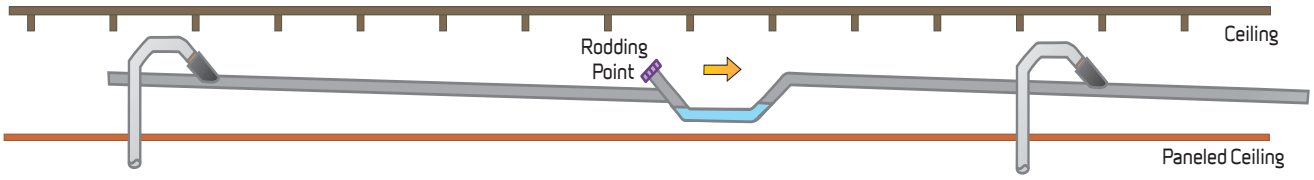

Inaccessible area for piping (Tanks, etc...)

# 4.3 Horizontal Pipes

## 4.3.1 Transport in horizontal pipes

**Upward directed outlet pipes from toilet:**

Vacuum pipes are preferably to be mounted with a slope between the “transport pockets” in flow direction




NOTE

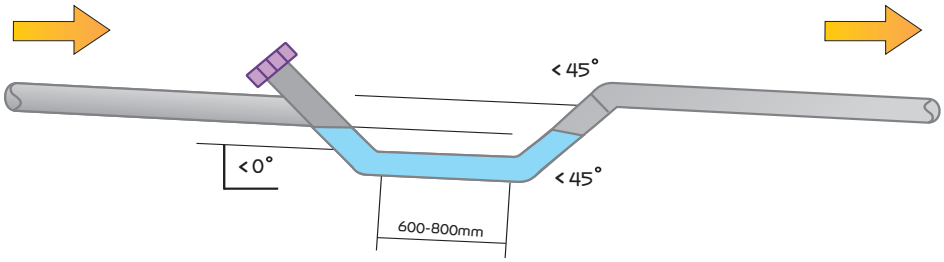
Important to remember:
- Total length of pipe branch
- Fall

**Downward directed outlet pipes from toilet:**

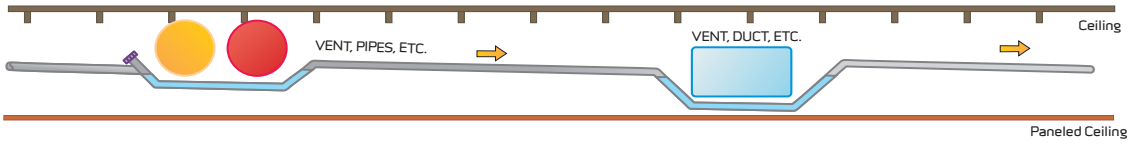
The pipes may be mounted horizontally between the “transport pockets”, provided that the outlet pipes from toilets have a downward direction, or backflow is prevented.

## 4.3.2 Transport Pocket

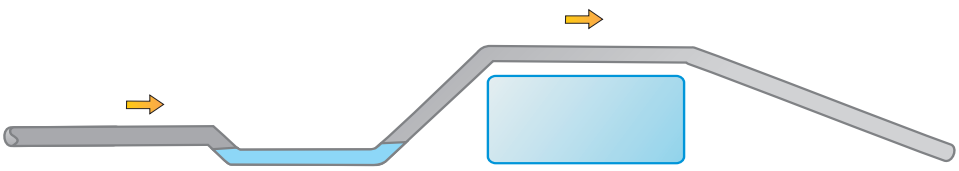
Transport pockets” are made to re-form slugs. When a toilet on the same pipeline is flushed, the pressure difference in front of and at the back of the pocket will “push” the slug on to the next pocket.




When passing obstructions like crossing ventilation ducts,crossing pipes and so on, it will be advantageous to construct the passing as a “transport pocket”.




If the vacuum pipe has to be placed above such obstructions, it is important to place a “transport pocket” in front of the rising pipe. In this way maximum speed of the transported sewage is obtained in the rising pipe:



The distance between transport pockets should be decided considering the size of the Installation.

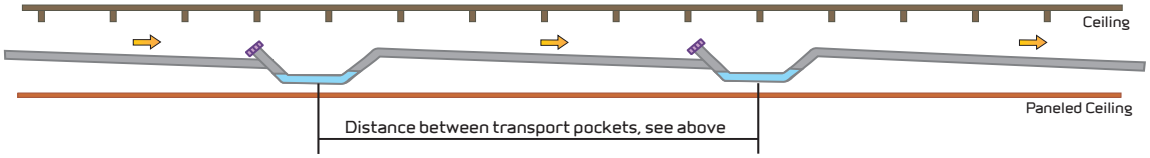
Recommended distances:

| Building type | Distance |
|---|---|
| Small building | 5 meters |
| Medium building | 10 meters |
| Large building | 15 meters |

For systems with downward directed outlet pipes from toilets to horizontal pipe branch, the distance between “transport pockets” may be max. 25meters

NOTE

Slope to be minimum 60 mm between transport pockets!




At transverse sections of vacuum pipes, distance between “transport pockets” should be considered separately. Even for large buildings, length of transverse sections may require reduced distance between “transport pockets”.

Bends in pipe lines will always obstruct the flow of transport. In horizontal lines bends will cause an accumulation of sewage just after the bend. It is therefore recommended to install a “transport pocket” just after such bends to collect the sewage and thereby obtain max flow speed at the next straight section. When several bends are located close to each other, a “transport pocket” should be located just after the last bend in flow direction.

It is recommended to install “transport pockets” close to branch joints in flow direction.

### 4.3.3 Mounting of vacuum pipes in ceiling

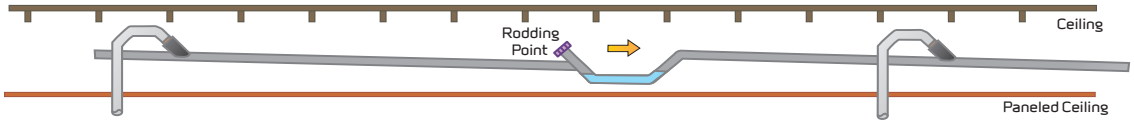
In many installations in buildings horizontal branch pipes are mounted in the ceiling between the ceiling and the paneled ceiling. As a consequence toilet outlets are connected to a vertical pipe which in turn is connected to a horizontal branch pipe in the ceiling.

The greatest challenge in such cases is to avoid “backflow” to the toilets. “Backflow” is when sewage from upper pipes flows back to the rising pipe connected to the toilet. If this rising pipe is filled with sewage, it will influence the discharge function, and in worst case cause sewage to flow into the toilet bowl.

#### 4.3.3.1 Mounting of horizontal branch pipes in the paneled ceiling

Horizontal branch pipes between ceiling and the paneled ceiling are to be placed as close to the paneled ceiling as possible, i.e. “transport pockets” to form lower boundary layer towards the ceiling.

In this way maximum space for gooseneck in the joint between rising pipe from toilet to horizontal pipe is obtained.



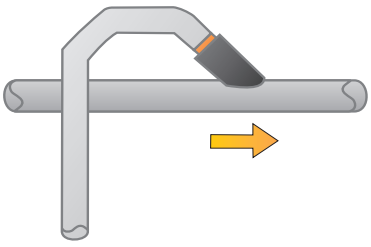

## 4.4 Pipe connections

### 4.4.1 Joining of pipes with different dimensions

The number of toilets connected to branches and collecting pipes will decide the pipe dimension. The most commonly used dimension for pipes from toilets, and also from branches is DN50 for a number of toilets up to 20- 25 toilets. For collecting pipes with larger quantity of toilets than this, DN 65 is used.

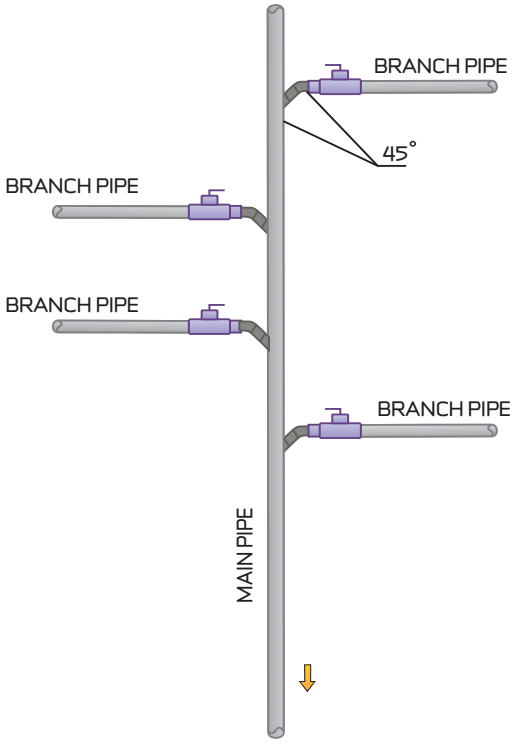
**CAUTION**

Rising pipes with vacuum transport from lower to higher levels must never be installed with transition to larger dimension of pipe! Correct way to this, see illustration under.



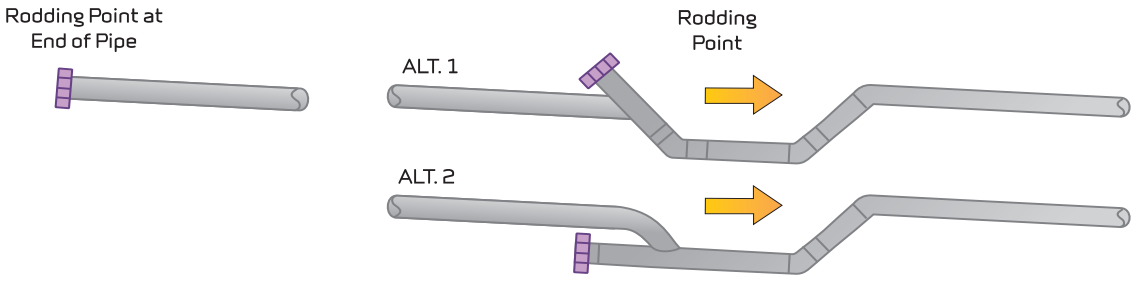
The reason for this is that larger dimension of pipe creates less speed of air and consequently slower transport and shorter distances of transport. The consequences of this are increased risk of build-up of sewage and thereby “backflow”.

Connection of horizontal branches to downward going collecting pipes shall always be done with a downward 45º connection. In larger systems we recommend shut-off valve for each branch. Remember to make sufficient access for shut-off valves.



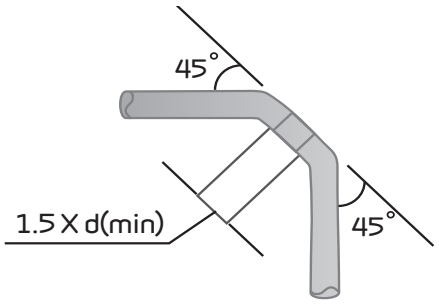

### 4.4.2 Rodding points

Rodding points should be installed with suitable distances and sufficient access. In longer stretches of pipes one should install the rodding points in connection with “transport pockets”.

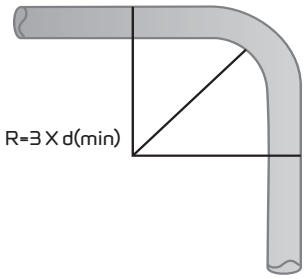


### 4.4.3 Bends

Bends to be made with a large radius of curvature.



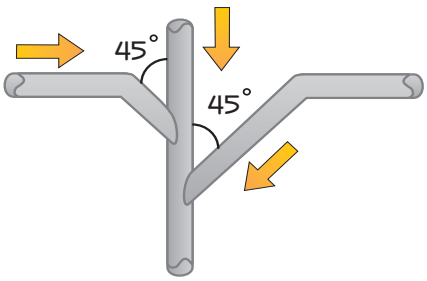

For plastic pipes, and steel “push-fit” pipes minimum radius to be 2 x D, or a 90º bend made of two 45o bend pieces.

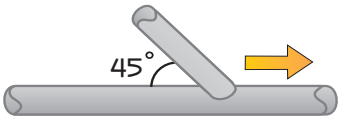



For welded steel pipes, minimum bend radius to be 3 x D

Inside of pipes and fittings to be smooth and without obstructions to avoid clogging.

### 4.4.4 Branches




Connecting of pipes to be made at maximum angle of 45º in direction of transport. T-pipes are not to be used. Branch pipes are always to be connected to horizontal main pipes from above. Branch pipes always to be connected to vertical main pipes at an angle of 45º

## 4.5 Connection to vacuum main branch

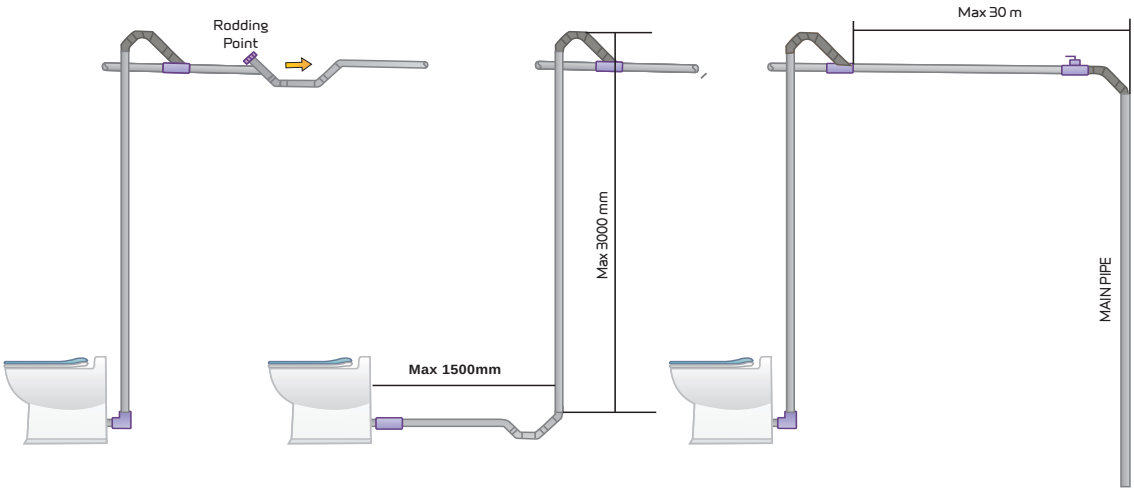
### 4.5.1 Rising pipes from toilets

NOTE

Vertical pipes connections are to be straight running with no bends, to obtain the best possible transport out from the toilet.

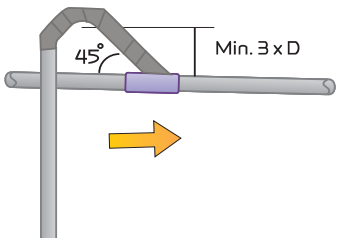
The diameter of the rising pipe must not be increased in the rising part.

Max. length of horizontal branch is not to exceed 30 m.




If horizontal outlet pipe from a toilet, a “transport pocket” must be installed in front of vertical rising pipe.

### 4.5.2 Gooseneck




The rising pipe is to be connected to the upper side of the horizontal branch pipe with a gooseneck and at an angle of 45° in the direction of flow.

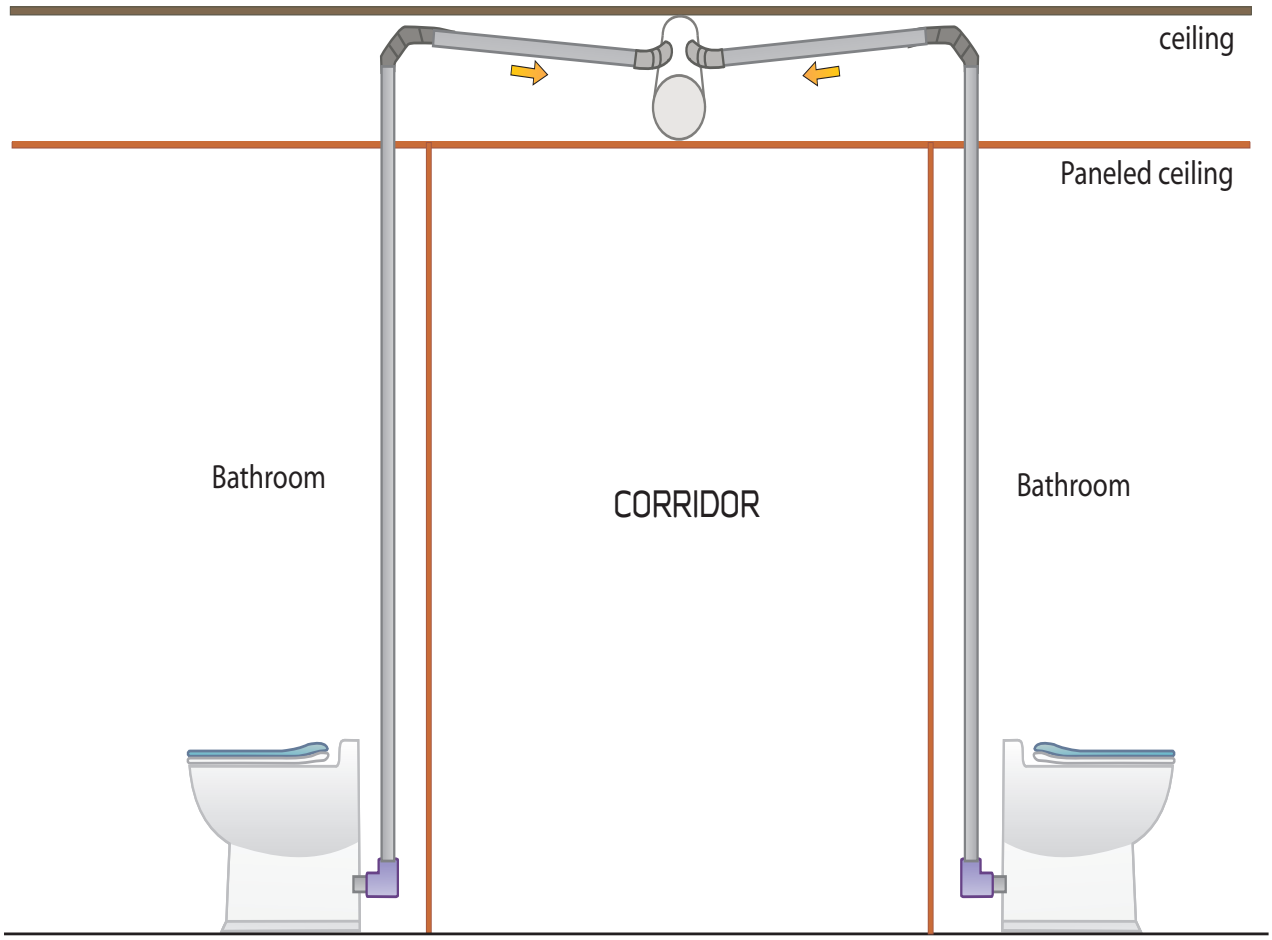
## 4.5.3 Connection to horizontal branch pipe

**CAUTION**

The rising pipe from a toilet must never be connected to a point on a horizontal branch pipe that may be filled with water, i.e. at a low level point of the pipe line.

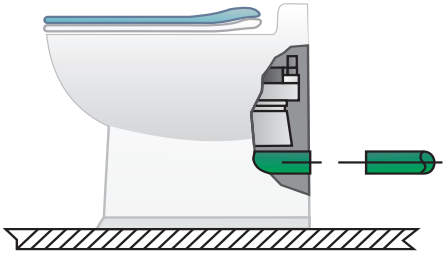
The reason for this is that in case of low vacuum in horizontal branch pipes, water may be sucked through the gooseneck and gradually the rising pipe will be filled with sewage.

In corridors where rising pipes from toilets on both sides are connected to a common branch pipe, the rising pipe should go as high up as possible and then point downwards towards the branch pipe.



## 4.6 Toilet Connections

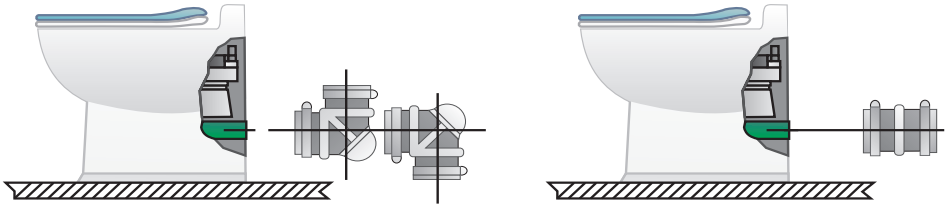
### 4.6.1 Alignment of pipe to toilet valve



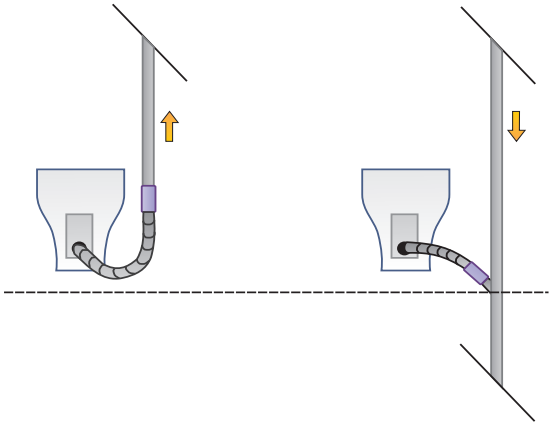
To avoid leakage between the toilet valve and the toilet bowl, it is important that the pipe is properly aligned.

### 4.6.2 Connection to toilet valve

Rubber sleeve and elbow to be secured by hose clamps.



### 4.6.3 Flexible hose



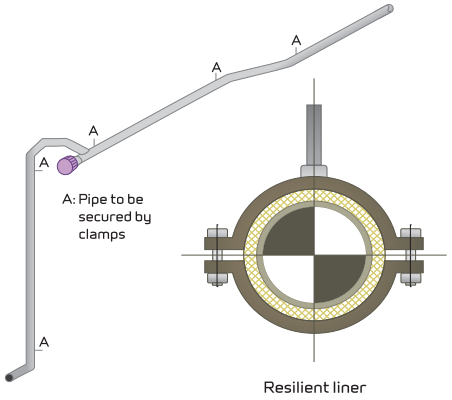
- For the purpose of using less pipe fittings and secure easier maintenance, we recommend to connect the toilet to the pipe system by means of a flexible hose.
- This flexible hose must not be longer than 1 m.
- The distance between toilet outlet and the pipe system must not exceed 70% of the totale length of the hose.
- The flexible hose is to be secured by hose clamps.

### 4.6.4 Pipe clamps

Pipes must be secured by clamps at:

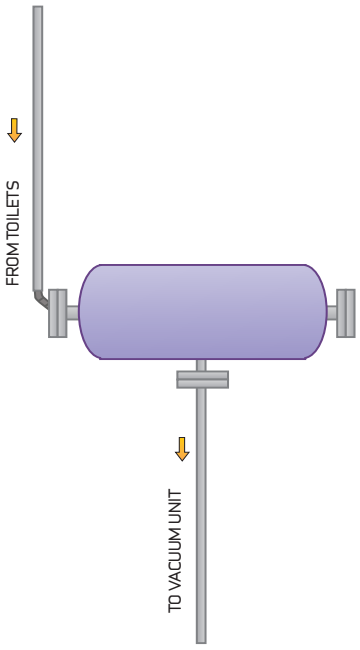
- Change of direction
- Vertical piping
- After connection of toilet or other equipment
- Every 1,5 m or (every 2nd. frame) for plastic pipes.
- Every 2,0 m for DN 40 steel pipe
- Every 2,3 m for DN 50 steel pipe
- Every 2,7 m for DN 65 steel pipe

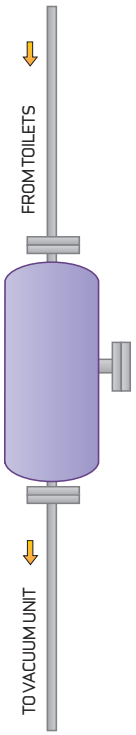
See also pipe manufactures recommendation.




### 4.6.5 Vacuum accumulating tank

For small vacuum systems (up to appr. 10 toilets), a vacuum accumulating tank to be considered. An accumulating tank is recommended if total pipe volume is less than 160 l (equal to appr. 85 m pipe length DN50).

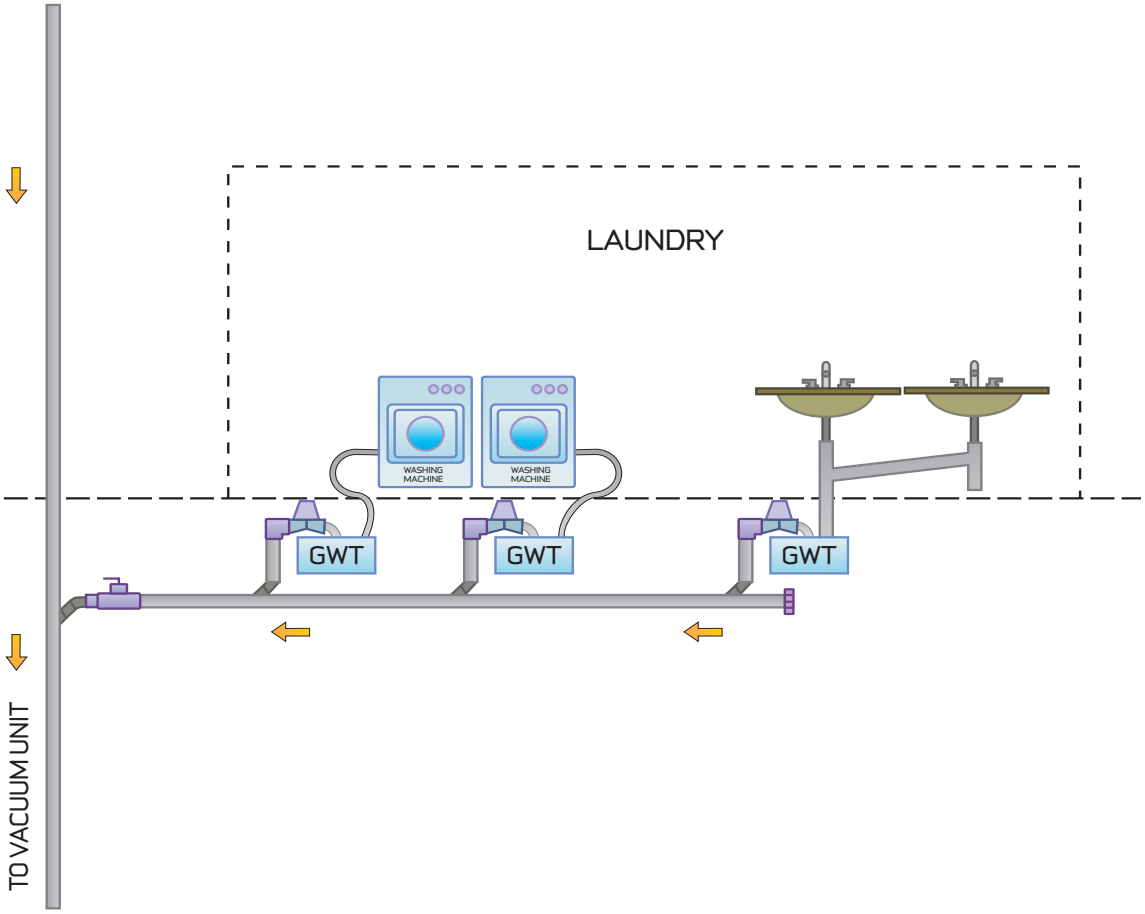


## 4.7 Grey Water

### 4.7.1 Grey water piping

Typical solution for grey water piping from laundry.




### 4.7.2 Grey water interface

Normally, grey water should be led in separate gravity pipe lines to STP or collecting tank.

However, in cases where the grey water must be connected to the buildings vacuum system, this can be done by installing a grey water tank with interface (ED valve) to the vacuum system.

# 5. Acceptance Criterias

## 5.1 Vacuum pipes only

Leakage test of complete vacuum pipes, without any components - toilets, grey water interface tanks, vacuumarators etc.- connected.

All pipe ends to be blinded.

Maximum accepted leakage: Vacuum drop from -0,6 bar to -0,5 bar during one hour.

## 5.2 Complete vacuum system

Leakage test of complete vacuum system, with all components- toilets, grey water interface tanks, vacuumarators etc.- connected.

Maximum accepted leakage: Vacuum drop from -0,55 bar to -0,4 bar during 20 minutes.

# 6. Descaling of Vacuum Sewage Pipelines

Urine scale is a hard substance that arises of a chemical reaction between the calcium in the water and the urine. Without any action taken there will be a build-up of scale in the vacuum pipes sooner or later depending on various factors. The temperature, the contents of calcium in the fresh water and the frequency of the use of the toilets are factors which decide the rapidity of the scale build-up.

In order to avoid scale build-up, it is recommended to follow the Jets descaling programmes.

The Jets descaling programmes give treatment for 4 different scenarios:

1. The Jets descaling maintenance programme offers treatment to clean pipes in order to avoid new scale build-up.
2. The Jets descaling programme offers treatment to minor scale build-up and is done over a longer period of time.
3. The Jets descaling boosting programme offers treatment to severe scale build-up where immediate action is necessary.
4. Strong acid treatment is recommended to extremely severe scale build-up. This requires that the toilets must be disconnected and the pipes plugged.

    a. Fill up the pipe line with a liquid mixture of phosphoric acid and water. 10% acid and 90% water
    b. Arrange circulation of the mixture if possible. Keep the circulation running for 24 hours
    c. Flush out with water.
    d. If there are still remains of urine scale, use the same procedure (a-c) with a mixture of 10% of Tetra Pyro-Potassium Phosphate.

The Jets descaling programmes allow running toilets during the processes 1-3.
It is therefore not necessary to disconnect the toilets or plug the pipes during the descaling process.

Jets recommend 2 options:

1. Manual dozing: Poor the Jets descaling liquid directly into the toilets according to recommended dosing programme by Jets.
2. Automatical dozing: Dosing units to be installed in the vessel according to the Jets recommendation.

It is highly recommended to follow the Jets recommendations accurately in order to obtain maximum effect.

Please contact Jets to get a dosing programme adapted to your installation.

| JETS | Sertifikat / Kontrollskjema- Jets Standard AS | | | |
|---|---|---|---|---|
| **Dokumentnavn:** | | **Dok.nr** | **Rev:** | **Dato:** |
| Control Chart Start-up Jets Standard AS | | 2501 | 0 | 25.06.09 |
| **Utarbeidet av:** | **Godkjent av:** | **Godkjent Dato:** | **Side** | **av:** |
| Systemkoordinator KS/IK | Systemkoordinator KS/IK | 25.06.09 | 1 | 3 |

# 2501 CONTROL CHART START-UP JETS STANDARD AS

| **Information** | | | |
|---|---|---|---|
| Owner: | | Owner representative | |
| Constructor | | Constructor representative: | |
| Building: | | Building: | |
| Jets unit No.: | | Jets representative: | |
| Scheduled completion: | | | |

| **Equipment installed** | | | |
|---|---|---|---|
| | Type: | No. off: | Power supply (V) |
| Vacuum unit: | | | |
| Discharge pump: | | | |
| Toilet: | | | |
| Toilet: | | | |
| Grey water tanks: | | | |
| Urinals: | | | |
| Other: | | | |
| Other: | | | |

| **Sewage Treatment Plant** | | | |
|---|---|---|---|
| STP type: | | No. off: | |
| Is STP delivered by Jets: | ☐ Yes ☐ No | | |
| Is STP commissioned by Jets: | ☐ Yes ☐ No | | |

**All functions in contract to be tested**

No. of toilets tested: _____
Comments:

No. of grey water tanks tested: _____
Comments:

| Dokumentnavn: | | | Dok.nr | Rev: | Dato: |
|---|---|---|---|---|---|
| Control Chart Start-up Jets Standard AS | | | 2501 | 0 | 25.06.09 |
| **Utarbeidet av:** | **Godkjent av:** | **Godkjent Dato:** | | **Side** | **av:** |
| Systemkoordinator KS/IK | Systemkoordinator KS/IK | 25.06.09 | | 2 | 2 |

No. of urinals tested: _____

Comments:

| **Test of vacuum unit** | | | | | | No. | | of | |
|---|---|---|---|---|---|---|---|---|---|
| S/N Vacuumarator: | | | | | | | | | |
| Snr. Vacuumarator: | | No.1 | | No.2 | | No.3 | | | |
| Vacuum switch adjusted | Vacuumarator No.1. | Start | | Bar | Stop | | | | Bar |
| | Vacuumarator No.2. | Start | | Bar | Stop | | | | Bar |
| | Vacuumarator No.3. | Start | | Bar | Stop | | | | Bar |
| Current with 50% vacuum | Vacuumarator No.1. | | | | | | | | Amp |
| | Vacuumarator No.2. | | | | | | | | Amp |
| | Vacuumarator No.3. | | | | | | | | Amp |
| Current Discharge Pump | Pump 1. | | | | | | | | Amp |
| | Pump 2. | | | | | | | | Amp |
| | Pump 3. | | | | | | | | Amp |
| Function in control cabinet | | | | | | | | | |
| | Pump Failure Alarm | ☐ Installed | | ☐ Approved | | | | | |
| | Low Vacuum Alarm | ☐ Installed | | ☐ Approved | | Adjusted: | | | % |
| | High Level Alarm | ☐ Installed | | ☐ Approved | | Delayed: | | | sec. |
| | High High Level Alarm | ☐ Installed | | ☐ Approved | | Delayed: | | | sec. |
| | Low Level Indication | ☐ Installed | | ☐ Approved | | | | | |
| | Temp Alarm | ☐ Installed | | ☐ Approved | | Temp adjusted to: | | | °C |
| | Flushing Sequence | ☐ Installed | | ☐ Approved | | Time adjusted to: | | | |
| | Running Time Alarm | ☐ Installed | | ☐ Approved | | Time adjusted to: | | | |
| | Auto Discharge | ☐ Installed | | ☐ Approved | | Delayed: | | | sec. |
| | Intermittent Discharge | ☐ Installed | | ☐ Approved | | Time adjusted to: | | | |
| | Running Signals | ☐ Installed | | ☐ Approved | | | | | |
| Additional functions | | ☐ Installed | | ☐ Approved | | | | | |
| | | ☐ Installed | | ☐ Approved | | | | | |
| | | ☐ Installed | | ☐ Approved | | | | | |

| Dokumentnavn: | | | Dok.nr | Rev: | Dato: |
|---|---|---|---|---|---|
| Control Chart Start-up Jets Standard AS | | | 2501 | 0 | 25.06.09 |
| **Utarbeidet av:** | **Godkjent av:** | **Godkjent Dato:** | | **Side** | **av:** |
| Systemkoordinator KS/IK | Systemkoordinator KS/IK | 25.06.09 | | 3 | 3 |

## Comments

## Signatures

| | | | |
|---|---|---|---|
| For owner/constructor: | | | |
| Date: | | Sign.: | |
| Name in block letters: | | | |
| For Jets Standard AS: | | | |
| Dato: | | Sign.: | |
| Name in block letters: | | | |

# Operation & Maintenance

Jets 15M 24V S1

JETS™
Sanitary Systems
– made to please


JETS™
Sanitary Systems
– made to please

# Operation & Maintenance

## Jets 15M 24V S1

JETS™
Sanitary Systems
– made to please


JETS™
Sanitary Systems
– made to please

# The Jets™ Sanitary Systems

Principle & Function



## Principle

Jets™ Vacuum System uses differential air pressure (vacuum) for the transport of sewage from the toilets to the vacuum generating unit (Jets™ pump).
From the pump the sewage is pumped either to a holding tank or to a sewage vacuum treatment plant (STP).
A NR-valve (Non-Return Valve) mounted on the vacuum side of the pump, separates the vacuum side from the atmospheric side of the system.
Start and stop is controlled by a pressure switch or vacuum transmitter, starting the pump at appr. 40% vacuum and stopping at appr. 55 % vacuum.

## Function

Each toilet is connected to the discharge pipes via the Jets™ interface valve. The valve is open only during the discharge cycle.
One or more pumps keep the discharge pipes under vacuum. Start and stop of the pump is controlled by a pressure switch or vacuum transmitter.
A non- return valve incorporated in the pump closes off the connection to the mains when the pump comes to a stop.
When a toilet is operated, the Jets™ interface valve is activated.
Sewage, waste water and air are sucked into the vacuum mains and transported to the pump.
The macerator integrated in the Jets™ Vacuumarator™ pump finally pulps the sewage while pumping it to a holding tank or a sewage treatment plant (STP).

Note: Changes without prior notice

# Jets Vacuumarator





## Mode of Operation

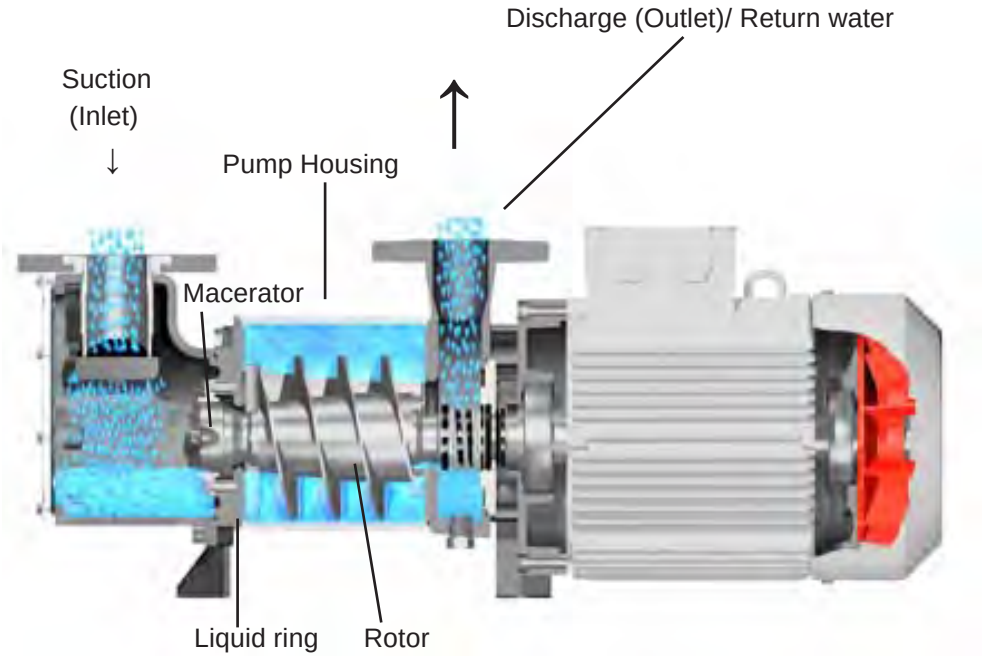
The Jets Vacuumarator's main function is to create vacuum in the piping system.The Vacuumarator is a screw pump with a built-on macerator. The principle of operation is a helical rotor running in a cylindrical housing, which together with two end plates forms the pump body.
When the Vacuumarator is in operation, a liquid ring is created round the rotor. The depth of the liquid ring is governed by the size of the opening in the end plate on the pressure side. This opening is arranged so that the created liquid ring will be touching the rotor hub on one side and the rotor tips on the other. This arrangement creates a series of progressive crescent shaped cavities travelling from suction to pressure side. Air, sewage and water is pulled into those cavities and transported through the vacuumarator.
The sewage is macerated by the built-on macerator before it enters the pump body.

The macerator consists of one rotating knife fixed to the shaft and one stationary knife fixed to the suction chamber.

In order to provide sufficient liquid level at the time when the Vacuumarator is starting, and thus securing the initial priming of the screw pump, a vacuumaratortank is mounted on the outlet pipe of the Vacuumarator. This is done for all types of Vacuumarator except for the Vacuumarator Jets 10N Tand 15MB/15MB-D, where the 50mm pipe on the outlet pipe functions as a tank to ensure return water.

How to fill water into the vacuumarator prior to start or after service:
Unscrew plug on side of suction chamber, one of the plugs. Fill fresh water through the plug hole up to plug hole level. Level may be controlled by looking through the suction chamber cover. Refit plug.

**For details: See Data Sheet 2108.**




Note: Changes without prior notice

# Jets™ Vacuumarator™ pump 15M 24V DC S1





## Jets™ Vacuumarator™ pump

- creates vacuum
- macerates sewage
- pumps sewage

Designed for direct connection to any kind of sewage treatment plant.
Outlet can also be connected to gravity piping or holding tank.
Safe operation is secured by black water from the toilets.

## Technical Data:

Capacity: ..... 15rm$^3$/hr
Flushing Capacity: ..... 120 flushes/hr
Outside Dimensions: ..... 610x214x332 mm. (LxWxH)
Electric Motor: ..... 1,5 kW DC Voltage
Pump Casing Material: ..... Bronze
Rotor Housing Material: ..... Stainless steel AISI 316
Pump Rotor Material: ..... Stainless steel AISI 316
Pump Knives Material: ..... Stainless steel AISI 420
Pump Shaft Material: ..... Stainless steel AISI 316
Connection Inlet: ..... Ø 50
Connection Outlet: ..... Ø 50
Total Weight: ..... 47 kg

| Voltage | Part No. |
|---|---|
| 24V DC S1 | 029015009 |
| Relay with cable | 121315152 |

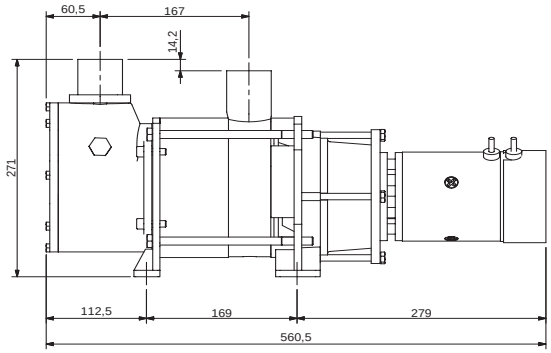
Note: Changes without prior notice

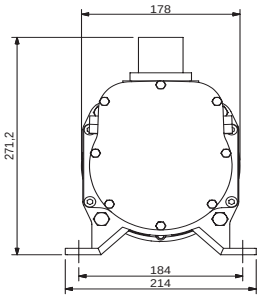
# Jets™ Vacuumarator™ pump 15M 24V DC S1





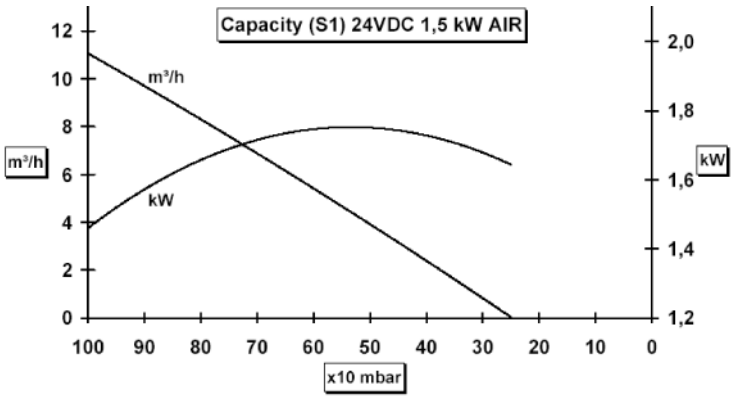
## Dimensions

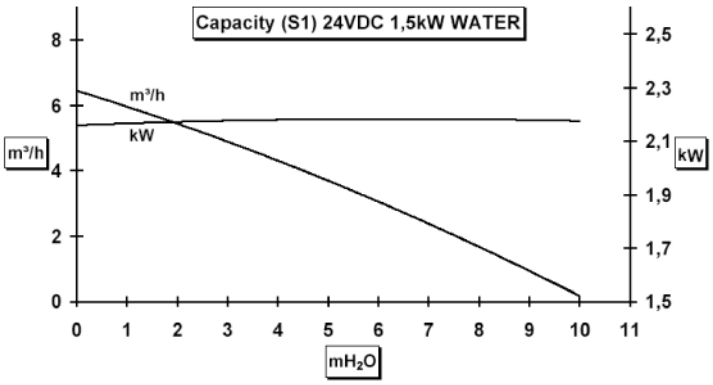



## Operating Data:

Speed (nom.): ..... 3000RPM
Power Connections (nom.): ..... 24V DC
Power Output (nom.): ..... 1,5kW
Current Consumption (nom.): ..... 88A
Current Consumption when discharging: ..... 92A
Overload 5% allowed for shorter period of time, max: ..... 10 minutes



| NORSOK<br><br>I-CR-001 | INSTRUMENT DATASHEET<br>PRESSURE INDICATOR | Datasheet<br>P02 |
|---|---|---|

## TAG RELATED TO THIS DATASHEET

| | |
|---|---|
| Tag number | : |
| Service description | : |
| P&ID | : |
| Line/equipment no. | : |
| Area | : |
| Package number | : |
| Process data sheet | : |
| Process data sheet rev | : |

## CALIBRATION VALUES

Calibrated range : -1-0Bar

## GENERAL

| | | | Note |
|---|---|---|---|
| 1 | Type | :Pressure Gauge | |
| 2 | Complete assembly | :Yes | |
| 3 | Manufacturer | :Skotselv Instrumentering AS | |
| 4 | Manufact.model no | :BM M/304-G 10.063<br>R¼" -1-0Bar | |
| 5 | Mounting | :Direct | |
| 6 | Weight | :0,2 kg | |

## INSTRUMENT CHARACTERISTICS

| | | |
|---|---|---|
| 7 | Characteristic | :Linear |
| 8 | Accuracy | :±1.6% FS |
| 9 | Repetability | :Included in 8 |
| 10 | Adjustable range | :No |
| 11 | Zero adjustment | :No |
| 12 | Span adjustment | :No |
| 13 | Operating limits | :-30 - +70ºC |

## BODY

| | | |
|---|---|---|
| 14 | Conn. size/type proc. | :R¼" |
| 15 | Rating | :1.3 x FS |
| 17 | Sour service spec. | :NA |
| 18 | Material, body | :316 SS |
| 19 | Protective coating | :No |

## ELEMENT

| | | |
|---|---|---|
| 20 | Type | :Bourdon tube |
| 21 | Capillary length | :NA |
| 22 | Material, element | Brass / Bronze |
| 23 | Material, capillary | :NA |

## METER

| | | | Note |
|---|---|---|---|
| 23 | Type | :Gauge | |
| 24 | Dial size/colour | : 63mm / White | |
| 25 | Scale range/colour | :0-16Bar+Psi / Black | |
| 26 | Pointer colour | :Black | |
| 27 | Shatterproof glass | :Yes | |
| 28 | Material housing | :304 SS | |
| 29 | Fill Fluid | :Glycerine | |
| 30 | Blow-out protection | :Yes, through vent plug | |

## MISCELLANEOUS

| | | |
|---|---|---|
| 31 | Pulsation damping | :No |
| 32 | Overpressure protection | :1.3 x FS |
| 33 | Chemical seal, connec | :NA |
| 34 | Chemical seal, matr | :NA |
| 35 | Chemical seal, fluid | :NA |

## NOTES

| Rev | Date | Issue/description | Prepared | Checked | Approved | Datasheet no |
|---|---|---|---|---|---|---|
| | | | | | | |

# Operation - Vacuum Unit

Operating Instructions



## Note: Not applicable when Vacuum Unit is controlled by Sewage Treatment Plant Control Cabinet

## Constant Vacuum System

### Operating

A Jets™ vacuum system is commissioned according to 501 Control Chart Start-up.

The systems operating mode can be selected via switches on control panel (see drawing).

On the control panel there is a separate switch for each pump. The switch has following positions:

0 - OFF
1 - MANUAL
2 - AUTO

In normal operation the system is set with all pumps in the AUTO mode. (switch in pos. 2 - AUTO). In this mode, start and stop is controlled by the pressure switch or vacuum transmitter and is normally set to start at 42% vacuum and stop at 55%.

In a system with more than one pump:

A system with 2 pumps: No. 2 pressure switch to be set to start at 40% vacuum.

A system with 3 pumps: No. 3 pressure switch to be set to start at 38% vacuum.

See also instruction for pressure switches.

Setting the switch in pos. 1 - MANUAL, the pump will be running until the switch is set in either pos. 0 - OFF or in pos. 2 - AUTO.

### Discharge Pump

Some systems are supplied with a pump for discharging the content from the holding tank. The operating modes for the discharge pump is chosen via a switch with following functions.

0 - OFF
1 - LOCAL
2 - REMOTE
3 - INTERMIT. or AUTO

When operating in pos. 1 - LOCAL mode, start and stop is manually operated from cabinet front. If not stopped manually, it will be stopped by low level switch.

When operating in pos.2: REMOTE, Same as LOCAL.

When operating in pos. 3: INTERMIT., start of the pump is controlled by a timer. Stop is controlled by low level switch.

When operating in pos.3 AUTO, start is controlled by high level switch and stop by low level switch.

### Pump used as Discharge

Put the 3-way valve(s) and the other valves involved, in discharge position (see pipeline drawing).

Put MODE SELECTOR in position

DISCHARGE.

Discharge will stop when the tank is empty.

Note: Part of the system may not be available during discharge

**Note!** The lay-out and practical use of each unit will decide the setting of pressure switch/vacuum transmitter as opposed to normal setting

Note: Changes without prior notice

# Control Cabinet

Operating Instructions



## Note: Not applicable when Vacuum Unit is controlled by Sewage Treatment Plant Control Cabinet

## Control cabinet

If the control cabinet is fitted with a main switch (inside cabinet), this must be switched on when in operating mode.

See enclosed drawing of front control cabinet for the system in mention.

## General functions

### Constant vacuum:

When commissioning a system all functions are preset.

Normal operating mode of system is AUTO. In this mode, start and stop of each pump is controlled either by a pressure switch or vacuum transmitter. Setting of Pressure Switches: See Data Sheet No. 3103.
Vacuum transmitter valves are preset in program.

On a system with more than one pump, the second (and third) are normally set to start at a slightly lower vacuum than that of no.1.

## Alarm

For control cabinets equipped with alarm running time: Running time should be preset to 10 minutes. See enclosed data sheet for Timing Relays, and El. Diagrams.

For control cabinets with alarm low vaccum, to be adjusted according to Data Sheet 3103.

## Functions Jets™ Vacuumarator™ pump

0. OFF

1. RUN
   Pump will run independent of pressure switch.

2. AUT0
   Normal operation mode.
   Pumps controlled by pressure switches.

Note: Changes without prior notice

# Relative Vacuum Value Table

Table

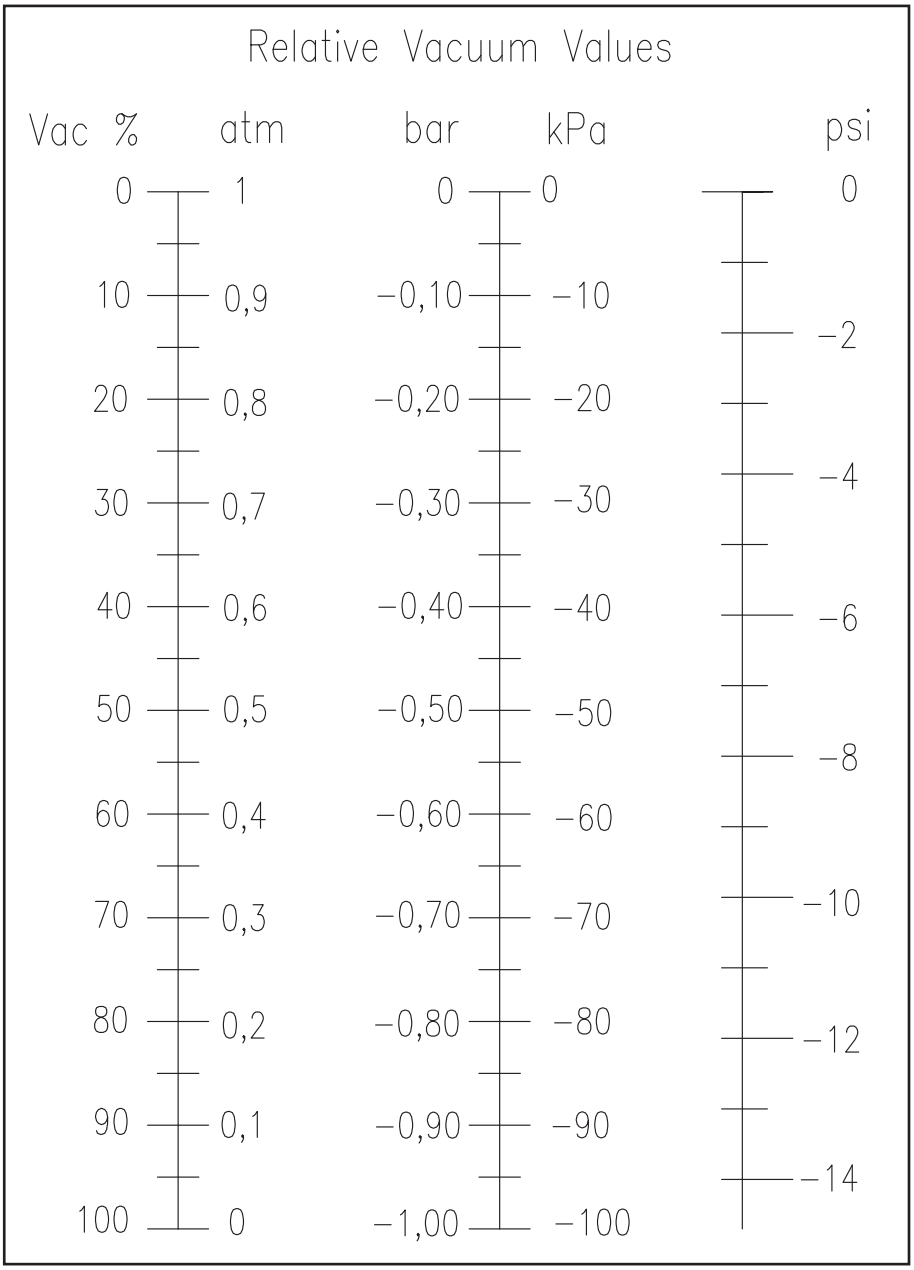


## Vacuum comparison table

100% vacuum (absolute vacuum) is in scientific terms defined as 0 (zero) pressure.

In practical use, makers of vacuum switches, vacuum gauges etc. defines atmospheric pressure as 0 (zero) pressure and absolute vacuum as - 1 Bar, -14,7 psi, etc.

This comparison table defines 0 as atmospheric pressure and 100% vacuum is -1 bar, -14,7 psi, etc.




Note: Changes without prior notice

# Troubleshooting & Repair
## Jets™ 15M 24V DC S1



Maintenance

## Vacuumarator™ Jets™ 15M 24V DC S1

| Maintenance Job | Data Sheet No | Drawing No | Part No | Interval | Comments |
|---|---|---|---|---|---|
| Check possible air leakages in vacuum system: Stop pumps and monitor possible drop on vacuum gauge | | Piping Diagram | | Monthly | |
| Check pumps for scale layer. Descaling to be carried out if required | | 31939-029 | | Yearly | |
| Clean connection pipe for pressure switches by letting in air | | Piping Diagram | | Daily | |
| Readjust preset settings of pressure switches (If needed) | 3103 | Piping Diagram | 032300100 | Monthly | |
| Check function pressure switches | 3103 | | 032300100 | Daily | |
| Replace shaft seal on Vaccumarator™. | 2156 | 31939-029 | 038201500 | 2 years/ 6000 hours or if water leakage should occur during running | See Data Sheet No.2156 for disassemly and assembly of Vacuumarator™ Jets™ 15M S1 |
| Change bearings on Vacuumarator™. | 2156 | 31939-029 | 038201710 038205910 | 2 years/ 6000 hours | See Data Sheet No.2156 for disassemly and assembly of Vacuumarator™ Jets™ 15M S1 |

Note: Changes without prior notice

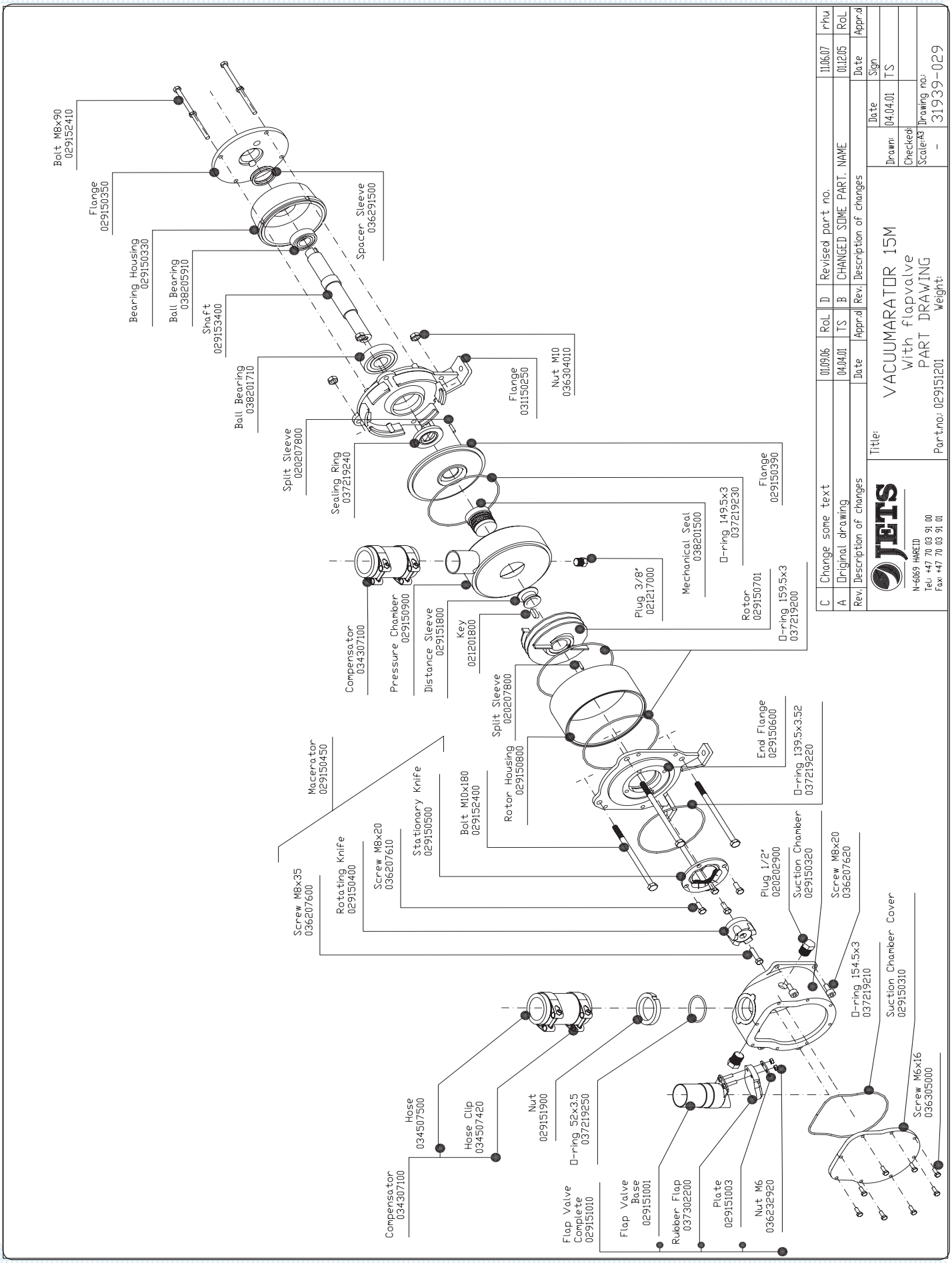
# Troubleshooting & Repair

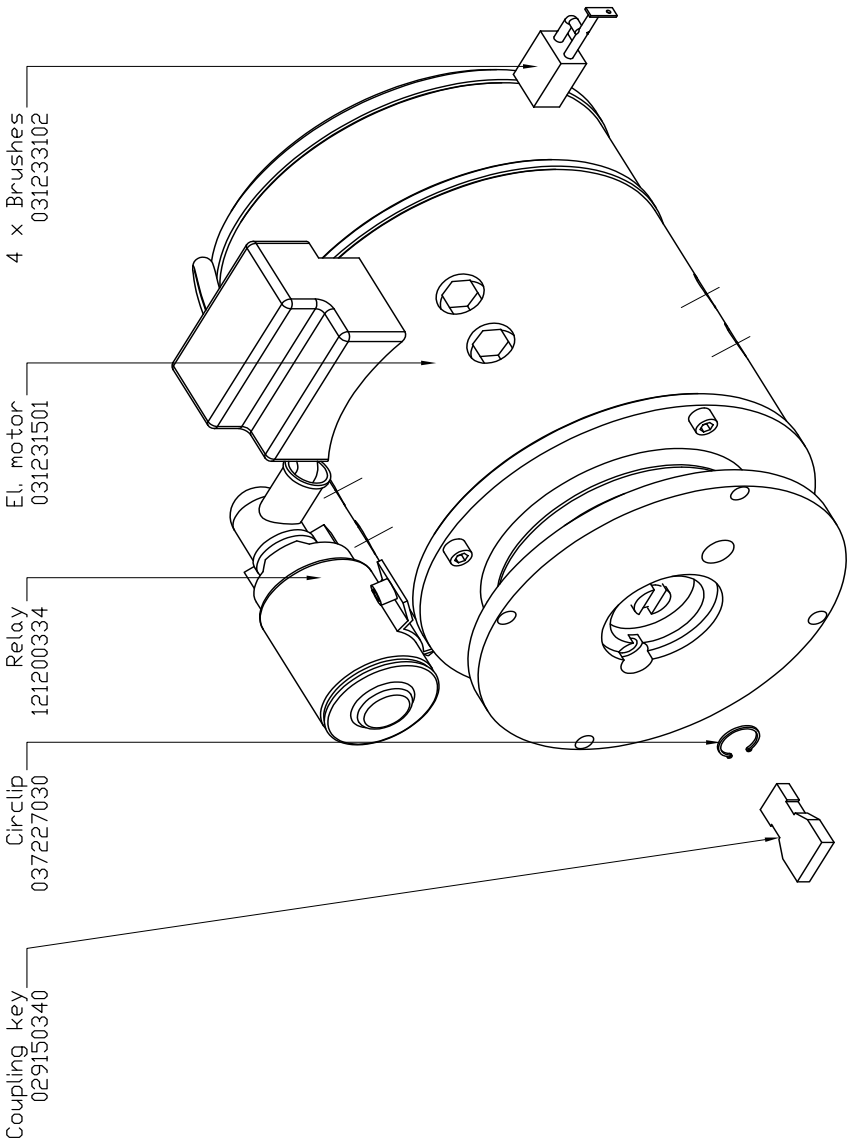
## Jets™ 15M 24V DC S1





| Problem | Causes | Action | Data Sheet No | Drawing No | Part No. |
|---|---|---|---|---|---|
| Low vacuum | Lack of liquid to Vacuumarators™ | Check that pumps has water during operation | 2148, 2106 | | |
| | Leaks in vacuum pipes | Check for leaks and repair | | Piping Diagram and Vacuum Piping Guide | |
| | Macerator clogged | Remove blockage | | 31939-029 | 029150400 |
| | Clogged pipes | Remove blockage | | Piping Diagram and Vacuum Piping Guide | |
| Water leakage from Vacuumarator™ | Defective Shaft Seals | Check and replace Shaft Seals | | 31939-029 | 038201500<br>037219240 |
| Frequent start and stop of Vacuumarator™ | Leaks in vacuum pipes | Check for leaks and repair | | Piping Diagram | |
| | Leaks caused by insufficient closing of Flap Valve (Vacuumarator™ non/return valve) | Check flap valve and clean surface of valve | | 31939-029 | 029151010 |
| Overload electrical motor | Motor protection relay tripped | Check causes for overload and repair | | El. Diagram | |
| Running time alarm (If installed) | Running time of Vacuumarator™ has extended preadjusted time | Check for leakages in pipe system and repair | | El. Diagram | |


Bolt M8x90 029152410
Flange 029150350
Bearing Housing 029150330
Ball Bearing 038205910
Shaft 029153400
Spacer Sleeve 036291500
Ball Bearing 038201710
Flange 031150250
Nut M10 036304010
Split Sleeve 020207800
Sealing Ring 037219240
Flange 029150390
Compensator 034307100
Pressure Chamber 029150900
Distance Sleeve 029151800
Key 021201800
Plug 3/8" 021217000
Mechanical Seal 038201500
O-ring 149.5x3 037219230
Rotor 029150701
O-ring 159.5x3 037219200
Split Sleeve 020207800
End Flange 029150600
O-ring 139.5x3.52 037219220
Macerator 029150450
Rotating Knife 029150400
Screw M8x35 036207600
Screw M8x20 036207610
Stationary Knife 029150500
Bolt M10x180 029152400
Rotor Housing 029150800
Plug 1/2" 020202900
Suction Chamber 029150320
Screw M8x20 036207620
O-ring 154.5x3 037219210
Suction Chamber Cover 029150310
Screw M6x16 036305000
Hose 034507500
Hose Clip 034507420
Nut 029151900
O-ring 52x3.5 037219250
Compensator 034307100
Flap Valve Complete 029151010
Flap Valve Base 029151001
Rubber Flap 037302200
Plate 029151003
Nut M6 036232920
C Change some text 01.09.06 RoL D Revised part no. 11.06.07 rhu
A Original drawing 04.04.01 TS B CHANGED SOME PART. NAME 01.12.05 RoL
Rev. Description of changes Date Apprd Rev. Description of changes Date Apprd
JETS
N-6069 HAREID
Tel: +47 70 03 91 00
Fax +47 70 03 91 01
Title: VACUUMARATOR 15M
With flapvalve
PART DRAWING
Part.no: 029151201 Weight:
Drawn: Date 04.04.01 Sign TS
Checked: Date Sign
Scale:A3 Drawing no: - 31939-029




| Rev. | Description of changes | Date | Appr'd |
|---|---|---|---|
| A | Original drawing | 22.08.2001 | T.G. |

JETS
N-6069 HAREID
Tel: +47 70 03 91 00
Fax +47 70 03 91 01

Title: El. motor S1 JETS 15M 24 VDC
Part drawing

Part.no:

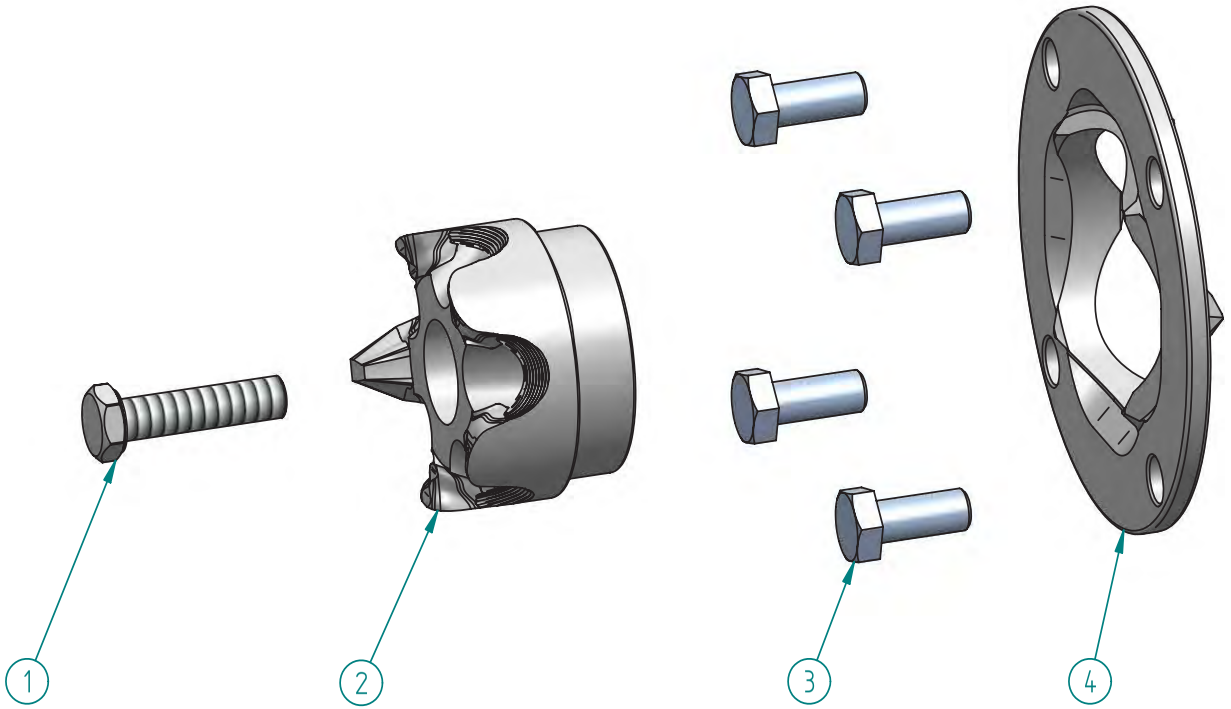
Weight:

| | Date | Sign |
|---|---|---|
| Drawn: | 22.08.2001 | T.G. |
| Checked: | | |

Scale: A3 Drawing no: - 32023-031

| ITEM | PART NO | TITLE | DWG NO | QTY |
|---|---|---|---|---|
| 1 | 036280101 | Screw M8x35 Din 933 A4 | | 1 |
| 2 | 029150400 | Rotating Knife | 15-17 | 1 |
| 3 | 036207610 | Screw M8x20 | | 4 |
| 4 | 029150500 | Stationary Knife | 15-18 | 1 |

| RevNo | Revision note | Date | Sign. | Checked |
|---|---|---|---|---|
| A | Original Drawing | 21.01.2009 | OAS | EØ |

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MJØS METALLVAREFABRIKK AS

| | | | | |
|---|---|---|---|---|
| Scale: 0,75 | Weight - | Checked EØ | Date 21.01.2009 |
| Tol. ISO 2768-M / Dwg size: A4 | Material | Design AØ | Date 15.04.2008 |
| Project: Jets AS | Replaces - | Replaces by - | |
| Title: Macerator 15MB/15MB-D | Drawing no. STD-102031-029 | | Rev. A |



Part no. 029150450

Revised issue 03.02.11.

# Spare part kit for Vacuumarator™ pump

## Recommended spare parts - on board spares

Scope of supply can be changed at any time, without any further notice

**For pump: 15M**

| | | | Kit no.: K1-15M |
|---|---|---|---|
| **Part number** | **Description** | **Drawing no.:** | **Quantity of spares** |
| 038201500 | Shaft seal | 31939-029 | 1 |
| 037219240 | Sealing ring | 31939-029 | 1 |
| 037219210 | O-ring | 31939-029 | 1 |
| 037219220 | O-ring | 31939-029 | 1 |
| 037219200 | O-ring | 31939-029 | 3 |
| 037219230 | O-ring | 31939-029 | 1 |
| 037219250 | O-ring | 31939-029 | 1 |
| 029150310 | Cover | 31939-029 | 1 |
| 037302200 | Rubber flap | 31939-029 | 1 |
| 020207800 | Split sleeve | 31939-029 | 1 |