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## Installation, Operating, and Maintenance Instructions for the BETE HydroWhirl® S Series Tank Washing Nozzles



For BETE HydroWhirl S Model Numbers:

- HWS-20
- HWS-30
- HWS-40
- HWS-40HF
- HWS-50

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# 1. Introduction

Congratulations on your purchase of a BETE HydroWhirl S series tank washing nozzle! The HydroWhirl S series nozzles are driven by liquid pressure only. There are no electrical parts or motors of any kind, making for a simple yet effective product for washing tanks, drums, containers, and vessels. The HydroWhirl S series nozzles are a precision product which are designed to have a minimum service life of 300 hours under normal operating conditions. Environmental conditions such as high temperature or the presence of chemicals may shorten the lifetime of the HydroWhirl S.

## 2. Safety and Precautions

### 2.1. Handling

HydroWhirl S nozzles should be handled carefully, paying special attention to the slots, which have sharp edges and can cut. The use of work gloves when handling is recommended.

### 2.2. Nozzle Connection

Prior to startup, the nozzle connection should be checked to ensure it is securely attached to the pipe. If the nozzle is loose it can detach from the pipe at a high velocity and cause personal injury or damage to nearby objects. Personnel should not be near the nozzle when it is starting up or running.

### 2.3. General Safety

General safety rules and guidelines of the facility where the nozzle is being installed should be followed at all times. In the event of conflicting directives between facility safety rules and guidelines and this manual, the facility safety rules and guidelines shall take precedence. If a conflict interferes with installation, use, or maintenance of the HydroWhirl S nozzle, please consult your local representative or the factory.

### 2.4. Tanks Larger than 3500 ft<sup>3</sup> (100m<sup>3</sup>)

For tanks with a volume larger than 3500 ft<sup>3</sup> (100 m<sup>3</sup>) dangerous electrical charges of the liquid sprayed can occur. Additional safety precautions must be taken!

### 2.5. Cleaning Liquid Chemical Composition

The cleaning liquid must not have any chemicals or additives that can create a flammable vapor.

### 2.6. Tank Drain

When cleaning the tank, a drain capable of allowing the liquid to exit the tank at the same rate it is entering the tank must be in operation in order to prevent the accumulation of liquid which can cause an insulating condition.

## 2.7 Dust Environments

When using the HydroWhirl S in a dust environment hybrid mixtures are not allowed.

## 3. Installation

### 3.1. Identifying Connection Type

There are three types of connections available for the HydroWhirl S series tank washing nozzles:

- a) Female threaded (NPT or BSP)
- b) Clip-on
- c) Welded

The type of connection can be identified comparing the HydroWhirl S nozzle to be installed to Figure 1 below:

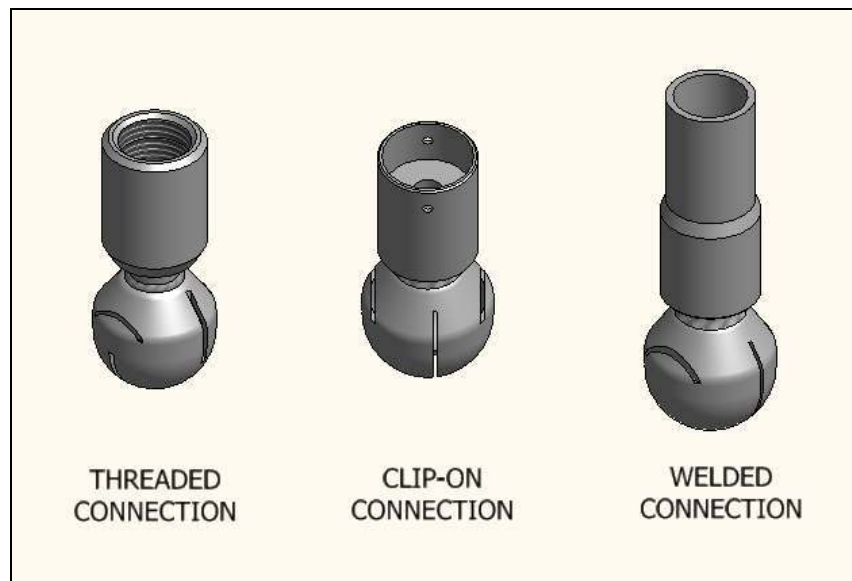


Figure 1 - Types of HydroWhirl S Connections

### 3.2. Identifying Pipe or Tube Size

The pipe or tube size for each type of connection can be identified in Table 1 below. If the nozzle has a welded pipe connection, the HWS30, HWS40, HWS40HF and HWS50 have two pipe sizes available. If your welded HydroWhirl S is one of these models, the pipe size can be determined by measuring the outside diameter (O.D.) and using Table 2.

<b>BETE HydroWhirl S Connection Sizes</b>					
<b>Connection Type</b>	<b>Nozzle Number</b>				
	<b>HWS20</b>	<b>HWS30</b>	<b>HWS40</b>	<b>HWS40HF</b>	<b>HWS50</b>
Pipe Clip-On	10 mm	3/8"	3/4"	3/4"	1 1/2"
Tube Clip-On	-----	3/4"	1"	1"	2"
Pipe Weld On	1/4"	3/8" or 1/2"	3/4" or 1"	3/4" or 1"	1 1/2" or 2"
Tube Weld On	1/2"	3/4"	1"	1"	2"
Female NPT/BSP	1/8"	1/4"	3/4"	3/4"	1 1/2"

**Table 1 - HydroWhirl S Available Connections**

Nominal Pipe Size (NPS)	Actual O.D., in. (mm)
3/8"	0.675 (17.1)
1/2"	0.840 (21.3)
3/4"	1.050 (26.7)
1"	1.315 (33.4)
1 1/2"	1.900 (48.3)
2"	2.375 (60.3)

**Table 2 - Actual O.D. of Nominal Pipe Sizes**

### 3.3. Preparing Pipe for Nozzle Installation

#### 3.3.1. Welded Connection Pipe Preparation

Welding procedures vary greatly by industry and company. The appropriate size pipe should be prepared in accordance with the weld procedure of the end user.

#### 3.3.2. Clip-On Connection Pipe Preparation

A hole of diameter D, located at a maximum distance L from the end of the pipe will need to be drilled completely through the pipe as shown in Figure 2. Values for diameter D and distance L are listed in Table 3 below.

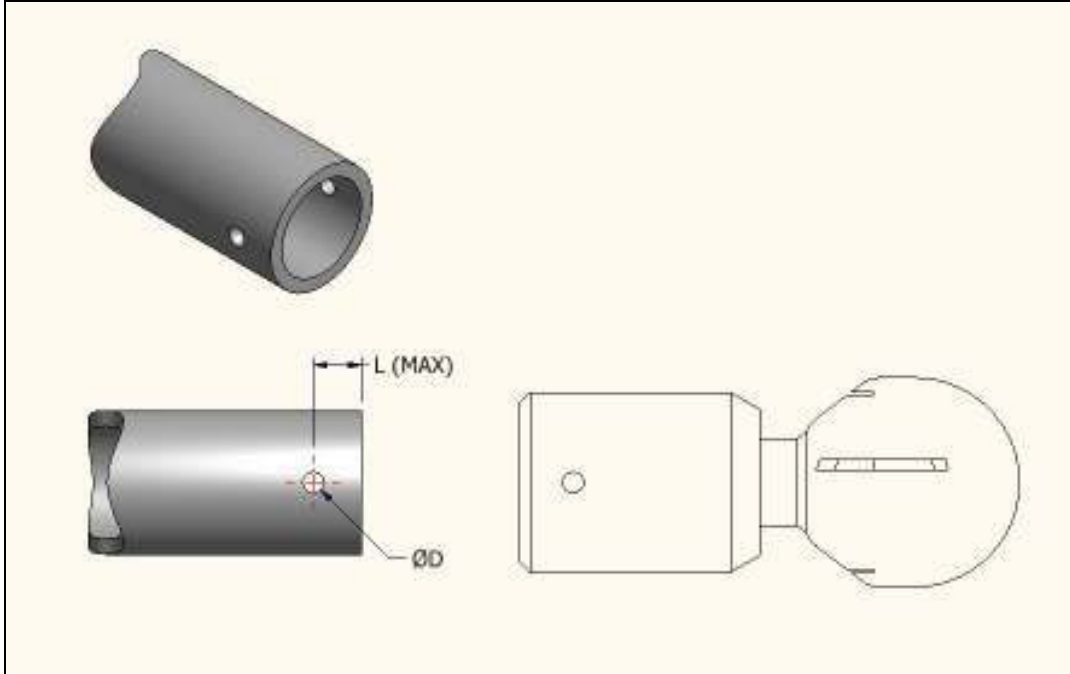


Figure 2 - Illustration of Hole Location for Clip-On Connections

Pipe and Tube Clip on Connection Hole Dimension and Location on Pipe or Tube			
Pipe/Tube	Size	L MAX, in. (mm)	ØD, in. (mm)
pipe	10 mm	0.147 (3.7)	0.089 (2.3)
pipe	3/8"	0.203 (5.2)	0.086 (2.2)
pipe	3/4"	0.344 (8.7)	0.156 (4.0)
pipe	1 1/2"	0.344 (8.7)	0.219 (5.6)
tube	3/4"	0.203 (5.2)	0.086 (2.2)
tube	1"	0.344 (8.7)	0.156 (4.0)
tube	2"	0.344 (8.7)	0.219 (5.6)

Table 3 - Values of D and L for Clip-On Connections

### 3.3.3. Female Threaded Connection Pipe Preparation

The end of the pipe should be prepared with a male NPT or BSP pipe thread in accordance with ASME B1.20.1 for NPT threads and either BS21 or ISO 228/1 for BSP threads. Use of thread sealant is not necessary. Use of an anti-galling compound is suggested.

### 3.4. Piping System Grounding

The piping system feeding the HydroWhirl S nozzle ***MUST*** be grounded in accordance with all applicable local, state, and government codes if used in any kind of explosive environment.

### 3.5. Piping System Filtration

Prior to installing the nozzle a filter should be installed upstream of where the nozzle will be installed. The filter should be 50 microns or finer to prevent the nozzle from clogging and reduce bearing wear.

### 3.6. Piping System Purge

Prior to installing the nozzle, the piping system should be purged to ensure all burrs, weld spatter, dirt, and any other debris is removed.

### 3.7. Installing the Nozzle

#### 3.7.1. Welded Connection Installation

The temperature in the area of the bearing balls (see Figure 3) must not exceed 194°F (91°C) when welding the nozzle, otherwise damage might be caused to the housing and a faulty rotary motion may result. Appropriate cooling measures must be taken to ensure this. The distance  $W$  from the end of the weld connector to the bearing balls can be found in Table 4. The nozzle should be welded in accordance with the welding procedures of the end user. Welding should only be performed by qualified personnel. For further information, contact a local mechanical contractor.

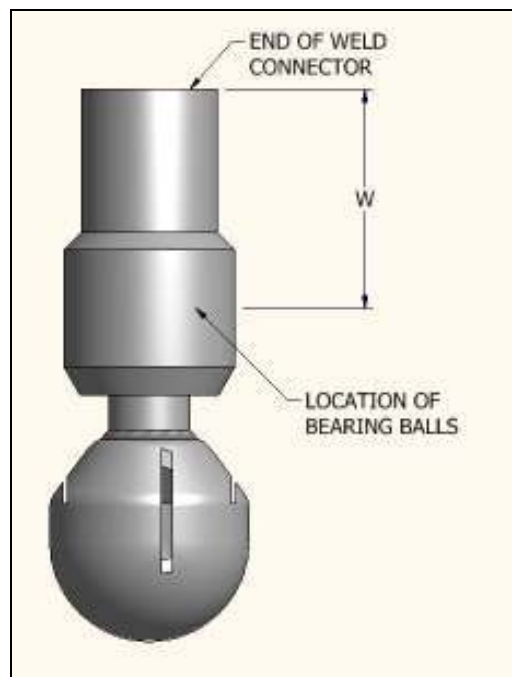


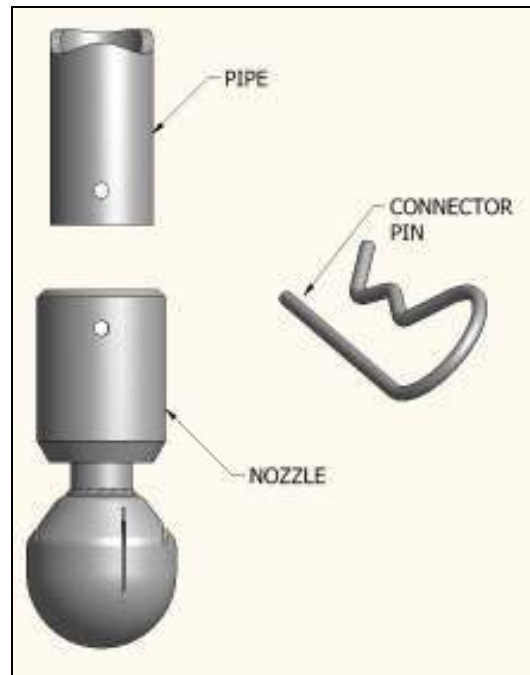
Figure 3 - Distance  $W$  from end of Weld Connector to Bearing Balls

Distance from end of Weld Connector to Bearing Balls for Welded Pipe and Tube Connectors		
Pipe/Tube	Size	W, in (mm)
Pipe	1/4"	1.5 (38.1)
Pipe	3/8"	1.5 (38.1)
Pipe	1/2"	1.5 (38.1)
Pipe	3/4"	1.5 (38.1)
Pipe	1"	1.5 (38.1)
Pipe	1 1/2"	2.0 (50.8)
Pipe	2"	2.0 (50.8)
Tube	1/2"	1.5 (38.1)
Tube	3/4"	1.5 (38.1)
Tube	1"	1.5 (38.1)
Tube	1 1/2"	2.0 (50.8)

**Table 4 - Values of D for Welded Connectors**

### 3.7.2. Clip-On Connection Installation

1. Have nozzle in one hand and connector pin in the other (Figure 4).
2. Align holes on pipe with holes on nozzle (Figure 5).
3. Insert the connector pin through all holes until it snaps into place (Figure 6).
4. Final assembly should look as shown in Figure 7.
5. If the connector pin needs to be replaced, it must be replaced with the specified BETE part number listed in Table 5 or the nozzle may become detached from the pipe and cause damage to the vessel or components in the vessel.



**Figure 4 - Preparation for Installation**



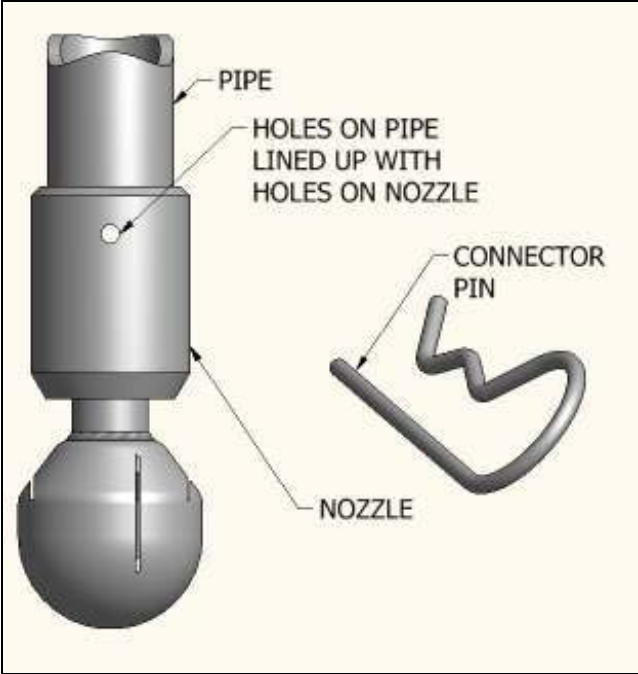


Figure 5 - Lining up Holes

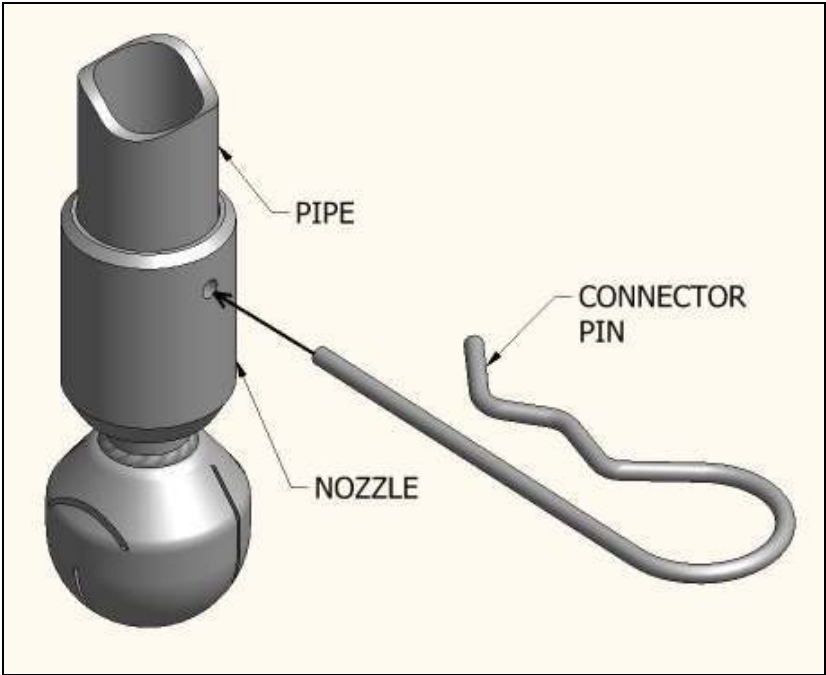


Figure 6 - Connector Pin Insertion

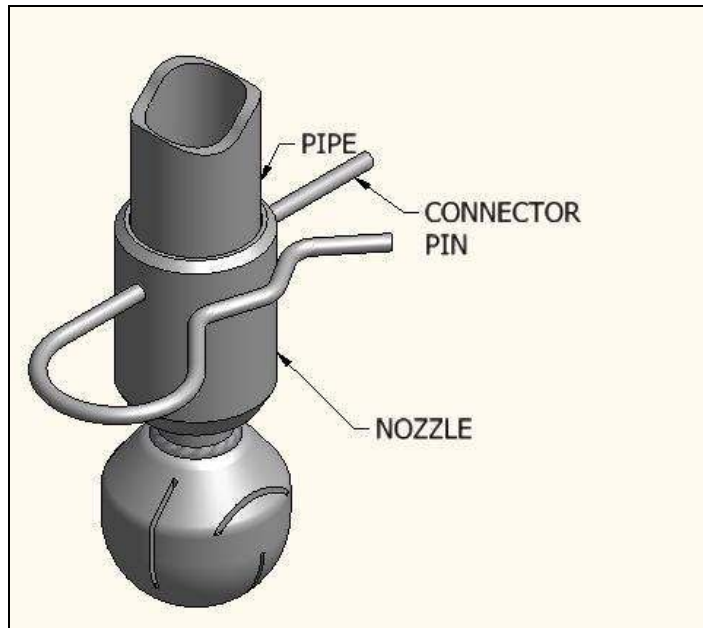


Figure 7 - Final Assembly of Nozzle with Clip-On Connection

Nozzle Number	Connector Pin Number
HWS20	2HWS-62289
HWS30	2HWS-62289
HWS40	2HWS-62290
HWS40HF	2HWS-62290
HWS50	2HWS-62291

Table 5 - BETE Connector Pin Part Numbers

### 3.7.3. Female NPT and BSP Installation

1. In order to properly install the HydroWhirl S nozzle with an NPT or BSP connection, the use of a strap wrench with a non-metallic strap or soft-jaw pliers is required in order to make sure the surface of the nozzle is not damaged.
2. Hand tighten the nozzle on to the pipe until it stops.
3. Using the strap wrench or soft jaw pliers on the thread section **ONLY** (see Figure 8) tighten the nozzle 1 to 2 turns.

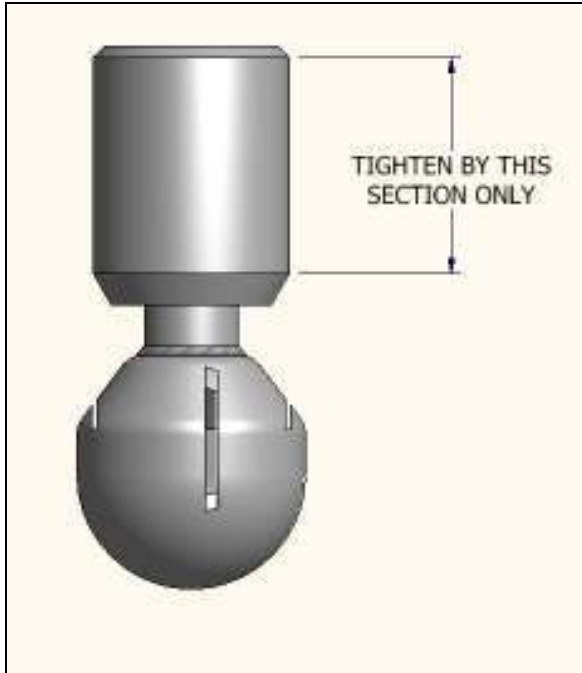


Figure 8 - Illustration of where to Tighten Threads

## 4. Operation

### 4.1. Startup

In order for the nozzle to operate, liquid pressure greater than 10 PSI (0.7 bar) must be present at the inlet of the nozzle. Typically pressure is generated by use of a pump or by supplying municipal water pressure and the nozzle is started by opening a valve upstream of the nozzle.

### 4.2. Nozzle Performance

Nozzle performance is measured by the flow rate of the nozzle. As the pressure at the nozzle increases so does the flow rate. The flow rates at various pressures are listed in Table 6. Flow rates for HydroWhirl S nozzles with a clip-on connector flow 10-15% higher than the values in Tables 6 and 7.

Nozzle Number	Gallons Per Minute @ PSI					
	10 PSI	20 PSI	30 PSI	40 PSI	50 PSI	60 PSI
HWS-20	3.7	4.6	5.4	6.3	6.4	6.5
HWS-30	6.4	8.7	10.4	12.0	13.1	14.1
HWS-40	10.5	14.5	17.5	20.2	22.3	24.1
HWS-40HF	16.7	23.1	28.1	32.4	35.8	38.8
HWS-50	38.0	53.0	64.3	73.6	82.1	89.7

Table 6 - Flow Rates at Different Pressures - English Units

Nozzle Number	Litres Per Minute @ bar					
	0.7 bar	1.4 bar	2.1 bar	2.8 bar	3.5 bar	4.1 bar
HWS-20	14.0	17.4	20.4	23.8	24.2	24.6
HWS-30	24.2	32.9	39.4	45.4	49.6	53.4
HWS-40	39.7	54.9	66.2	76.5	84.4	91.2
HWS-40HF	63.2	87.4	106.4	122.6	135.5	146.9
HWS-50	143.8	200.6	243.4	278.6	310.7	339.5

**Table 7 - Flow Rates at Different Pressures - Metric Units**

### 4.3. Operating Pressure Range

The HydroWhirl S nozzle operates best in a pressure range of 10-60 PSI (0.7-4.1 bar). Pressures below 10 PSI (0.7 bar) result in less effective cleaning. Pressures above 60 PSI (4.1 bar) also result in less effective cleaning, and in addition, cause the nozzle to rotate faster, which may shorten bearing life. The recommended pressure for the best performance and maximum service life is 60 PSI (4.1 bar).

### 4.4. Maximum Operating Pressure

The maximum operating pressure for the HydroWhirl S is 145 PSI (10 bar).

### 4.5. Maximum Operating Temperature

The maximum operating temperature for the HydroWhirl S is 175°F (80.1°C).

## 5. Maintenance

### 5.1. Preventative Maintenance

The most important preventative maintenance that will ensure a long, trouble free lifetime for the HydroWhirl S nozzle is to have 50 micron or finer filtration upstream of the nozzle that is cleaned on a regular basis. The frequency of cleaning depends on the quality of the liquid flowing through the filter and must be determined by facility maintenance personnel.

### 5.2. Cleaning

The HydroWhirl S is designed to be self cleaning and if recommended filtration is provided and maintained, the nozzle should not clog. In the event that the nozzle does become clogged, it should be removed from service and soaked in a liquid that acts as a solvent to whatever is clogging the nozzle, and is compatible with the material of construction of the nozzle. The nozzle should then be rinsed with clean water. If this does not remove what is clogging the nozzle then cleaning in an ultrasonic bath for 30-60 minutes is suggested. If this does not remove what is clogging the nozzle then it must be replaced.

### 5.3. Replacement Parts

With the exception of connector pins for clip-on connectors (see section 2.5.2, Table 4), there are no replacement parts for the HydroWhirl S nozzle. These pins should be periodically inspected for wear and replaced if worn. Once the HydroWhirl S nozzle has reached the end of its service life it should be replaced.

## 6. Support

### 6.1. Nearest Distributor or Representative

The most up-to-date list of BETE representatives and distributors can be found at <http://www.bete.com/contact/index.html>.

### 6.2. BETE Corporate

#### 6.2.1. BETE Corporate Contact for Europe

BETE Deutschland  
Dr.-C.-Otto-Str. 190  
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[www.bete-deutschland.de](http://www.bete-deutschland.de)

#### 6.2.2. BETE World Headquarters

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[appeng@bete.com](mailto:appeng@bete.com)  
[www.bete.com](http://www.bete.com)



## 7.1 EC Type Examination Certificate

- [1] **1<sup>st</sup> Addition to**  
**EC-TYPE EXAMINATION CERTIFICATE IBExU11ATEX1099 X**  
according to Directive 94/9/EC, Annex III  
- Translation -



- [2] Equipment: **Hydrowhirl™S series tank washing nozzles**  
Type HWS

*Sizes*

...HWS 20, ...HWS 30, ...HWS 40, ...HWS 40HF, ...HWS 50

*Designs*

PC HWS..., TC HWS..., PW HWS..., TW HWS..., and HWS...

- [3] Manufacturer: BETE Fog Nozzle, Inc.

- [4] Address: 50 Greenfield Street  
Greenfield, MA 01301  
USA

- [5] **Addition/Modification**

An additional, technical drawing was incorporated. The fulfilment of the requirements of the actual standard status was checked. In addition, it was checked, whether the equipment mentioned in [2] is suitable for use in presence of dusts.

- [6] **Test Report**

The results of the examination are recorded in the Test Report IB-11-2-159 of 7 December 2011. All documents underlying this examination and the operating range are mentioned in the test report. Only designs in accordance with these documents are allowed.

- [7] **Test Result**

The spray nozzles fulfil the requirements of the standard EN 13463-5:2011. The equipment mentioned in [2] is also suitable for use in presence of combustible dusts. The marking of the equipment mentioned in [4] shall include the following:



The "X" after the EC-Type Examination Certificate number means that for the safe use of the spray nozzles mentioned in [2] the following special conditions have to be kept:

- Hazardous charging of the spraying liquid can arise during cleaning tanks with volumes > 100 m<sup>3</sup>. The operator must prepare additional protective measures.
- The spraying liquid must not contain contaminants which could form a second phase.
- Any accumulation of isolating liquid in the tank during the cleaning process must be avoided.
- All conductive parts which could be charged by the directed spray must be included in the potential bonding.
- The use of the spray nozzles in presence of hybrid mixtures is not permitted.

**IBExU Institut für Sicherheitstechnik GmbH**  
An-Institut der TU Bergakademie Freiberg

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**This addition is only valid in combination with the EC-Type Examination Certificate  
IBExU11ATEX1099 X of 22 August 2011.**

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Authorized for certifications  
- Explosion protection -

By order

  
(Dipl.-Ing. Willamowski)



Freiberg, 7 December 2011

Certificates without signature and  
seal are not valid.  
Certificates may only be duplicated  
completely and unchanged.  
In case of dispute, the German text  
shall prevail.