

# PIPELINE

*IPEX Industrial Newsletter*

- 1 Static Leach Analysis
- 2 Dynamic Leach Analysis
- 3 Socket Fusion Joining Method



## Enpure® proves itself as the superior high purity system

**M**anufacturing industries & research facilities are increasingly requiring high purity water systems that will meet the stringent requirements of their operations. Whether the application is for ultra pure water or for transporting chemically pure agents of foodstuffs, water purification technologies such as distillation, de-ionization, reverse osmosis and filtration eliminate a variety of impurities such as bacteria, particulates and both organic and inorganic contaminants.

The purity of a system depends on the leach ability of the material and joining method used to assemble the system.

Traditional materials used for handling high purity water have been metal and glass piping. The issue is that metals can exhibit

problems with trace metal contamination; and elements such as sodium, boron, silica, lead and arsenic can be leached out of glass piping.

Over the past twenty years, advances in thermoplastic technology have enabled the effective use of plastics for high-purity water distribution systems, even in aggressive ultra high purity applications. There are two main thermoplastic systems that can be selected for this application: PVDF and PP. There is also a new product claiming to meet the stringent standards of high purity water: translucent blue PVC. There are many considerations to take into account when selecting the correct material for a high purity system. The most important considerations are the leach ability of the material and the joining method used to assemble the system.

To ensure the highest purity possible, the IPEX Enpure system was tested for trace leachables. Testing was conducted by an independent analytical laboratory and a summary of the procedures and findings are provided in tabular and graphical form on the following pages. Also, for comparative analysis, translucent blue PVC, currently promoted for the same application, was tested under identical conditions.



Enpure is manufactured from special high purity natural polypropylene materials. No regrind material or pigment is used in the production of pipe or fittings. Using virgin un-pigmented material ensures purity. To avoid contamination during manufacturing, the pipe is capped and boxed immediately after production. Enpure is a low-cost solution with a high resistance to chemicals, corrosion, and abrasion. It also has improved flow characteristics compared to traditional purity systems.

MASTER  
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WATER  
CLOSURE



# TESTING METHODS

## Static Leach Analysis

This test represents a process shutdown scenario where the piping system would be offline for a given amount of time. Higher concentration levels of trace elements would leach out of the piping system due to the stagnant process water.

This test utilized 18.2 MegOhm-cm UPW and Enpure Schedule 80 – 1" diameter by 16" long pipe samples (approximately 47 square inches of wet surface contact area).

The test was performed at 73°F. The test results shown in Tables 1 & 2 detail the trace leachables recorded. Type E-2 Water requirements (Table 1) along with AAMI water requirements (Table 2) are shown as an indicator of suitability for the semiconductor and dialysis industries.

This test was then repeated at elevated temperatures 180°F for Enpure and 140°F for Blue PVC (max for PVC). When temperature is elevated, the leachable concentrations generally increase. At higher temperatures, the Enpure product out performed the Blue PVC for trace leachables.

**Table 1: Static Leach Test results comparing Enpure to Translucent Blue PVC and Type E-2 water requirements.**

Element	Detection Limit (x10 <sup>-8</sup> )	Type E-2 Water Req. (x10 <sup>-8</sup> )	Enpure x 10 <sup>-8</sup> @ 73°F	Blue PVC x10 <sup>-8</sup> @ 73°F
TOC	2	5	5	<b>150</b>
Fluoride	0.2	-	*	*
Chloride	0.02	0.1	*	<b>0.74</b>
Nitrate	0.05	0.1	0.09	*
Phosphate	0.05	0.1	*	*
Sulfate	0.05	0.1	*	<b>0.69</b>
Aluminum	0.005	-	*	*
Arsenic	0.02	-	*	*
Barium	0.001	-	*	0.009
Calcium	0.05	-	*	0.91
Chromium	0.003	-	*	*
Copper	0.005	0.1	*	*
Lead	0.005	-	*	*
Magnesium	0.002	-	*	0.029
Mercury	0.005	-	*	*
Nickel	0.005	0.1	*	*
Potassium	0.01	0.2	*	0.03
Selenium	0.7	-	*	*
Silver	0.003	-	*	*
Sodium	0.006	0.1	*	0.092
Tin	0.002	-	*	0.018
Zinc	0.006	0.1	*	*

\* below detection limit  
- not required by test method

## Dynamic Leach Analysis

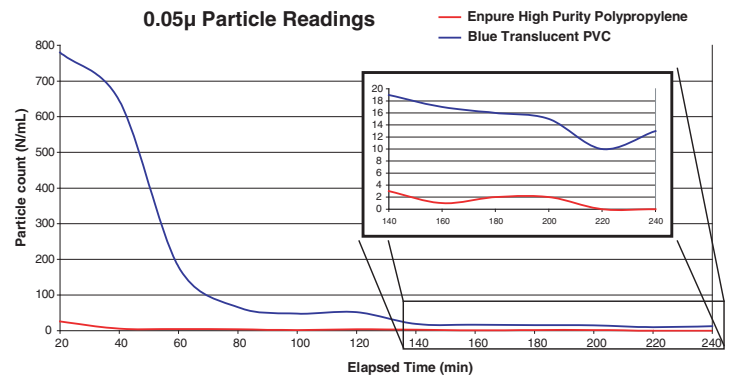
This test represents the purging of contaminants in a process line during a start-up phase. Since Ultra Pure Water (UPW) is expensive, the expectation is for these contaminants to fall within acceptable levels as soon as possible. The longer time required for the contaminants to drop in concentration results in added expense and is representative of what will occur every time the system is started up after a shutdown.

The test assembly rig was hooked up to the UPW supply on the upstream side and on the downstream side of the test rig and the water was allowed to "run to drain". The test rig UPW was setup to "run to drain" as a result of the independent test laboratory concerns that the blue PVC would contaminate their piping system rig.

The test utilized 18.2 MegOhm-cm UPW flowing at 1 US gallon per minute (US GPM) & Enpure Schedule 80 – 1" diameter by 48" long pipe samples (approximately 141 square inches of wet surface contact area). The test duration was 4 hours and all UPW, after passing through the test samples was analyzed and then "run to drain".

The particle frequency of 4 sizes, ranging from 0.05 micron up to 0.20 micron( N/mL), were recorded and are presented in figures 1 & 2.

**Figure 1: 0.05 micron particle count during successive 20 minute intervals over a four hour time period**



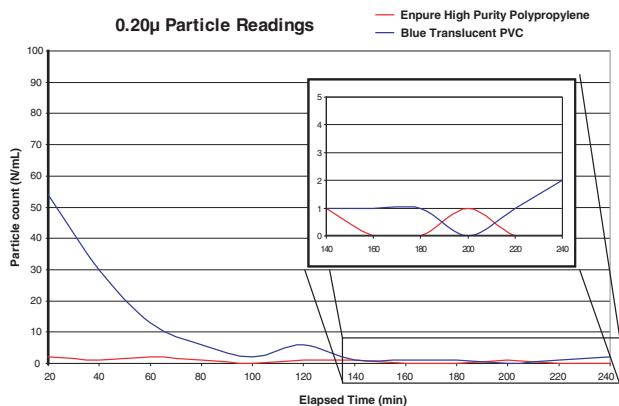
**Table 2: Static Leach Test results comparing Enpure, Translucent Blue PVC and AAMI Dialysis**

Element	Detection Limit (x10 <sup>-8</sup> )	AAMI Dialysis Req.	Enpure x 10 <sup>-8</sup> @ 73°F	Blue PVC x10 <sup>-8</sup> @ 73°F
TOC	2	-	5	150
Fluoride	0.2	200	*	*
Chloride	0.02	-	*	0.74
Nitrate	0.05	2000	0.09	*
Phosphate	0.05	-	*	*
Sulfate	0.05	100000	*	0.69
Aluminum	0.005	10	*	*
Arsenic	0.02	5	*	*
Barium	0.001	100	*	0.009
Calcium	0.05	2000	*	0.91
Chromium	0.003	14	*	*
Copper	0.005	100	*	*
Lead	0.005	5	*	*
Magnesium	0.002	4000	*	0.029
Mercury	0.005	0.2	*	*
Nickel	0.005	-	*	*
Potassium	0.01	8000	*	0.03
Selenium	0.7	90	*	*
Silver	0.003	5	*	*
Sodium	0.006	70000	*	0.092
Tin	0.002	-	*	0.018
Zinc	0.006	100	*	*

**NOTE:**

1. TOC = total organic carbon
2. Electronics and semiconductor Type E-2 Water per ASTM D5127-99
3. Association for the Advancement of Medical Instrumentation (AAMI) guidelines for dialysis water.

**Figure 2: 0.20 micron particle count during successive 20 minute intervals over a four hour time period**



# ENPURE PURITY SYSTEM'S THE WINNER

In conclusion, the purity levels found in IPEX Enpure High purity polypropylene achieved the following results.

- ✓ Reduces cost on system start-up and shutdowns (UPW)
- ✓ Meets electronics industry E-2 water standards
- ✓ Meets AAMI dialysis water standards
- ✓ Exceeds the performance of Blue Translucent PVC
- ✓ Assure no contamination from a solvent cement with a socket fusion joining method

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