Report on the DMP System

L.Perasso *

August 20,2002,; doc updated: February 27, 2003

1 Introduction

The DMP (dimethyl phthalate) plant consists of a single wall cylindrical shaped 316L Stainless Steel storage tank - D301 - [1] connected :

- at the bottom to the filling station [1]: to send, through gravity and the high pressure High Purity Nitrogen line (4 bar maximum), the DMP to the DMP-PC static mixer during the Borexino buffer filling [2];

- at the top to the low pressure High Purity Nitrogen line for blanketing and to the high pressure HP Nitrogen line.

A 500 mm diameter man-hole allowed to enter the tank during construction, testing and cleaning.

In june 2002 the tank has been filled with DMP at La Chemial (Biella), blanketed with HP Nitrogen then moved to Hall C where it is located on the last floor of BBE [3] on two compression loading cells with 1 Kg resolution and is controlled by the general Borexino control system.

The final connection to the Hall-C HP Nitrogen system will be done in september.

2 Technical Specifications

The tank had to satisfy the requirements of all the other Borexino tanks: only certified materials could be used, final electropolishing was required with a final surface roughness with $R_a < 0.5\mu m$, electropolished piping, orbital weldings, VCR fittings, high tightness o-rings (each better than $10^{-6} mbar\ l/sec$ of Helium).

The D301 tank has been constructed by C.M.G. at Bondeno (Ferrara - Italy) and electropolished by Ricerca Chimica at Vighizzolo d'Este (Padova - Italy); its technical specifications are listed in table 1.

3 Construction and Testing Procedures

Extreme care had to be taken in the tank construction and assembly. After the mechanical grinding of the surface to reach the required $R_a < 0.7 - 0.9\mu m$ value before the electropolishing, the surface has been washed with high pressure (160-180 bar) regular water, then degreased and rinsed twice. The electropolishing was performed to remove at least $25\mu m$ of the surface, and was followed by passivation, various regular water rinsings and a final rinsing using the Hall-C deionized water.

The tank has then been dried with High Purity Nitrogen, closed with temporary fittings, filled with HP Nitrogen at 40 mbar and shipped to Gran Sasso.

In Hall-C the final checks of the tank inside and flange surface were done, imperfections had been fixed, and the final cleaning was done using high pressure (> 120 bar) deionized water and

*for the DMP Vessel Group: A. Ianni, S. Parmeggiano, **L. Perasso**, L. Papp, C. Salvo, **G. Testera**

[1]via the 12" line $DMP181 - 5 - I1J2$

Material	St. Steel 316L
Thickness side	7 mm
Thickness top and bottom	9 mm
Final surface smoothness	$R_a < 0.5\mu m$
Nominal Capacity	5.51 m^3
Project pressure	4 bar
Test pressure	6 bar
Internal Diameter	1.800 m
Length	2.630 m
Weight (empty)	1510.1 kg
DMP weight	6840 kg
Total weight (full of DMP)	8350 kg
DMP density	1200 kg/m^3

Table 1: Technical characteristics of tank D301.

checking the output water to satisfy the required values (better than class 100) for particulate content.

In the meantime a Stainless Steel (first part) and Teflon (second part) pipe had been prepared at INFN - Genova to be inserted in the tank for HP Nitrogen sparging during the DMP filling at La Chemial. In the teflon part of this pipe $200\mu m$ diameter holes had been laser drilled, at $50mm$ distance on the full surface, for a total of 3402 holes displaced in $486X7$ rows. This pipe was filled with Stainless Steel balls (1.5 cm diameter) to avoid fluctuation during the HP Nitrogen sparging and then inserted in the HP Nitrogen tank; both the SS balls and the pipe had been previously washed very carefully in the LNGS Chemical lab. This pipe will be removed before the final connection to the HP Nitrogen line.

Finally all the final o-rings had been put in place and a leak test was done with 40% He put inside the tank. The measured values range between 2 10^{-6} and 6.7 $10^{-8} mbar\ l/sec$.

4 Referencies

All these docs, including this report, is on the web page: http://www.ge.infn.it/borexino/Dmp/Dmp.html.

1. DMP storage tank - D301: Dwg. 083-D-001 (rev.1, date 26/01/01)
2. DMP storage tank D301, "dettagli costruttivi" : Dwg 083-M-001 (rev. 5, date 09/01/02)
3. DMP storage and Feeding to filling stations: Dwg 2000-03-181 (rev. 7)
4. BBE Equipment layout: Dwg 083-I-001 (rev. 7, date 05/07/01)