fabrication are also likely to contaminate the surface of these chambers with organic and inorganic compounds, which can cause incomplete fusion during welding and increase specific out gassing rate at the time of vacuum conditioning. Post fabrication surface treatments are necessary for providing a clean surface required for leak free welding, minimize out gassing and to reduce beam induced desorption of trapped gases. Chemical cleaning plays a vital role in removing the contaminants (cutting oils, dust, finger prints etc.) to provide a clean surface with as little as desorbable gas as possible by modifying the oxide layer.

Aluminum specimens were prepared from the same alloy to optimize the cleaning methods and operating conditions. All the specimens were ultrasonically cleaned in trichloroethylene for removing oil, grease and other dust particles. Three chemical cleaning procedures (a) Vapour degreasing in trichloroethylene (b) cleaning in non-silicate mild alkaline cleaner and (c) strong etching in sodium hydroxide, suitable for this alloy were adopted on separate specimens. All the specimens were dipped in nitric acid to remove other metallic impurities as a final step. Auger analysis for trace impurities, scanning electron microscopic studies and out gassing rate measurements were used in evaluating the effectiveness of cleaning process for welding and vacuum conditioning. From Auger analysis, it was found that carbon contamination is removed to a maximum extent by method 'c' with no peaks for trace impurities like chlorine, magnesium and nitrogen. Leak free welding was achieved after cleaning by method 'c' only. The specific out gassing rates obtained for samples cleaned by methods 'a' and 'b' are comparable, whereas it is marginally high for method 'c'. From these results, strong etching in sodium hydroxide was selected for cleaning of dipole chambers for welding and vacuum applications. All the dipole chambers of Indus-2 were cleaned after welding in the workshop.

(Reported by: P. Ramshankar; prs@cat.ernet.in)

## A.10 Indus-2 LCW (Low Conductivity Water) plant control system

A Supervisory Control And Data Acquisition System has been developed for Indus-2 LCW plant. The system is designed to handle (control, monitor, log) more than 600 parameters for effective plant operation. It follows three-layer control system architecture as for Indus-2. The system uses VME based control modules running OS-9 for front-end control, Labview for graphical operator interface and high level application. The software is highly modular and configurable thus allowing for easy system evolution. Fig. A.10.1 shows a view of a screen shot of plant mimic on operator panels.
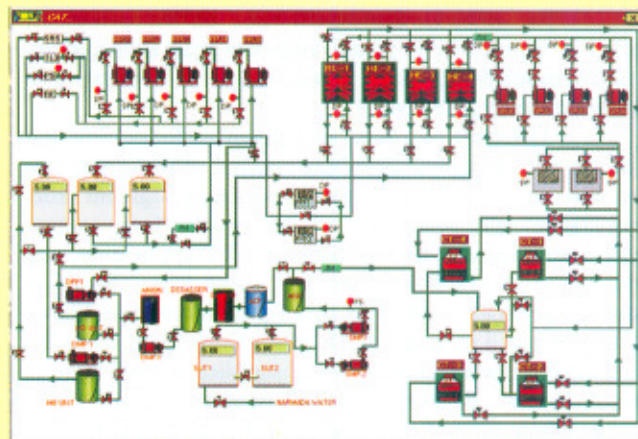


Fig. A.10.1 Indus-2 LCW plant mimic system

Reported by: P. Fatnani; fatnani@cat.ernet.in

## A.11.1 Precise reference generation & control system for Indus-2 new booster dipole power supply

Different types of magnets are used in the booster and storage rings for guiding the high current and high-energy electron beam and maintaining a circular path. Dipole magnets are responsible for maintaining a circular orbit for the increasing energy of electron beam. Dipole magnets are connected in series and powered by a dipole magnet power supply. To maintain a stable and precise ramping magnetic field, this power supply should have very high stability and requires a precise, stable and programmable reference signal. For generating such a signal and managing other control operations, a system has been developed and commissioned. It uses the in-house developed VME bus based boards in a modular fashion. This system provides 16-bit resolution and 0.01% accuracy.

**The scheme**

The system uses a two-layer architecture. Layer one is graphical user interface (GUI) layer, providing human machine interface, periodic status monitoring, reference ramp signal parameter settings and control operations in a user-friendly manner. This is a Visual C++ application running on IBM PC compatible (486 or higher). This communicates to lower layer, Layer-2 VME crate on a serial link.

Layer-2 comprises of an Equipment Interface Unit (EIU) consisting of different VME modules. This VME system is designed around a processor board based on Motorola MC 68000 CPU and running OS-9 real time operating system (RTOS). Other boards used in the system are digital input and output boards, reference controller and DAC boards.