

# CLS RF Specification

**8.4.32.2 Rev. 0**  
(formerly CLS32-001 Rev. 0)

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### REVISION HISTORY

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## **1. INTRODUCTION**

### **1.1 Purpose**

This section outlines the general specifications for all RF systems at the Canadian Light Source.

### **1.2 Scope**

### **1.3 Background**

The Canadian Light Source, CLS, is a national facility in the initial phase of construction on the University of Saskatchewan campus in Saskatoon, Saskatchewan. This facility is a 3<sup>rd</sup> generation synchrotron light source, which will produce a high intensity source of infrared, visible, ultraviolet and x-ray radiation.

The RF systems for the Booster and Storage Ring will be 476 MHz (one sixth of the linac frequency of 2856 MHz). The following will be supplied by the CLS:

- The master oscillator shall be followed by a 100W amplifier to supply a phase stable reference system around the facility.
- Each feed off of the phase stable reference cable shall be accomplished via a 30 dB coupler.
- The master oscillator frequency shall be tuneable over a range of at least +/- 1 MHz.

## **2. REQUIREMENTS**

### **2.1 Functional Requirements**

2.1.1 A 476 MHz master RF feed will be provided by the CLS. The exact frequency will be determined by the size of the CLS storage ring which will be designed for exactly 476 MHz but may vary due to factors such as thermal expansion.

2.1.2 All high power RF amplifiers should be equipped with a high power circulator.

2.1.3 Waveguide components should be pressurized with dehydrated air and be equipped with arc detection and pressure sensors. These should be provided to the machine protection system.

2.1.4 RF amplifiers should be sized so that they will run at no more than 90 percent of their design maximum under normal operation.

2.1.5 Provisions shall be made for adjusting the phasing between cavities and between the cavity and the master oscillator.

2.1.6 The following parameters shall be monitored and guarded in the interlock system.

- Arcing in the waveguide.
- Arcing in the circulator.
- Arcing in the klystron.
- Power to all high power loads.
- Reflected power to the klystron.
- Reflected power from the cavity.
- Temperatures of the cavities, circulator, cavity windows, and klystron windows.
- Air pressure in the waveguide runs.
- Cavity vacuum pressure.
- Water flow to the circulators, cavities, windows (if applicable), or tuner.
- Air flows to the cavity windows.
- Any vac ion pumps power supplies on the klystrons.

2.1.7 The following things will be monitored but not guarded in the protection system

- Forward power out of the klystron.
- Forward power to the cavity.

### **2.2 Performance**

2.2.1 All high power loads shall be sized to absorb 100 percent of the RF power.

2.2.2 All high power distribution should be accomplished with standard WR 1800 waveguide components.

2.2.3 Low power RF components should be made with standard N type, or SMA connectors.

2.2.4 The characteristic impedance for all components, except waveguide, should be 50 ohms.

### **2.3 Safety and Environmental**

2.3.1 The nominal operating temperature within the CLS shielding tunnel shall be 27°C with a minimum temperature of 20°C and a maximum temperature of 35°C.

2.3.2 The nominal operating temperature external to the CLS shielding tunnel shall be 22°C with a minimum temperature of 15°C and a maximum temperature of 35°C.

2.3.3 The relative humidity will be a minimum of 25% during the winter months, and a maximum of 50% during the summer months.

2.3.4 X-ray shielding around the body of the klystrons shall be such that during a standard 2000 hr work year, the radiation dose shall be less than 1 mSv/year.

2.3.5 The high power RF shall be capable of quick shutdown for purposes of machine safety, RF station safety, and personnel safety. The RF drive should be capable of shutdown within 1 μsec of fault, by use of a PIN diode and RF relay.

2.3.6 The DC supply for the RF amplifier should be able to “crow bar” the supply and remove the DC voltage. The “crow bar” time must meet the specifications of the amplifier manufacturer.

2.3.7 There shall be no measurable RF leakage.

## **2.4 Applicable Codes, Standards and Procedures**

## **2.5 Quality Assurance**

2.5.1 Predelivery Inspection and Testing at Proponent's Facility. The Proponent shall perform inspections and tests on all components at the Proponent's facility to assure all structures conform to this specification.

2.5.2 Source Inspection. CLS representatives shall be permitted to witness all manufacturing and testing operations herein required. When so requested, Proponent shall notify CLS 15 days prior to the performance of any test operation requested to be witnessed.

2.5.3 CLS shall inspect and test some or all components after delivery. Successful completion of the inspections and tests to verify compliance with this specification shall be the basis for final acceptance.

## **2.6 Inspection, Testing and Commissioning**

## **2.7 Reliability and Maintainability**

2.7.1 Waveguide connections should be installed with adequate flex sections to allow for easy installation and replacement of components.

2.7.2 We request that all installed components be readily available for future servicing and or replacement.

## **2.8 Layout**

## **2.9 Other Requirements and Constraints**

### **2.9.1 Documentation**

Documentation shall conform to CLS Documentation Specification CLS01-001.

### **2.9.2 Component identification**

2.9.2.1 All elements shall be labelled with a permanent unique serial number following the form outlined in the referencing document.

2.9.2.2 The serial number label shall be visible from exterior.

2.9.2.3 The serial number label size should be 36 point.

### **2.9.3 Preparation for shipment and delivery.**

2.9.3.1 The Proponent shall package all fabricated components to insure acceptance and safe delivery by common or other carrier, and so components can be delivered in an undamaged condition.

2.9.3.2 All shipping containers shall be marked or tagged with the following information:

2.9.3.2.1 CLS purchase order number

2.9.3.2.2 Shipping address as specified within contract

2.9.3.2.3 Proponent's name

2.9.3.2.4 Components contained within package

2.9.3.2.5 "Top-side up" if required

2.9.3.2.6 "Fragile" if required

### **3. REFERENCES**