

# INTERFACE CONTROL DOCUMENT

## NFM-AD-01-0104 Environmental Cover Assembly

<u>Prepared by</u>	<u>Date</u>	<u>Approved by</u>	<u>Date</u>	<u>Rev.</u>	<u>Rev. Date</u>
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### 1. Introduction

This document specifies the interface between the Environmental Cover Assembly (ECA) and other assemblies in the vicinity of the telescope focal plane. It is comprised of three drawings, a materials list, and a written description. It is provided as a control document to the fabrication team for this assembly.

We specify critical mechanical dimensions for integration with other assemblies (locating surfaces, matching bolt patterns), and an envelope for the physical assembly. We also specify some interface requirements arising from the installation procedure for this assembly.

The interface is between groups of people as well as between mechanical assemblies. For this reason we include some fabrication details and a list of deliverables for a clear mutual understanding.

This ICD is to be used together with relevant System Design Notes (SDN's) which state requirements and describe design specifications. Any apparent conflicts shall be discussed with the design engineer before proceeding with fabrication.

### 2. Interface specifications

Drawings are described briefly, and appended as separate items. Written description follows below. The design engineer contact for this interface is Ruben Dominguez, 520-318-8275, [rdominguez@noao.edu](mailto:rdominguez@noao.edu).

Environmental cover requirements are given in SDN 3101 Environmental Cover Requirements. They are incorporated into this ICD by reference, i.e., the delivered assembly shall meet these requirements. Performance specifications of the final design will be given in SDN 3201 Environmental Cover Specifications.

#### 2.1 Interface drawings

Drawing NFM-MD-06-0007 shows the Environmental Cover Assembly with reference to surrounding assemblies near the telescope focal plane. Critical planes are located. The Z axis location of the assembly is defined by the plane of contact with the Nitrogen Manifold Assembly. The fundamental reference point in the X-Y plane is the centerline of the instrument optical axis. The environmental cover assembly bolts to the Nitrogen Manifold Assembly below it. It interacts with the Guider Assembly above it through a labyrinthine seal but the two assemblies are not mechanically connected

Drawing NFM-MD-06-0008 shows interface control dimensions for the Environmental Cover Assembly as a unit. These are basically a box defined by a length, a width, and a thickness; a bolt circle for the connection to the Nitrogen Manifold Assembly; and a clear aperture for the light path. No intrusions by other assemblies are permitted into the box or into the light path, with the exception of the Guider Assembly portion of the labyrinthine seal. This intrudes into the box around the light path and is shown as a detail on the drawing. For the bolt-up, the Nitrogen Manifold Assembly has Keenserts for M6 screws, and the Environmental Cover Assembly has clearance holes for M6 screws.

#### 2.2 Other drawings

The basic reference for production of 2D fabrication drawings is the Environmental Cover Assembly (FWA) drawing NFM-MD-01-0041. The electrical schematic drawing NFM-EL-02-2100 is the reference for internal wiring such as limit switches to connectors.

### **2.3 Description**

Internally, the Environmental Cover Assembly contains two rectangular shutters. In the closed position these contact on a line containing the optical axis. In the open position these retract into covered housings. They are motor driven with a manual override capability. The design is intended to keep the shutter surfaces clean in operation so that dirt, grease, etc. is not transported onto the Dewar entrance window.

The electromechanical portion of the assembly includes two drive motors and two sets of limit switches used for shutter position sensing. The Tucson-based NEWFIRM team will specify and procure the motors and will provide them to the fabrication team. Provision and Installation of all other parts and associated wiring, including connectors for external cables, as shown on drawing NFM-MD-01-0012, are part of the fabrication task. See also Sec. 4.1 below.

Operationally, the shutters are opened at the start of the night to observe, and closed when not observing. They are not used to control exposure times of images acquired with the science detector. Their purpose is to protect the Dewar entrance window from dust, dirt, and damage when not observing.

### **3. Installation driven requirements**

The ECA is estimated to weigh 47 pounds. It will be lowered into place and bolted to the Nitrogen Manifold Assembly prior to installation of the instrument on the telescope. The shutters are moved to the open position to enable access to the bolts. This procedure imposes these additional interface requirements:

1. The contacting surfaces of the ECA and the Nitrogen Manifold Assembly shall be plane and smooth. For example, any bolt heads in these surfaces shall be slightly recessed.
2. Otherwise, the ECA envelope shall be maintained but there is no requirement on smoothness or regularity of shape within it. For example, bolt heads may protrude as long as they do not extend outside of the envelope.

### **4. Fabrication details**

We gather here important points of detail from design drawings, SDN's, prior discussion, etc. These are subject to discussion with the design engineer as part of the approval process for fabrication drawings.

#### **4.1 Materials and parts**

Materials are commonly used varieties of stainless steel, aluminum, plastics, etc. and commonly used types, materials, and grades of connectors such as screws. A materials list is provided as an Excel spreadsheet in the interface documentation. The fabrication team shall provide all materials.

The Tucson-based team shall specify, procure, and provide the drive motors to the fabrication team. This is to maintain consistency with the instrument control hardware and software.

All off-the-shelf parts, such as gears and electrical connectors, called out on drawing NFM-MD-01-0041 shall be provided to the fabrication team by the Tucson-based NEWFIRM team. Any other such parts that the fabrication team may elect to use shall be specified by them, then procured and provided by the Tucson team. This includes all spares. This has proven to be an easier route than direct procurement from Chile for most such parts.

## **4.2 Surface finishes**

Internal surfaces are to be blackened wherever possible for absorption of scattered light. Aeroglaze Z306 is the preferred finish. A hard black anodized finish may be used where greater wear resistance is needed.

The single exception to this in the ECW are the downlooking faces of the two shutter leaves. In order to avoid a thermal load into the Dewar, these are to be left with a bare machined surface finish, or lightly polished.

## **4.3 Lubrication**

The sealed bearings at the motor ends of the two shutter lead screws shall be lubricated. Other than these bearings, no oil, grease, or dry lubricants shall be used in the ECA. Note that the lead screw nut is made of Teflon and is self-lubricating.

## **4.4 Cleaning**

The ECA will be used in an ambient telescope environment. Nevertheless, it must remain internally clean so as not to transport contaminants onto the Dewar entrance window. All parts shall be solvent cleaned prior to final assembly. Ultrasonic degreasing is preferred. Assembly and subsequent handling, such as for testing and packing for shipping, shall be done in a manner that preserves a high degree of cleanliness. It is expected that the ECA as delivered will be ready for integration into the instrument without additional cleaning.

## **4.5 Testing**

The assembled FWA shall be bench tested for proper operation by manually driving the motor shafts. This includes (i) ascertaining that warm drive torque required is per specification, and (ii) electrically verifying the limit switch positional encoding against the mechanical position of each shutter. Any adjustment or rework necessary to meet these requirements is the responsibility of the fabrication team prior to delivery and within the agreed upon schedule.

## **5. Spares**

Spares shall be produced and provided for any procured off-the-shelf parts that are subsequently modified or processed for use in the ECA, and for selected unmodified parts. These are identified presently as

1. Bearings: one complete set of lead screw assembly bearings, ready for installation.
2. Lead screws: one spare lead screw, modified as indicated per drawings and ready for installation.
3. Drive motor: one drive motor, with any modifications needed to make it ready for installation.

Other procured parts used as-is, and fabricated parts, are not required to be spared.

## **6. Deliverables**

The deliverable items are

1. ECA electromechanical assembly, cleaned and ready for integration into the instrument

2. Spares identified in Sec. 5, appropriately packaged and labeled.
3. A set of as-built 2D and 3D fabrication drawings in electronic form. Each drawing is to be accompanied by a parts list.
4. A performance report incorporating (i) a description of the as-built assembly and (ii) test results from warm tests. The description shall include measured as-built critical dimensions, notes on surface finishes, and a detailed assembly procedure documented with digital photos. The test results shall include torque measurements and verification of shutter position sensing.

The performance report is the place to preserve information that is important, and perhaps not obvious to other engineering and technical people, for operation and maintenance of the assembly over its ten year life.