**Division 23 – Heating, Ventilating, and Air Conditioning**

**Section 23 37 13 – Diffusers, Registers, and Grilles**

The following specification is for a defined application. Global IFS would be pleased to assist in developing a specification for your specific need.

**PART 1 – GENERAL**

* 1. **Summary**
1. This section includes the following:
2. Hyper Heat Terminals

**1.02 Related Documents**

1. Section 01 30 00 – Administrative Requirements
2. Section 01 40 00 – Quality Requirements
3. Section 01 60 00 – Product Requirements
4. Section 01 74 19 – Construction/Demolition Waste Management and Disposal
5. Section 01 78 00 – Closeout Submittals
6. Section 01 79 00 – Demonstration and Training
7. Section 23 30 00 – HVAC Air Distribution
8. Section 23 32 00 – Air Plenums and Chases
	1. **Reference Standards**
9. All referenced standards and recommended practices in this section pertain to the most recent publication thereof, including all addenda and errata.
10. ASHRAE Standard 55 – Thermal Environmental Conditions for Human Occupancy
11. ASHRAE Standard 62.1 – Standards for Ventilation and Indoor Air Quality
12. ASHRAE Standard 70 – Method of Testing the Performance of Air Outlets and Air Inlets
13. ASTM Standard D610 – Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
14. ASTM Standard D714 – Standard Test Method for Evaluating Degree of Blistering of Paints
15. ASTM Standard D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
16. ASTM Standard D1654 – Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
17. ASTM Standard D4752 – Standard Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub
18. ASTM Standard E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
19. NFPA Standard 70A, Article 100 – National Electrical Code

**1.04 Administrative Requirements**

A. Pre-installation Meeting: Conduct a pre-installation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and efficient manner.

**1.05 Submittals**

1. See Section 01 30 00 – Administrative Requirements for submittal procedures.
2. Product Data:
	1. Provide data indicating configuration, general assembly, materials used in fabrication, rated capacities, and furnished specialties and accessories.
	2. Include drawings indicating size, profiles and dimensional requirements of the linear floor grilles that are based on the specific system indicated.
	3. Include catalog performance ratings that indicate airflow volume, initial pressure drops, sound performance, and throw, as tested in accordance with ASHRAE 70.
3. Shop Drawings: For each type of product indicated, include the following:

1. Equipment assemblies and indicated dimensions.

2. Required clearances.

3. Method of field assembly.

4. Revit models.

1. Coordination Drawings:
	1. Include floor plans, and other details, drawn to scale, on which the following items are shown and coordinated based on input from installers:
	2. Floor or underfloor-mounted items including:
		* 1. Floor structure (floor tiles, concrete, etc.)
			2. Floor finishing (carpet, tile, etc.)
			3. Access panels
			4. Electrical components
			5. Plumbing
			6. Networking components
			7. Terminal Units and other HVAC components
2. Operation and Maintenance Data: Include manufacturer’s descriptive literature, operating instructions, maintenance schedules and repair data, and parts lists.

**1.06 Quality Assurance**

1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum ten years of documented experience.
2. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
3. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100 by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

**1.07 Warranty**

1. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
2. Provide 12 month manufacturer warranty from date of shipment for grilles and registers.

**PART 2 – PRODUCTS**

**2.01 General**

1. Basis of Design: Global IFS
2. Floor Hyper Heater Terminal [ Global IFS Model HHT]
3. Hyper Heat Terminal with auxiliary heat and recirculation [Global IFS Model HHT-RC]
4. Hyper Heat Terminal with hydronic heat and recirculation plenum [Global IFS Model HHT-RCV]
5. General Product Information:
6. Furnish and install Global IFS model HHT Hyper Heat Terminals of the sizes and capacities indicated on the drawings or outlet schedule.
7. Unit sizes shall be selected in accordance with ASHRAE guidelines and manufacturer’s literature.
8. Manufacturers shall demonstrate that they have successfully supplied and installed underfloor HVAC products, as well as the computer modeling thereof for a minimum of 10 years.
9. Manufacturers must be pre-qualified to bid based on the completion of a minimum of [xx] jobs in similar climates.
10. Manufacturers shall provide a list of completed jobs and references.
11. Underfloor Air System Controls:
	1. Air Grilles and diffusers specified for underfloor service shall incorporate the following requirements:
	2. Damper construction shall include an integral flow-modulation damper and motor (air valve) that is specifically designed for low static pressure air distribution.
	3. Air dampers shall not include fast acting actuators that require high life cycle ratings.
	4. Airflow and throw heights shall decrease in response to lower space demands with flow-modulation of constant temperature plenum air. The flow-modulation technique shall be implemented to maximize stratification, leading to energy savings and increased thermal comfort.
	5. Modulation by timed duty cycle of fully open and closed periods shall not be acceptable. This type of modulation can greatly reduce stratification, removing potential energy savings. Timed duty cycle modulation also increases the possibility of creating stagnant zones and starving buoyancy driven flow. Any use of this type of modulation shall be modified in order to demonstrate stratification to the project team prior to being considered acceptable.
	6. Plenum Rated Cables: Color-coded plug-and-play plenum rated cable connectors shall be used between devices.
	7. Terminal block type plugs shall not be acceptable.
	8. Plug-and-play cables shall carry both the power and control signal to each device and connect to a single port on the device control board.
	9. Cable types shall be limited to no more than one type and connector per device to reduce complexity in wiring and future modifications.
	10. Cables shall be stranded wire to increase flexibility in the wires, to improve ease of installation, and reduce damage during installation.
	11. Cables shall have six wires with redundant wires to provide a more robust system and protection against damage, and to allow the current for multiple devices to be controlled through a single cable. Solid wires shall not be acceptable.
	12. The Power and Control Module shall include a direct digital controller (DDC) and transformer to supply both power and control signals to air devices.
12. Paint Specification:
13. The baked on powder coat finish shall meet the following specifications:
	* + - 1. The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.
				2. The paint film thickness shall be a minimum of 2.0 mils.
				3. The finish shall have a hardness of 2H.
				4. The finish shall withstand a minimum salt spray exposure of 1000 hours with no measurable creep in accordance with ASTM D1654, and 1000 hours of exposure with no rusting or blistering as per ASTM D610 and ASTM D714.
				5. The finish shall have an impact resistance of 80 inch-pounds.

**2.02 Linear Floor Heater**

1. Description:
2. Furnish and install Global IFS model HHT hyper heater terminal in the sizes, core style, configurations and capacities indicated on the plans and air outlet schedule.
3. Performance:
	1. The manufacturer of the linear floor heater shall provide performance data for air volume, initial pressure drop, and sound levels.
	2. Air shall be delivered to the space without the use of nozzles.
	3. All data must be tested in accordance with the most recent publication of ASHRAE 70.
4. Construction:
	1. The grille face shall have an extruded aluminum border and an overall nominal dimension of (**select one**):
		1. 24 x 6 inches
		2. 48 x 6 inches
	2. The grille face and border shall be suitable for a straight drop installation.
	3. Grilles shall have fixed [0 degree], [15 degree], or [30 degree] blades spaced [1/4 inch] or [7/16 inch] on center, with the blades running parallel to the long dimension of the grille.
	4. The outlet core shall have extruded aluminum receiving bar.
	5. The grille border shall be heavy-duty extruded aluminum construction with precise factory mitered corners and reinforcing support bars for extra support for the core receiving bar.
	6. The support and receiving bars shall not exceed eight inches on center.
	7. The HHT shall be supplied complete with two modular jacks for system connections and modular plug-in control cable.
5. The NetC35 cable shall be 35 feet in length and shall be plenum rated.
6. Each cable shall have two (2) modular male plugs for plug-and-play system connections.
7. The cable shall be constructed of eight (8) individually insulated wires wrapped in an insulated jacket.
8. Each wire shall be constructed of stranded copper fibers; solid core copper is not acceptable.
9. The plenum shall be constructed of minimum 22 gauge steel.
10. The plenum shall have a finished height of 10.5 inches, and shall be suitable for installation above conduit in a twelve inch raised floor.
11. The HHT shall be provided with ETL certified electrical enclosure which houses the integrated transformer and circuit board.
12. Heater:
13. The unit shall be supplied with a [hydronic] **or** [electric coil] heater element (**select one**):
	1. Hydronic Heater:
14. The HHT shall be constructed with integral hydronic copper tube and aluminum fin element mounted directly above a [24 x 6 inch] or [48 x 6 inch] gasketed modulating damper for VAV control.
15. The hydronic heater shall be supplied with a 1.125 inch outside diameter, 1 inch nominal sweat connection.
	1. Electric Heater:
16. The HHT shall be constructed with integrated electric aluminum fin element mounted directly above a [24 x 6 inch] or [48 x 6 inch] gasketed modulating damper for VAV control.
17. Mounting/Fastening:
	1. The plenum shall be dropped in place from the room side of the tile into a rectangular opening cut through the tile by others. The grille shall be fastened to the plenum.
	2. The core shall be held into the border with removable core clips, allowing the removal of the core without special tools.
	3. The frame shall be attached to the floor with (**select one**):
		1. Countersunk screws
		2. Spring-clips

**2.03 Hyper Heat Terminal with Electric Heat**

1. Description:
	1. Furnish and install Global IFS model HHT-RC (L x W) with the sizes, configurations and capacities indicated on the plans and air outlet schedule.
2. Performance:
3. The manufacturer of the linear floor grilles shall provide performance data for air volume, initial pressure drop, and sound levels.
4. Air shall be delivered to the space without the use of nozzles.
5. All data must be tested in accordance with the most recent publication of ASHRAE 70.
6. Construction:
	1. The grille face shall have an extruded aluminum border and an overall nominal dimension of (**select one**):
7. 24 x 10 inches
8. 48 x 10 inches
9. 72 x 10 inches
10. 96 x 10 inches
	1. The HHT-RC shall be supplied complete with two modular jacks for system connections and modular plug-in control cable.
	2. The NetC35 cable shall be 35 feet in length and shall be plenum rated.
	3. Each cable shall have two (2) modular male plugs for plug-and-play system connections.
	4. The cable shall be constructed of eight (8) individually insulated wires wrapped in an insulated jacket.
	5. Each wire shall be constructed of stranded copper fibers; solid core copper is not acceptable.
	6. The plenum shall be constructed of minimum 22 gauge steel.
	7. The plenum shall have a finished height of 10-3/8 inches, and shall be suitable for installation above conduit in a twelve inch raised floor.
	8. The HHT-RC shall be provided with ETL certified electrical enclosure which houses the integrated transformer and circuit board.
11. Heater:
12. The unit shall be supplied with a [hydronic] **or** [electric coil] heater element (**select one**):
13. Hydronic heater.
	* + 1. The HHT-RC shall be constructed with integral hydronic copper tube and aluminum fin element mounted directly above a [24 x 6 inch] or [48 x 6 inch] gasketed modulating damper for VAV control.
			2. The hydronic heater shall be supplied with a 1.125 inch outside diameter, 1 inch nominal sweat connection.
14. Electric heater:
	* + 1. Shall be supplied with an electric finned strip heater constructed of stainless steel sheath material and nickel plated fins. Heaters are of UL construction, and shall be equipped with over temperature protection through an automatic temperature reset switch that allows sensing throughout a continuous unit length. The thermal cutoff switch should be designed for sensitivity that allows a response to individual hot spots along the unit length. Optional disconnect switch may be included.
			2. The electric heater element shall be mounted in the sheet metal plenum below the grille.
			3. The electric heater shall be supplied with a [120 volt, single phase, 60 Hertz – *24 inch wide model only*], [240 volt, single phase, 60 Hertz], **or** [277 volt, single phase, 60 Hertz], complete with a transformer.
			4. The electric heater capacity shall be:
				1. 500 Watts [24 inch long units]
				2. 1000 Watts [48 inch long units]
				3. 1500 Watts [72 inch long units]
				4. 2000 Watts [96 inch long units]
15. Finish:
16. The plenum shall be finished in B17 Black Powder Coat.
17. The grille shall comply with the grille paint specification described in paragraph 2.01.D, and shall be finished in (**select one**):
18. B15 Aluminum powder coat
19. B17 Black powder coat
20. B25 Baked enamel color to match a customer supplied sample
21. #66 Brushed aluminum with clear powder coat
22. Black anodized
23. Clear anodized
24. Light bronze anodized
25. Medium bronze anodized
26. Dark bronze anodized
27. Champagne anodized
28. Special anodized color to match customer supplied sample
29. Mounting/Fastening:
30. The plenum shall be dropped in place from the room side of the tile into a rectangular opening cut through the tile by others. The grille shall be fastened to the plenum.
31. The core shall be installed from the room-side and held into the border with removable core clips, allowing the removal of the core without special tools.
32. The frame shall be attached to the floor with (**select one**):
33. Countersunk screws
34. Spring-clips

1. Options:
	1. Directional Vanes:
2. Directional vanes shall be provided to allow the throw and spread performance of the HHT-RC to be adjusted.
3. The directional vanes shall be extruded aluminum construction spaced on one inch centers.
4. Fiber-Free acoustic insulation:
5. Insulation shall comply with UL 181 erosion, mold growth and humidity requirements in accordance with ASHRAE 62.1, and shall have a maximum flame/smoke spread of 25/50 for both the insulation and the adhesive when tested in accordance with ASTM E84.
6. The insulation shall be secured with adhesive.
7. Insulation thickness shall be 1/2 inch thick, three pound density, R-value of 2.0.

* 1. Continuous construction:
	2. The plenum shall be supplied in multiple sections to the required length up to a maximum of 96 inches.
	3. The sections shall be assembled in the field for continuous appearance.

**2.04 Hyper Heater Terminal with Recirculation and VAV Cooling**

1. Description:
	1. Furnish and install Global IFS model HHT-RCV (L x W) with the sizes, configurations and capacities indicated on the plans and air outlet schedule.
2. Performance:
3. The manufacturer of the linear floor grilles shall provide performance data for air volume, initial pressure drop, and sound levels.
4. Air shall be delivered to the space without the use of nozzles.
5. All data must be tested in accordance with the most recent publication of ASHRAE 70.
6. Construction:
7. The grille face shall have an extruded aluminum border and an overall nominal dimension of (**select one**):
	1. 24 x 10 inches
	2. 48 x 10 inches
	3. 72 x 10 inches
	4. 96 x 10 inches
8. The HHT-RCV shall be supplied complete with a 24 VAC floating point actuator furnished with two modular jacks for system connections and one modular plug-in control cable.
	1. The NetC35 cable shall be 35 feet in length and shall be plenum rated.
	2. Each cable shall have two (2) modular male plugs to interface with plug-and-play system connections.
	3. The cable shall be constructed of six (6) individually insulated wires wrapped in an insulated jacket.
	4. Each wire shall be constructed of stranded copper fibers; solid core copper is not acceptable.
9. The plenum shall be constructed of minimum 22 gauge steel and finished in black.
10. The plenum shall have a finished height of 10-3/8 inches, and shall be suitable for installation above conduit in a twelve inch raised floor.
11. The HHT-RC shall be provided with ETL certified electrical enclosure which houses the integrated transformer and circuit board.
12. Heater:
13. The unit shall be supplied with a [hydronic] **or** [electric coil] heater element (**select one**):
14. Hydronic heater.
	* + 1. The hydronic heater shall have integral copper tube and aluminum fin elements mounted in the sheet metal plenum below the grille.
			2. The hydronic heater shall be supplied with a 1.125 inch outside diameter, 1 inch nominal sweat connection.
15. Electric heater:
	* + 1. Shall be supplied with an electric finned strip heater constructed of stainless steel sheath material and nickel plated fins. Heaters are of UL construction, and shall be equipped with over temperature protection through an automatic temperature reset switch that allows sensing throughout a continuous unit length. The thermal cutoff switch should be designed for sensitivity that allows a response to individual hot spots along the unit length. Optional disconnect switch may be included.
			2. The electric heater element shall be mounted in the sheet metal plenum below the grille.
			3. The electric heater shall be supplied with a [120 volt, single phase, 60 Hertz – *24 inch wide model only*], [240 volt, single phase, 60 Hertz], **or** [277 volt, single phase, 60 Hertz], complete with a transformer.
			4. The electric heater capacity shall be:
				1. 500 Watts [24 inch long units]
				2. 1000 Watts [48 inch long units]
				3. 1500 Watts [72 inch long units]
				4. 2000 Watts [96 inch long units]
16. Finish:
17. The plenum shall be finished in B17 Black Powder Coat.
18. The grille shall comply with the grille paint specification described in paragraph 2.01.D, and shall be finished in (**select one**):
19. B15 Aluminum powder coat
20. B17 Black powder coat
21. B25 Baked enamel color to match a customer supplied sample
22. #66 Brushed aluminum with clear powder coat
23. Black anodized
24. Clear anodized
25. Light bronze anodized
26. Medium bronze anodized
27. Dark bronze anodized
28. Champagne anodized
29. Special anodized color to match customer supplied sample
30. Mounting/Fastening:
31. The plenum shall be dropped in place from the room side of the tile into a rectangular opening cut through the tile by others. The grille shall be fastened to the plenum.
32. The core shall be installed from the room-side and held into the border with removable core clips, allowing the removal of the core without special tools.
33. The frame shall be attached to the floor with (**select one**):
34. Countersunk screws
35. Spring-clips

1. Options:
	1. Directional Vanes:
2. Directional vanes shall be provided to allow the throw and spread performance of the HHT-RCV to be adjusted.
3. The directional vanes shall be extruded aluminum construction spaced on one inch centers.
4. Fiber-Free acoustic insulation:
5. Insulation shall comply with UL 181 erosion, mold growth and humidity requirements in accordance with ASHRAE 62.1, and shall have a maximum flame/smoke spread of 25/50 for both the insulation and the adhesive when tested in accordance with ASTM E84.
6. The insulation shall be secured with adhesive.
7. Insulation thickness shall be 1/2 inch thick, three pound density, R-value of 2.0.
8. Continuous construction:
	1. The plenum shall be supplied in multiple sections to the required length up to a maximum of 96 inches.
	2. The sections shall be assembled in the field for continuous appearance.

**PART 3 – EXECUTION**

**3.01 Examination**

A. Verify that conditions are suitable for installation.

B. Verify that field measurements are as shown on the drawings.

## 3.02       Manufacturer’s Field Services

* + 1. The manufacturer shall provide the services of an underfloor air systems specialist. This engineer shall make at a minimum the following trips to the site with construction and design personnel.
			1. The first trip to the job shall occur right before the raised access floor is being installed. The engineer will inspect all plenum penetrations and construction to see that proper methods are being used. Any deficiencies found shall be brought to the general contractor's attention on site that day. Site observation report shall be made and emailed to the HVAC engineer for approval. If approved they shall forward the report to the construction team as appropriate.
			2. The second trip to the job shall occur during the building commissioning process. Communication shall occur with all associated trades to solve any problems that prevent contract completion. The engineer shall assist with system testing and verify proper functioning of the UFAD system. Any deficiencies found shall be brought to the general contractor's attention on site that day. Site observation report shall be made and emailed to the HVAC engineer for approval. If approved they shall forward the report to the construction team as appropriate.

**3.03 Installation**

1. Install linear floor grilles level and plumb.
2. Complete installation and startup checks according to manufacturer’s instructions and perform the following.

1. Verify that inlet duct connections are as recommended by manufacture to achieve proper performance.

2. Verify that any identification tags are visible.

3. Verify locations of thermostats, humidistats, and other exposed control sensors with drawings and room details before installation.

1. Maintain sufficient clearance for normal services, maintenance, or in accordance with construction drawings.
2. See drawings for the size(s) and locations of linear floor grilles.
3. Connect to ductwork in accordance with Section 23 31 00.

**3.04 Adjusting**

1. Balance outlets according to manufacturer’s recommendations.
2. Verify that field measurements are as shown on the drawings.

**3.05 Field Quality Control**

1. See Section 01 40 00 – Quality Requirements for additional requirements.

**3.06 Cleaning**

1. See Section 01 74 19 – Construction Waste Management and Disposal for additional requirements.

**3.07 Closeout Activities**

1. See Section 01 78 00 – Closeout Submittals for closeout documentation requirements.
2. See Section 01 79 00 – Demonstration and Training for additional requirements.