NJSDA Design Manual
For
Design-Build Projects

Design Phase Deliverables and Submission Requirements

June 5, 2012

NJSDA Design Manual for Design-Build Projects

Design Phase Deliverables and Submission Requirements

Table of Contents

INTRODUCTION 1
GENERAL SUBMISSION REQUIREMENTS 1
Design Submission Information 1
Design Submission Format Requirements: 1
Electronic Document Submission Requirements: 2
Submission Requirements (Quantities): 2
PRELIMINARY DESIGN PHASE SUBMISSION REQUIREMENTS 3
Detailed Preliminary Design Phase Submission Requirements 3
A. Drawings 3
B. Specifications 7
C. Color/Material Selections 7
D. Color Renderings 7
E. LEED Compliance 7
F. Building Commissioning Submissions 7
G. Other Submission Requirements 7
FINAL DESIGN PHASE SUBMISSION REQUIREMENTS 8
Detailed Final Design Phase Submission Requirements 8
A. Drawings: 8
B. Specifications 10
C. LEED Compliance 11
D. Building Commissioning Submissions 11
E. Other Submission Requirements 11

INTRODUCTION

This Design Manual defines the minimum Design Phase deliverables and submission requirements for SDA projects being delivered through a Design-Build form of Agreement. Design Phase submissions shall demonstrate conformance with the requirements of the Design-Build Contract Documents including the NJSDA Materials & Systems Standards and all Project performance requirements.

Performance Specifications for the Project have been provided as a supplement to the NJSDA Materials and Systems Standards. In the event of any variance between the requirements of Project Performance Specifications and the NJSDA Materials and Systems Standards, the requirements of the Project Performance Specifications shall take precedence. Any variance from the Materials and Systems Standards proposed by the Design-Builder must be approved by the Authority in accordance with the Variance Request procedure outlined in the Materials and Systems Standards.

Design Phase submissions shall be made in accordance with the agreed upon project schedule. In general, all Design Phase submissions shall be made in sufficient time to allow fourteen (14) days for Authority review as well as sufficient time for revision, resubmission, and acceptance prior to any subsequently required design, approval, procurement or construction actions or activities related to or dependent upon the submission.

GENERAL SUBMISSION REQUIREMENTS

Design Submission Information

A. All design submissions shall include the following information:

   1. Names of the Project, School District, Design-Builder, Construction Manager (if applicable), the NJSDA package number and the DOE project number.

   2. Original document date and current revision date (if applicable), formatted: YYMMDD.

Design Submission Format Requirements:

A. Drawings: All drawings shall be submitted on consistent sheet sizes of either “Arch D”, 24” x 36” or “Arch E1”, 30” x 42” with all lettering at least 1/8” high. Maintain consistent orientation of building between site and floor plans (North up preferred). Where overall site or floor plans are necessary, provide key plans on larger scale drawings to indicate portion of building or site being depicted in relationship to overall building or site.

   1. Site Plans (all disciplines): Minimum scale: 1” = 30’-0”. Where necessary, provide multiple plans at required scale and smaller scale overall site plans.

   2. Floor Plans (all disciplines) Roof Plans, Reflected Ceiling Plans: Minimum scale: 1/8”=1’-0”. Where necessary, provide multiple floor plans at required scale and smaller scale overall building floor plans (max. 1/16” preferred).

   3. Enlarged Floor Plans: Minimum scale: 1/4”=1’-0”.

   4. Elevations: Minimum scale: 1/16”=1’-0” with appropriate enlargements at 1/8” or 1/4" scale.

   5. Wall Sections, Details, and other drawings: Scale as appropriate to level of detail being portrayed.

   6. Schedules: May be included in drawings or specifications as appropriate.

B. Color Renderings: Minimum size: 20”x30” framed with matte and glazing.

C. Interior finish color/material selection boards: Format appropriate to the materials and information being presented, but not larger than 24' x 36".

D. Specifications: 8½" x 11", utilizing the most current version of CSI/MasterFormat.

E. Other reports, including calculations, shall be 8½" x 11"

Electronic Document Submission Requirements:

In addition to required number and type of hard copy submissions, submit electronic copies in accordance with the following requirements.

A. Electronic File Submission Organization:

1. Provide both individual document files, in formats as described below, as well as composite copies of all final end-of-phase submissions in .dwf or .pdf format, organized similar to submission organization.

B. Electronic File Formats

1. Drawings: Provide electronic copies of all files in both native AutoCad (.dwg) and .dwf formats.

2. Other Documents: Provide electronic copies of all in both native (MS Word, Exel, etc.) and in .pdf format.

C. Electronic File Naming:

1. All electronic drawing files (DWG & DWF) shall be named as to refer to the sheet number referenced therein and include current revision date (formatted: YYMMDD).

2. All other electronic files shall be named so as to be readily identifiable and to include current revision date (formatted: YYMMDD).

Submission Requirements (Quantities):

A. Design Phase Submissions (Preliminary and Final Design):

1. Six complete, full sized sets of all deliverables and one half sized set of all large format deliverables

2. One complete electronic set of all submission documents on disk

B. DOE Final Educational Adequacy Submission (For SDA review prior to submission to DOE)

1. SIx complete, full sized sets of all deliverables and one half-sized set of all large format deliverables

2. One complete electronic set of all submission documents on disk

C. Approved DOE FEA Submission, DCA Plan Release (Full or Partial Filing Submissions as applicable) and other Agency Approval Submissions:

1. Three complete, full sized sets of all documents and one half-sized set of all large-format documents.

2. One complete electronic set of all submission documents on disk

PRELIMINARY DESIGN PHASE SUBMISSION REQUIREMENTS

The Design-Builder shall submit Preliminary Design Documents as described below for review and acceptance by the Authority in accordance with the schedule and time frames established in the agreed upon project schedule. The Preliminary Design Documents shall describe the project in sufficient detail to demonstrate compliance with SDA Materials and Systems Standards as well as performance and other requirements established by the Design-Build Contract Documents.

Detailed Preliminary Design Phase Submission Requirements

The following are the minimum Preliminary Design Phase Submission requirements.

A. Drawings

1. Cover Sheet
   a. Name of Project, NJSDA package number, NJDOE number, Location maps, New Jersey State Seal and name of the Governor
   b. Drawing Index, Legends and Symbols
   c. Rendering of project (optional)
2. Site Drawings
   a. Existing Conditions Plan(s) indicating existing site boundaries, topography, and utilities
   b. Site Logistics Plan indicating location of temporary facilities for construction including site access, fencing, trailers, staging, lay-down, and storage areas
   c. Demolition, abatement, and construction phasing drawings (if applicable)
   d. Site plan(s) showing size and location of all site improvements, including:
      i. Proposed site improvements, buildings and structures, site ingress and egress
      ii. Site pedestrian and vehicular access, parking and circulation improvements
      iii. Fencing, lighting, landscaping, site furniture and retaining walls
      iv. Existing and proposed grades at 5-foot contour intervals
      v. Spot elevations at all entrances, exits, and building corners, and on a 20-foot grid for parking lots and open areas
   e. Preliminary Site Drainage Plan showing storm water drainage, retention, detention, infiltration and any other above or below grade drainage systems with proposed elevations and inverts in plan and profile
   f. Preliminary Site Utility Plan showing location and sizing of all major above and below grade utilities serving the building and site
   g. Site Plan demonstrating compliance with DCA “Best Practices” requirements
3. Architectural Drawings
   a. Floor Plan(s)
      i. Show layouts with sufficient detail and dimensions, including net area of all rooms, so that critical dimensions, clearances, and relationships can be ascertained and confirmed.
      ii. Indicate wall types and ratings and all required chases and shafts.
      iii. Include structural elements, doors and windows, and all furniture, furnishings, and equipment to be provided by Design-Builder.
      iv. Provide overall and partial floor plans as needed to indicate all floors at the scales noted above.

v. Identify and provide references for all building elevations, sections, and enlarged plans.

b. Room Layout Plans locating and identifying each item of required furniture, fixtures, and equipment, per DOE-approved Documents, indicating necessary clearances with schedules or other identification indicating whether each item is to be provided by the Design-Builder, NJSDA, or the District

c. Interior Partition schedules indicating partition types and demonstrating compliance with requirements for fire ratings and acoustic values

d. Coordinated Roof Plan(s) showing roof types, drainage systems, roof top equipment (including exposed duct and piping mains), walk pads, roof ladders and penetrations

e. Exterior Building Elevations of all major exterior conditions indicating all exterior materials, floor-to-floor heights, and section references

f. Building Sections (minimum of four) indicating floor-to-floor heights and ceiling heights with all spaces labeled

g. Interior Elevations for all typical spaces, assembly spaces and specialized instructional spaces indicating doors, windows, equipment, and any special acoustic treatment, materials, or finishes

h. Wall Sections and details of each major type of exterior wall and fire wall to indicating compliance with requirements for fire ratings, energy performance, acoustic values, and continuity of building envelope

i. Reflected Ceiling Plans including ceiling types and heights and indicating locations of lighting, registers and grilles. Indicate any special acoustic materials or treatment in assembly areas or other areas with special acoustic requirements

j. Finish schedules, including ceiling heights, identifying wall, base, floor, and ceiling finishes for all spaces

k. Preliminary details of any special items or conditions

l. Preliminary Door Schedules indicating door, frame and hardware types as well as fire and acoustical ratings

m. Window and storefront elevations (may be included with Exterior Building Elevations) indicating size and fenestration patterns and any special glazing requirements

n. Other typical details, as necessary, to demonstrate compliance with project requirements

4. Structural Drawings

a. Preliminary Foundation Plan(s) showing location, type, size and depth of each foundation component. Identify expansion joints, fire walls, and any other isolation assemblies

b. Preliminary Structural Plans for each floor and roof, indicating columns, beams, bearing and shear walls, slabs, decks, and other major structural elements, with typical sizing. Identify expansion joints, fire walls, and any other isolation assemblies

c. Preliminary Structural Sections through foundations, below-grade construction, slabs on grade, walls, floors and roofs, with depths of structural elements. (May be incorporated in Architectural Wall Sections)

d. Preliminary Plan and section details of typical structural conditions, including building movement and fire separation conditions

e. Roof equipment support types and locations (Include in Coordinated Roof Plans)

5. Food Service Facilities Drawings
    a. Enlarged Floor Plans of food service areas indicating size and location of all required food service equipment and demonstrating necessary operating clearances (Ceiling mounted equipment should be indicated on Architectural Reflected Ceiling Plans.)
    b. Equipment Schedule (drawings or specifications) of all required food service equipment with utility requirements
    c. Roof-top equipment (Include in Coordinated Roof Plans)
6. Plumbing Drawings
    a. Floor Plans indicating utility entrances, fixtures, equipment, pumps and drains, and location and routing of all piping systems including sanitary, storm, domestic water, natural gas and radon mitigation, with sizing
    b. Enlarged plans and/or sections for Kitchen, Mechanical and Pump Rooms, and other spaces with special plumbing requirements
    c. Vent stacks and other roof penetrations (include in Coordinated Roof Plans)
7. Fire Protection Drawings
    a. Floor Plans with performance criteria noting Use Group, hazard and hydraulic flow test summary and date of test
    b. Floor Plans noting incoming fire water service size and location, zone control valve assemblies, standpipes, fire pumps, and other major components
    c. Enlarged Floor Plans of areas to be served by specialized fire protection systems such as dry pipe, pre-action, or chemical fire suppression systems
8. HVAC Drawings
    a. Floor Plans showing HVAC system distribution drawings for all floors indicating equipment, piping, ductwork and unitary equipment. The following must also be indicated:
        i. HVAC System Zoning, with floor plans highlighting HVAC zoning for each area of the building
        ii. Diagrammatic indication of air terminal units, reheat coils, fan coil units, heat pumps, and unitary systems, noting zoning and dedicated conditions of specialized spaces
        iii. Detailed layout of typical spaces occurring multiple times, including ductwork distribution, air devices, thermostat locations and perimeter systems
        iv. Diagrammatic indication of perimeter systems, including finned tube panels, radiation elements, ceiling radiation, fan powered air terminals, etc.
        v. Locations and ratings of fire and smoke dampers and other rated conditions
        vi. Heating and cooling pipe main distribution, noting main sizes, equipment connections, typical connections to common terminal equipment, and roof and wall penetrations
        vii. Specialized and independent systems serving areas such as computer rooms, telecommunication rooms, kitchen, etc.
        viii. Services for special equipment
    b. Riser and Flow Diagrams sufficient to describe basic system design
    c. Enlarged Floor Plans of mechanical equipment rooms indicating equipment, piping and ductwork mains, and louvers, indicating all required shafts and soffits to and from mechanical equipment rooms

d. Roof-top equipment (Include in Coordinated Roof Plans)
e. Equipment Schedule (drawings or specifications) identifying all equipment. Indicate capacities, outside air quantity, location and area served by equipment

9. Electrical Drawings
   a. Electrical Site Plan showing utility transformer, incoming underground conduit bank to main electrical room, telephone/data conduit bank and other services, with manholes and related equipment
   b. Site Lighting Plan with light fixture locations, photometric information and typical pole types
   c. Lighting Floor Plans of each floor indicating type and location of light fixtures throughout building, including typical room layouts, indicating controls and emergency lighting
   d. Power Floor and Roof Plans showing panel boards, motor control centers, transformers, conduit bank routing/size from main electric room to electric closets and risers, major HVAC and plumbing equipment, elevator motors, and any other major equipment or systems.
   e. Photometric plans for each room type demonstrating compliance with code and project requirements
   f. Light fixture schedule (drawings or specifications) indicating all fixtures types, including photometric and other performance information
   g. Equipment schedules (drawings or specifications) for all switchboards, panels and motor control centers.
   h. Fire alarm riser diagram showing fire alarm control panels and typical components
   i. Preliminary Electrical grounding grid plan, showing building grounding. (May incorporate in Preliminary Power Plans)
   j. Preliminary Lightning protection plan showing all components. (May incorporate in Preliminary Power Plans)

10. Information Technology and Security Drawings
    a. Floor Plans indicating MDF, IDF and designated telecom spaces, including the following:
       i. Entrance cabling (MPOE) and conduit paths
       ii. MDF to IDF conduit paths. Include bend radius where applicable to all conduits
       iii. Distribution paths from MDF and IDF locations to station drops
       iv. Paths and locations of wire trays, ladder racks, J-hooks, ceiling straps and any other distribution support systems. Display all bend radiuses
    b. Enlarged Floor Plans for MDF and IDF indicating placements and clearances on all sides for two post telecom racks, server cabinets, free standing floor equipment, wall mounted equipment, power receptacles with NEMA type, overhead cable pathways and conduit entrances.
    c. Interior Elevations of MDF and IDF depicting rack elevations, wall mounted equipment; cross connect blocks, overhead cable pathway access points. The diagram shall list port densities per rack with relevant patch panel count(s). Include rack, patch panel and patch panel port numbering to match station labeling.
    d. Enlarged Floor Plans of typical instructional areas indicating type and location of all IT systems outlets, devices, equipment, and other components

e. Security Systems Plans in sufficient detail to demonstrate compliance with DCA "Best Practices" requirements

B. Specifications

Provide outline specifications in the prescribed format describing the type and characteristics of all materials and systems to be incorporated in the Work. The Specifications shall describe materials and systems in sufficient detail to demonstrate compliance with Project requirements and shall identify requirements for submittals, quality assurance, warranties, and guarantees, as well as any requirements for LEED and Building Commissioning.

(Note: With Authority's prior approval, product data for proposed materials and systems may be submitted as a supplement to or in lieu of outline specifications provided such data clearly demonstrates compliance with project performance and other requirements.)

C. Color/Material Selections

1. Exterior Materials:
   a. Exterior Material and Color Boards: Provide samples of proposed exterior materials and color finishes including masonry products and color samples of exterior doors and frames, metal roofing, copings, flashings, and other trim materials.
   b. Exterior Renderings: Provide color renderings of exterior elevations indicating application of exterior materials including masonry patterning.
2. Interior Colors and Finishes:
   a. Interior Color and Finish Boards: Provide samples of proposed interior materials, colors, and finishes including flooring, base, ceiling finishes, and paint colors,
   b. Finish Plans – Provide color floor plans indicating application of interior color and finishes including floor patterns and any special finish applications

D. Color Renderings

Following acceptance of exterior material and color selections, provide color rendering of one exterior view of design as selected by Authority.

E. LEED Compliance

1. LEED Checklist identifying elements and features incorporated in design to achieve required LEED certification
2. Copies of any project submissions to USGBC

F. Building Commissioning Submissions

(See Procedural Specifications)

G. Other Submission Requirements

1. Supplementary Geotechnical Data required by code
2. Preliminary Structural analysis indicating all static and dynamic loads on major structural elements.
3. Preliminary load and energy model calculations using an approved energy modeling method.
4. HVAC control diagrams and preliminary written sequence of operation of the HVAC system depicting control devices and components, safety devices, control and monitoring points, and other system components and equipment to be interlocked.

FINAL DESIGN PHASE SUBMISSION REQUIREMENTS

Following acceptance of the Preliminary Design Documents, the Design-Builder shall submit Final Design Documents as described below for review and acceptance by the Authority in accordance with the schedule and time frames established in the agreed upon project schedule. The Final Design Documents shall be consistent with the accepted Preliminary Design Documents and shall describe the project in sufficient detail for purposes of construction and securing of any necessary approvals.

Detailed Final Design Phase Submission Requirements

In addition to the requirements for the Preliminary Design Submission, the following are the Detailed Final Design Submission requirements.

A. Drawings:

1. Cover Sheet
    a. Name of Project, NJSDA package number, NJDOE number, Location maps, New Jersey State Seal and name of the Governor
    b. Drawing Index, Legends and Symbols
    c. Rendering of project (optional)
2. Site Drawings
    a. Existing Conditions Plans
    b. Site Logistics Plan
    c. Demolition, abatement, and phasing drawings (if applicable)
    d. Site plan(s) showing all site improvements, in addition to Preliminary Design requirements, indicate:
        i. Final plan and profile drawings for each utility system, including the identification of conflicting utilities.
        ii. Final drainage plan showing storm water retention, detention, infiltration and any other above or below grade systems, in plan and profile.
        iii. Soils erosion and Sediment Control plans in accordance with the respective Soil Conservation District rules and regulations.
    e. Typical details and sections of all proposed improvements
    f. Site sections and profiles, if needed to fully describe site conditions.
3. Architectural Drawings
    a. Final Floor Plans
    b. Final Coordinated Roof Plans showing roof types, drainage systems, roof top equipment (including exposed duct and piping mains), walk pads, roof ladders and penetrations
    c. Final sections through the building showing floor-to-floor heights and ceiling heights with all spaces labeled
    d. Final Interior Elevations for all typical spaces, assembly spaces and special instructional spaces
    e. Final Interior Partition drawings and schedules identifying all partition types and demonstrating compliance with acoustic performance and other requirements
    f. Final Wall Sections and details of each major type of exterior wall and fire wall treatment, to indicate compliance with requirements for fire ratings, acoustic values, and continuity of building envelope.
    g. Final details of major special items or conditions

h. Final Door Schedules indicating door, frame and hardware types as well as fire and acoustical ratings.

4. Structural Drawings
   a. Final structural analysis indicating all static and dynamic loads on major structural elements.
   b. Final Foundation Plan(s) showing type, location, size and depth of each foundation component.
   c. Final Structural Plans for each floor and roof, indicating columns, beams, bearing and shear walls, slabs, decks, and other major structural elements, with typical sizing.
   d. Final Structural Sections through foundations, below-grade construction, slabs on grade, walls, floors and roofs, with depths of structural elements.
   e. Final plan and section details of typical structural conditions, including building movement and fire separation conditions.
5. Food Service Facilities Drawings
   a. Final Food Service Equipment plans and schedules with utility requirements and locations.
   b. Final equipment product data and specifications.
   c. Final Reflected Ceiling Plan indicating equipment and utilities.
6. Plumbing Drawings
   a. Final Plumbing Plans for each floor and roof showing utility entrances, locations and quantity of fixtures, equipment, pumps and drains, and all piping systems including sanitary, storm, domestic water, natural gas and radon mitigation, with sizing.
   b. Final Riser Diagrams of sanitary, storm, domestic water, natural gas and radon mitigation systems, with main pipe sizes and equipment indicated.
   c. Final equipment schedules identifying each type of fixture and item of equipment, with product data and specifications.
   d. Final enlarged plans and/or sections for Kitchen, Mechanical and Pump Rooms, and other spaces with special plumbing requirements.
7. Fire Suppression Drawings
   a. Floor plans with performance criteria noting Use Group, hazard and hydraulic flow test summary and date of test.
   b. Floor plans noting incoming fire water service size and location, zone control valve assemblies, standpipes, fire pumps, and other major components.
   c. Enlarged plans of areas to be served by specialized fire protection systems such as dry pipe, pre-action, or chemical fire suppression systems.
8. HVAC Drawings
   a. Final floor plans showing HVAC system distribution drawings for all floors indicating equipment, piping, ductwork and unitary equipment. The following must also be indicated:
      i. Double-line ductwork for all mains 24 inches and larger, with sizes noted.
      ii. Single-line ductwork downstream of air terminal units to air devices.
      iii. Double-line ductwork within shafts and mechanical rooms and for ductwork exposed to the outdoors and penetrating walls or roofs.
   b. Final Riser and Flow Diagrams sufficient to describe basic system design.
   c. Final mechanical equipment room layout(s) indicating equipment, piping and ductwork mains, and louvers, indicating all required shafts and soffits to and from

mechanical equipment rooms.

d. Final Equipment Schedule (drawings or specifications) identifying all equipment. Indicate capacities, outside air quantity, location and area served by equipment.

9. Electrical Drawings
   a. Final lighting plans showing light fixtures, exit signs, and emergency lights, indicating controls and emergency lighting.
   b. Final power floor and roof plans showing receptacles, panel boards, motor control centers, transformers, conduit bank routing/size from main electric room to electric closets and risers, HVAC and plumbing equipment, elevator motors, and communications outlets.
   c. Final photometric plans demonstrating compliance with code and project requirements.
   d. Final fire alarm riser diagram showing fire alarm control panels and typical components.
   e. Final site plan showing utility transformer, incoming underground conduit bank to main electrical room, telephone/data conduit bank and other services, with manholes and related equipment.
   f. Final site lighting plan with light fixture locations, photometric information and typical pole types.
   g. Final electrical grounding grid plan, showing building grounding and typical details.
   h. Final lightning protection plan showing all components and typical details.
10. Information Technology and Security Drawings
   a. Telecom floor plans indicating MDF, IDF and designated telecom spaces, including the following:
      i. Entrance cabling (MPOE) and conduit paths.
      ii. MDF to IDF conduit paths. Include bend radius where applicable to all conduits.
      iii. Distribution paths from MDF and IDF locations to station drops.
      iv. Paths and locations of wire trays, ladder racks, J-hooks, ceiling straps and any other distribution support systems. Display all bend radiuses.
   b. Telecom floor plan with placement and count for all data drops. Include labels for all station drops.
   c. Enlarged MDF and IDF floor plans indicating placements and clearances on all sides for two post telecom racks, server cabinets, free standing floor equipment, wall mounted equipment, power receptacles with NEMA type, overhead cable pathways and conduit entrances.
   d. Enlarged MDF and IDF Sectional floor plans depicting rack elevations, wall mounted equipment; cross connect blocks, overhead cable pathway access points. The diagram shall list port densities per rack with relevant patch panel count(s). Include rack, patch panel and patch panel port numbering to match station labeling.
   e. Line diagram indicating MDF to IDF cable types, conduits, and termination types.
   f. Riser diagram depicting cable types, counts, and total length.
   g. MDF / IDF grounding diagram, grounding points and continuity.
   h. Equipment Schedule for cable routing and support systems, including J-Hooks, celling straps, wire trays, ladder racks and other distribution mechanisms.

B. Specifications

Provide detailed technical specifications in the prescribed format describing the type and characteristics of all materials and systems to be incorporated in the Work. The specifications shall describe materials and systems in sufficient detail to demonstrate

compliance with Project requirements and shall identify requirements for submittals, quality assurance, warranties, and guarantees, as well as any requirements for LEED and Building Commissioning.

(Note: With Authority's prior approval, product data for proposed materials and systems may be submitted as a supplement to or in lieu of technical specifications provided such data clearly demonstrates compliance with project performance and other requirements.)

C. LEED Compliance

1. Updated LEED Checklist identifying elements and features incorporated in design to achieve required LEED certification
2. Copies of any project submissions to USGBC

D. Building Commissioning Submissions

(See Procedural Specifications)

E. Other Submission Requirements

1. Supplementary Geotechnical Data required by code
2. Structural Calculations
3. Final load calculations for all energy and utility systems
4. Final energy model calculations using an approved energy modeling method
5. Final HVAC control diagrams and written sequence of operation of the HVAC system depicting control devices and components, safety devices, control and monitoring points, and other system components and equipment to be interlocked