

DATE: November 15, 2022

DEPARTMENT OF GENERAL SERVICES
BUREAU OF CAPITAL PROJECT DESIGN MANAGEMENT
1800 HERR STREETS
HARRISBURG, PENNSYLVANIA

ADDENDUM NO. 12

on

PROJECT NO. DGS C-0210-0004 PHASE 001

PROJECT TITLE - PA State Police Greensburg - DNA Laboratory Facility New Building

PROFESSIONAL:

DRS Architects, Inc.

One gateway Center

Pittsburgh, PA, 15222

If you submitted a bid prior to this Addendum being issued, your bid has been discarded and you must re-submit your bid(s) prior to the bid opening date and time.

See attached Addendum 12 document

November 15, 2022

DGS 0210-0004
PA State Police Greensburg
New DNA Laboratory Facility

ADDENDUM 12

Item	Description
Item 1	The RFI response spreadsheet in Addendum 11 was missing the last page and a half. Attached is the corrected spreadsheet with the missing responses.
Item 2	Also missing were the details and design guide for the response to .1 contract RFI 42, regarding the metal arch culvert. The are attached to this addendum.

Thank you,



Jon Funari
DRS Architects

DGS 210-4 Phase 1 - New Pennsylvania State Police DNA Lab
Bid RFIs and Responses

Contract+RFI #	Date	Bidder	Question	Response	Response date
.1 Contract - RFI 01	10.12.2022 09:42 AM	Ron Smith, DiMarco Construction Co. Inc.	Drawing L503 is missing from the documents.	Sheet L503 is included with Addendum 8	11.01.2022
.1 Contract - RFI 02	10.12.2022 01:53 AM	Ron Smith, DiMarco Construction Co. Inc.	Addendums 4 and 5 have been uploaded. What about Addendums 1,2 and 3?	Previous addenda 1, 2, and 3 applied to the first bidding of this project in 2109 and are no longer relevant. All prior drawings, specifications, and bidding documents have been superceded.	11.01.2022
.1 Contract - RFI 03	10.21.2022 10: 58 AM	Ron Smith, DiMarco Construction Co. Inc.	Regarding the Storm Sewer: It appears the profiles for pipe are incomplete. Cannot get pipe sizes. Also, it appears they are running larger diameter pipe into smaller diameter pipe (18" to 15"). Is that correct?	Profiles 'EW-2 TO RD-1' and 'OS-3 TO EW-6 have been added to sheets C301 and C302 to cover the missing portions of the storm system. The pipes between structures I-4 and I-6 have been upsized to 18". Revised Sheets C301 and C302 are included with Addendum 8	11.01.2022
.1 Contract - RFI 04	10.21.2022 11: 40 AM	Ron Smith, DiMarco Construction Co. Inc.	Regarding Lab casework: 1) Multiple spec sections mention seismic requirements. Please confirm if any seismic requirements and stamped engineering drawings are required for this project. 2) Please confirm standard epoxy resin is acceptable for ILO Greenstone. Only one manufacturer makes Greenstone. 3) Please confirm a 3" caster is acceptable ILO 2.5" caster called out in plans for mobile cabinets. 3" caster is industry standard size. 4) 115300 Dishwasher model number is no longer available. Please confirm new model number for this product. 5) 115300 spec mentions autoclave is OFCI. Typical autoclave installation is completed by the autoclave manufacturer. Please confirm autoclave will be handled by the owner/autoclave manufacturer and not part of lab casework/equipment scope.	1) There are no seismic requirements for this project. 2) Standard epoxy resin is acceptable. 3) 3" caster is acceptable 4) New dishwasher model # is G 5006 SCU 5) The contractor will be responsible for installing the autoclave. If specialized knowledge from the autoclave manufacturer is required for installation, contractor should include the cost of that manufacturer's assistance in the bid.	11.01.2022
.1 Contract - RFI 05	10.24.2022 04: 26 PM	Alice Mento, J. C. Orr & Son, Inc	Some of the structures do not have elevations and/or pipe sizes. They are as follows: EW-2, EW-6, I-10 & OS-3	All structures listed are included in the new profiles described in the response to RFI 03 above.	11.01.2022
.1 Contract - RFI 06	10.26.2022 08:34 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	Spec 088853, 3.6, A, refers to Entrance Lobby 144, Vestibule 143, Open Office Area 142, and Door 146 and GL-3. These rooms/door do not correspond to the floor plans. Glass type GL-3 is not designated on A501, A502, or A503.	In Specification Section 088853, Lobby 144 should read Lobby 126. Vestibule 143 should read Vestibule 125. Ballistic Glazing (Type GL-3) is required at the locations designated per the specification, using the corrected room numbers above.	11.01.2022
.1 Contract - RFI 07	10.27.2022 10:23 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	Specification section 101420-1.3.G.1. states that signs shall be provided at all room entrances. Please provide a drawing showing signage locations, or provide a bid quantity.	For bidding purposes, assume one sign for every door in the building.	11.01.2022
.1 Contract - RFI 08	10.27.2022 10:24 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	Specification section 11 53 00 contains the following product which is not shown on the drawings: MSDS Cabinet (MSD): Hazard Information Center Cabinet with swing down shelf. Please provide locations and quantities for the MSDS cabinets.	Provide one MSDS Cabinet. Cabinet Location to be determined by owner.	11.01.2022
.1 Contract - RFI 09	10.27.2022 10:25 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	Specification Section 11 53 00 references the following product: Stainless Steel Floor Mounted Shelving [Equipment Number SHxxyy]. The quantity is stated to be where shown on lab plan drawings to maximize linear feet of shelves. There are no SHxxyy shelves shown on the lab plan drawings. Please provide locations and quantities for SHxxyy Shelving.	All stainless steel shelving was removed from the project, please disregard this part of the specification.	11.01.2022

.1 Contract - RFI 10	10.27.2022 01:04 PM	Ron Smith, DiMarco Construction Co. Inc.	Earthwork: Do you know if this material can be lost on-site or will it need to be hauled away?	The site is balanced, therefore material will not need to be hauled away. Assuming 6" of topsoil, the earthwork of the site has been calculated as 12,900 CY of cut and fill.	11.01.2022
.1 Contract - RFI 11	10.27.2022 03:44 PM	Ron Smith, DiMarco Construction Co. Inc.	Sitework: 1. Need size of pipe AND grades for No. 10 and No. 11 Inlets. 2. REF: Undercut footer; need to know how far does footer excavation go out on each side of the footer.	1. These structures are included in the new profile on sheet C301. 2. Per Drawing S001, Foundation Subgrade Preparation Requirements, Note #2: "For bidding purposes assume 3 foot undercut under footings and slabs at entire building area plus 5 feet beyond." The entire building area is to be assumed to be undercut.	11.01.2022
.1 Contract - RFI 12	10.28.2022 01:02 PM	Ron Smith, DiMarco Construction Co. Inc.	Cost Submittal Form: Will there be a new Appendix C Cost Submittal Form sent out?	There have been no changes that would result in the need for a revised Appendix C Cost Submittal form.	11.14.2022
.1 Contract - RFI 13	10.28.2022 02:48 PM	Ron Smith, DiMarco Construction Co. Inc.	323119 DECORATIVE METAL FENCES AND GATES: I could not find the decorative metal fence and gates on the plans.	That section should be ignored - there are no decorative fences or gates on the project.	11.14.2022
.1 Contract - RFI 14	10.31.2022 09:54 AM	Ron Smith, DiMarco Construction Co. Inc.	102239 – "Folding Glass Partition": On page 5 of spec section 102239 – "Folding Glass Partition" under "Accessories", it mentions pocket doors and describes them. The drawings do not show pocket doors. Shall they be included in my bid?	Pocket doors should be included in the bid	11.14.2022
.1 Contract - RFI 15	10.31.2022 10:32 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	In Specification Section 074130 - INSULATED METAL PANELS, on page 7, item 2.5.B.2.a lists three different facing thicknesses. Please clarify which of the three is the correct thickness requirement	.022 inches is correct.	11.14.2022
.1 Contract - RFI 16	10.31.2022 11:34 AM	Ron Smith, DiMarco Construction Co. Inc.	Earthwork: Are there CADD Files available?	CAD files can be made available to the selected contractors	11.14.2022
.1 Contract - RFI 17	11.01.2022 08:29 AM	Ron Smith, DiMarco Construction Co. Inc.	Section 010400: What size job trailer do you want for the DGS Coordination Office?	Refer to Spec Section 010400, 1.22 B.	11.14.2022
.1 Contract - RFI 18	11.01.2022 02:59 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	The footing at Column Lines C-7 on drawing S102 is marked F13. F13 is not listed on the footing schedule on drawing S504. Please provide the required footing information for an F13 footing.	Footing size F13 is 13'-0"x13'-0"x30" with 11 - #8 reinforcing, bottom, each way.	11.14.2022
.1 Contract - RFI 19	11.01.2022 03:16 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	115313 1.5 C.2: Seismic Restraints – are Seismic restraints needed for the fume hoods on this project?	Seismic restraints are not necessary.	11.14.2022
.1 Contract - RFI 20	11.01.2022 03:16 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	123553 1.5 C: are Seismic anchors required on laboratory casework?	Seismic anchors are not necessary.	11.14.2022
.1 Contract - RFI 21	11.01.2022 03:17 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	123553 1.5.F.1: If approved, will the mockup become part of the project?	Yes, the mock-up can become part of the project	11.14.2022
.1 Contract - RFI 22	11.01.2022 03:17 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	123553 2.2.A.5.A: Will roller catches be an acceptable? Positive catches are often faulty.	No, roller catches are not acceptable	11.14.2022
.1 Contract - RFI 23	11.01.2022 03:17 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	115353 Cannot find 2.2.H MSD, or para 2.2.G, SCB, please advise.	SCB located in Loading/Receiving 100. Provide (1) MSD, mounting location to be provided by the owner.	11.14.2022

.1 Contract - RFI 24	11.01.2022 03:18 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	115353 2.2.N - Autoclave FB5, who is responsible for the removal and storage of the Autoclave? Who is responsible for moving the autoclave from storage to room 230?	The autoclave will be furnished, stored, and moved by the using agency.	11.14.2022
.1 Contract - RFI 25	11.01.2022 03:18 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	123553 2.12D The emergency shower and eyewash fixtures are covered under both the plumbing (224500) and lab casework spec sections. Please advise who is to provide these fixtures.	EWS - As located on Lab plans. These fixtures are to be provided by Div. 12 and turned over to Div. 22 for installation.	11.14.2022
.1 Contract - RFI 26	11.01.2022 03:18 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	123553 Epoxy Resin Color-the finish legend on A901, calls out the resin color as Putty, paragraph 2.9 calls out for Greenstone Gray. Please advise the correct color, as it will impact pricing.	The correct color is Putty.	11.14.2022
.1 Contract - RFI 27	11.01.2022 03:19 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	123553 2.5 epoxy resin shelving. Can we substitute phenolic resin in lieu of the epoxy resin shelving as the resin shelving is quite heavy, and it doesn't come finished on the underside of the shelf. Phenolic resin will give you same chemical resistant, is lighter in weight and is available with finish on the underside. Please advise.	Phenolic shelves are not acceptable. Provide Epoxy resin shelving as shown.	11.14.2022
.1 Contract - RFI 28	11.01.2022 03:19 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	Drawing L202 Room 139 shows two (2) OHCR-1 above the tables in the middle of the room. Who is to supply these? Please provide a spec and mounting detail.	The .4 contractor will supply them. Basis of design is "Chemetron" 12' electrical cord reel, 9 amps. Mounting methods will be per the manufacturer's instructions.	11.14.2022
.1 Contract - RFI 29	11.02.2022 07:28 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	115313 2.1.D.8.h Battery packs for the airflow alarm. The airflow alarms are by div. 23, is the battery pack by div 23 as well?	Yes.	11.14.2022
.1 Contract - RFI 30	11.02.2022 07:29 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	In specification 074213.23 Metal Composite Panels, Part 2.1 B1 lists panel thickness as 6mm. Please confirm if this is design intent. Most ACM vendors carry a maximum thickness of 4mm.	There are no longer any metal composite panels on the project. This spec section should be deleted.	11.14.2022
.1 Contract - RFI 31	11.02.2022 07:30 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	In specification 074160 Sheet Metal Wall Cladding, Part 2.1 A does not list if product to be galvanized or aluminum. Please advise.	Wall cladding material is galvanized steel.	11.14.2022
.1 Contract - RFI 32	11.02.2022 07:30 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	In specification 074130 Insulated Metal Panels Part 2.1 A, panels are listed to have a three coat fluoropolymer finish, due to the fact that these panels will be behind other panels it is recommended that these panels should the manufacturer's standard finish and color. Please advise if standard finish and color can be used.	Standard finishes are acceptable.	11.14.2022
.1 Contract - RFI 33	11.02.2022 10:42 AM	Ron Smith, DiMarco Construction Co. Inc.	Drywall: 1) Finish List (A901) lists Acoustic Wall Panels (AWP-1). I cannot find these on the drawings. Are there any Acoustic Wall Panels on the project? If so, where? 2) There are a few discrepancies between the Finish schedule and the RCP's regarding ceilings. Please clarify the following: Room #116- Gypsum board or Exposed Stair S103- Gypsum board or Exposed Stair S203- Gypsum board or Exposed Room #302- ACT-1 or Exposed	There are no acoustical wall panels on the project. Room 116 will have an exposed ceiling. S103 will have a gypsum board ceiling. S203 will have a gypsum board ceiling. Room 302 will have a gypsum board ceiling.	11.14.2022
.1 Contract - RFI 34	11.02.2022 10:58 AM	Ron Smith, DiMarco Construction Co. Inc.	Toilet Compartments: What the Doors and Intermediate Panel Sizes are for the Toilet Compartments? Also the Urinal Screen Sizes? And Lastly, the Ceiling Height in those rooms. I am concerned the drawings may not be to scale.	Compartment panels will be standard heights, 55" high, mounted 14" off the floor. Urinal screens will match compartment panels. Ceiling heights are shown on the reflected ceiling plans.	11.14.2022

.1 Contract - RFI 35	11.02.2022 12:04 PM	JR Bittner, Rycon Construction, Inc.	Acoustic Wall Panels: AWP-1 on the finish legend indicates to be installed at the training room and per elevations. This material is not shown on the finish plans or elevations. We assume none is required. Is this correct?	There are no acoustical wall panels on the project.	11.14.2022
.1 Contract - RFI 36	11.02.2022 12:07 PM	JR Bittner, Rycon Construction, Inc.	Ceiling Finish Rm 116: The finish schedule call for ACT-1 in this room and the RCP shows no ceiling. We assume the RCP shall govern. Is this correct?	The RCP is correct in this instance.	11.14.2022
.1 Contract - RFI 37	11.02.2022 01:41 PM	JR Bittner, Rycon Construction, Inc.	Terrazzo Dividers: We assume the lines shown on the plans at the terrazzo locations are the divider strips. Is this correct? We assume the terrazzo base is to be 4" high. Is this correct?	The lines shown on Sheet A932 are preliminary divider stip locations. Final divider locations, including in Vestibule, will be determined during shop drawing review.	11.14.2022
.1 Contract - RFI 38	11.02.2022 03:33 PM	JR Bittner, Rycon Construction, Inc.	Corridor 216: The finish schedule calls for CPT-1, The floor finish plan calls for VCT 1 and VCT 2. We assume the finish plan should be followed. Is this correct?	The finish plan is correct in this instance.	11.14.2022
.1 Contract - RFI 39	11.03.2022 07:30 AM	Ron Smith, DiMarco Construction Co. Inc.	Acoustical Ceilings: 1) Finish List A901 calls for Ultima 2x4 ceiling tile for ACT-2. RCP Legend calls for 2x8 ceiling tile for ACT-2. Ultima tile is not made in lengths longer than 6'. Please clarify what ACT-2 should be. (A product # would be helpful.)	ACT 2 can be Ultima 2' x 4' panels	11.14.2022
.1 Contract - RFI 40	11.03.2022 08:14 AM	JR Bittner, Rycon Construction, Inc.	ACT2 - Ultima 2x4: The finish list A901 calls for Ultima 2x4 tile for ACT-2. The RCP legend calls for this tile to be 2x8 (This tile is not available in 2x8). We assume that the 2x4 tile should be included. Is this correct?	ACT 2 can be Ultima 2' x 4' panels	11.14.2022
.1 Contract - RFI 41	11.03.2022 10:34 AM	JR Bittner, Rycon Construction, Inc.	Ceiling Details: Open Office 200/Corridor 216—There are no details indicated on how to transition from ACT1, ACT2 and ACT3A Data Base Open Office 218 does not have Gyp Board Ceiling Heights or a detail showing the transition from Gyp Bd to ACT 2. It appears there are 6" pieces of ACT 2 as well. These ceilings are very complex and we need more details.	Details for the transition are on Sheet A831, but were mistakenly not referenced on the ceiling plan. The applicable detail between ACT 1 and ACT 2 is 1/A831. The applicable detail between both ACT 1 and ACT 2, and ACT 3A, is also 1/A831.	11.14.2022
.1 Contract - RFI 42	11.03.2022 11:54 AM	Ron Smith, DiMarco Construction Co. Inc	Earthwork: For the metal arch culvert, we are not seeing a detail for that. Does one exist?	A standard detail and design guide for the 73" x 55" CMP pipe arch will be attached to this addendum.	11.14.2022
.1 Contract - RFI 43	11.03.2022 04:01 PM	Joseph Matsko, Massaro Corporation	Flooring: A901 calls for VCT – Armstrong “BBT/Striations” but this product is discontinued. Please alert the architect so they can reselect a product. I will also need to know the height that the sheet vinyl should be covered up the wall, 4 inches or 6 inches?	A similar VCT product will be selected if the Armstrong product is no longer available. The sheet vinyl floor will have a 4" high cove.	11.14.2022
.1 Contract - RFI 44	11.04.2022 11:05 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	There are varying dimensions shown for the plastic toilet compartments and urinal screens on sheets A402 and A403. Please clarify dimensions for all urinal screens and all toilet partitions.	Compartment panels will be standard heights, 55" high, mounted 14" off the floor. Urinal screens will match compartment panels.	11.14.2022
.1 Contract - RFI 45	11.08.2022 08:05 AM	Ron Smith, DiMarco Construction Co. Inc	Drywall: 1) Gypsum spec 092900 Paragraph 3.6C1 says that Aluminum Reveal trim is to be used wherever gypsum board abuts any other material. Does this include exterior window and door openings? Do we need to figure aluminum reveal trim at all the window jambs, heads, and sills?	Aluminum trim is not required at wall-to-door or wall-to-window transitions.	11.14.2022
.1 Contract - RFI 46	11.08.2022 08:27 AM	Angel Farabaugh, Leonard S. Fiore, Inc	The Pre-Proposal Conference sign-in sheet has not been issued as part of an addendum or posted to dgs.pa.gov. Please provide the Pre-Proposal Conference sign-in sheet.	The sign in sheet will be attached to this addendum	11.14.2022
.1 Contract - RFI 47	11.08.2022 08:28 AM	Angel Farabaugh, Leonard S. Fiore, Inc	Project Labor Agreement: The Appendix P Project Labor Agreement (PLA) issued as Addendum #7 references an “Appendix Documents B-Local Union Collective Bargaining Agreements”. However, Appendix B is left blank within the PLA. Please provide the referenced Appendix B-Local Union Collective Bargaining Agreements.		

.1 Contract - RFI 48	11.08.2022 08:28 AM	Angel Farabaugh, Leonard S. Fiore, Inc	Project Labor Agreement: Several qualified subcontractors have indicated they will not be bidding this project do to the inclusion of the Project Labor Agreement. Can the Appendix P Project Labor Agreement be eliminated from this RFP?	The Project Labor Agreement (PLA) will remain in the Project. Please refer to the RFP and Addenda for information regarding the PLA.	11.14.2022
.1 Contract - RFI 49	11.08.2022 09: 48 AM	Joseph Matsko, Massaro Corporation	Gypsum spec 092900 Paragraph 3.6C1 says that Aluminum Reveal trim is to be used wherever gypsum board abuts any other material. Does this include exterior window and door openings? Do we need to figure aluminum reveal trim at all the window jambs, heads, and sills?	Aluminum trim is not required at wall-to-door or wall-to-window transitions.	11.14.2022
.1 Contract - RFI 50	11.08.2022 09:52 AM	Ron Smith, DiMarco Construction Co. Inc	Standing Seam Wall Panels: Are these panels to be standing seam roof panels with staggered joints or we to fabricate a flat stock panel system with the same .040 material? It is not clear what they want. Shop fabrication is good, but if the architect wants a factory fabricated panel, neither Centria or Fabral make a flat seam panel. Atas has a matching standing seam roof panel and fabricates a flat seam panel, would Atas be accepted?	If the specified system doesn't allow for flat horizontal seams, an alternate system will be considered once the project has been awarded.	11.14.2022
.1 Contract - RFI 50	11.08.2022 01:26 PM	JR Bittner, Rycon Construction, Inc.	Room 241 Elevation: Sheet A124, room 241 has the same elevation call out from the floor below. We assume this is in error and no casework is required in room 241. Is this correct?	It is a drafting error. No casework is required in Room 241.	11.14.2022
.1 Contract - RFI 51	11.08.2022 01:29 PM	JR Bittner, Rycon Construction, Inc.	Window Type 'B' – B/A501 shows a section view (4/A504) which calls for a Plastic Laminate Window Sill. The same elevation shows a lower section detail (1/A505) calling for Epoxy Resin Window Sill. What sill should be included for the Window Type 'B' units? If Plastic laminate what is the finish for this window sill section?	All windows in the labs will have epoxy sills.	11.14.2022
.1 Contract - RFI 52	11.08.2022 01:29 PM	JR Bittner, Rycon Construction, Inc.	Window Type 'T' – Does not have a section view. Does this window type need a window sill? If so what kind of sill will be required?	Window T will have a sill similar to Deatil 5/A503.	11.14.2022
.1 Contract - RFI 53	11.08.2022 01:29 PM	JR Bittner, Rycon Construction, Inc.	Window Type 'F' – F/A501 shows a section view (4/A505) which calls for solid surface material. What is the solid surface finish for the window type 'T' window sills?	Plastic laminate can be used for Window F stools.	11.14.2022
.1 Contract - RFI 54	11.08.2022 01:54 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	Please provide a structural framing plan for Stair #2.	A plan and details are attached to this addendum.	11.14.2022
.1 Contract - RFI 55	11.09.2022 07:22 AM	Ron Smith, DiMarco Construction Co. Inc	Metal Stud Framing: 1) Section detail 1/A311 shows a cut through the North Loading Dock Canopy. It calls out 3 5/8" Metal Stud Framing with an arrow pointing towards the soffit area of this canopy. Details on Drawing A324 seem to indicate that the Structural steel of this same canopy is all exposed and painted, and there is no additional framing added. Please clarify the intent regarding the soffit of the Loading Dock Canopy.	That is a drafting error. There will be no metal stud framing at the canopies - the structural steel and bottom of deck will be exposed.	11.14.2022
.1 Contract - RFI 56	11.09.2022 07:51 AM	Joseph Matsko, Massaro Corporation	Canopy: Section detail 1/A311 shows a cut through the North Loading Dock Canopy. It calls out 3 5/8" Metal Stud Framing with an arrow pointing towards the soffit area of this canopy. Details on Drawing A324 seem to indicate that the Structural steel of this same canopy is all exposed and painted, and there is no additional framing added. Please clarify the intent regarding the soffit of the Loading Dock Canopy.	That is a drafting error. There will be no metal stud framing at the canopies - the structural steel and bottom of deck will be exposed.	11.14.2022
.1 Contract - RFI 57	11.09.2022 08:31 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	Technical Submittal, T-1A, asks for "proposer's experience with integration work with laboratory casework". Please expand on this request. What defines "integration work"?	Experience with and ability to coordinate the various trades and prime contractors involved with the installation of laboratory casework and the associated utilities, plumbing, and so forth.	11.14.2022

.1 Contract - RFI 58	11.14.2022 10:34 AM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	The summary of specification section 074213.23 (1.2-A) states that metal composite panels are to be used at soffits of canopies and roof projections. The drawings do not depict any metal composite panels at the canopies. There is one note on section 1 on sheet A311 that calls out composite panels, however it isn't pointing to anything, and there doesn't appear to be any metal panels drawn on the underside of this canopy. Please confirm there are no metal composite panels at the canopies. Please clarify if there are any metal composite panels on the project and note where they are to be used.	There are no metal composite panels in the project. You can disregard this specification section.	11.14.2022
.1 Contract - RFI 59	11.14.2022 02:45 PM	Ron Smith, DiMarco Construction Co. Inc	Roofing: The architectural roof plan, A126, lists a column line B.5 that does not appear on the structural drawings. The Penthouse roof structural plan, S107, shows the roof sloping from column line D down to column line B. In order to move the water from the low point on column line B back to B.5 tapered insulation would need to be installed at twice the structural slope to counter it and provide net positive slope back to the drains at B.5. This can be avoided if the drains are installed up against the parapet wall on column line B. Please review and advise.	The columns on B.5 are on the structural drawings, although the column line is not noted. Your suggestion for roof drainage is noted and will be reviewed once the project has been awarded.	11.14.2022
.1 Contract - RFI 60	11.11.2022 04:40 PM	Sherri Hoe	Spec section 115313 Laboratory Fume Hoods: Bedcolab is listed as an approved manufacturer for laboratory casework under spec section 123553. Would Bedcolab fume hoods be acceptable for inclusion under spec section 115313?	DGS policy does not allow product substitutions during bidding.	11.14.2022
.1 Contract - RFI 61	11.14.2022 10:38 AM	Ron Smith, DiMarco Construction Co. Inc	Earthwork: Addendum #8 Answers to questions presented to architect indicate the job is a balanced site. Our takeoff shows a considerable amount of haul off. Can the architect explain how the site is balanced.	Our understanding is that site is balanced, but we are willing to take another look at our calculations once the project has been awarded.	11.14.2022
.1 Contract - RFI 62	11.14.2022 01:39 PM	Ron Smith, DiMarco Construction Co. Inc	Site Utilities: It looks like the following specifications, which are listed in the table of contents, have not been included in the Project Manual. Please advise, thank you. 221113 – Facility Water distribution (civil) 221313 – Facility Sanitary Sewer (civil)	They are included in the attached addendum	11.14.2022
.1 Contract - RFI 63	11.14.2022 01:53 PM	Jeffrey Mascaro, Mascaro Construction Company, L. P.	The following specifications, which are listed in the table of contents, have not been included in the Project Manual: 221113 – Facility Water distribution (civil) 221313 – Facility Sanitary Sewer (civil)	They are included in the attached addendum	11.14.2022
.2 Contract - RFI 01	10.12.2022 06:16 AM	Lyn Noah, Renick Brothers Construction Co	Please clarify BB #1 work vs. BB #2 work for the .2 contract. Is BB#1 to be all work on the H drawings, with the exception of the final connection to fume hoods? Are all hood valves and associated duct still to be included in base bid #1? Are hood/sash controls to still be included in BB #1?	Per Addendum 4, there will only be a single base bid for the project.	11.01.2022
.2 Contract - RFI 02	10.12.2022 06:17 AM	Lyn Noah, Renick Brothers Construction Co	Please confirm the hood for the reagent preparation lab (accurex/greenheck xd2 or equal) Is provided by the .2 contract, and this is the only hood the .2 contract is to provide.	This is correct.	11.01.2022
.2 Contract - RFI 03	10.12.2022 06:18 AM	Lyn Noah, Renick Brothers Construction Co	Please clarify intent regarding delegated hanger design 230529.1.7.B. Is this required for every hanger in the building for the piping for the .2 contract? Is this still required if we use manufactured MSS standard hangers?	Hangers for piping with individual / dedicated hangers meeting the referenced MSS standards are permitted to be omitted from the delegated design.	11.01.2022

.2 Contract - RFI 04	10.12.2022 01:30 PM	Lyn Noah, Renick Brothers Construction Co	Are addendum #1 dated 12-23-2019, #2 dated 12-23-2019, and #3 dated 02-08-2020 still part of this bid / contract? Or are all previous drawings/specifications/addenda superseded by the 09/30/2022 issued drawings and specifications? If they are superseded - should we reference addendum #4 and beyond only on our bid form (and omit #1,#2,#3)?	Previous addenda 1, 2, and 3 applied to the first bidding of this project in 2109 and are no longer relevant. All prior drawings, specifications, and bidding documents have been superceded.	11.01.2022
.2 Contract - RFI 05	10.12.2022 04:20 PM	Lyn Noah, Renick Brothers Construction Co	Are Grooved Fittings and Couplings as manufactured by Anvil/ASC for pressure piping ("Gruvlok" brand) acceptable for grooved mechanical joint fittings and couplings? Reference 232113.2.1.A.1.a.	Product substitutions are not being entertained during bidding.	11.01.2022
.2 Contract - RFI 06	10.14.2022 10:34 AM	Lyn Noah, Renick Brothers Construction Co	Schematic shows manual shut-off valves on main branch connections (HHW) and valves leaving/entering mechanical rooms/penthouses (CHW) on H701/H702 to be high performance butterfly valve type. Are the manual shut-off valves for the boilers (HHW), pumps, air separators, and remote evaporators (CHW) to be high performance butterfly type? Or can these be standard resilient seated butterfly valves?	Per 232523-3.9.C.2.a, high performance valves are only required where indicated on the Drawings.	11.01.2022
.2 Contract - RFI 07	10.17.2022 08:26 AM	Lyn Noah, Renick Brothers Construction Co	H113P, H117, H118 show 2" HHWS/R down to feed 2nd floor offices. H701 shows 2-1/2" with high performance butterfly valves. Which is correct? if 2" is correct - can we provide standard ball valves in lieu of high performance butterfly valves?	2" is the correct size. Ball valves may be provided at this size in lieu of a HP butterfly valve.	11.01.2022
.2 Contract - RFI 08	10.17.2022 08:27 AM	Lyn Noah, Renick Brothers Construction Co	H116 calls for 4" piping around HCP-1A and HCP-1B (off the runout to the lab AHU). H601 calls for 4" piping to lab AHU. H115 & H117 calls for 3" piping to the lab AHU. Which is correct?	3" is the correct size.	11.01.2022
.2 Contract - RFI 09	10.17.2022 02:14 PM	Lyn Noah, Renick Brothers Construction Co	H401 upper level plan calls for 4" CHW going to remote evaporators. H401 lower level plan calls for 5" CHW going to the remote evaporators. H702 calls for 4". Which is correct, 4" or 5"?	4" is the correct size.	11.01.2022
.2 Contract - RFI 10	10.18.2022 03:27 PM	Lyn Noah, Renick Brothers Construction Co	Please clarify condensate drain requirements and which contract provides. It appears that for SSAHUs and FCUs, the drains are by the PC complete as they show on the plumbing drawings. Please confirm these drains are by the PC complete, and other condensate drains for the HVAC Equipment (Lab AHU, Office AHU, Boilers, Plenum, LEF, etc) are provided by the HC complete to a funnel drain provided by the PC.	For SSAHUS and FCUs, other than those in Mechanical Closet 113, condensate traps and any specified / required condensate pumps shall be provided under the 0.2 Contract, and the remainder of the condensate piping shall be by the 0.3 Contractor. For the units in Mechanical Closet 113, all of the work shall be by the 0.2 Contractor, other than the floor or funnel drains. Drains for equipment in the Penthouse are entirely by the 0.2 Contractor, other than the floor or funnel drains.	11.01.2022
.2 Contract - RFI 11	10.19.2022 03: 40 PM	Lyn Noah, Renick Brothers Construction Co	Please confirm all painting of HVAC piping, if required, is provided by the .1 GC contract. If this is to be by the .2 contract, can the scope of painting required be clarified – is it only piping exposed in mechanical rooms? Are there any duct or equipment painting requirements?	There is no painting required of the 0.2 Contract other than touch up of factory finishes on HVAC work as noted in various Division 23 Sections, and where galvanizing is damaged on galvanized HVAC work as per 230500-3.14.F.	11.01.2022
.2 Contract - RFI 12	10.20.2022 09: 23 AM	Lyn Noah, Renick Brothers Construction Co	If a hydronic piping system is at a size where grooved end piping/fittings/couplings are permitted, are resilient seated grooved end valves (such as a nibco GD-4765) acceptable in that system? Or must all valves be lug type, if a vic-300 is not utilized?	Grooved end valves are only permitted where grooved ends are specified for a particular valve. Note that butterfly valves other than the Vic-300 valve are specified in Section 230523 to have lug wafer bodies.	11.01.2022

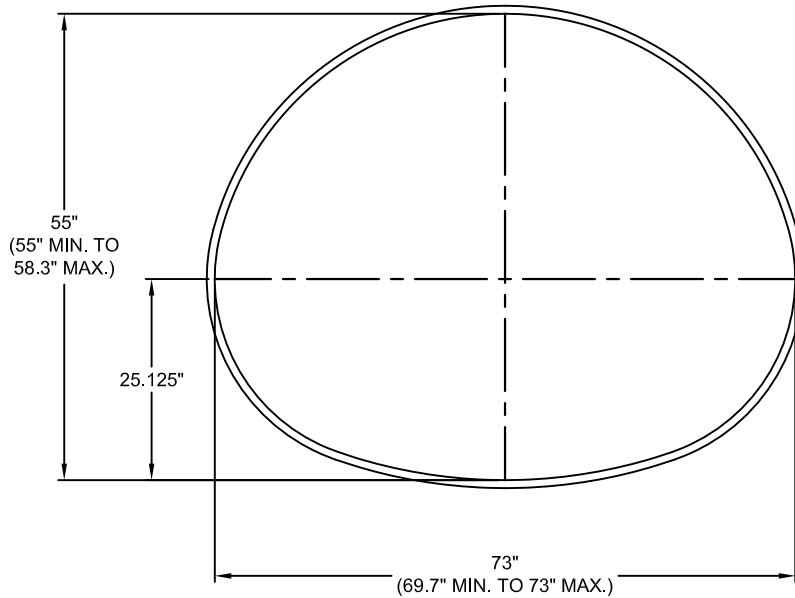
.2 Contract - RFI 13	10.26.2022 05:09 PM	Lyn Noah, Renick Brothers Construction Co	Balancing Subcontractor-Northstar Environmental: Is Northstar Environmental, LTD an acceptable balancing subcontractor for this project? They bid the 2020 version of this project as a critical subcontractor.	Substitutions are not being entertained during bidding. Per 230593-1.4.B, the .2 Contractor may submit to use another firm other than those listed in 1.4.A, however this shall be after contact award. The .2 bidding Contractors are advised to base their bid on one of the pre-approved TAB Agents listed, as Northstar, or any other proposed substitution, may or may not be accepted.	11.01.2022
.2 Contract - RFI 14	10.28.2022 08:53 AM	Lyn Noah, Renick Brothers Construction Co	Spec 230713.3.6E: Please confirm that the intent is that the return / exhaust duct associated with the lab AHU is to receive wrap insulation where concealed in the building / in duct shafts, per 230713.3.6.E	Lab AHU exhaust ducts that are not located in the Penthouse may be uninsulated.	11.14.2022
.2 Contract - RFI 15	10.28.2022 08:54 AM	Lyn Noah, Renick Brothers Construction Co	Relief Air: Please clarify if the relief air associated with the office air handler in the penthouse is to receive board insulation? Is the intent of the spec that all ducts in the penthouse are to receive board insulation where exposed in the penthouse?	Relief duct associated with the Office AHU requires board insulation. Comply with material and thickness indicated in 230713-3.6.F.	11.14.2022
.2 Contract - RFI 16	10.28.2022 09:08 AM	Lyn Noah, Renick Brothers Construction Co	Vertical Duct: Is it the intent that the vertical duct drops in the penthouse space (the ducts that continue to the floor below) are to be concealed / chased in a shaft and therefore the ducts receive wrap insulation? Or are they to be exposed to the floor penetration into the floor below and therefore are required to be board insulation? It appears from the drawings that there is some sort of drywall / shaft wall around the ducts, but it is not clear if this chase is chased the entirety of the penthouse, or if it is just the opening going to the floor below / shaft to the 1st floor.	The shafts terminate with a 'cap' near the penthouse floor, so nearly all ductwork in the penthouse is exposed, and therefore requires board insulation per 230713-3.6.F.	11.14.2022
.2 Contract - RFI 17	10.31.2022 09:07 AM	Lyn Noah, Renick Brothers Construction Co	Temporary Heat: Are self-contained exterior vented / outdoor self-vented and temporary ducted natural-gas fired heaters acceptable for temporary heat, once the building is enclosed? If they are acceptable, please confirm that the lead contractor still owns fuel for this system.	See Specification Section 015000, Part 1.4.	11.14.2022
.2 Contract - RFI 18	11.01.2022 08:34 AM	Lyn Noah, Renick Brothers Construction Co	Duct Insulation: Is the intent for the duct insulation for round downstream of VAV, SAV to be 1 1/2" blanket insulation and if so may we also choose to insulated the rectangular that way as well?	Duct liner is required on such ducts as per 233113-2.3.B, and 233113-2.3.C.5. Lined supply ducts do not require external blanket in addition to the liner.	11.14.2022
.2 Contract - RFI 19	11.02.2022 01: 24 PM	Justin Clark, Scalise Industries (EMCOR Services)	Wall Penetration Coordination: How are all wall penetrations being handled on this job? does .2 HVAC Contractor layout for the .1 General contractor to perform?	Refer to 230500, Article 3.1.	11.14.2022
.2 Contract - RFI 20	11.02.2022 01: 25 PM	Justin Clark, Scalise Industries (EMCOR Services)	Bid Submission: The new addendum refers to the bid being submitted online on E-Builder, however that system is locked at the moment. Please confirm this bid will be submitted online as stated in the addendum, and the form will be unlocked to do so.	Proposals must be submitted per the instructions in the RFP	11.14.2022
.2 Contract - RFI 21	11.02.2022 02:38 PM	Lyn Noah, Renick Brothers Construction Co	TAB Subcontractors: None of the pre-approved TAB subcontractors (Flood & Sterling, TABworks, WAE, Kahoe) are interested in bidding this project (we have verified this with all named bidders). Please advise how we are to handle the TAB work for this project?	Any TAB Agent which meets the requirements of Article 1.9 of 230593 will be acceptable.	11.14.2022

.2 Contract - RFI 22	11.02.2022 02:46 PM	Lyn Noah, Renick Brothers Construction Co	Drawing H111D notes 15 and 16: Please clarify if notes #15 and #16 on H111D are required? we cannot find any of these return vav boxes RTD-1B, RTD-2A, RTD-2B and associated controls. We can only find RTD #1A (note #13 and #14) on the drawings.	Not all keynotes are used on a given sheet as per the general note on H111D (look just above the HFL logo near the titleblock info). Keynote 15 is applied on H112D near rooms 127 and 128. Also on H112D, keynote 16 is applied near Room 138. RTD-1B consists of a damper and airflow station and is located above Room 127 (see dwg. H112D). RTD-2A is a motorized damper and is located near column lines 5 and B in the penthouse (see dwg. H115). RTD-2B is a motorized damper and is located near column lines 7.5 and B in the penthouse (see dwg. H115).	11.14.2022
.2 Contract - RFI 23	11.14.2022 02:05 PM	Justin Clark, Scalise Industries (EMCOR Services)	Controls: Electrical drawings E-113P and E-114P Lab area's A and B do not show any 120v power designated for the Lab Control Air Valves, Fume Hood Air Valves, and Room Pressure monitors. On drawing E-602 showing Lab breaker Panels A through F there are spare circuits. Will/Can the DIV.26 contractor provide the 120v wiring to a junction box close or near to the bulk of the Lab Air Control Valves for the DDC contractor to install a 24v transformer for power to the Lab DDC Control System devices?	There are several junction boxes (tagged "VAV") indicated to be installed throughout the lab areas designated for HVAC control power. Refer to enlarged power plans for these areas on sheets E401P and E402P.	11.14.2022
.3 Contract - RFI 01	10.12.2022 01:30 PM	Lyn Noah, Renick Brothers Construction Co	Are addendum #1 dated 12-23-2019, #2 dated 12-23-2019, and #3 dated 02-08-2020 still part of this bid / contract? Or are all previous drawings/specifications/addenda superseded by the 09/30/2022 issued drawings and specifications? If they are superseded - should we reference addendum #4 and beyond only on our bid form (and omit #1,#2,#3)?	Previous addenda 1, 2, and 3 applied to the first bidding of this project in 2109 and are no longer relevant. All prior drawings, specificfations, and bidding documents have been superceeded.	11.01.2022
.3 Contract - RFI 02	11.01.2022 01:49 PM	Lyn Noah, Renick Brothers Construction Co	Specification section 220529 paragraph 1.5-B-1: Does delegated design apply to this project for pipes 2" and above running parallel within the same structural bay even if the pipes are supported by their own hangers and not a trapeze type hanger?	Hangers for piping with individual / dedicated hangers meeting the referenced MSS standards are permitted to be omitted from the delegated design.	11.14.2022
.3 Contract - RFI 03	11.01.2022 01:49 PM	Lyn Noah, Renick Brothers Construction Co	Specification section 220516 paragraph 1.3: Does this section apply to this project?	Yes - Furnish and install pipe anchors, guides and expansion loops in domestic hot water supply and return piping for thermal expansion of the piping systems. Refer to pipe anchor and guide detail 5/ P010.	11.14.2022
.3 Contract - RFI 04	11.02.2022 11:30 AM	Rusty Stoner, Negleys Water	Bidders List: I am looking for a list of prospective bidders. My company can provide water treatment related products, installation and services. I am trying to see who is bidding on the plumbing sections and who may be interested in my company providing quotes or proposals to them for water treatment and water purification items. We are a small business and we are registered with Pennsylvania.	DRS Architects does not have access to the bidders list, but we believe you can see who is bidding by registering in eBuilder as a bidder yourself.	11.14.2022
.4 Contract - RFI 01	10.25.2022 01:09 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Floor Boxes: Can you provide a manufacture and catalog number for the floor boxes shown on drawing E111P, E114P, E111S, and E112S?	See revised sheet E605, attached to this addendum	11.14.2022

.4 Contract - RFI 02	10.25.2022 01:10 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Lab Table Top boxes: Can you provide a manufacture and catalog number for the power and data lab table top boxes per drawing E401P, E401S, E402P and E402S?	See revised sheet E605, attached to this addendum	11.14.2022
.4 Contract - RFI 03	10.25.2022 01:12 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Furniture Feeds: Can you provide a manufacture and catalog number for the furniture feed devices as shown on drawings E112P and E113P?	See revised sheet E605, attached to this addendum	11.14.2022
.4 Contract - RFI 04	11.01.2022 10:35 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Type L4, L6, & L8 Light Fixtures: On drawing E113L and E114L, there are Type L4, L6, & L8 Light Fixtures shown. All other Type L4, L6 & L8 have an 'H' or a 'D' beside them. Which of these light fixtures are to be 'H' and which fixtures are to be 'D'?	Refer to the remarks column in the light fixture schedule.	11.14.2022
.4 Contract - RFI 05	11.01.2022 10:37 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Elevator Light Fixtures: On drawing E112L and E114L, the light fixtures in the elevators are noted as 'S' however, they have a different symbol than the other Type S fixtures. Are the elevator lights the same as the other Type S fixtures or do they have a different manufacture and catalog number?	For the purposes of bidding, assume they are the same.	11.14.2022
.4 Contract - RFI 06	11.01.2022 11:01 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Motorized Shades: What contract is to provide and install the motorized shades? What contract is to provide the controls for the motorized shades? What contract is required for the power and control wiring for the motorized shades?	The .1 (general) contractor to provide and install motorized shades and control system. .4 (electrical) contractor to provide power to shade locations.	11.14.2022
.4 Contract - RFI 07	11.01.2022 11:02 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Lab wiremold: Drawing E401P, what type of dual compartment raceways is to be in Room 228, Rapid DNA?	The raceway will be the same as that used in the other lab rooms.	11.14.2022
.4 Contract - RFI 08	11.01.2022 11:04 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Evidence 223 dual compartment raceway: On drawing E402P, what type of dual compartment raceway is to be installed in Evidence 223?	The raceway will be the same as that used in the other lab rooms.	11.14.2022
.4 Contract - RFI 09	11.01.2022 11:07 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Dual compartment Raceway: On drawings E401P, E401S, E402P and E402S, the receptacles and data outlets are drawing on the floor plans. Are the receptacles and data outlets shown on the floor plans the exact quantities that are to be provided or will additional devices need to be added per the details on drawing E501?	Refer to Detail E501-1 for outlet spacing. Provide active outlet quantities per drawings, Provide blank covers for unused windows.	11.14.2022
.4 Contract - RFI 10	11.01.2022 11:09 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Dual Compartment Raceway: On drawing E402P and E402S, the lengths of dual compartment don't match between the power and system pages. Which length is correct?	For bidding, assume the longer version is needed.	11.14.2022
.4 Contract - RFI 11	11.01.2022 11:38 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Drawing E101: What contract is responsible for the trenching, backfilling, concrete encasement for the new underground electrical conduits? Who is responsible for installing the concrete light pole bases?	The .4 (electrical) contractor to provide trenching, backfilling, and concrete encasement associated with any new underground electrical conduits. The .4 contractor also to provide concrete light pole bases.	11.14.2022
.4 Contract - RFI 12	11.01.2022 11:42 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Concrete Pads: What contractor is to supply the concrete generator and transformer pad, GC or EC?	The .1 (general) contractor should provide the generator and transformer pads.	11.14.2022
.4 Contract - RFI 13	11.01.2022 11:48 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	MC Cable: Is branch circuit wiring inside the building to be with Type EMT conduit and MC Cable can only be used for a maximum length of 6'-0" for fixture whips or dropdowns to receptacles?	Yes, this is the intent.	11.14.2022
.4 Contract - RFI 14	11.01.2022 11:53 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Diesel Fuel for Generator: Who is to supply the diesel fuel for the generator?	Fuel is provided by .4 contractor during construction and testing	11.14.2022

.4 Contract - RFI 15	11.01.2022 11:59 AM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Drawing E101: On drawing E101, is PVC conduit to be used for underground electrical conduits, if so Schedule 40 or 80 PVC? There is a duct bank detail showing conduits being concrete encased. Do the underground lighting conduits need to be concrete encased?	Schedule 80 PVC is to be used for underground electrical conduits. Underground lighting conduits do not need to be concrete encased.	11.14.2022
.4 Contract - RFI 16	11.01.2022 01:46 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Cable Tray: On drawing E111S and E112S, is all the cable tray to be wire-mesh style cable tray?	Cable tray within Telecom rooms to be Cable Runway. Cable tray outside Telecom rooms to be wire basket cable tray.	11.14.2022
.4 Contract - RFI 17	11.01.2022 03:19 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Lightning Protection System: In the specification 264113, 1.5, B requires a UL Master Label Certificate for this project. The lightning protection layout on drawings E119 and E120 does not meet the requirements for a UL Master Label Certificate. Do you want us to include only what is shown on the drawings or do we need to add terminals and cables to meet the requirements for a UL Master Label Certificate?	Lightning protection drawings are diagrammatic. Provide adequate quantities of terminals and cables to meet UL Master Label Certificate.	11.14.2022
.4 Contract - RFI 18	11.01.2022 03:21 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Cable Tray: Is all the cable tray on drawing E113S and E114S to be wire-mesh style cable tray?	Cable tray within Telecom rooms to be Cable Runway. Cable tray outside Telecom rooms to be wire basket cable tray.	11.14.2022
.4 Contract - RFI 19	11.01.2022 03:28 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Low Voltage System Wiring: Is all the low voltage system wiring systems (Door Access, CCTV, Intercom, Access Control) to be run in conduit above the ceilings or can system cabling be run as loose cables above the ceiling in J-Hooks or cable tray?	Low voltage wiring to run in cable tray, then j-hooks to device location.	11.14.2022
.4 Contract - RFI 20	11.01.2022 03:56 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	VFD Cable: Is VFD cable required from the VFD to the motor or just XHHW-2 conductors in conduit?	Provide VFD cable between each drive and associated motor.	11.14.2022
.4 Contract - RFI 21	11.01.2022 04:00 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Lighting Control System Wiring: Is it acceptable to run the low voltage lighting control wiring loose above the ceiling or does the low voltage lighting control wiring need to be run in conduit above the ceiling?	Low voltage lighting control wiring is not required to be routed in conduit. All loose wiring shall be supported and installed neatly	11.14.2022
.4 Contract - RFI 22	11.01.2022 04:16 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Training Room 122: On drawing E112S, the Training Room 122 has what appear to be speakers in the ceiling. Who is providing these speakers? If EC, please provide a spec on the requirements for these items.	The using agency will supply the speakers. Electrical contractor will provide infrastructure for pathway for speaker wire to be connected back to location indicated for speaker system control panel in same room.	11.14.2022
.4 Contract - RFI 23	11.01.2022 04:19 PM	Jim Clark, TSB Inc. d/b/a Schultheis Electric	Area of Refuge / Area of Rescue Communication System: There is a specification section 283163 for Area of Refuge / Area of Rescue Communication System. There are no symbols on the drawings for the Area of Refuge / Area of Rescue Communication System. Is an Area of Refuge / Area of Rescue Communication System required for this project and if so, what components are needed?	There is no area of rescue or refuge in this project. The communication system is not required.	11.14.2022
.4 Contract - RFI 24	11.02.2022 03:14 PM	Brian Owens, Westmoreland Electric Services, LLC	Project Labor Agreement: We are requesting that the project labor agreement be removed from the project.	The Project Labor Agreement (PLA) will remain in the Project. Please refer to the RFP and Addenda for information regarding the PLA.	11.14.2022
.4 Contract - RFI 25	11.11.2022 12:52 PM	Roseann March, CLISTA ELECTRIC INC	Branch Circuits - Specification 260519 3.2 E states branch circuits THHN single conductor in a raceway or MC cable (maximum 6'). Will you accent MC cable concealed in walls and above accessible ceilings with EMT for exposed areas and homeruns?	All branch circuits to be installed in EMT. MC cable permitted for light fixture whips only.	11.14.2022

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NOMINAL 73" X 55" (66" ROUND EQUIVALENT)

AREA= 23.2 SF

NOTES:

1. ALL DIMENSIONS ARE TO THE INSIDE CORRUGATION CREST UNLESS NOTED OTHERWISE.
2. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
3. RISE AND SPAN DIMENSIONS ACCOUNT FOR SPECIFICATION TOLERANCES FROM NOMINAL DIMENSIONS. (AASHTO M 36 STEEL, M 196 ALUMINUM, ASTM A 760 STEEL, B 745 ALUMINUM).

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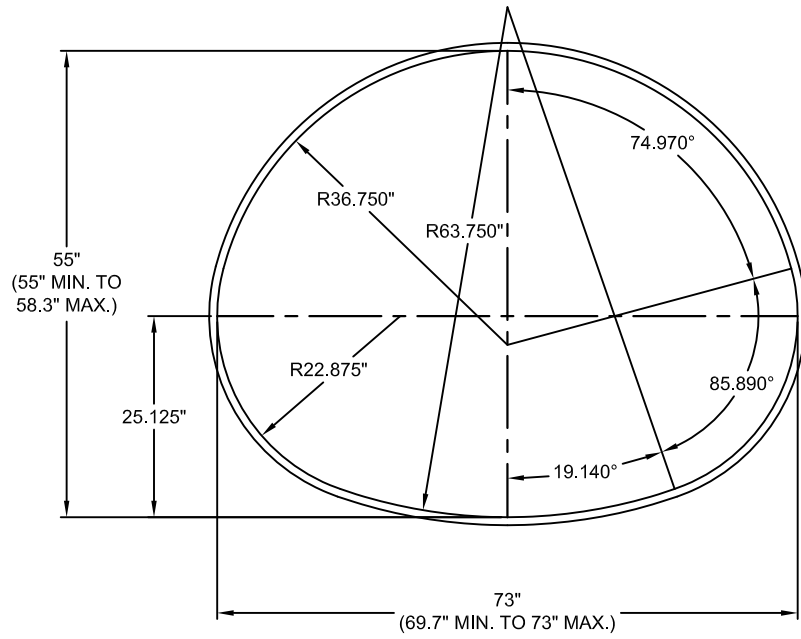
REV DATE:

SCALE: N.T.S.

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SHAPE DRAWING
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 66" EQ DIA 73"x55"

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Corrugated Metal Pipe Design Guide

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Corrugated Metal Pipe (CMP) Design Guide

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Durability Design Guide

Proper design of culverts and storm sewers requires structural, hydraulic and durability considerations. While most designers are comfortable with structural and hydraulic design, the mechanics of evaluating abrasion, corrosion and water chemistry to perform a durability design are not commonly found in most civil engineering handbooks.

The durability and service life of a drainage pipe installation is directly related to the environmental conditions encountered at the site and the type of materials and coatings from which the culvert is fabricated. Two principle causes of reduced service life in drainage pipe materials are corrosion and abrasion.

Service life can be affected by the corrosive action of the backfill in contact with the outside of a drainage pipe or more commonly by the corrosive and abrasive action of the flow in the invert of the drainage pipe. The design life analysis should include a check for both the water side and soil side environments to determine which is more critical— or which governs service life.

The potential for metal loss in the invert of a drainage pipe due to abrasive flows is often overlooked by designers and its effects are often mistaken for corrosion. An estimate for potential abrasion is required at each pipe location in order to determine the appropriate material and gage.

This manual is intended to guide specifiers through the mechanics of selecting appropriate drainage products to meet service life requirements. The information contained in the following pages is a composite of several national guidelines.



Using the CMP Design Guide

The choice of material, gage and product type can be extremely important to service life. The following steps describe the procedure for selecting the appropriate drainage product, material and gage to meet a specific service life requirement.

Design Sequence

1. Select pipe or structure based on hydraulic and clearance requirements. Use Tables 5 and 6 as reference for size limits and hydraulic properties of all drainage products.
2. Use Height of Cover tables for the chosen pipe or structure to determine the material gage required for the specific loading condition.
3. Use Table 1 to select the appropriate material for the site-specific environmental conditions. Whenever possible, existing installations of drainage structures along the same water course offer the most reliable estimate of long-term performance for specific environment conditions. In many cases, there will be more than one material that is appropriate for the project environmental conditions. Generally speaking, the metal material types increase in price as you move from top down on Table 1. Please contact your local Contech Sales Representative for pricing.
4. Use Table 2 to determine which abrasion level most accurately describes the typical storm event (2 year storm). The expected stream velocity and associated abrasion conditions should be based on a typical flow and not a 10 or 50-year design flood.
5. Use Table 3 to determine whether the structural gage for the selected material is sufficient for the design service life. If the structural gage is greater than or equal to the gage required for a particular abrasion condition and service life, use the structural gage. Conversely, if the structural gage is less than the gage required for a particular abrasion condition and service life, use the gage required by Table 3.

Note:

Both Contech round pipe and pipe-arch are available with either helical or annular corrugations. Contech HEL-COR pipe (helical corrugations) is furnished with continuous lock seams and annular re-rolled ends or non-rerolled ends. For 3"x1" and 5"x1" HEL-COR pipe-arch, we recommend non-rerolled ends with flat or dimpled bands and flat gaskets. Contech riveted pipe is furnished with annular corrugations only. The height of cover tables in this guide are helical corrugations only. Consult your Contech representative for Height of Cover tables on riveted pipe.

Material Type	Soil* and Water pH										Resistivity (ohm-cm)	
	3	4	5	6	7	8	9	10	11	12	Minimum	Maximum
Galvanized Steel*											2,000	10,000
Aluminized Steel Type 2 (ALT2)											1,500	N/A
Polymer-Coated											250	N/A
Aluminum Alloy											500	N/A

*Appropriate pH range for Galvanized Steel is 6.0 to 10



Abrasion Level	Abrasion Condition	Bed Load	Flow Velocity (fps)
1	Non-Abrasive	None	Minimal
2	Low Abrasion	Minor	< 5
3	Moderate Abrasion	Moderate	5 - 15
4	Severe Abrasion	Heavy	> 15

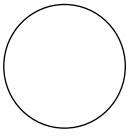
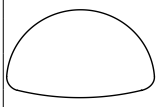
"Interim Direct Guidelines on Drainage Pipe Alternative Selection." FHWA, 2005.

Application	Culverts, Storm Drain, Cross Drain, Median Drain, Side Drain												
	Rural	Minor	Major	Urban	Rural	Minor	Major	Urban	Rural	Minor	Major	Urban	
Roadway Classification													
Design Service Life	25	50	75	100	25	50	75	100	25	50	75	100	
Abrasion Level	Abrasion Level 1 & 2				Abrasion Level 3				Abrasion Level 4				
CMP (1/2" & 1" deep corrugations), ULTRA FLO® & Smooth Cor™													
Minimum gage required to meet design service life, assuming that structural design has been met.													
Galvanized (2 oz.)	16	12	10	8 ⁴	14	10	8	N/A	14 ⁵	10 ⁵	8 ⁵	N/A	
Galvanized and Asphalt Coated	16	14	10	8	14	12	8	N/A	14 ⁵	12 ⁵	8 ⁵	N/A	
Galv., Asphalt Coated & Paved Invert	16	16	14	10	16	14	12	8	14	12	10	N/A	
Aluminized Type 2 (ALT2)	16	16	16	14	14	14	14	12	14 ⁶	14 ⁶	14 ⁶	12 ⁶	
Polymer-Coated	16	16	16 ⁸	16 ⁹	16	16	16 ⁸	16 ⁹	14 ⁷	14 ⁷	14 ^{7,8}	14 ^{7,9}	
Aluminum Alloy	16	16	16	16	14	14	14	14	14 ⁵	14 ⁵	14 ⁵	14 ⁵	

1. Based on Table 1 - Recommended Environments.
2. Smooth Cor™ Steel Pipe combines a corrugated steel exterior shell with a hydraulically smooth interior liner.
3. Service life estimates for ULTRA FLO® and Smooth Cor™ Pipe assume a storm sewer application. Storm sewers rarely achieve abrasion levels 3 or 4. For applications other than storm sewers or abrasion conditions above Abrasion Level 2, please contact your Contech Sales Representative for gage and coating recommendations.
4. Design service life for 8 GA galvanized is 97 years.
5. Invert protection to consist of velocity reduction structures.
6. Asphalt coated and paved invert or velocity reduction structures are needed.
7. Requires a field applied concrete paved invert with minimum thickness 1" above corrugation crests.
8. 75 year service life for polymer-coated is based on a pH range of 4-9 and resistivity greater than 750 ohm-cm.
9. 100 year service life for polymer-coated is based on a pH range of 5-9 and resistivity greater than 1500 ohm-cm.

	Material Type	Material	Pipe	Design*	Installation*
Pipe & Pipe-Arch	CMP (1/2" or 1" deep corrugations)				
	Galvanized (2 oz.)	M218	M36	Section 12	Section 26
	Asphalt Coated	M190	M36	Section 12	Section 26
	Asphalt Coated and Paved Invert	M190	M36	Section 12	Section 26
	Aluminized Type 2	M274	M36	Section 12	Section 26
	Polymer-Coated	M246	M36 & M245	Section 12	Section 26
	Aluminum Alloy	M197	M196	Section 12	Section 26
	ULTRA FLO® (3/4" x 3/4" x 7-1/2" corrugation)				
	Galvanized (2 oz.)	M218	M36	Section 12	Section 26
	Aluminized Type 2	M274	M36	Section 12	Section 26
	Polymer-Coated	M246	M36 & M245	Section 12	Section 26
	Aluminum Alloy	M197	M196	Section 12	Section 26
	Smooth Cor™				
	Polymer-Coated	M246	M36 & M245	Section 12	Section 26

* AASHTO LRFD Bridge Design Specification and AASHTO Standard Specification for Highway Bridges

Table 5 - Product Dimensions					
	Drainage Product	Common Uses	Size Limits*		Manning's "n" Value
			Minimum	Maximum	
	Corrugated Steel (1/2" deep corrugation)	Culverts, small bridges, storm water detention/retention systems, conduits, tunnels, storm sewers.	12"	84"	0.011 - 0.021
	Corrugated Steel with Paved Invert (1/2" deep corrugation)		12"	84"	0.014 - 0.020
	Corrugated Steel (1" deep corrugation)		54"	144"	0.022 - 0.027
	Corrugated Steel with Paved Invert (1" deep corrugation)		54"	144"	0.019 - 0.023
	Corrugated Aluminum (1/2" deep corrugation)		12"	72"	0.011 - 0.021
	Corrugated Aluminum (1" deep corrugation)		30"	120"	0.023 - 0.027
	ULTRA FLO® Steel	Storm sewers, culverts, storm water detention/retention systems.	18"	102"	0.012
	ULTRA FLO® Aluminum		18"	84"	0.012
	Smooth Cor™ Steel (1/2" deep corrugation)		18"	66"	0.012
	Smooth Cor™ Steel (1" deep corrugation)		48"	126"	0.012
	Corrugated Steel (1/2" deep corrugation)	Culverts, small bridges, storm water detention/retention systems, conduits, tunnels, storm sewers.	17" x 13"	83" x 57"	0.011 - 0.021
	Corrugated Steel with Paved Invert (1/2" deep corrugation)		17" x 13"	83" x 57"	0.014 - 0.019
	Corrugated Steel (1" deep corrugation)		53" x 41"	142" x 91"	0.023 - 0.027
	Corrugated Steel with Paved Invert (1" deep corrugation)		53" x 41"	142" x 91"	0.019 - 0.022
	Corrugated Aluminum (1/2" deep corrugation)		17" x 13"	71" x 47"	0.011 - 0.021
	Corrugated Aluminum (1" deep corrugation)		60" x 46"	112" x 75"	0.023 - 0.027
	ULTRA FLO® Steel	Storm sewers, culverts, storm water detention/retention systems.	20" x 16"	66" x 51"	0.012
	ULTRA FLO® Aluminum		20" x 16"	66" x 51"	0.012
	Smooth Cor™ Steel (1/2" deep corrugation)		21" x 15"	77" x 52"	0.012
	Smooth Cor™ Steel (1" deep corrugation)		53" x 41"	137" x 87"	0.012

* For sizes outside of these limits, please contact your Contech representative.

Table 6 — Corrugated Steel Pipe—Values of Coefficient of Roughness (Manning's "n")											
	Helical* Corrugation – 2 2/3" x 1/2"							1-1/2" x 1/4"		Annular	
	12 in.	15 in.	18 in.	24 in.	36 in.	48 in.	60 in. +	8 in.	10 in.		
2 2/3" x 1/2"											
Unpaved	0.011	0.012	0.013	0.015	0.018	0.020	0.021	0.012	0.014	All Diameters	
Paved Invert				0.014	0.017	0.020	0.019			0.024	
Smooth Cor™			0.012	0.012	0.012	0.012	0.012			0.021	
	Helical* – 3" x 1"										
3" x 1"	36 in.	42 in.	48 in.	54 in.	60 in.	66 in.	72 in.	78 in. +		All Diameters	
Unpaved	0.022	0.022	0.023	0.023	0.024	0.025	0.026	0.027		0.027	
Paved Invert	0.019	0.019	0.020	0.020	0.021	0.022	0.022	0.023		0.023	
Smooth Cor™			0.012	0.012	0.012	0.012	0.012	0.012		N/A	
	Helical* – 5" x 1"										
5" x 1"			48 in.	54 in.	60 in.	66 in.	72 in.	78 in. +		All Diameters	
Unpaved			0.022	0.022	0.023	0.024	0.024	0.025		N/A	
Paved Invert			0.019	0.019	0.020	0.021	0.021	0.022		N/A	
ULTRA FLO®	3/4" x 3/4" x 7-1/2"										
	All diameters n = 0.012										N/A

* Tests on helically corrugated pipe demonstrate a lower coefficient of roughness than for annularly corrugated steel pipe. Pipe-arches have approximately the same roughness characteristics as their round equivalent pipes.

Area and Hydraulic Radius for Corrugated Steel Pipe Flowing Full

Round Pipe – Area & Hydraulic Radius		
Diameter (in.)	Area (Ft ²)	Hydraulic Radius (ft.)
12	0.8	0.250
15	1.2	0.312
18	1.8	0.375
21	2.4	0.437
24	3.1	0.500
30	4.9	0.625
36	7.1	0.750
42	9.6	0.875
48	12.6	1.000
54	15.9	1.125
60	19.6	1.250
66	23.8	1.375
72	28.1	1.500
78	33.2	1.625
84	38.5	1.750
90	44.2	1.875
96	50.3	2.000
102	56.8	2.125
108	63.6	2.250
114	70.9	2.375
120	78.5	2.500
126	86.6	2.625
132	95.0	2.750
138	103.9	2.875
144	113.1	3.000

Pipe-Arch – Area & Hydraulic Radius			
2 2/3" x 1/2" Corrugated Steel Pipe			
Diameter (in.)	Pipe-Arch Equivalent Size (in.)	Waterway Area (Ft ²)	Hydraulic Radius A/πD (ft.)
15	17 x 13	1.1	0.280
18	21 x 15	1.6	0.340
21	24 x 18	2.2	0.400
24	28 x 20	2.4	0.462
30	35 x 24	4.5	0.573
36	42 x 29	6.5	0.690
42	49 x 33	8.9	0.810
48	57 x 38	11.6	0.924
54	64 x 43	14.7	1.040
60	71 x 47	18.1	1.153
66	77 x 52	21.9	1.268
72	83 x 57	26.0	1.380

Pipe-Arch – Area & Hydraulic Radius			
3" x 1" or 5" x 1" Corrugated Steel Pipe			
Diameter (in.)	Pipe-Arch Equivalent Size (in.)	Waterway Area (Ft ²)	Hydraulic Radius A/πD (ft.)
54	60 x 46	15.6	1.104
60	66 x 51	19.3	1.230
66	73 x 55	23.2	1.343
72	81 x 59	27.4	1.454
78	87 x 63	32.1	1.573
84	95 x 67	37.0	1.683
90	103 x 71	42.4	1.800
96	112 x 75	48.0	1.911
102	117 x 79	54.2	2.031
108	128 x 83	60.5	2.141
114	137 x 87	67.4	2.259
120	142 x 91	74.5	2.373

Notes:

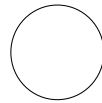
1. Listed pipe arch dimensions do not include tolerance.
2. For additional detail, please reference the hydraulic radius tables (Figure 4.32 and 4.33) found in the NCSA CSP Design Manual, 2008.

ULTRA FLO® Pipe-Arch – Area & Hydraulic Radius			
2 2/3" x 1/2" Corrugated Steel Pipe			
Diameter (in.)	Pipe-Arch Equivalent Size (in.)	Waterway Area (Ft ²)	Hydraulic Radius A/πD (ft.)
18	20 x 16	1.7	0.36
21	23 x 19	2.3	0.42
24	27 x 21	3.0	0.48
30	33 x 26	4.7	0.60
36	40 x 31	6.7	0.71
42	46 x 36	9.2	0.84
48	53 x 41	12.1	0.96
54	60 x 46	15.6	1.10
60	66 x 51	19.3	1.23

HEL-COR® Corrugated Steel Pipe

Heights of Cover

2 2/3" x 1/2" Height of Cover Limits for Corrugated Steel Pipe



H 20 and H 25 Live Loads

Diameter (in.)	Minimum Cover (in.)	Maximum Cover ⁽²⁾ (ft.)					
		Specified Thickness (in.) and Gage					
		(0.052) 18	(0.064) 16	(0.079) 14	(0.109) 12	(0.138) 10	(0.168) 8
6 ⁽⁸⁾	12	388	486				
8 ⁽⁸⁾	12	291	365				
10 ⁽⁸⁾	12	233	292				
12	12	197	248	310			
15	12	158	198	248			
18	12	131	165	206			
21	12	113	141	177	248		
24	12	98	124	155	217		
30	12		99	124	173		
36	12		83	103	145	186	
42	12		71	88	124	159	195
48	12		62	77	108	139	171
54	12			67	94	122	150
60	12				80	104	128
66	12				68	88	109
72	12					75	93
78	12						79
84	12						66

H 20 and H 25 Live Loads, Pipe-Arch

Size		Minimum Thickness (in.)	Minimum Cover (in.)	Maximum Cover (ft.)
Round Equivalent (in.)	Span x Rise (in.)			2 Tons/Ft. ² Corner Bearing Pressure
15	17 x 13	0.064	12	16
18	21 x 15	0.064	12	15
21	24 x 18	0.064	12	15
24	28 x 20	0.064	12	15
30	35 x 24	0.064	12	15
36	42 x 29	0.064	12	15
42	49 x 33	0.064*	12	15
48	57 x 38	0.064*	12	15
54	64 x 43	0.079*	12	15
60	71 x 47	0.109*	12	15
66	77 x 52	0.109*	12	15
72	83 x 57	0.138*	12	15

E 80 Live Loads

Diameter (in.)	Minimum Cover (in.)	Maximum Cover ⁽²⁾ (ft.)					
		Specified Thickness (in.) and Gage					
		(0.052) 18	(0.064) 16	(0.079) 14	(0.109) 12	(0.138) 10	(0.168) 8
12	12	197	248	310			
15	12	158	198	248			
18	12	131	165	206			
21	12	113	141	177	248		
24	12	98	124	155	217		
30	12		99	124	173		
36	12		83	103	145	186	
42	12		71	88	124	159	195
48	12		62	77	108	139	171
54	18			67	94	122	150
60	18				80	104	128
66	18				68	88	109
72	18					75	93
78	24						79
84	24						66

E 80 Live Loads, Pipe-Arch

Size		Minimum Thickness (in.)	Minimum Cover (in.)	Maximum Cover (ft.)
Round Equivalent (in.)	Span x Rise (in.)			3 Tons/Ft. ² Corner Bearing Pressure
15	17 x 13	0.079	24	22
18	21 x 15	0.079	24	22
21	24 x 18	0.109	24	22
24	28 x 20	0.109	24	22
30	35 x 24	0.138	24	22
36	42 x 29	0.138	24	22
42	49 x 33	0.138*	24	22
48	57 x 38	0.138*	24	22
54	64 x 43	0.138*	24	22
60	71 x 47	0.138*	24	22

* These values are based on the AISI Flexibility Factor limit (0.0433 x 1.5) for pipe-arch.

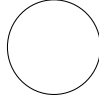
Heights of Cover Notes:

- These tables are for lock-seam or welded-seam construction. They are not for riveted construction. Consult your Contech Sales Representative for Height of Cover tables on riveted pipe.
- These values, where applicable, were calculated using a load factor of $K=0.86$ as adopted in the NCSIPA CSP Design Manual, 2008.
- The haunch areas of a pipe-arch are the most critical zone for backfilling. Extra care should be taken to provide good material and compaction to a point above the spring line.
- E 80 minimum cover is measured from top of pipe to bottom of tie.
- H 20 and H 25 minimum cover is measured from top of pipe to bottom of flexible pavement or top of rigid pavement.
- The pipe-arch tables are based on the corner bearing pressures as shown. These values may increase or decrease with changes in allowable corner bearing pressures. Consider the use of a round pipe in cases where the height of cover exceeds 8'.

- For construction loads, see Page 15.
- 1-1/2" x 1/4" corrugation. H 20, H 25 and E 80 loading.
- Smooth Cor™ has same Height of Cover properties as corrugated steel pipe. The exterior shell of Smooth Cor™ is manufactured in either 2 2/3" x 1/2" or 3" x 1" corrugations; maximum exterior shell is 12 GA.

Heights of Cover

5" x 1" or 3" x 1" Height of Cover Limits for Corrugated Steel Pipe



H 20 and H 25 Live Loads

Diameter (in.)	Minimum Cover (in.)	Maximum Cover (ft.)				
		Specified Thickness (in.) and Gage				
		(0.064) 16	(0.079) 14	(0.109) 12	(0.138) 10	(0.168) 8
54	12	56	70	98	127	155
60	12	50	63	88	114	139
66	12	46	57	80	103	127
72	12	42	52	74	95	116
78	12	39	48	68	87	107
84	12	36	45	63	81	99
90	12	33	42	59	76	93
96	12	31	39	55	71	87
102	18	29	37	52	67	82
108	18		35	49	63	77
114	18		32	45	58	72
120	18		30	42	54	66
126	18			39	50	61
132	18			36	46	58
138	18			33	43	53
144	18				39	49

Maximum cover heights shown are for 5" x 1".
To obtain maximum cover for 3" x 1", increase these values by 12%.

E 80 Live Loads

Diameter or Span (in.)	Minimum Cover (in.)	Maximum Cover (ft.)				
		Specified Thickness (in.) and Gage				
		(0.064) 16	(0.079) 14	(0.109) 12	(0.138) 10	(0.168) 8
54	18	56	70	98	127	155
60	18	50	63	88	114	139
66	18	46	57	80	103	127
72	18	42	52	74	95	116
78	24	39	48	68	87	107
84	24	36	45	63	81	99
90	24	33 ⁽¹⁾	42	59	76	93
96	24	31 ⁽¹⁾	39	55	71	87
102	30	29 ⁽¹⁾	37	52	67	82
108	30		35	49	63	77
114	30		32 ⁽¹⁾	45	58	72
120	30		30 ⁽¹⁾	42	54	66
126	36			39	50	61
132	36			36	46	58
138	36			33 ⁽¹⁾	43	53
144	36				39	49

Maximum cover heights shown are for 5" x 1".
To obtain maximum cover for 3" x 1", increase these values by 12%.
(1) These diameters in these gages require additional minimum cover.

Heights of Cover Notes:

- These tables are for lock-seam or welded-seam construction. They are not for riveted construction. Consult your Contech Sales Representative for Height of Cover tables on riveted pipe.
- These values, where applicable, were calculated using a load factor of $K=0.86$ as adopted in the NCSA CSP Design Manual, 2008.
- The span and rise shown in these tables are nominal. Typically the actual rise that forms is greater than the specified nominal. This actual rise is within the tolerances as allowed by the AASHTO & ASTM specifications. The minimum covers shown are more conservative than required by the AASHTO and ASTM specifications to account for this anticipated increase in rise. Less cover height may be tolerated depending upon actual rise of supplied pipe-arch.
- The haunch areas of a pipe-arch are the most critical zone for backfilling. Extra care should be taken to provide good material and compaction to a point above the spring line.
- E 80 minimum cover is measured from top of pipe to bottom of tie.
- H 20 and H 25 minimum cover is measured from top of pipe to bottom of flexible pavement or top of rigid pavement.
- The pipe-arch tables are based on the corner bearing pressures as shown. These values may increase or decrease with changes in allowable corner bearing pressures. Consider the use of a round pipe in cases where the height of cover exceeds 8'.
- For construction loads, see Page 15.
- Smooth Cor™ has same Height of Cover properties as corrugated steel pipe. The exterior shell of Smooth Cor™ is manufactured in either 2 2/3" x 1/2" or 3" x 1" corrugations; maximum exterior shell is 12 GA.

5" x 1" Pipe-Arch Height of Cover Limits for Corrugated Steel Pipe



H 20 and H 25 Live Loads

Round Equivalent (in.)	Size		Minimum Thickness (in.)	Minimum Cover (in.)	Maximum Cover (ft.)
	Nominal				
	Min. Span (in.)	Max. Rise (in.)			
54	60 -2.7	46 +2.7	0.109	18	21
60	66 -3.0	51 +3.0	0.109	18	21
66	73 -3.3	55 +3.3	0.109	18	21
72	81 -3.6	59 +3.6	0.109	18	21
78	87 -4.4	63 +4.4	0.109	18	20
84	95 -4.8	67 +4.8	0.109	18	20
90	103 -5.2	71 +5.2	0.109	18	20
96	112 -5.6	75 +5.6	0.109	21	20
102	117 -5.9	79 +5.9	0.109	21	19
108	128 -6.4	83 +6.4	0.109	24	19
114	137 -6.9	87 +6.9	0.109	24	19
120	142 -7.1	91 +7.1	0.138	24	19

Larger sizes are available in some areas of the United States. Check with your local Contech representative. Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerance in opposite direction.

E 80 Live Loads, Pipe-Arch

Round Equivalent (in.)	Size		Minimum Thickness (in.)	Minimum Cover (in.)	Maximum Cover (ft.)
	Nominal				
	Min. Span (in.)	Max. Rise (in.)			
54	60 -2.7	46 +2.7	0.109	30	21
60	66 -3.0	51 +3.0	0.109	30	21
66	73 -3.3	55 +3.3	0.109	30	21
72	81 -3.6	59 +3.6	0.109	30	21
78	87 -4.4	63 +4.4	0.109	30	18
84	95 -4.8	67 +4.8	0.109	30	18
90	103 -5.2	71 +5.2	0.109	36	18
96	112 -5.6	75 +5.6	0.109	36	18
102	117 -5.9	79 +5.9	0.109	36	17
108	128 -6.4	83 +6.4	0.109	42	17
114	137 -6.9	87 +6.9	0.109	42	17
120	142 -7.1	91 +7.1	0.138	42	17

Some 3" x 1" and 5" x 1" minimum gages shown for pipe-arch are due to manufacturing limitations. Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerance in opposite direction.

Heights of Cover

3" x 1" Pipe-Arch Height of Cover Limits for Corrugated Steel Pipe-Arch

H 20 and H 25 Live Loads



Round Equivalent (in.)	Size		Minimum Thickness (in.)	Minimum Cover (in.)	Maximum Cover (ft.)
	Nominal				
	Min. Span (in.)	Max. Rise (in.)			
48	53 -2.4	41 +2.4	0.079	12	25
54	60 -2.7	46 +2.7	0.079	15	25
60	66 -3.0	51 +3.0	0.079	15	25
66	73 -3.3	55 +3.3	0.079	18	24
72	81 -3.6	59 +3.6	0.079	18	21
78	87 -4.4	63 +4.4	0.079	18	20
84	95 -4.8	67 +4.8	0.079	18	20
90	103 -5.2	71 +5.2	0.079	18	20
96	112 -5.6	75 +5.6	0.079	21	20
102	117 -5.9	79 +5.9	0.109	21	19
108	128 -6.4	83 +6.4	0.109	24	19
114	137 -6.9	87 +6.9	0.109	24	19
120	142 -7.1	91 +7.1	0.138	24	19

Larger sizes are available in some areas of the United States. Check with your local Contech Sales Representative. Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerance in opposite direction.

Heights of Cover Notes:

1. These tables are for lock-seam or welded-seam construction. They are not for riveted construction. Consult your Contech Sales Representative for Height of Cover tables on riveted pipe.
2. These values, where applicable, were calculated using $K=0.86$ as adopted in the NCSA CSP Design Manual, 2008.
3. The span and rise shown in these tables are nominal. Typically the actual rise that forms is greater than the specified nominal. This actual rise is within the tolerances as allowed by the AASHTO & ASTM specifications. The minimum covers shown are more conservative than required by the AASHTO and ASTM specifications to account for this anticipated increase in rise. Less cover height may be tolerated depending upon actual rise of supplied pipe-arch.
4. The haunch areas of a pipe-arch are the most critical zone for backfilling. Extra care should be taken to provide good material and compaction to a point above the spring line.
5. E 80 minimum cover is measured from top of pipe to bottom of tie.
6. H 20 and H 25 minimum cover is measured from top of pipe to bottom of flexible pavement or top of rigid pavement.
7. The pipe-arch tables are based on the corner bearing pressures as shown. These values may increase or decrease with changes in allowable corner bearing pressures. Consider the use of a round pipe in cases where the height of cover exceeds 8'.
8. For construction loads, see Page 15.
9. Smooth Cor™ has same Height of Cover properties as corrugated steel pipe. The exterior shell of Smooth Cor™ is manufactured in either 2 2/3" x 1 1/2" or 3" x 1" corrugations; maximum exterior shell is 12 GA.

E 80 Live Loads, Pipe-Arch

Round Equivalent (in.)	Size		Minimum Thickness (in.)	Minimum Cover (in.)	Maximum Cover (ft.)
	Nominal				
	Min. Span (in.)	Max. Rise (in.)			
48	53 -2.4	41 +2.4	0.079	24	25
54	60 -2.7	46 +2.7	0.079	24	25
60	66 -3.0	51 +3.0	0.079	24	25
66	73 -3.3	55 +3.3	0.079	30	24
72	81 -3.6	59 +3.6	0.079	30	21
78	87 -4.4	63 +4.4	0.079	30	18
84	95 -4.8	67 +4.8	0.079	30	18
90	103 -5.2	71 +5.2	0.079	36	18
96	112 -5.6	75 +5.6	0.079	36	18
102	117 -5.9	79 +5.9	0.109	36	17
108	128 -6.4	83 +6.4	0.109	42	17
114	137 -6.9	87 +6.9	0.109	42	17
120	142 -7.1	91 +7.1	0.138	42	17

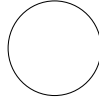
Some 3" x 1" and 5" x 1" minimum gages shown for pipe-arch are due to manufacturing limitations. Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerance in opposite direction.



CORLIX® Corrugated Aluminum Pipe

Heights of Cover

2 2/3" X 1/2" Height of Cover Limits for Corrugated Aluminum Pipe



HL 93 Live Load

Diameter (in.)	Minimum Cover (in.)	Maximum Cover (ft.)					
		Specified Thickness (in.) and Gage					
		(0.048) 18	(0.060) 16	(0.075) 14	(0.105) 12	(0.135) 10	(0.164) 8
6 ⁽⁴⁾	12	197	247				
8 ⁽⁴⁾	12	147	185				
10 ⁽⁴⁾	12	119	148				
12	12		125	157			
15	12		100	125			
18	12		83	104			
21	12		71	89			
24	12		62	78	109		
27	12			69	97		
30	12			62	87		
36	12			51	73	94	
42	12				62	80	
48	12				54	70	85
54	15				48	62	76
60	15					52	64
66	18						52
72	18						43

2 2/3" x 1/2" Height of Cover Limits for Corrugated Aluminum Pipe-Arch



HL 93 Live Load

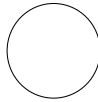
Size		Minimum Gage	Minimum Cover (in.)	Maximum Cover (ft.)
Round Equivalent (in.)	Span x Rise (in.)			2 Tons/Ft.² for Corner Bearing Pressures
15	17 x 13	16	12	13
18	21 x 15	16	12	12
21	24 x 18	16	12	12
24	28 x 20	14	12	12
30	35 x 24	14	12	12
36	42 x 29	12	12	12
42	49 x 33	12	15	12
48	57 x 38	10	15	12
54	64 x 43	10	18	12
60	71 x 47	8 ⁽⁵⁾	18	12

Notes:

1. Height of cover is measured to top of rigid pavement or to bottom of flexible pavement.
2. Maximum cover meets AASHTO LRFD design criteria.
3. Minimum cover meets AASHTO and ASTM B 790 design criteria.
4. 1 1/2" x 1/4" corrugation.
5. 8 GA pipe has limited availability.
6. For construction loads, see page 15.
7. Consult your Contech Sales Representative for E 80 Live Loads.

Heights of Cover

3" x 1" Height of Cover Limits for Corrugated Aluminum Pipe



HL 93 Live Load

Diameter (in.)	Minimum Cover (in.)	Maximum Cover (ft.)				
		Specified Thickness (in.) and Gage				
		(0.060) 16	(0.075) 14	(0.105) 12	(0.135) 10	(0.164) 8
30	12	57	72	101	135	159
36	12	47	60	84	112	132
42	12	40	51	72	96	113
48	12	35	44	62	84	99
54	15	31	39	55	74	88
60	15	28	35	50	67	79
66	18	25	32	45	61	72
72	18	23	29	41	56	66
78	21		27	38	51	61
84	21			35	48	56
90	24			33	44	52
96	24			31	41	49
102	24				39	46
108	24				37	43
114	24					39
120	24					36

3" x 1" Height of Cover Limits for Corrugated Aluminum Pipe-Arch



HL 93 Live Load

Size		Minimum Gage	Minimum Cover (in.)	Maximum Cover (ft.)
Round Equivalent (in.)	Span x Rise (in.)			2 Tons/Ft.² for Corner Bearing Pressures
54	60 x 46	14	15	20
60	66 x 51	14	18	20
66	73 x 55	14	21	20
72	81 x 59	12	21	16
78 ⁽⁴⁾	87 x 63	12	24	16
84 ⁽⁴⁾	95 x 67	12	24	16
90 ⁽⁴⁾	103 x 71	10	24	16
96 ⁽⁴⁾	112 x 75	8 ⁽⁵⁾	24	16

Notes:

1. Height of cover is measured to top of rigid pavement or to bottom of flexible pavement.
2. Maximum cover meets AASHTO LRFD design criteria.
3. Minimum cover meets ASTM B 790 design criteria.
4. Limited availability on these sizes.
5. 8 GA pipe has limited availability.
6. For construction loads, see page 15.
7. Consult your Contech Sales Representative for E 80 Live Loads.

Approximate Weight/Foot CORLIX® Corrugated Aluminum Pipe

(Estimated Average Weights—Not for Specification Use)

2 2/3" x 1/2" Corrugation Aluminum Pipe						
Diameter (in.)	Weight (Lb./Lineal Ft.) ¹					
	Specified Thickness (in.) and Gage					
	(0.048) 18	(0.060) 16	(0.075) 14	(0.105) 12	(0.135) 10	(0.164) 8
6 ⁽²⁾	1.3	1.6				
8 ⁽²⁾	1.7	2.1				
10 ⁽²⁾	2.1	2.6				
12		3.2	4.0			
15		4.0	4.9			
18		4.8	5.9			
21		5.6	6.9			
24		6.3	7.9	10.8		
27			8.8	12.2		
30			9.8	13.5		
36			11.8	16.3	20.7	
42				19.0	24.2	
48				21.7	27.6	33.5
54				24.4	31.1	37.7
60					34.6	41.9
66						46.0
72						50.1

3" x 1" Corrugation Aluminum Pipe					
Diameter (in.)	Weight (Lb./Lineal Ft.) ¹				
	Specified Thickness (in.) and Gage				
	(0.060) 16	(0.075) 14	(0.105) 12	(0.135) 10	(0.164) 8
30	9.3	11.5	15.8	20.2	24.5
36	11.1	13.7	18.9	24.1	29.3
42	12.9	16.0	22.0	28.0	34.1
48	14.7	18.2	25.1	32.0	38.8
54	16.5	20.5	28.2	35.9	43.6
60	18.3	22.7	31.3	40.0	48.3
66	20.2	24.9	34.3	43.7	53.0
72	22.0	27.1	37.4	47.6	57.8
78		29.3	40.4	51.5	62.5
84			43.5	55.4	67.2
90			46.6	59.3	71.9
96			49.6	63.2	76.7
102				66.6	80.8
108				71.0	86.1
114					90.9
120					95.6

Notes:

1. Helical lockseam pipe only. Annular riveted pipe weights will be higher.
2. 1 1/2" x 1/4" Corrugation.
3. 8 GA pipe has limited availability.



ULTRA FLO®

Heights of Cover

Galvanized, ALUMINIZED STEEL Type 2 or Polymer-Coated** Steel ULTRA FLO® H 20 and H 25 Live Load

Diameter (in.)	Minimum/Maximum Cover (ft.)			
	Specified Thickness (in.) and Gage			
	(0.064) 16	(0.079) 14	(0.109) 12	(0.138) 10
18	1.0 / 108	1.0 / 151		
21	1.0 / 93	1.0 / 130	1.0 / 216	
24	1.0 / 81	1.0 / 113	1.0 / 189	
30	1.0 / 65	1.0 / 91	1.0 / 151	
36	1.0 / 54	1.0 / 75	1.0 / 126	
42	1.0 / 46	1.0 / 65	1.0 / 108	
48	1.0 / 40	1.0 / 56	1.0 / 94	1.0 / 137
54	1.25 / 36	1.25 / 50	1.0 / 84	1.0 / 122
60	1.25*/32*	1.25 / 45	1.0 / 75	1.0 / 109
66		1.5 / 41	1.25 / 68	1.25 / 99
72		1.5*/37*	1.25 / 63	1.25 / 91
78		1.75*/34*	1.5 / 58	1.5 / 84
84			1.75 / 54	1.75 / 78
90			2.0*/50*	2.0 / 73
96			2.0*/47*	2.0 / 68
102			2.5*/43*	2.5 / 61
108				2.5*/54*
114				2.5*/49*
120				2.5*/43*

Galvanized, ALUMINIZED STEEL Type 2 or Polymer-Coated** Steel ULTRA FLO® E 80 Live Load

Diameter (in.)	Minimum/Maximum Cover (ft.)			
	Specified Thickness (in.) and Gage			
	(0.064) 16	(0.079) 14	(0.109) 12	(0.138) 10
18	1.0 / 93	1.0 / 130		
21	1.0 / 79	1.0 / 111	1.0 / 186	
24	1.0 / 69	1.0 / 97	1.0 / 162	
30	1.0 / 55	1.0 / 78	1.0 / 130	
36	1.5 / 46	1.25 / 65	1.0 / 108	
42	1.5 / 39	1.5 / 55	1.25 / 93	
48	2.0 / 34	1.75 / 48	1.5 / 81	1.5 / 118
54	3.0* / 28*	2.0 / 43	1.5 / 72	1.5 / 104
60		2.0 / 39	1.75 / 65	1.75 / 94
66		2.5* / 35*	2.0 / 58	2.0 / 85
72			2.0 / 49	2.0 / 78
78			2.5 / 42	2.5 / 72
84			2.75* / 35*	2.5 / 67
90				2.5 / 62
96				2.5* / 58*
102				3.0* / 52*

Notes:

- The tables for Steel H 20 and H 25 loading are based on the NCSPA Design Manual, 2008 and were calculated using a load factor of K=0.86. The tables for Steel E 80 loading are based on the AREMA Manual. The tables for Aluminum HL 93 loading are based on AASHTO LRFD Design Criteria.
- The haunch areas of a pipe-arch are the most critical zone for backfilling. Extra care should be taken to provide good material and compaction to a point above the spring line.
- E 80 minimum cover is measured from top of pipe to bottom of tie.
- H 20, H 25 and HL 93 minimum cover is measured from top of pipe to bottom of flexible pavement or top of rigid pavement.
- The pipe-arch tables are based on the corner bearing pressures as shown. These values may increase or decrease with changes in allowable corner bearing pressures. Consider the use of a round pipe in cases where the height of cover exceeds 8'.
- Larger size pipe-arches may be available on special order.
- M.L. (Heavier gage is required to prevent crimping at the haunches.)
- For construction loads, see Page 15.
- Sewer gage (trench conditions) tables for corrugated steel pipe can be found in the AISI book "Modern Sewer Design," 4th Edition, 1999. These tables may reduce the minimum gage (GA) due to a higher flexibility factor allowed for a trench condition.

Galvanized, ALUMINIZED STEEL Type 2 or Polymer-Coated** Steel ULTRA FLO® Pipe-Arch H 20 and H 25 Live Load

Round Equivalent (in.)	Size Span x Rise (in.)	Minimum/Maximum Cover (ft.)		
		Specified Thickness (in.) and Gage		
		(0.064) 16	(0.079) 14	(0.109) 12
18	20 x 16	1.0 / 16		
21	23 x 19	1.0 / 15		
24	27 x 21	1.0 / 13		
30	33 x 26	1.0 / 13	1.0 / 13	
36	40 x 31	1.0 / 13	1.0 / 13	
42	46 x 36	M.L. ⁷	M.L. ⁷	1.0 / 13
48	53 x 41	M.L. ⁷	M.L. ⁷	1.25 / 13
54	60 x 46	M.L. ⁷	M.L. ⁷	1.25 / 13
60	66 x 51	M.L. ⁷	M.L. ⁷	1.25 / 13

Galvanized, ALUMINIZED STEEL Type 2 or Polymer-Coated** Steel ULTRA FLO® Pipe-Arch E 80 Live Load

Round Equivalent (in.)	Size Span x Rise (in.)	Minimum/Maximum Cover (ft.)	
		Specified Thickness (in.) and Gage	
		(0.064) 16	(0.109) 12
18	20 x 16	2.0 / 22	
21	23 x 19	2.0 / 21	
24	27 x 21	2.0 / 18	
30	33 x 26	2.0 / 18	
36	40 x 31	2.0 / 17	
42	46 x 36		2.0 / 18
48	53 x 41		2.0 / 18
54	60 x 46		2.0 / 18
60	66 x 51		2.0 / 18

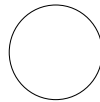


Polymer-coated ULTRA FLO® provides added durability.

- All heights of cover are based on trench conditions. If embankment conditions exist, there may be restriction on gages for the large diameters. Your Contech Sales Representative can provide further guidance for a project in embankment conditions.
- All steel ULTRA FLO® is installed in accordance with ASTM A798 "Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications."
 - * These sizes and gage combinations are installed in accordance with ASTM A796 paragraphs 18.2.3 and ASTM A798. For aluminum ULTRA FLO® refer to ASTM B790 and B788.
 - ** Contact your local Contech representative for more specific information on Polymer-Coated ULTRA FLO® for 12 GA and 10 GA.
 - ***Consult your Contech Sales Representative for E 80 Live Loads for Aluminum ULTRA FLO®.

Heights of Cover

Aluminum ULTRA FLO® HL 93 Live Load



Diameter (in.)	Minimum/Maximum Cover (ft.) Specified Thickness (in.) and Gage			
	(0.060) 16	(0.075) 14	(0.105) 12	(0.135) 10
	18	1.0/43	1.0/61	
21	1.0/38	1.0/52	1.0/84	
24	1.0/33	1.0/45	1.0/73	
30	1.25/26	1.25/36	1.25/58	
36	1.5*/21*	1.50/30	1.5/49	1.5/69
42		1.75*/25*	1.75/41	1.75/59
48			2.0/36	2.0/51
54			2.0/32	2.0/46
60			2.0*/29*	2.0/41
66				2.0/37
72				2.5*/34*

Aluminum ULTRA FLO® Pipe-Arch HL 93 Live Load



Size		Minimum/Maximum Cover (ft.) Specified Thickness (in.) and Gage			
		(0.060) 16	(0.075) 14	(0.105) 12	(0.135) 10
Round Equivalent (in.)	Span x Rise (in.)				
18	20 x 16	1.0/16			
21	23 x 19	1.0/15			
24	27 x 21	1.25/13	1.25/13		
30	33 x 26	1.5/13	1.5/13	1.5/13	
36	40 x 31		1.75/13	1.75/13	
42	46 x 36			2.0/13	2.0/13
48	53 x 41			2.0/13	2.0/13
54	60 x 46			2.0*/13*	2.0/13
60	66 x 51				2.0/13

See previous page for height of cover notes.

Approximate Weight/Foot Contech ULTRA FLO® Pipe

Handling Weight for ALUMINIZED STEEL Type 2 or Galvanized Steel ULTRA FLO®

Diameter (in.)	Weight (Pounds/Lineal Foot) Specified Thickness (in.) and Gage			
	(0.064) 16	(0.079) 14	(0.109) 12	(0.138) 10
	18	15	18	
21	17	21	29	
24	19	24	36	
30	24	30	42	
36	29	36	50	
42	33	42	58	
48	38	48	66	80
54	45	54	75	90
60	48	60	83	99
66		66	91	109
72		72	99	119
78		78	108	129
84			116	139
90			124	149
96			132	158
102			141	168
108				175
114				196
120				206

Handling Weight for ALUMINUM ULTRA FLO®

Diameter (in.)	Weight (Pounds/Lineal Foot) Specified Thickness (in.) and Gage			
	(0.060) 16	(0.075) 14	(0.105) 12	(0.135) 10
	18	5	6	
21	6	8	11	
24	7	9	13	
30	9	11	15	
36	11	13	18	23
42		15	21	26
48			24	30
54			27	34
60			30	37
66				41
72				45

Weights for polymer-coated pipe are 1% to 4% higher, varying by gage.



ULTRA FLO® is available in long lengths, and its light weight allows it to be unloaded and handled with small equipment.



Reduced excavation due to the smaller outside diameter of ULTRA FLO®.

Installation of CMP

Overview

Satisfactory site preparation, trench excavation, bedding and backfill operations are essential to develop the strength of any flexible conduit. In order to obtain proper strength while preventing settlement, it is necessary that the soil envelope around the pipe be of good granular material, properly placed and carefully compacted.

Bedding

Bedding preparation is critical to both pipe performance and service life. The bed should be constructed to uniform line and grade to avoid distortions that may create undesirable stresses in the pipe and/or rapid deterioration of the roadway. The bed should be free of rock formations, protruding stones, frozen lumps, roots and other foreign matter that may cause unequal settlement.

Placing the pipe

Corrugated metal pipe weighs much less than other commonly used drainage structures. This is due to the efficient strength of the metal, further improved with carefully designed and formed corrugations. Even the heaviest sections of Contech pipe can be handled with relatively light equipment compared with equipment required for much heavier reinforced concrete pipe.

Backfill

Satisfactory backfill material, proper placement and compaction are key factors in obtaining maximum strength and stability. Backfill should be a well-graded granular material and should be free of large stones, frozen lumps and other debris.

Backfill materials should be placed in layers about six inches deep, deposited alternately on opposite sides of the pipe. Each layer should be compacted carefully. Select backfill is placed and compacted until minimum cover height is reached, at which point, standard road embankment backfill procedures are used.

Installation References

For more information, see AASHTO Bridge Construction Specification Section 26, the Installation Manual of the National Corrugated Steel Pipe Association, ASTM A798 for steel and ASTM B788 for aluminum ULTRA FLO®.

Additional Considerations for ULTRA FLO® Installations Bedding and Backfill

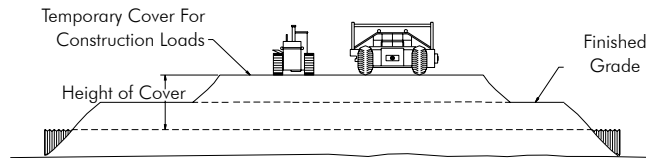
Typical ULTRA FLO® installation requirements are the same as for any other corrugated metal pipe installed in a trench. Bedding and backfill materials for ULTRA FLO® follow the requirements of the CMP installation specifications mentioned above, and must be free from stones, frozen lumps or other debris. When ASTM A796 (steel) or B790 (aluminum) designs are to be followed for condition III requirements, indicated by asterisk (*) in the tables on page 13 and 14, use clean, easily compacted granular backfill materials.

Embankment Conditions

ULTRA FLO® is a superior CMP storm sewer product that is normally installed in a trench condition. In those unusual embankment installation conditions, pipe sizes and gages may be restricted. Your Contech Sales Representative can provide you with further guidance.

Construction Loads

For temporary construction vehicle loads, an extra amount of compacted cover may be required over the top of the pipe. The Height of Cover shall meet minimum requirements shown in the table below. The use of heavy construction equipment necessitates greater protection for the pipe than finished grade cover minimums for normal highway traffic.



Min. Height of Cover Requirements for Construction Loads				
HEL-COR® Corrugated Steel Pipe*				
Diameter (in.)	Minimum Cover (ft.) for Indicated Axle Loads (kips)			
	18-50	50-75	75-110	110-150
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

Min. Height of Cover Requirements for Construction Loads				
CORLIX® Corrugated Aluminum Pipe*				
Diameter (in.)	Minimum Cover (ft.) for Indicated Axle Loads (kips)			
	18-50	50-75	75-110	110-150
12-42	3.0	3.5	4.0	4.0
48-72	4.0	4.0	5.0	5.5
78-120	4.0	5.0	5.5	5.5

Min. Height of Cover Requirements for Construction Loads				
ULTRA FLO® Pipe*				
Diameter (in.)	Minimum Cover (ft.) for Indicated Axle Loads (kips)			
	18-50	50-75	75-110	110-150
	Steel 3/4" x 3/4" x 7-1/2"			
15-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-108	3.0	3.5	4.0	4.5
	Aluminum 3/4" x 3/4" x 7-1/2"			
15-42	3.0	3.5	4.0	4.0

* Minimum cover may vary depending on local conditions. The contractor must provide the additional cover required to avoid damage to the pipe. Minimum cover is measured from the top of the pipe to the top of the maintained construction roadway surface.

Smooth Cor™ Pipe

Excellent Hydraulics, Long Lengths and Easy Installation

Corrugated Steel Shell

Smooth Cor pipe has a smooth interior steel liner that provides a Manning’s “n” of 0.012. Its rugged, corrugated steel shell supplies the structural strength to outperform rigid pipe. Smooth Cor pipe is both the economical and performance alternate to concrete.

Superior hydraulics

Smooth Cor, with its smooth interior surface, is hydraulically superior to conventional corrugated steel pipe and with fewer joints and better interior surface, outperforms reinforced concrete pipe.

Smooth Cor, with its long lengths, light weight and beam strength, is superior to concrete pipe in many difficult situations such as poor soils, poor subsurface drainage conditions, steep slopes and high fills. Smooth Cor should be specified as an alternate under normal site conditions, and specified exclusively under very difficult situations that demand the strength of CSP with positive joints and a hydraulically efficient smooth liner.

Two Pipe Shapes

In addition to full-round pipe, Smooth Cor comes in a pipe-arch shape for limited headroom conditions. The low, wide pipe-arch design distributes the flow area horizontally, enabling it to be installed with lower head room than a round pipe.

Structural Design

Reference specifications

Material	Polymer-Coated	ASTM A 929 AASHTO M246 ASTM A 742
Pipe	Polymer	AASHTO M245 ASTM A 762 & A 760
Design	Steel Pipe	AASHTO Section 12 ASTM A 796
Installation	Steel Pipe	AASHTO Section 26 ASTM A 798

Smooth Cor is lined with either 18 or 20 gage (GA) steel. Contech has taken a conservative approach to the Height of Cover. The maximum heights of cover are based on the shell thickness with no additional structural allowance for the liner as provided for in the AASHTO and ASTM design specifications. Using this approach, the Height of Cover tables for 2 2/3" x 1/2" and 3" x 1" steel corrugations can be used for Smooth Cor.

Diameters

Smooth Cor is available in diameters ranging from 18 inches to 66 inches in 2 2/3" x 1/2" corrugation. The 3" x 1" corrugation is available in diameters of 48" to 126".

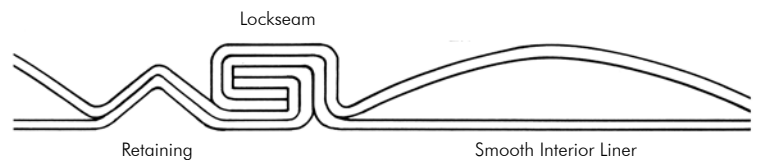
Pipe-arch sizes range from 21" x 15" through 77" x 52" for 2 2/3" x 1/2" corrugations, and 53" x 41" through 137" x 87" for 3" x 1" corrugations.

Materials

Smooth Cor is available with a heavy-gage polymer coating that allows the engineer to design for long service life. This coating is a tough, heavy-gage polymer film laminated to both sides of the steel coil, providing a barrier to corrosion and mild abrasion which is particularly effective for protection in corrosive soils.

Fittings

Smooth Cor can be fabricated into any type of structure including tees, elbows, laterals, catch basins, manifolds and reducers. Pre-fabricated fittings are more economical and have superior hydraulic characteristics when compared to concrete structures.



QUICK STAB® Joint

Save Time and Money With Faster Pipe Bell and Spigot Coupling

The Contech QUICK STAB Bell and Spigot joint speeds installation of corrugated metal pipe (CMP), reducing your costs. With the QUICK STAB coupling system, installation of CMP storm sewers and culverts has never been easier or faster.

The QUICK STAB joint creates a bell and spigot joining system with the bell only 1-1/2" larger than the pipe's O.D. Assembled at the factory, the QUICK STAB bell is shipped to the job site ready for installation. The only field operation is placing a special fluted gasket onto the spigot end of the pipe, applying lubricant and pushing it into the bell end of the preceding pipe. Without bands, bolts and wrenches to work and worry with, you can join pipe segments 50% to 90% faster—saving time, money and aggravation.

Soil Tight Joint

Contech's QUICK STAB joint provides the same soil tightness as conventional CMP bands. Each QUICK STAB joint uses a double sealing fluted gasket to seal the spigot against the bell. A flat gasket is installed at the plant between the pipe and the corrugated end of the bell. With the deep bell, you gain maximum soil tightness with minimal installation effort.

Wide Variety of Coatings and Materials

- Plain galvanized
- Aluminized Steel Type 2 (ALT2)
- Aluminum
- Polymeric coated

Four Times Faster Installation Than Concrete

The QUICK STAB's bell and spigot joining system allows pipe segments to be joined quicker than reinforced concrete pipe. Next, add in Contech's corrugated metal pipe's length advantage—each segment is four times longer than standard concrete pipe lengths. That means fewer joints and faster installation—up to four times faster! Plus, with the bell only 1-1/2" larger than the pipe, trench excavation is considerably less compared with concrete—again, saving time and money.

Field Installation Instructions

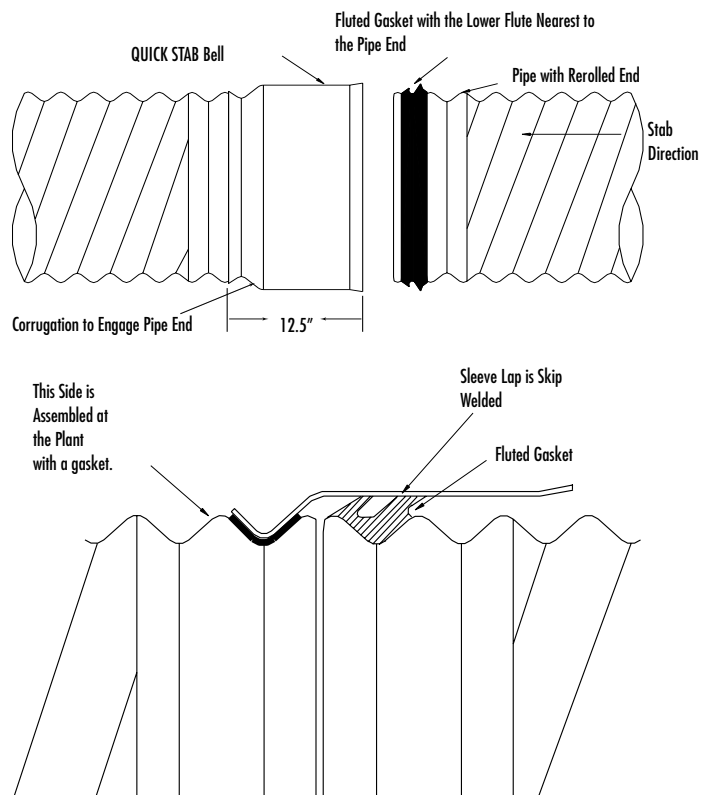
The spigot and bell ends must be cleaned of any dirt or debris prior to assembly. The fluted gasket shall be placed in the first corrugation with the lower flute nearest the end of the pipe. The bell & gasket shall be thoroughly lubed just before stabbing in the bell. Do not place hands, fingers, or any other body parts between bell and spigot during assembly. If it is necessary to pull the joint apart, the bell, spigot and gasket shall be inspected and cleaned of any dirt or debris prior to re-stabbing.

Corrugated Metal Pipe Bell and Spigot Joint Specification

The joints shall be of such design and the ends of the corrugated metal pipe sections so formed that the pipe can be laid together to make a continuous line of pipe. The joint shall be made from the same material as the pipe and shall prevent infiltration of the fill material.



Bell and Spigot Coupling System for CMP



The Bell and Spigot joint is available on ULTRA FLO® and 2 2/3" x 1/2" corrugation in 15" through 60" diameter.

End Sections

Easily installed, easily maintained culvert end treatments for corrugated metal pipe, reinforced concrete pipe and HDPE Pipe

Contech End Sections provide a practical, economical and hydraulically superior method of finishing a variety of culvert materials.

The lightweight, flexible metal construction of Contech End Sections creates an attractive, durable and erosion-preventing treatment for all sizes of culvert inlets and outlets. They can be used with corrugated metal pipe having either annular or helical corrugations, and both reinforced concrete and plastic pipes. End sections can be salvaged when lengthening or relocating the culvert.

Standard End Sections are fabricated from pregalvanized steel. For added corrosion resistance, Aluminized Type 2 or Aluminum End Sections are available in smaller sizes. Special End Sections for multiple pipe installations may be available on a specific inquiry basis.

Better hydraulics

Flow characteristics are greatly improved by the exacting design of Contech End Sections. Scour and sedimentation conditions are improved, and headwater depth can be better controlled. Culverts aligned with the stream flow and finished with Contech End Sections generally require no additional hydraulic controls.

Improved appearance

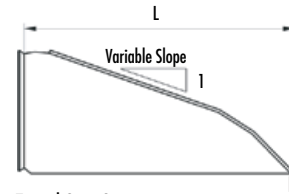
Contech End Sections blend well with the surroundings. The tapered sides of an End Section merge with slope design to improve roadside appearance. Unsightly weeds and debris collection at the culvert end are reduced.

Economical installation

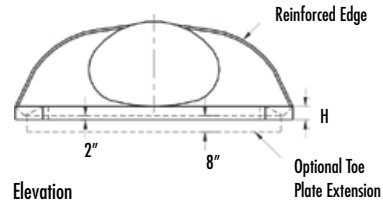
Lightweight equipment and simple crew instructions result in smooth and easy installation. Contech End Sections are easily joined to culvert barrels, forming a continuous, one-piece structure. For easiest installation, End Sections should be installed at the same time as the culvert. Installation is completed by tamping soil around the End Section.

Low maintenance

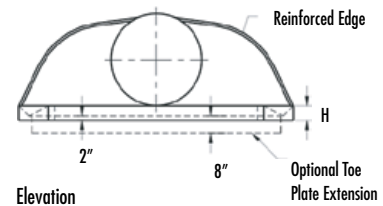
Contech End Sections reduce maintenance expense because their tapered design promotes easier mowing and snow removal. There is no obstruction to hamper weed cutting.



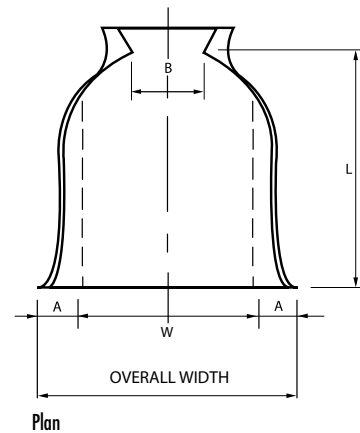
Typical Cross Section



Elevation



Elevation



Plan

Notes for all End Sections:

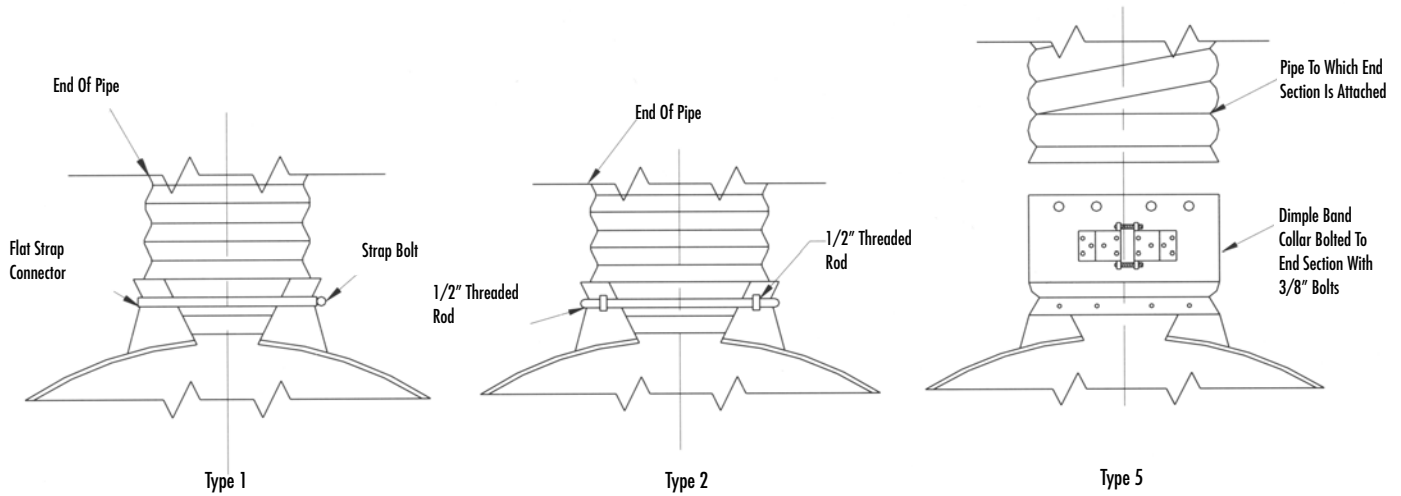
1. All three-piece bodies to have 12 GA sides and 10 GA center panels. Multiple panel bodies to have lap seams which are to be tightly joined by galvanized rivets or bolts.
2. For 60" through 84" sizes, reinforced edges are supplemented with stiffener angles. The angles are attached by galvanized nuts and bolts. For the 66" and 72" round equivalent pipe-arch sizes, reinforced edges are supplemented by angles. The angles are attached by galvanized nuts and bolts.
3. Angle reinforcements are placed under the center panel seams on the 66" and 72" round equivalent pipe-arch sizes.
4. Toe plate is available as an accessory, when specified on the order, and will be same gage (GA) as the End Section.
5. Stiffener angles, angle reinforcement, and toe plates are the same base metal as end section body.
6. End sections with 6:1 and 4:1 slopes are available in 12" through 24" diameters.
7. Actual dimensions may vary slightly.
8. During manufacturing, a slight invert slope may result along the length of the end section to be accommodated in the field.

End Sections for Round Pipe (2-2/3" x 1/2", 3" x 1" and 5" x 1")							
Approximate Dimensions, Inches ⁽⁷⁾							
Pipe Diameter	Gage	A (+/- 1")	B (Max)	H (Min)	L (+/- 2")	W (+/- 2")	Overall Width (+/- 4")
12	16	6	6	6	21	24	36
15	16	7	8	6	26	30	44
18	16	8	10	6	31	36	52
21	16	9	12	6	36	42	60
24	16	10	13	6	41	48	68
30	14	12	16	8	51	60	84
36	14	14	19	9	60	72	100
42	12	16	22	11	69	84	116
48	12	18	27	12	78	90	126
54	12	18	30	12	84	102	138
60	12/10	18	33	12	87	114	150
66	12/10	18	36	12	87	120	156
72	12/10	18	39	12	87	126	162
78	12/10	18	42	12	87	132	168
84	12/10	18	45	12	87	138	174

End Sections for Pipe-Arch (2-2/3" x 1/2")								
Approximate Dimensions, Inches ⁽⁷⁾								
Round Equivalent	Span x Rise (in.)	Gage	A (+/- 1")	B (Max)	H (+/- 1")	L (+/- 2")	W (+/- 2")	Overall Width (+/- 4")
15	17 x 13	16	7	9	6	19	30	44
18	21 x 15	16	7	10	6	23	36	50
21	24 x 18	16	8	12	6	28	42	58
24	28 x 20	16	9	14	6	32	48	66
30	35 x 24	14	10	16	6	39	60	80
36	42 x 29	14	12	18	8	46	75	99
42	49 x 33	12	13	21	9	53	85	111
48	57 x 38	12	18	26	12	63	90	126
54	64 x 43	12	18	30	12	70	102	138
60	71 x 47	12/10	18	33	12	77	114	150
66	77 x 52	12/10	18	36	12	77	126	162
72	83 x 57	12/10	18	39	12	77	138	174

End Sections for Pipe-Arch (3" x 1" and 5" x 1")								
Approximate Dimensions, Inches ⁽⁷⁾								
Round Equivalent	Span x Rise (in.)	Gage	A (+/- 1")	B (Max)	H (+/- 1")	W (+/- 2")	L (+/- 2")	Overall Width (+/- 4")
48	53 x 41	12	18	25	12	90	63	126
54	60 x 46	12	18	34	12	102	70	138
60	66 x 51	12/10	18	33	12	116	77	152
66	73 x 55	12/10	18	36	12	126	77	162
72	81 x 59	12/10	18	39	12	138	77	174
78	87 x 63	12/10	20	38	12	148	77	188
84	95 x 67	12/10	20	34	12	162	87	202
90	103 x 71	12/10	20	38	12	174	87	214
96	112 x 75	12/10	20	40	12	174	87	214

Contech End Sections attach to corrugated metal pipe, reinforced concrete and plastic pipe.



Note: The Type 3 connection is not illustrated. This connection is a one-foot length of pipe attached to the end section.



Multiple End Section on Round CSP



End Sections are available for CSP Pipe-Arch



Contech End Sections are often used on concrete pipe. They can be used on both the bell and spigot end.



Low-slope End Sections—Contech manufactures 4:1 and 6:1 low-slope End Sections for corrugated metal pipe. This photo shows the optional field-attached safety bars.

Contech® Engineered Solutions provides innovative, cost-effective site solutions to engineers, contractors and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

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