

**BOARD OF WATER COMMISSIONERS  
DENVER, COLORADO**

**ADDENDUM NO. 3**

TO THE CONTRACT DOCUMENTS

**DILLON DAM OUTLET WORKS GATE REPAIRS**

CONTRACT 13327A

December 29, 2011

**TO ALL PLAN-HOLDERS:**

This Addendum No. 3 consists of Page AD3-1. The following changes, additions, and/or deletions are hereby made part of the Contract Documents for Dillon Dam Outlet Works Gate Repairs, Contract 13327A, dated December, 2011, as fully and completely as if the same were fully set forth therein:

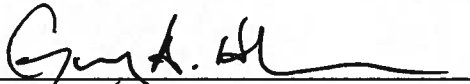
**SPECIFICATIONS:**

1. **SECTION 35 20 15 – OUTLET GATE REPAIRS:**

**DELETE:** Delete Section in its entirety.

**SUBSTITUTE:** Replace with attached Section.

All Bidders shall acknowledge receipt and acceptance of this Addendum No. 3 in the space provided on the Bid Form.



Greg Hempelman, P.E.  
Engineering Manager  
Denver Board of Water Commissioners

SECTION 35 20 15  
OUTLET WORKS GATE REPAIRS

PART 1 GENERAL

1.1 SUMMARY

A. This work includes:

1. Providing maintenance and repairs to existing gates.
2. Work is divided into Required Work and Potential Work. Required Work is Work that is to be completed regardless of existing condition, Potential Work is work that is dependent on existing conditions which will be verified by the CONTRACTOR and ENGINEER.
3. Include all required work and potential work in the Contract proposal. A more detailed cost breakdown for these items shall be provided in the cost loaded schedule.
4. Assume all painted or coated surfaces contain lead. Refer to Exhibit E of the Contract Documents.
5. Assume all pipe and gate gaskets contain asbestos. Refer to Exhibit E of the Contract Documents.

B. Related Sections:

1. SECTION 01 32 16 – COST LOADED SCHEDULE
2. SECTION 01 44 33 – MANUFACTURERS SERVICES
3. SECTION 05 05 26 – WELDING
4. SECTION 09 90 00 – PAINTING AND COATING
5. SECTOPM 35 11 53 – HYDRAULIC POWER CONTROL SYSTEMS FOR GATES

1.2 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. American Society for Testing and Materials (ASTM):
  - a. A 36 – Standard Specification for Carbon Structural Steel.
  - b. A 126 – Standard Specification for Gray Iron Castings.
  - c. A 276 - Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
  - d. A 594 – Standard Specification for Stainless Steel Nuts
  - e. B 21 – Standard Specification for Naval Brass Rod, Bar, and Shapes.
  - f. B 62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
  - g. B 98 – Standard Specification for Copper-Silicon Alloy Rod
  - h. B 148 - Standard Specification for Aluminum-Bronze Sand Castings.
  - i. B 308 - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Shapes.
  - j. B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
  - k. C 651 – Standard Test Methods for Flexural Strength of Manufacturer Carbon and Graphite Articles Using Four-Point Loading at Room Temperature
  - l. F 593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
  - m. F 594 – Standard Specification for Stainless Steel Nuts.
2. American Water Works Association (AWWA):
  - a. C560 - Cast Iron Slide Gates.

3. The Society for Protective Coatings (SSPC):
  - a. QP1, Standard Procedure for Evaluating Qualifications of Painting Contractors.
  - b. QP2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint.
  - c. SP 1, Surface Preparation Specification No. 1, Solvent Cleaning.
  - d. SP 2, Hand Tool Cleaning.
  - e. SP 3, Power Tool Cleaning.
  - f. SP 5, White Metal Blast Cleaning.
  - g. SP 6, Commercial Blast Cleaning.
  - h. SP 7, Brush-Off Blast Cleaning.
  - i. SP 8, Pickling.
  - j. SP 10, Near-White Blast Cleaning.
  - k. SP 11, Power Tool Cleaning to Bare Metal.
  - l. Guide No. 3, PA, Guide to Safety in Paint Applications.

### 1.3 SUBMITTALS

#### A. Shop Drawings:

1. Make, model, weight, of each equipment assembly.
2. Manufacturer's catalog information, descriptive literature, Specifications, and identification of materials of construction.
3. Detailed drawings showing the equipment fabrications. Include tolerances, surface finishes, dimensions, sizes, and weights of equipment.

#### B. Quality Control Submittals:

1. Special shipping, storage and protection, and handling instructions.
2. Manufacturer's written/printed installation instructions.
3. Manufacturer's Certificate of Proper Installation in accordance with SECTION 01 44 33.
4. Provide Testing Plans

### 1.4 EXTRA MATERIALS

- A. Furnish and tag any special tools required to maintain or dismantle the gate, seats or components associated with the gates.

## **PART 2 PRODUCTS**

### 2.1 GENERAL

- A. Each Type of repair shall be shown on the Cost Loaded Schedule as a separate activity with associated costs. Label the activity with an identifier for Required or Potential Work.
- B. Gates shall be removed from the Gate Chamber via horizontal transport to the elevator shaft through access tunnel. Existing elevator removal and frame modifications are required per Contract Drawings. Vertical transport shall be performed via mobile crane to Control House finished floor elevation. Reference Contract Drawings for extents of horizontal and vertical transports and Paragraph 2.2 for further description of removal requirements.

### 2.2 REMOVAL AND INSTALLATION OF GATE LEAFS AND ACCESSORIES

- A. Work on gate leaves requires the leaf be completely removed from the gate frame and worked on at an ENGINEER approved machine shop. No machine work on gate leaves is allowed in the Gate Chamber except for final alignment during re-installation.

- B. Gate leafs shall be removed from the gate frames after disassembly by overhead monorail hoists. The CONTRACTOR shall provide means of transporting the gate leaf from the end of the hoist travel in the Gate Chamber through the access tunnel to the elevator shaft. The elevator frame and basket shall be removed and modified as shown on the Contract Drawings to allow for extraction of the gate leaf. The elevator hoist does not have the lifting capacity to remove the gate leafs from the bottom of the elevator shaft. A mobile crane shall be used to remove all components from the gate chamber that exceed the elevator weight capacity. The CONTRACTOR shall modify the roof in the Control House as shown on the Contract Drawings to allow for mobile crane cable access to elevator shaft. After completion of work on gate leafs the reverse process to remove the gate leafs shall be followed for transporting the gates back to the Gate Chamber.

2.3 MATERIALS

<u>Components</u>	<u>Material</u>	<u>ASTM Specification</u>
Seating Faces	Bronze	B 21, B 98, C 651
Fasteners	Stainless steel	A 594

2.4 GATE REPAIRS

A. Repair Descriptions

GATE	REQUIRED WORK	REPAIR TYPE	POTENTIAL WORK	REPAIR TYPE
Control Gate No 1	Channel Steel Liner	II	Cylinder Internal Components	XVI
	Gate Leaf and Seats	III, IV, XIII, XIV, XII		
	Frame Seats	VII, XI		
	Cylinder	XV		
	Position Indicator Maintenance	XVIII		
	Lubrication System	XIX		
Control Gate No 2	Channel Steel Liner	I	Cylinder Internal Components	XVI
	Gate Leaf and Seats	IV, XII, XIII, XIV		
	Frame Seats	VII, XI		
	Cylinder	XV		
	Position Indicators	XVII		
	Channel Steel Liner	II	Cylinder Internal Components	XVI
Control Gate No 3	Gate Leaf and Seats	III, IV, XII, XIII, XIV,		
	Frame Seats	VII, XI		
	Cylinder	XV		
	Position Indicator Maintenance	XVIII		
	Lubrication System	XIX		

GATE	REQUIRED WORK	REPAIR TYPE	POTENTIAL WORK	REPAIR TYPE
Guard Gate No 1	Channel Steel Liner	II	Cylinder Internal Components	XVI
	Gate Leaf and Seats	IV, VIII, IX, X	Temporary Cover Plate	XXI
	Frame Seats	V, VII, VI		
	Cylinder	XV		
Guard Gate No 2	Channel Steel Liner	I	Cylinder Internal Components	XVI
	Gate Leaf and Seats	IV, XII, XIII, XIV		
	Frame Seats	VII, XI		
	Cylinder	XV		
	Position Indicators	XVII		
Guard Gate No 3	Channel Steel Liner	II	Cylinder Internal Components	XVI
	Gate Leaf and Seats	IV, VIII, IX, X		
	Frame Seats	V, VI, VII		
	Cylinder	XV		
Gate Chamber Piping	Small Diameter Piping (less than 12-inches)	XX		

B. Repair Type Definitions

1. Type I: Surface Cleaning.
  - a. Remove surface material buildup and deposits without damaging existing coatings in accordance with SSPC-SP 1 and SP 2.
2. Type II: Surface Preparation.
  - a. Remove material buildup and coating down in accordance with SSPC-SP 10.
  - b. Clean, prepare and paint in accordance with SECTION 09 90 00.
3. Type III: Surface Repair.
  - a. Repair voids in seating material using welding repair methods in accordance with SECTION 05 05 26.
  - b. Estimated quantity of welding required per gate: 56 square-inches at a depth of 0.25 inches.
  - c. Material: AISI Type 309 stainless steel facing bonded to gate leaf material, UNE-3600 A-37b.
  - d. Refer to Subparagraph 3.3 of this Section for detailed descriptions of repair requirements.
4. Type IV: Surface Preparation.
  - a. Work to be done after gate leaf is removed from gate body.
  - b. Remove surface material buildup and deposits in accordance with SSPC-SP 10 from all non-seating surfaces of gate.
  - c. Clean, prepare and paint in accordance with SECTION 09 90 00.
5. Type V: Vertical Frame Seats.
  - a. Two seats per gate frame.
  - b. Machine top of fastener heads to obtain manufacturer's required recess of 1/32-inches below finished face of seat. Maximum overbore of recessed hole is 0.125-inches.
6. Type VI: Horizontal Frame Seat.
  - a. One seat per gate frame.
  - b. Machine top of fastener heads to obtain manufacturer's required recess of 1/32-inches below finished face of seat. Maximum overbore of recessed hole is 0.25-inches.
7. Type VII: Horizontal Embedded Frame Sill Seat.
  - a. Remove surface buildup in accordance with SSPC-SP 2. Finish polish surface of seat to 32 micro-inches Center Line Average.
8. Type VIII: Replace Vertical Leaf Seats.
  - a. Two seats per gate leaf.
  - b. Remove existing fasteners and seats from leaf. Clean leaf fastener threads and seat recesses in leaf prior to installation of new materials.
  - c. Install OWNER-Furnished seats and fasteners in accordance with Exhibit D. Tighten fasteners from center of leaf outwards towards ends of seat.
  - d. Finish polish seat to 32 micro-inches Center Line Average after installation.
9. Type IX: Replace Horizontal Upper Leaf Seat.
  - a. One seat per gate leaf.
  - b. Remove existing fasteners and seat from leaf. Clean leaf fastener threads and seat recesses in leaf prior to installation of new materials.
  - c. Install OWNER-Furnished seats and fasteners in accordance with Exhibit D. Tighten fasteners from center of leaf outwards towards ends of seat.
  - d. Finish polish seat to 32 micro-inches Center Line Average after installation.
10. Type X: Replace Horizontal Bottom Leaf Seat.
  - a. One seat per gate leaf.
  - b. Machine OWNER-Furnished bulk material for new seat in accordance with Exhibit D.
  - c. Machine bottom of gate leaf to accept new Bottom Leaf Seat in accordance with Exhibit D.
  - d. Install OWNER-Furnished seat and fasteners in accordance with Exhibit D.

- e. Provide a high performance, elastomeric sealant between new seat and gate leaf at material interface in channel section of gate leaf per sealant manufacturer's installation instructions. Refer to Paragraph 2.6 of this Section.
- f. Finish polish seat to 32 micro-inches Center Line Average after installation.
- 11. Type XI: Vertical and Horizontal Frame Seats.
  - a. Two vertical and one horizontal seat per gate.
  - b. Clean and polish to 32 micro-inches Center Line Average.
- 12. Type XII: Horizontal Leaf Seats.
  - a. One seat per gate.
  - b. Clean and polish to 32 micro-inches Center Line Average.
- 13. Type XIII: Vertical Leaf Seats.
  - a. Two seats per gate.
  - b. Clean and polish to 32 micro-inches Center Line Average.
- 14. Type XIV: Leaf Horizontal Bottom Seating Surface.
  - a. One surface per gate.
  - b. Provide work after Type III repairs are complete (Not Applicable to Control Gate No. 2 and Guard Gate No. 2).
  - c. Machine seat surface to original Specifications in accordance with Exhibit B (Not Applicable to Control Gate No. 2 and Guard Gate No. 2).
  - d. Clean and polish to 32 micro-inches Center Line Average.
- 15. Type XV: Cylinder Overhaul.
  - a. One cylinder per gate.
  - b. Disassemble and clean cylinders, pistons and other internal components. Reference Exhibits A, B and C for Cylinder Drawings and Specifications.
  - c. Hone internal surface of cylinder. Finish cylinder bore to 16 micro-inches Center Line Average
  - d. Fabricate and Install new seals for all sealing surfaces and all fasteners in accordance to Exhibits A, B and C.
- 16. Type XVI: Cylinder Internal Components.
  - a. Inspect internal components for wear and intolerances. Reference Exhibits A, B and C for Specifications. Submit shop drawings of existing components after inspection for ENGINEER review.
  - b. Internal components to include, but not limited to:
    - 1) Cylinder Head, Piston, Piston Rings, Stem, Keys and Keyways, Key Retainers, Fasteners, Leaf Nuts, Gaskets, Seals, Packing, Packing Glands, Packing Seats, Position Indicator Rod and Packing Assembly.
  - c. Fabricate and install worn or out of tolerance components. Use like materials and tolerances. Submit shop drawings of new components to ENGINEER for review and approval prior to fabrication. Submit material Specifications and certificates of material Specifications to ENGINEER for approval.
  - d. Reassemble internal components and cylinders. Apply pre-lubrication to moving parts. Verify travel of piston is smooth and even.
- 17. Type XVII: Position Indicator Modifications.
  - a. Demolish existing mechanical and electrical position indicator devices, brackets and accessories.
  - b. Fabricate and Install new stainless steel brackets to accept new electrical position indicator switches that cover 120% of gate stem travel. Provide mounting surfaces for electrical devices. Coordinate with Contract Electrical Drawings and devices. Submit shop drawings to ENGINEER for approval prior to installation.
  - c. Verify limits of travel are not hindered by brackets.
- 18. Type XVIII: Position Indicator Maintenance
  - a. Disassemble and remove cables, pulleys, shafts, counterweight and other related components in accordance with Exhibit B.

- b. Clean and inspect for worn components. Consult ENGINEER if worn components require replacement.
  - c. Fabricate and replace fasteners in accordance with Exhibit B.
  - d. Reassemble and adjust mechanical position indicator. Verify proper operation and smooth travel. Coordinate and Calibrate mechanical counter with travel of gate stem.
19. Type XIX: Lubrication System
- a. Disassemble system and remove existing grease from system per Contract Drawings and Exhibit G.
  - b. Clean all accessible components including grease ports in gate frame.
  - c. Reassemble system and fill with new grease prior to gate leaf installation. Flush system until air is relieved and new grease is in entire system.
  - d. Application: Grease system is to be used only for function testing of gate during dry operation. After gate functional test is completed and accepted by ENGINEER grease system shall be tagged with orange, laminated 8.5"x11" paper stock indicating:
    - 1) Lubrication system is intended to be used during gate operation in the dry. Lubrication system is not required to be used during normal operating conditions under differential head conditions.
  - e. Grease Specification:
    - 1) Type: Ulti-Plex EP
    - 2) Manufacturer: Chevron
20. Type XX: Small Diameter Piping
- a. Disassemble small piping, valves and fittings within the Gate Chamber connected to gate bodies and used for filling and venting. Generate a diagram of existing piping and valve configurations. Label all piping and coordinate with diagram prior to disassembly.
  - b. Remove existing coatings in accordance with SSPC-SP 10.
  - c. Replace gaskets and fasteners.
    - 1) Gaskets: Shall be 1/8 inch ring-type Garlock No. 3200 compressed non-asbestos sheet packing. Gaskets shall be one piece.
    - 2) Fasteners: All-threaded studs in accordance with ASTM A 193, Grade B7 with heavy hex nuts per ASTM A 194, Grade 2H. Studs and bolts shall extend through the nut a minimum of 1/4 inch. Hardened steel washers in accordance with ASTM F 436.
  - d. Clean, prepare and paint in accordance with SECTION 09 90 00.
  - e. Reconnect piping, valves and fittings to original configuration and install pipe stands.
21. Type XXI: Temporary Cover Plate
- a. Fabricate one temporary cover plate to mount to one of the two guard gates after gate bonnet is removed per Contract Drawings.
  - b. OWNER will furnish one additional cover plate already fabricated for use on other guard gate.

## 2.5 FINISHING

- A. Application: Gate bodies, cylinders, and accessories exposed in Gate Chamber. Do not paint stainless steel, bronze or aluminum materials.
- B. In accordance with Section 09 90 00.

## 2.6 SEALANTS

- A. Specifications:
  - 1. Application: Submerged conditions in fresh water at 40°F. Apply primer first and sealant last in accordance with Manufacturer's Instructions.
  - 2. High performance, elastomeric sealant shall be designed for sealing and bonding between two metal surfaces in compression.

- B. Manufacturers and Products:
  - 1. Primer: Sika, 260.
  - 2. Sealant: Sika, 17LM..
  - 3. No substitutions.

**PART 3 EXECUTION**

**3.1 GATE DISASSEMBLE AND REASSEMBLY**

- A. The CONTRACTOR shall mark or measure the current positions and orientations of all components during disassembled of gate assemblies. It is critical that the leaf stems be reassembled to the gate leaf with the leaf nuts in the same position on the stem to ensure the original stroke from open to closed is maintained.
- B. The CONTRACTOR shall record in writing and photographs the exact process to disassemble the gates using a pre-determined labeling system to ensure proper reassembly. Operation and Maintenance manuals are not available for all gates.

**3.2 GATE REPAIRS**

- A. Repairs by Work type: Required and Potential Work in accordance with Paragraph 2 of this Section.

**3.3 CONTROL AND GUARD GATE SEAT REPAIRS AND REPLACEMENTS**

- A. Provide a detailed written description of the recommended repair procedures for ENGINEER approval. Describe the proposed methods and proposed materials for repairs.
- B. Notify and coordinate a meeting between the ENGINEER and MILLWRIGHT to discuss the proposed repair procedures.
- C. ENGINEER shall be directly involved in the repair process; prior, during and after, to verify expectations of end product are met.

**3.4 TESTING PLANS**

- A. Provide Functional and Performance Test Plans to include, but not limited to:
  - 1. Provide separate plans for Functional and Performance Testing.
  - 2. Schedule and sequence of activities required for testing of gates. Include time for filling tunnel per Paragraph 3.3 of this Section.
  - 3. Identify the system to be tested and the responsible party for conducting test.
  - 4. Identify groups required for test: sub-contractors, manufacturer, CONTRACTOR, ENGINEER, OWNER, etc.

**3.5 FIELD QUALITY CONTROL**

- A. General:
  - 1. The performance test requires full differential head across the gate leaf. To obtain this condition the tunnel upstream of the gates will need to be filled. The filling process and draining process durations are shown below. The CONTRACTOR shall coordinate filling and draining activities with OWNER and shall include these durations in their project schedule.
    - a. Draining: 2 days
    - b. Filling: 10 days
- B. Functional Tests:
  - 1. Coordinate with SECTION 35 11 53.

2. Test shall be witnessed by ENGINEER. Testing without ENGINEER present the test will not be approved.
3. Sub-Systems –Hydraulics and Electrical
  - a. Verify functionality of equipment under all operating scenarios.
  - b. Adjust or modify and retest as necessary.
4. Gates:
  - a. Conduct test on every gate, one at a time.
  - b. Perform in the dry without differential head across gate.
  - c. Apply pre-startup lubrication to all gate seating surfaces.
    - 1) Type: Silone Spray Lubricant, 116DA
    - 2) Manufacturer: Permatex
  - d. Apply grease lubrication to Control Gates No 1 and 3 with manual grease lubrication system during first open cycle of gate.
  - e. Operate each gate through two complete open-close cycles without binding, creeping or damage. If binding, creeping or damage occurs, adjust and repair as required and retest until accepted by ENGINEER.
  - f. Verify position indication and travel limits.

C. Performance Test:

1. Coordinate with SECTION 35 11 53.
2. Test shall be witnessed by ENGINEER. Testing without ENGINEER present the test will not be accepted.
3. Conduct test on every gate, one at a time.
4. Perform under maximum differential head conditions at the time of the test.
5. Partial Operation: Maximum opening of gates under full differential head is 6 inches.
6. Operate each gate through three partial open and close cycles to verify proper system integration and operation. Components shall be adjusted until all systems operate properly.
7. After successful operations of gate, close gate under full differential head and measure leakage. Record leakage and locations of leakage.
  - a. Allowable Leakage Rates:
    - 1) Guard Gates No 1 and 3: 0.1 gpm per foot of seating perimeter.
    - 2) Control Gates No 1 and 3: 0.1 gpm per foot of seating perimeter.
    - 3) Guard and Control Gates No 2: 0.1 gpm per foot of seating perimeter.
8. Leakage exceeding allowable rates shall be corrected by the CONTRACTOR. Identify areas of issue, repair and retest until leakage test is accepted by ENGINEER.
9. Verify coefficient of friction between gate leaf seats and frame seats. Record pressures at Hydraulic Cylinder Ports during opening of gate and closing of gate at 1-inch intervals of gate travel for both Functional and Performance Testing. For opening cycle record pressures at lower cylinder port, for closing cycle record pressures at upper cylinder port. Record reservoir elevation at time of operating gates. Tabulate data for ENGINEER review.

3.6 MANUFACTURER'S SERVICES

- A. Manufacturer's Representative: Present at site for minimum 5 person-days for inspection, functional and performance testing, and completion of Manufacturer's Certificate of Proper Installation.

**END OF SECTION**