



**Purchasing Division**  
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## INVITATION TO BID

### MINNESOTA SLIP BRIDGE PARALLEL SHAFT REDUCERS

**BID NUMBER: 16-0628**

**BID OPENING: MONDAY, OCTOBER 31, 2016 AT 2:00 PM**

The City of Duluth requests sealed bids for the fabrication, assembly, lubrication, testing, painting, packaging and delivery of two (2) **Parallel Shaft Reducers** for use at the Minnesota Slip (Pedestrian) Bridge in Duluth, MN.

The Parallel Shaft Reducers shall be manufactured, tested and delivered, installation ready, to specified City of Duluth location for unloading by City of Duluth's Contractor within **twenty-two (22) weeks of award**. The City anticipates requiring seven (7) calendar days for shop drawing/submittal review by the City and its agents. The 22-week time from award to delivery must include the shop drawing/submittal review period.

Reducers shall be custom models with special extended input shafts and lubrication provisions to suit the bridge application. Extended input shafts shall allow for proper mounting of motor brakes and motor couplings as shown on the attached sketch. Lubrication provisions shall allow the reducer to operate and/or lay dormant through 81 degrees of anticipated travel. Please see the attached specification and drawing for more information.

CITY OF DULUTH

Amanda Ashbach  
Purchasing Agent

#### Attachments:

1. City of Duluth General Bid Requirements
2. Bid Form
3. Specification
4. Drawing



## GENERAL BID SPECIFICATIONS

1. General. This document covers bids requested by the City of Duluth ("City"), including those requested on behalf of its Agents and Authorities. Each authority may issue their own purchase order or contract and will be responsible for it. The City of Duluth Authorities are as follows:
    - a. Duluth Airport Authority
    - b. Spirit Mountain Recreational Area Authority
    - c. Duluth Entertainment and Convention Center
    - d. Duluth Transit Authority
    - e. Duluth Economic Development Authority
    - f. Duluth Housing and Redevelopment Authority
  2. Instruction to Bidders. All bids must be complete, signed, and transmitted in a sealed envelope plainly marked with the bid number, subject matter, and opening date.

Bids may be mailed to the Purchasing Office, City Hall, 411 West 1st Street, Room 100, Duluth, MN 55802 or dropped off in person at the same address. Bids must be received by Purchasing before 2:00 PM local time on the date specified. Bids will not be accepted via e-mail unless specifically stated in the Invitation for Bids.
  3. Preparation of Bids. Erasures or other changes to the bid must be initialed and dated, however no special conditions shall be made or included in the bid form by the bidder.

At the time of the opening of bids, each bidder will be presumed to have read and to be thoroughly familiar with the plans, specifications and contract documents (including all addenda). The failure or omission of any bidder to examine any form, instrument, or document shall in no way relieve the bidder from any obligation in respect to their bid.
  4. Bidder Questions. Responses to general questions regarding the Invitation for Bids may be made at the discretion of the City. Every request for such interpretation should be in writing and delivered via e-mail or postal mail to the Purchasing Division before the deadline indicated on the Invitation for Bids, or if no deadline is specified, at least five (5) days prior to the scheduled bid opening. Responses will be issued in writing in the form of an Addenda or e-mail to prospective bidders.
  5. Non-Collusion Clause. By submitting a bid, the bidder, their agent and/or employee(s) hereby affirm that the attached bid or bids have been arrived at by the bidder independently and have been submitted without collusion with, and without agreement, understanding or planned common course of action with any other vendor of materials, supplies, equipment or services described in the Invitation for Bids, designed to limit independent bidding or competition
  6. Bidder Qualifications. Per Sec 41.23(e) of Duluth City Code, price may not be the only consideration for award. The City will make such investigations as deemed necessary to determine the ability, capacity and skill of the bidder to perform the work and perform it in the time specified without delay or interference, the character, integrity, reputation, judgment, experience and efficiency of the bidder, the quality of the bidder's performance of previous contracts or services, and the sufficiency of the financial resources, equipment available and ability of the bidder to perform the contract.
- Bidders shall furnish to the City all such information and data for this purpose, when requested.
- The City reserves the right to reject any bid if the evidence obtained by the City through such investigation fails to satisfy the City that the bidder is properly qualified to carry out the obligations of the contract and to complete the work as required by the plans and specifications.
7. Award. Award, if made, will be to the responsible bidder submitting the lowest bid which complies with the conditions of the Invitation for Bids and specifications. A bid summary will be posted on the City website immediately following the bid opening. Awards for construction services and parts /supplies over \$100,000 must be approved by City Council.
  8. Rejection of Bids. The City of Duluth reserves the right to reject any and all bids and to waive any informalities in bids received whenever such rejection or waiver is in its interest.
  9. Liquidated Damages for Failure to Enter into Contract. The successful bidder, upon their failure or refusal to accept a purchase order or execute and deliver the contract, proof of insurance and bonds required within 10 days after receipt of a notice of the acceptance of their bid, shall forfeit to the City, as liquidated damages for such failure or refusal, the security deposited with their bid (if required).
  10. Equal Employment Opportunity. Contractor will be required to comply with all applicable Equal Employment Opportunity (EEO) laws and regulations. Affirmative action must be taken to insure that the employees and applicants for employment are not discriminated against because of their race, color, creed, sex or national origin. The City of Duluth is an equal opportunity employer.
  11. Quantities. The City reserves the right to increase or decrease the quantities of items as required, unless otherwise noted.
  12. Prevailing Wages. Per Sec 2-26 of Duluth City Code, payment of not less than the prevailing wage and salary rates specified in the contract documents and the conditions of employment with respect to certain categories and classifications of employees is required for all "Public Works" type projects estimated to exceed \$2,000. This does not apply to off-site production and manufacturing of parts and supplies.

The rates of set forth under the General Conditions are the minimums to be paid during the life of the contract. It is therefore the responsibility of bidders to inform themselves as to local labor conditions, such as the length of work day and work week, overtime compensation, health and welfare contributions, labor supply, and prospective changes or adjustments of rates.
  13. Validity of Bids: All bids must remain firm for 60 days from the date of bid opening, unless another period is noted in bid documents or if an extension is agreed upon, in writing prior to the end of the 60-day period.
  14. Insurance. All vendors doing work on City property, except vendors making routine deliveries, shall submit an insurance certificate verifying insurance coverage as per current city requirements.

**BID FORM**  
**BID # 16-0628**

**MINNESOTA SLIP BRIDGE PARALLEL SHAFT REDUCERS**

ITEM	QTY	PRICE PER UNIT	TOTAL
PARALLEL SHAFT REDUCERS PER THE ATTACHED SPECIFICATION & DRAWING	2		\$

\*\*Please note that quantities are fixed for this bid.

\_\_\_\_\_  
TOTAL PRICE IN WRITING

Signature \_\_\_\_\_ Date \_\_\_\_\_

Name/Title \_\_\_\_\_

Company Name \_\_\_\_\_

Address \_\_\_\_\_

City, State, Zip \_\_\_\_\_

Tel. \_\_\_\_\_ E-Mail \_\_\_\_\_

General

Under this item, fabricate, assemble, lubricate, test, paint, package and deliver two (2) parallel shaft reducers for use at the Minnesota Slip (Pedestrian) Bridge in Duluth, MN.

Reducers shall be custom models with special extended input shafts and lubrication provisions to suit the bridge application. Extended input shafts shall allow for proper mounting of motor brakes and motor couplings as shown on the attached sketch. Lubrication provisions shall allow the reducer to operate and/or lay dormant through 81 degrees of anticipated travel. (See attached sketch – Parallel Shaft Reducer)

Design Specifications

Parallel Shaft Reducer – Enclosed Design

Input Horsepower Rating: 25.1 HP @ 870 RPM

Quadruple Reduction Ratio: 428.6:1 nominal (+/- 2%)

Service Factor: 1.0

Output Torque Rating: 779,000 in-lbs

Fabricated Steel Housing

Double Extended Input Shafts and Double Output Shafts

Nominal HS to LS Shaft Center Distance: 34.50" (some shaft bearings may be below split line)

Quantity: 2 Units

Reducers shall comply with AASHTO specifications for movable highway bridges.

Reducers shall be designed to meet all applicable requirements of the American National Standards Institute (ANSI)/American Gear Manufacturers Association (AGMA) Standard 6013-A06 "American National Standard for Industrial Enclosed Gear Drives" for design, rating lubrication, testing and selection information.

Reducers shall be designed to meet all applicable requirements of the ANSI/AGMA Standard 6001-E08 "Design and Selection of Components for Enclosed Gear Drives".

Reducers shall be able to withstand a momentary overload equal to three (3) times the rated full load torque of the driving motor without any component reaching 75 percent of its yield strength.

Reducer housings shall be manufactured from ASTM A36 plate steel and welded/fabricated with inspection per AWS D1.1. Sand blast clean the inside of the housings prior to assembly and also protect from rusting.

Reducer helical gearing shall be manufactured from ASIS 4300 Series steel, case carburized and machined to a minimum AGMA A8 or approved equal. Pinions must be proportioned so that the root diameter of the pinion is not smaller in diameter than the diameter of the journals for the pinion shaft.

Reducer rolling element bearings shall have a minimum L10 life rating of 40,000 hours at the motor's full load speed and torque.

Reducers shall be provided with automatic lubrication of gears and bearings when the units are in operation. It is preferable that a bath lubrication system be utilized. In a bath lubrication system, all components in the reducer that require or feed lubrication are partially submerged in an oil bath.

When the configuration of gears and bearings prevent bath lubrication, a splash lubrication system should be used. Use splash lubrication systems that provide continuous proper lubrication for all gears and bearings. Oil feed troughs may be used to supply oil to bearings and gears that are above the bath. Design splash lubrication systems such that equal lubrication is supplied to each internal component for both directions of operation.

If a pressurized lubrication system is required for the reducer, provide a redundant lubrication system that operates at all times when the primary system is functioning.

Furnish grease-lubricated reducer bearings with separate fill and purge fittings when oil splash is not practical, readily accessible after installation of reducer. Furnish the grease-lubricated reducer bearings with internal seals between the bearing housing and reducer cavity, preventing grease and gear oil from interacting.

Reducer input and output shaft extensions shall be provided with dual single lip contact type oil seals with grease purge or approved equal. Seal arrangements shall prevent oil leakage while the units remain stationary and during bridge operations.

Reducer input and output shaft extensions shall be provided with a single parallel keyway per ANSI Standard B17.1 "Keys and Keyseats" meeting the requirements of Class 2 fits. **All external keys will be provided by others.**

Reducer fasteners (Hex Bolts and Threaded Rods) for securing the gear reducer's housing halves and bearing cover plates shall be based on ASTM A449 and ANSI B18.2.1.

Provide inspection ports in the top portion of housings for inspection of all gears, bearings, and other internal components. Position the ports above the oil level, if practicable, so that oil

draining is not required for inspection. Size the port such that minor repairs could be made to reducers without requiring housing disassembly. Provide seals that properly seal the ports and do not require replacement when ports are opened.

Provide reducers equipped with moisture trap breathers, oil fills, break proof glass oil level indicators, drains, and inspection ports.

Position moisture-trap breathers above maximum oil levels in all positions of the reducer during operation, with piping entering the unit at the highest point possible. Do not mount breathers in bearing caps.

Oil level indicators must be mounted in locations that can be easily viewed by maintenance crews with bridge in the 'span closed' position. Graduate the sight glass on reducers in which the oil level varies by more than 1/2 inch (12.7 mm) per 50 °F (27 °C) temperature change. Vent the indicator back to the case. Provide sight glasses made of rugged construction and protected against breakage.

Locate oil drains at the lowest point possible in the 'span closed' position. Provide a drain with a hand operated lever which can be locked in the closed position. Also include a plug to prevent oil leakage if the valve is opened accidentally.

Position oil sampling cocks in accessible positions on the reducers with two sampling cocks on each, one located at the lowest level of oil and one just below the upper oil level, with the bridge in the 'span closed' position.

Provide reducers with details for oil expansion due to churning and temperature change.

#### Quality Assurance Requirements

Reducer housings shall be manufactured from ASTM A36 plate steel of USA origin steel and verified with Certified Mill Test Reports. Housings shall be welded/fabricated with inspection per AWS D1.1. Housing welds shall be subject to magnetic particle inspection and be inspected by a Certified Weld Inspector.

Reducer gears and shafts shall be manufactured from USA origin steel and verified with Certified Mill Test Reports. Gear tooth hardness shall be verified and certifications shall be made available upon request. Gears and shafts required mechanical properties shall be confirmed as part of the manufacturer's quality control process. Magnetic particle inspection after machinery of each gear shall be performed to confirm no surface imperfections.

### Shop Testing Requirements

The reducer manufacturer shall provide a two (2) week written notification on the shop testing schedule.

Reducers shall be mounted on respective test beds and secured with hold down fasteners. All testing shall be performed with the reducers mounted in one of two planes, i.e. at 2 degrees off horizontal and 83 degrees off horizontal, both measured from horizontal to the underside of the reducer housing and with the input shaft above the output shaft.

Bluing dye shall be applied to the reducer's gear teeth during pre-assembly and prior to testing.

Reducers shall be subject to a two hour spin test (under no load) at 100% of the rated speed, one hour in each direction at 2 degrees. Reducers shall also be subject to a 30 minute spin test (under no load) at 100% of the rated speed, 15 minutes in each direction at 83 degrees.

Testing must be performed in the presence of a representative of the City. Perform the test runs with the reducers filled to the dipstick mark, with new oil of the viscosity the manufacturer recommends on his lubrication chart for normal operation. Immediately before the start of testing, and at 15 minute intervals thereafter, make the following measurements and record and submit with the certificate of compliance:

Temperature of ambient air

Temperature of oil near bottom of crankcase

Surface temperature of each shaft extension adjacent to shaft seal

Sound level at point above and 3 feet distant from center of unit

During testing, the temperature of the oil is to rise no more than 40 °F from ambient and no shaft is to experience a temperature rise of more than 50 °F from the ambient. The noise level of the reducer is not to exceed 90 dB with the microphone held 3 feet from the reducer housing.

During testing, check each reducer for unusual noise (thumping or any non-uniformity), excessive bearing clearance, and other unusual operating characteristics. The units are to operate smoothly and without excessive vibration or temperature rise. Record and correct all malfunctions, and retest the units, if necessary, before release from the manufacturer's shop. After the unit has passed the test, submit a Certificate of Compliance to the City.

Demonstrate the proper operation of the lubricating and sealing system during both shop tests. In addition to the test specified above, demonstrate the proper distribution of load on the gear teeth

by the application of tooth bluing liquid and a documented report containing digital photographs, to be submitted with the Certificate of Compliance.

After shop testing, drain lubricant and strain with a 50 micron filter to remove any wear particles and contain lubricant for reuse.

Painting Requirements:

Interior of reducer housings shall be protected with a special oil-resistant crankcase paint or approved equal.

Exterior of reducer housings shall be protected with a primer coat and intermediate coat. The primer shall be a modified aluminum epoxy mastic, Carbomastic 15 or approved equal, and the intermediate coat shall be an epoxy polyamide, Carboguard 888 or approved equal, which shall be compatible with the finish coat. **Finish coat will be provided by others.**

Oil Lubrication Requirements:

Reducer oil grade lubrication shall be specified by the reducer manufacturer per ANSI/AGMA Standard 90058-E02 "Industrial Gear Lubrication".

Shipping Requirements

Reducers shall be drained of necessary oil prior to shipment and properly packaged for shipment.

Reducers exposed metal surfaces that would be damaged by corrosion shall be coated with a rust inhibiting compound and wrapped as appropriate.

Reducers shall be mounted on wood skids for protection during handling and shipment.

Reducers shall be delivered to the Minnesota Slip Pedestrian Bridge, 400 South Lake Avenue, Duluth, MN 55802. The City of Duluth's Bridge Contractor will be available to accept and unload the reducers.

Buy USA Requirements

All manufacturing processes for the gear reducer's components, including gearing, shafting, bearing cover plates and housing shall take place in the USA. The subcomponents (or raw material) of these components shall be supplied from USA origin steel.



The reducer manufacturer shall make every practical attempt to procure reducer rolling element bearing components from USA original equipment manufacturers. Accepted manufacturers include Timken, SKF and FAG.

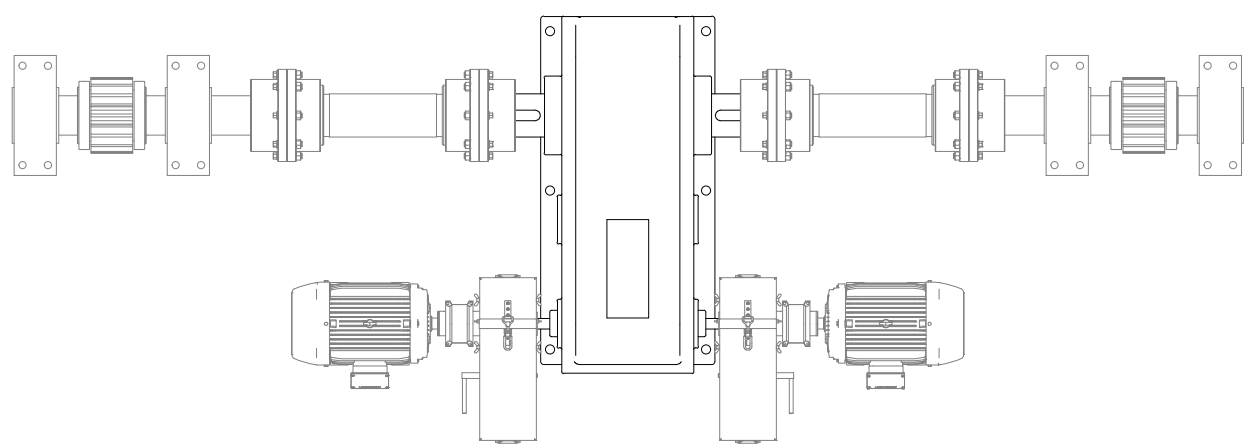
The reducer manufacturer shall make every practical attempt to procure threaded fastener components from USA manufacturers.

Reducer Submittals:

Submit for the Engineer's approval, a certified print of each speed reducer showing as a minimum the following:

- All external mounting dimensions including shaft and keyway sizes required to verify proper fit with mating brake hubs and couplings.
- Internal drawings showing each reducer component with part numbers.
- The ratings that will appear on the nameplate.
- Location of all lubricant connections.
- Lubrication recommendations.

All detailed individual component drawings (external and internal) will be considered proprietary to the reducer manufacturer and not required as a submittal to the City.

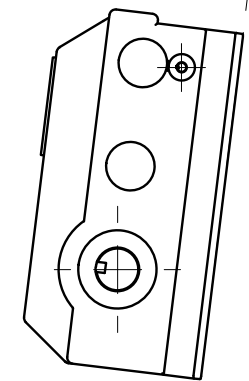
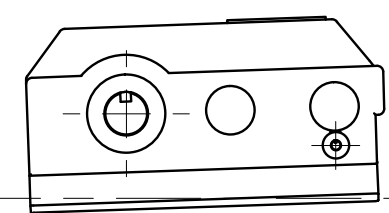


### OPERATING MACHINERY — PLAN VIEW

SCALE: 3/8"=1'-0"

REDUCER POSITION  
WITH SPAN CLOSED

2°

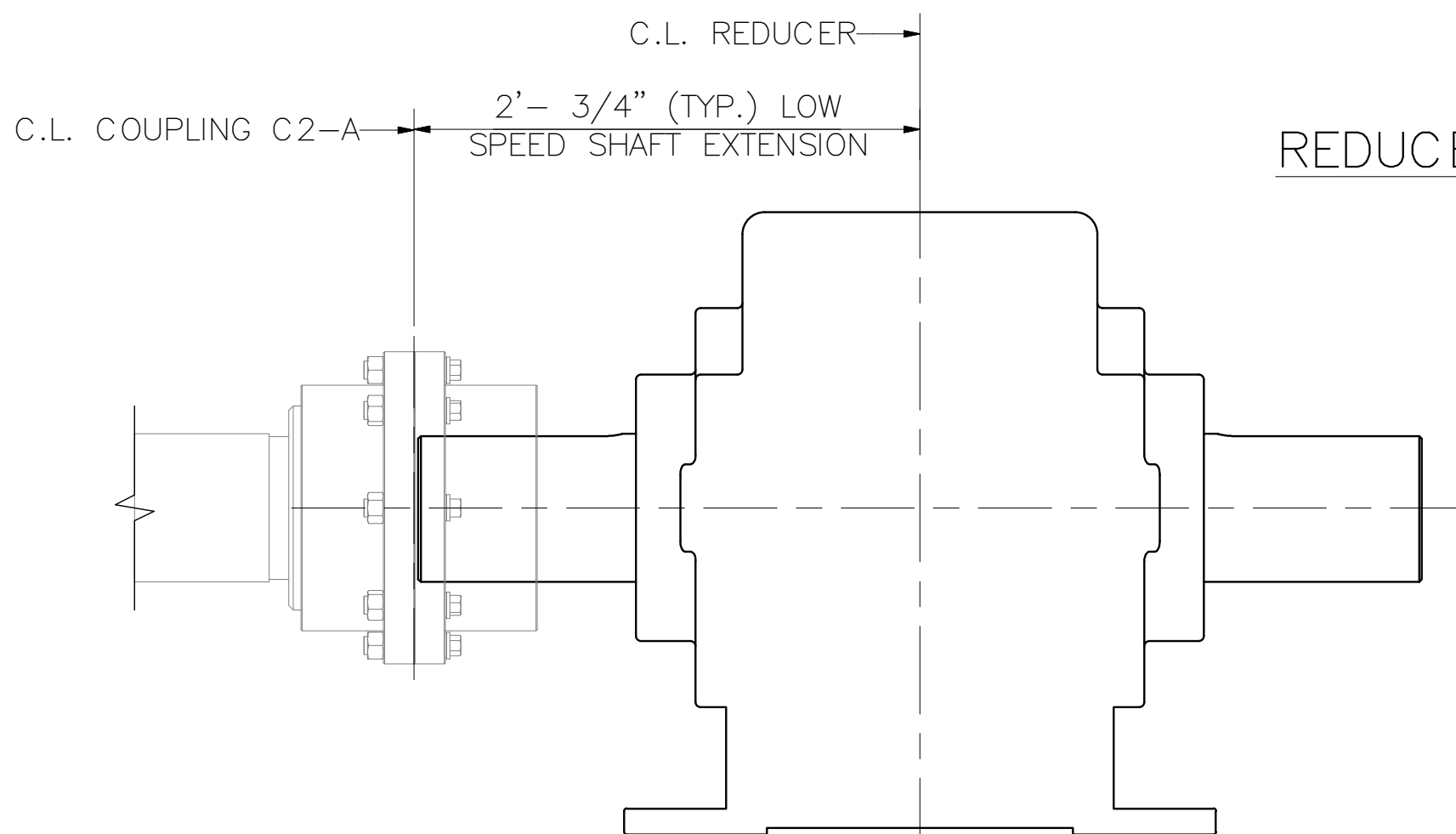


REDUCER POSITION  
WITH SPAN OPEN

81°

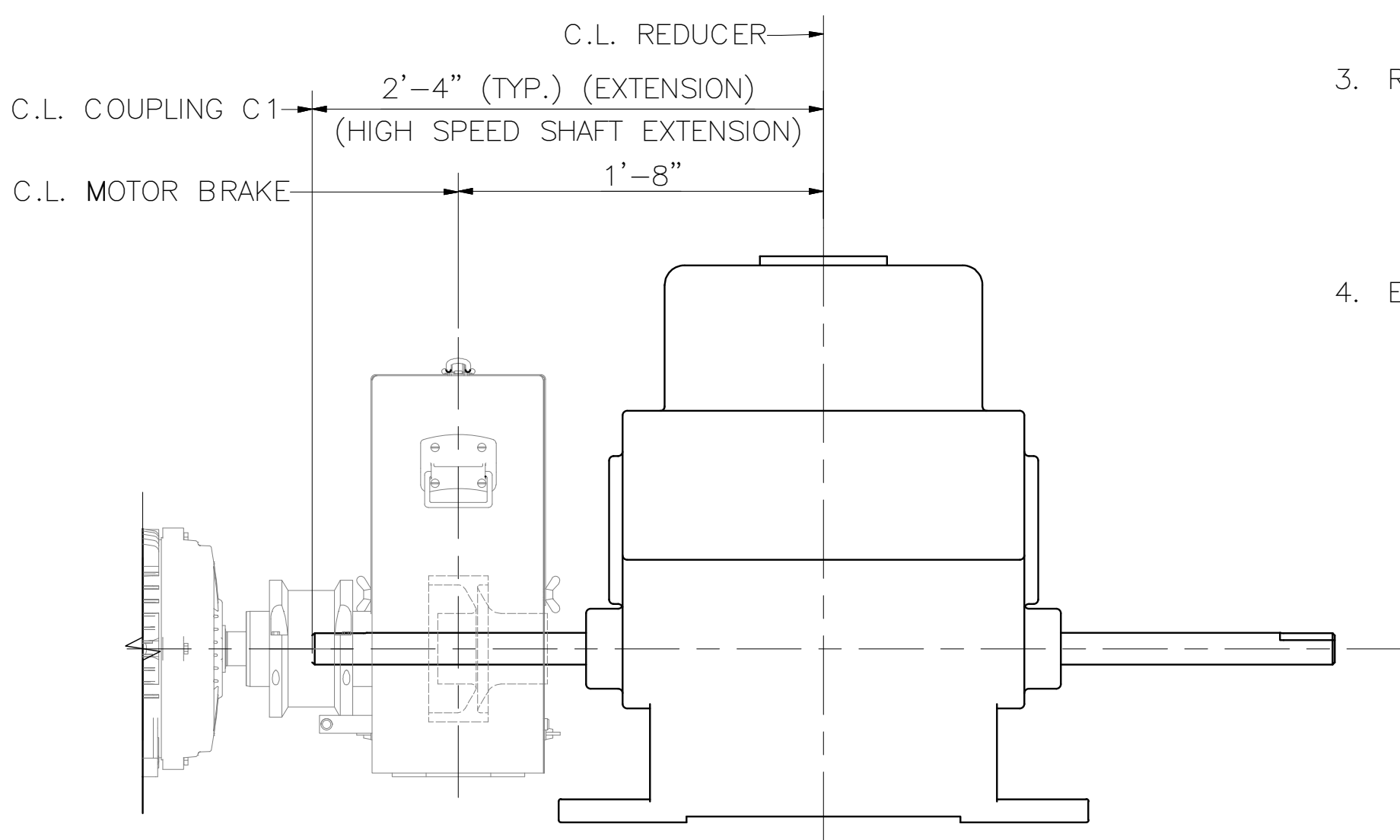
### REDUCER POSITION DURING SPAN OPERATION

SCALE: 3/8"=1'-0"



### REDUCER OUTPUT (LOW SPEED) SHAFT ASSEMBLY

SCALE: 1 1/2"=1'-0"



### REDUCER INPUT (HIGH SPEED) SHAFT ASSEMBLY

SCALE: 1 1/2"=1'-0"

#### NOTES:

1. UNLESS OTHERWISE NOTED, ALL REDUCER-RELATED DIMENSIONS TO MATCH MANUFACTURERS CATALOG DIMENSIONS, SEE BELOW FOR REDUCER DESCRIPTION.
2. REDUCER INFORMATION:
  - FALK CORPORATION (OR APPROVED EQUAL)
  - MODEL: A-PLUS
  - TYPE: A QUADRUPLE REDUCTION (FOOT MOUNTED)
  - SIZE: 465
  - RATIO: 437.9:1 (428.6:1 EXACT)
  - MINIMUM TORQUE CAPACITY: 779,000 LBF-IN
  - TYPE A (FOOT MOUNTED)
  - SERVICE FACTOR: 1.0
3. REDUCER SPECIAL REQUEST
  - HIGH-SPEED SHAFT MUST EXTEND 2 FEET 4 INCHES FROM REDUCER CENTERLINE.
  - THE LOW-SPEED SHAFT MUST EXTEND 2 FEET 3/4 INCHES FROM REDUCER CENTERLINE.
  - LUBRICATION SYSTEM TO ACCOMMODATE THE REDUCER ORIENTATION DURING NORMAL OPERATION.
4. ELECTRIC MOTOR INFORMATION
  - (2) MOTOR, REDUNDANT DRIVE SET-UP.
  - 15 HP MOTOR
  - 870 RPM

PREPARED BY:



1501 Broadway, Suite 601  
New York, NY 10036 U.S.A.  
Ph +1-212-944-1150 Fax +1-212-391-0297

REFERENCE:

OPERATING MACHINERY  
REQUEST FOR QUOTATION

DESIGN BY

DRAWN BY

APPROVED

DATE

10/19/2016

SCALE

SIZE

A

SKETCH:

PARALLEL SHAFT REDUCER

SHEET

MINNESOTA SLIP BRIDGE

DULUTH, MINNESOTA

CITY OF DULUTH