Technical Guidelines for Three Phase Electrical Services

These guidelines (for new property developments requiring three phase power) are designed to help property owners, developers, and consultants (**"Customer"**) to coordinate the installation or upgrade of a three-phase electrical service with **GrandBridge Energy Inc. ("GBE")**.

They should be used alongside:

- GBE's **Conditions of Service**
- **GBE Metering Specifications**
- The **Service Connection Process for New Property Developments Requiring Three Phase Power**

Getting Started

Before Design Begins:

- **Contact GBE's Engineering Department** to confirm:
  - Service requirements
  - Service configuration
- Follow all submission timelines and document requirements as outlined in the **Service Connection Process for New Property Developments Requiring Three Phase Power**.

All costs related to the installation, relocation, or removal of GBE-owned infrastructure for three-phase electrical services are the Customer's responsibility.

What You Can Expect GBE to Provide

In most cases:

- GBE supplies and owns:
  - **Transformers**
  - **High-voltage cables**
- The **Customer** is responsible for:
  - Installing all required **civil infrastructure** (e.g., duct banks, vaults) on their property according to GBE specifications. Customers can reach out to GBE approved contractors to facilate the completion of this work.

If more than one transformer is needed, a **multi-way switchgear** may be required to support power reliability and infrastructure maintenance.

If you choose to supply and own your own transformer, GBE will provide power at the primary (high-voltage) level to your equipment. The point where GBE's responsibility ends will be an ESA-approved, customer-owned service entrance switchgear, which acts as the official demarcation point between GBE's infrastructure and yours. All high-voltage cables beyond this switchgear, including those connected to your transformer, will be fully owned, operated, and maintained by you. This setup allows you to manage your own transformer while GBE supplies the power up to the switchgear.

Typical Required Infrastructure

Depending on your project, the following infrastructure may be required:

Underground

- **High-voltage concrete encased duct bank(s)** from GBE's supply point to transformer(s)/switchgear(s)
- **Low-voltage ducts or duct bank(s)** from pad-mounted transformer(s) to electrical room(s) of the building(s)
- **Pad-mounted transformer(s)**
- **Pad-mounted switchgear(s)**
- **Pad-mounted primary metering equipment**
- **Outdoor-rated SCADA equipment** installed within an enclosure

Overhead

- Polelines consisting of **poles and conductors**
- **Pole-mounted switche(s)**
- **Pole-mounted transformer(s)**
- **Pole-mounted primary metering equipment**
- **Outdoor-rated SCADA equipment** installed within an enclosure

Inside the Building

- Electrical room containing:
    - Low-voltage distribution equipment
    - GBE secondary metering equipment
    - SCADA installed within electrical room

Easement Requirements

GBE may require easement(s) for GBE owned high voltage infrastructure on private property that serves as part of its larger distribution system. Easements must be free of buildings, utilities, trees, and other obstructions.

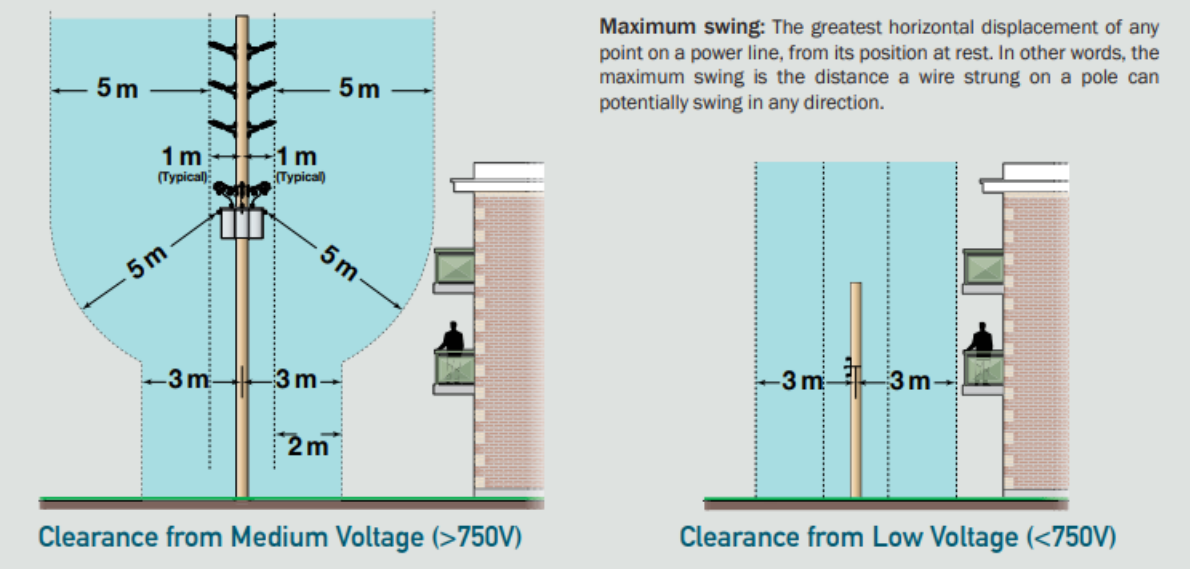
Infrastructure	**Minimum Easement Required**
Underground high-voltage duct bank	3.0 m wide
Pad-mounted transformer	6.2 m x 6.8 m
Switchgear unit	8.0 m x 8.0 m
Guy anchors from GBE hydro poles	As required

Clearance Requirements

For Overhead Infrastructure:

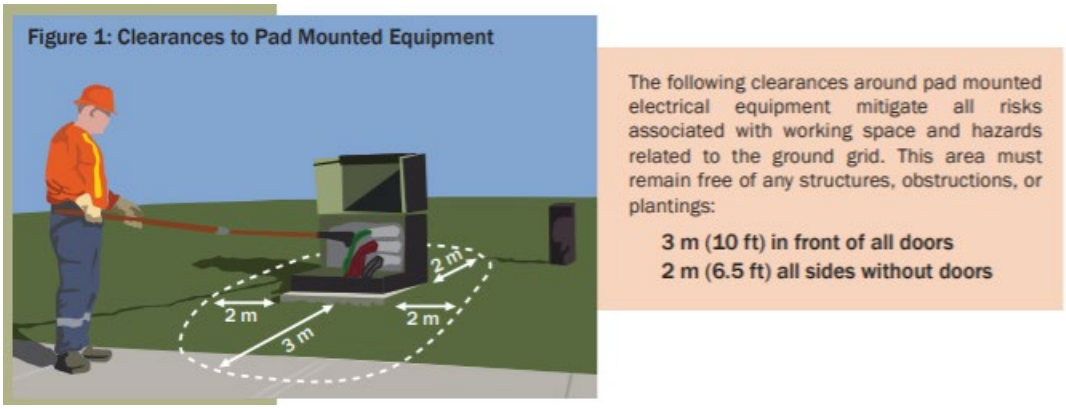
- **For 750V and greater: 5.0 m minimum** radial clearance between any structure and the outermost conductor.

- **For less than 750V: 3.0 m minimum** radial clearance between any structure and the outermost conductor.



For Underground Infrastructure:

- Pad-Mounted Transformers and Switchgear
  - Keep at least **3 meters (10 feet)** of clear space in front of the transformer (access side).
  - Keep at least **2 meter (6.5 feet)** of clear space at the bsack or sides (non-access side) of the transformer or switchgear.
  - This area must be **level, free of any sudden or steep drop-offs, and covered with grass or a similar surface**—no obstructions (e.g., walls, landscaping, fences).



- Vaults
    - This area should maintain a 2% slope
    - Swales must not direct water toward any GBE equipment.

- Metering Equipment (Inside the Electrical Room)
    - Allow a minimum of **1 meter** of unobstructed space in front of GBE-owned meters.
    - Ensure the ceiling above the meters is at least **2.1 meters** high.
    - For complete details, please refer to the latest **GBE Metering Specifications**.

Anything metal within **2.4 meters** of GBE equipment is required to be **bonded**. This includes metal buildings, streetlights and fire hydrants. Please reach out to your GBE Design Technologist for more specific requirements.

GBE will **not cover or isolate live lines** for third-party contractors during construction.

Access Requirements

- To allow safe access for installation, maintenance, and emergency service, the following access standards must be met:
    - **Access Road**: Provide a well-maintained access road that is:
        - At least **4.0 meters wide**
        - Has a **minimum turning radius of 15 meters**
        - Free of any obstructions (e.g., fences, landscaping, parked vehicles)
        - Able to support a **vehicle load of up to 25,000 kg**
    - **Overhead Clearance**: Any building structure (e.g., canopy) above the driveway must have a **minimum vertical clearance of 5.0 meters**.
    - **Working Space at Transformer Location**:
        - Allow **8.5 meters of clear width** for truck outriggers at the transformer
        - Provide an additional **2.5 meters** between the transformer and the truck to allow for safe crane operation
- GBE must have **free and safe access** to all equipment on the property
- **Keys must be provided to GBE** if access is through locked areas
- Meter rooms for multi-unit setups must have:
    - **Ground-level exterior doors** (minimum: 2000mm x 810mm / 6’8” x 2’8”)
    - Adequate lighting (minimum: 6 lux / 65 footcandles)

Installation Standards

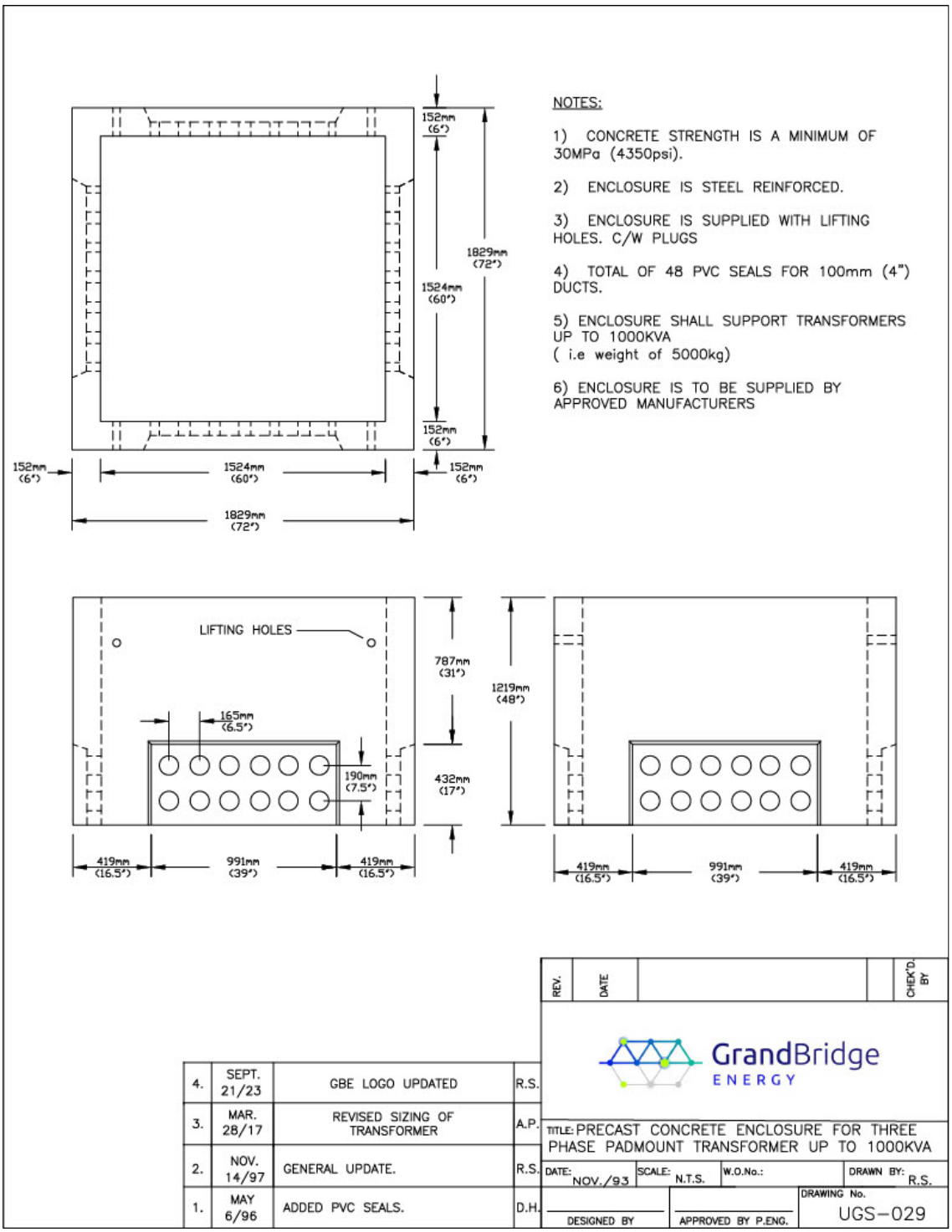
The Customer is responsible for installing all infrastructure in **agreed-to locations following GBE standards**:

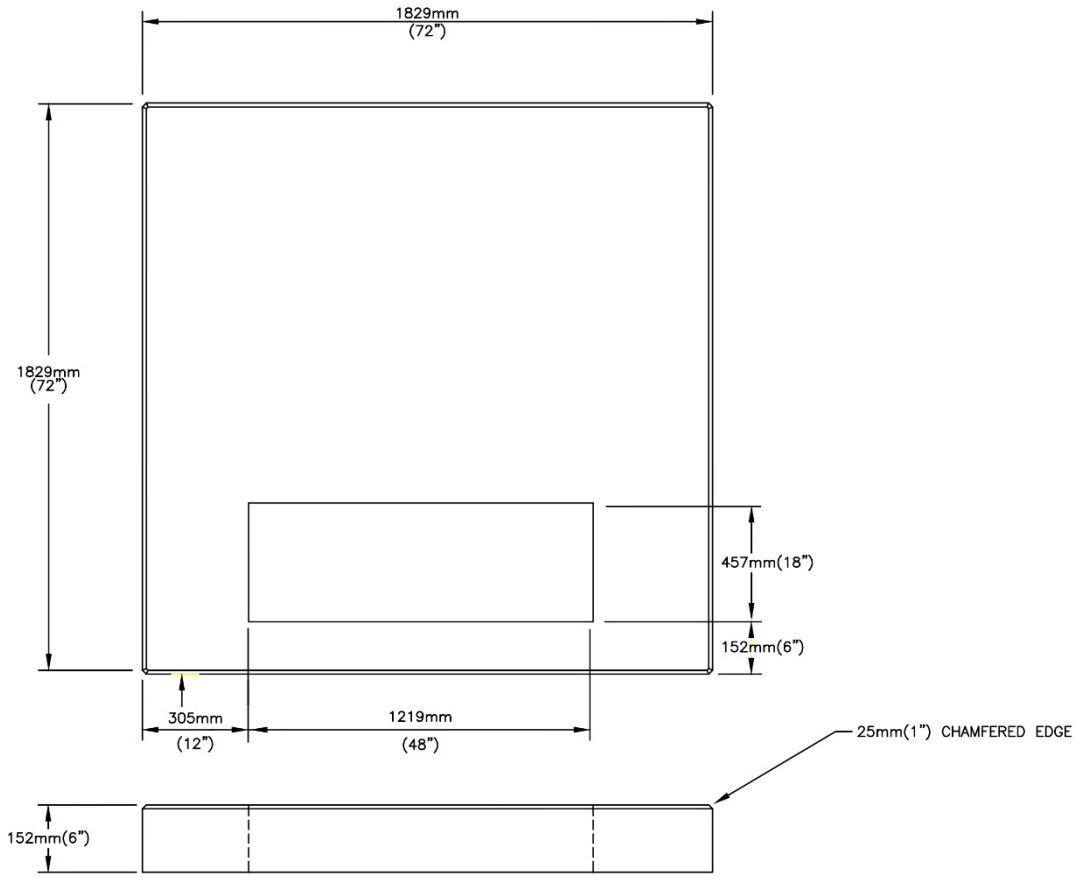
Component	Reference
Transformer	GBE Standard UGS-029, UGS-029-A, UGS-029-B, UGS-031, UGS-033, UGS-035, UGS-040
Switchgear	GBE Standard UGS-012
Duct Bank	GBE Standard UGS-013, UGS-014-A, UGS-014-B, UGS-015
Metering	GBE Metering Specifications

Please note that GBE regularly updates its standards. We recommend **contacting your GBE Design Technologist to confirm** you are referencing the most current version prior to procurement or installation.

If your site uses a customer-owned transformer, bulk metering must support transformer discounting. Please reach out to your GBE Design Technologist for more specific requirements.

Appendices:


NOTES:
1) CONCRETE STRENGTH IS A MINIMUM OF 30MPa (4350psi).
2) ENCLOSURE IS STEEL REINFORCED.
3) ENCLOSURE IS SUPPLIED WITH LIFTING HOLES. C/W PLUGS
4) TOTAL OF 48 PVC SEALS FOR 100mm (4") DUCTS.
5) ENCLOSURE SHALL SUPPORT TRANSFORMERS UP TO 1000KVA (i.e weight of 5000kg)
6) ENCLOSURE IS TO BE SUPPLIED BY APPROVED MANUFACTURERS
152mm (6")
1524mm (60")
1829mm (72")
LIFTING HOLES
165mm (6.5")
190mm (7.5")
787mm (31")
432mm (17")
1219mm (48")
419mm (16.5")
991mm (39")
REV.
DATE
CHEK'D. BY
GrandBridge ENERGY
4. SEPT. 21/23 GBE LOGO UPDATED R.S.
3. MAR. 28/17 REVISED SIZING OF TRANSFORMER A.P.
2. NOV. 14/97 GENERAL UPDATE. R.S.
1. MAY 6/96 ADDED PVC SEALS. D.H.
TITLE: PRECAST CONCRETE ENCLOSURE FOR THREE PHASE PADMOUNT TRANSFORMER UP TO 1000KVA
DATE: NOV./93
SCALE: N.T.S.
W.O.No.:
DRAWN BY: R.S.
DESIGNED BY
APPROVED BY P.ENG.
DRAWING No. UGS-029



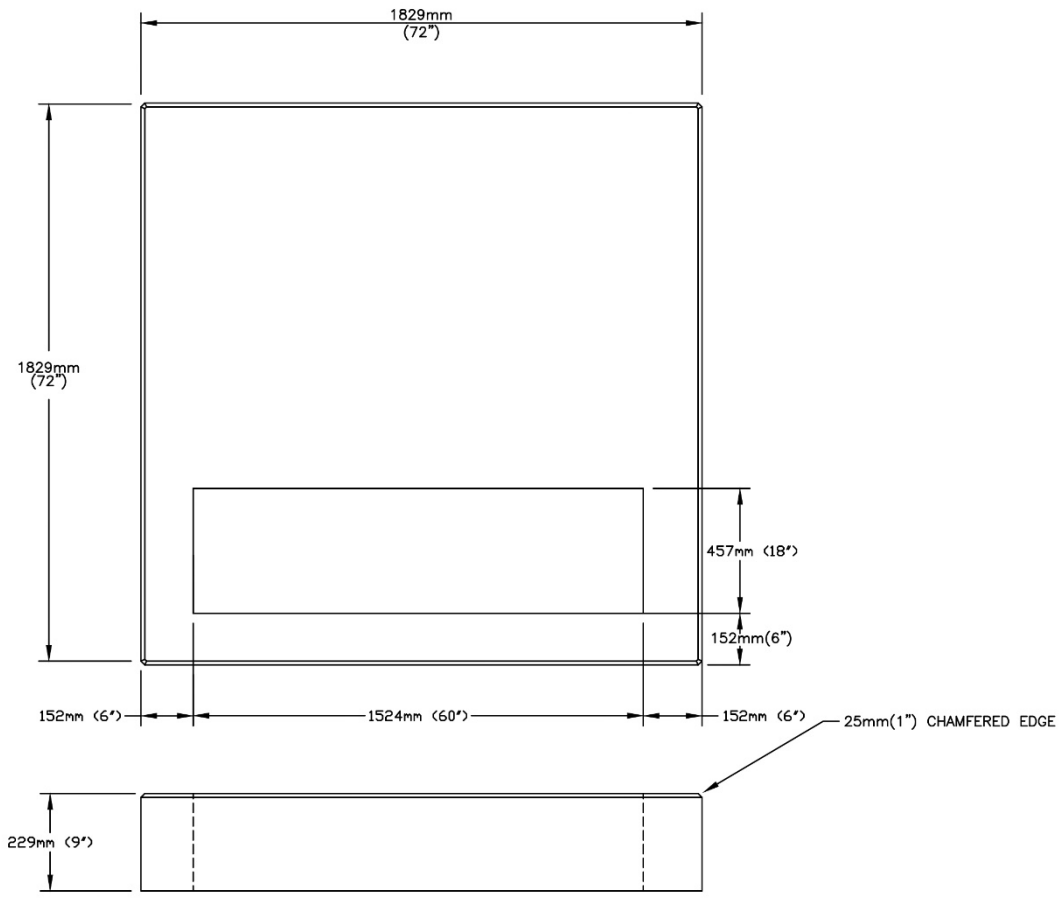
NOTES:

1) LID IS TO BE SUPPLIED WITH LIFTING PROVISIONS.
2) LID IS TO BE SUPPLIED BY APPROVED MANUFACTURERS
3) LID SHALL SUPPORT TRANSFORMERS 150KVA TO 500KVA (i.e weight of 3000 kg.)

REV.	DATE			CHEK'D. BY
3.	SEPT. 21/23	GBE LOGO UPDATED	RS	
2.	APR. 25/11.	REVISED MAX. TRANSFORMER SIZE TO 500kVA.	ST	
1.	MAY 2/96	REVISED LENGTH TO MATCH 3 ø PADMOUNT TRANSFORMER ENCLOSURE.	D.H.	

GrandBridge ENERGY

TITLE: 152mm (6") THREE PHASE PRECAST CONCRETE PAD.			
DATE: NOV. 15/93.	SCALE: N.T.S.	W.O.No.:	DRAWN BY: S.L.TILLEY
DESIGNED BY	APPROVED BY P.ENG.	DRAWING No. UGS-029A	



NOTES:

2) LID IS TO BE SUPPLIED FROM APPROVED MANUFACTURER
3) LID IS TO BE SUPPLIED WITH LIFTING PROVISIONS.
4) LID AND ENCLOSURE BELOW SHALL SUPPORT A TRANSFORMERS 750KVA TO 1000KVA (i.e weight of 5000kg)

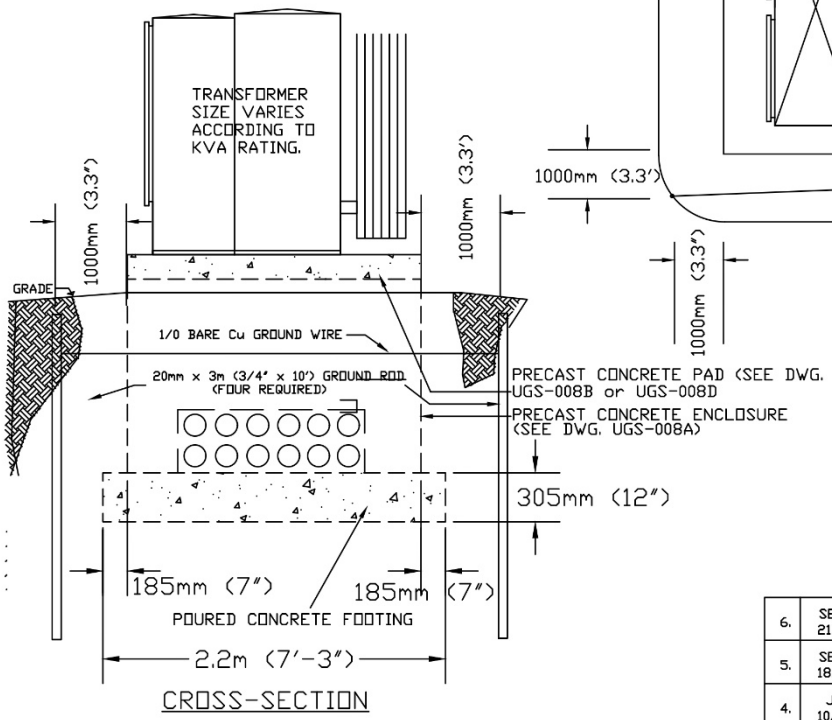
3.	SEPT 21 2023	GBE LOGO UPDATED	RS	
2.	MARCH 28 2017	REVISED TO REFLECT ACCEPTABLE TRANSFORMER SIZES	AP	
1.	APR. 25/11.	REVISED TITLE TO REFLECT ACCEPTABLE TRANSFORMER SIZES.	ST	

GrandBridge ENERGY

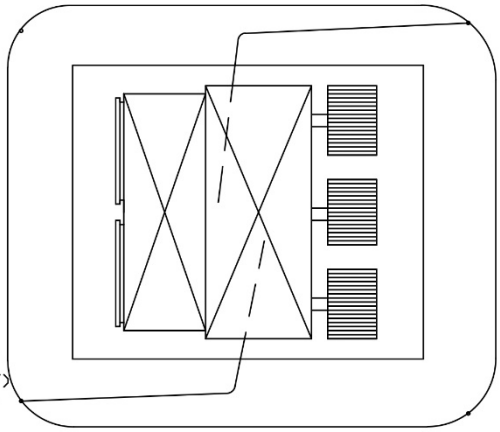
TITLE: 229mm (9") THREE PHASE PRECAST PRECAST PAD TO ACCEPT 750kVA – 1000KVA TRANSFORMERS			
DATE: AUG.6/99	SCALE: N.T.S.	W.O.No.:	DRAWN BY: S.T./R.S.
DESIGNED BY	APPROVED BY P.ENG.	DRAWING No. UGS-029B	

NOTES:

1. FOUR 20mm x 3m (3/4" x 10') COPPER CLAD GROUND RODS ARE TO BE INSTALLED 305mm (12") FROM TRANSFORMER ENCLOSURE & DIAGONALLY INSTALLED FROM THE CORNERS.
2. 1/0 BARE Cu GROUND WIRE IS TO BE CONNECTED TO GROUND ROD WITH APPROVED COMPRESSION AND BOLTED JOINT CLAMPS. (SIX REQUIRED)
3. 305mm THICK POURED CONCRETE FOOTING IS TO BE INSTALLED BELOW ENCLOSURE
4. 3m (10') COILS OF Cu GROUND WIRE ARE TO BE LEFT INSIDE ENCLOSURE.
5. 20MM PLYWOOD IS TO BE SECURED ON TOP OF PAD UNTIL TRANSFORMER IS INSTALLED.
6. EXCAVATION DEPTH TO BE 1.45m (4'9") BELOW FINISHED GRADE.



CROSS-SECTION



PLAN VIEW

REV.	DATE			CHEK'D. BY
6.	SEPT. 21/23.	GBE LOGO UPDATE	RS	
5.	SEPT. 18/17.	REVISED SPEC'S FOR TX SIZES	STW	
4.	JUN. 10/13	EXCAVATION DEPTH SPECIFIED.	DC	
3.	SEPT. 01/06	GENERAL UPDATE	STW	
2.	Jan 06/00	GROUND RODS CHANGED TO 3m	KE	
1.	NOV. 14/97	GENERAL UPDATE.	R.S.	

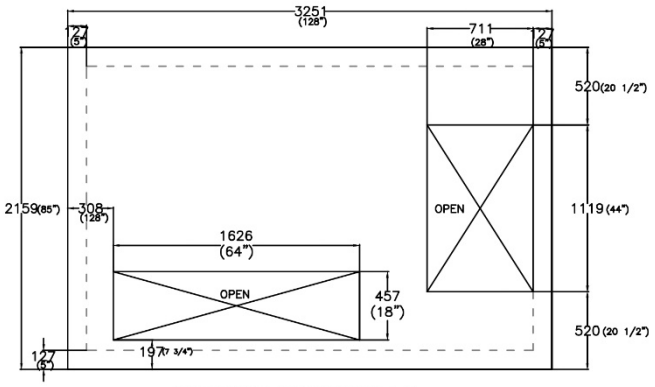
SEE DWG. UGS-029 FOR THREE PHASE ENCLOSURE DETAILS AND UGS-029A (500 KVA & BELOW) AND UGS-029B (750-1000 KVA & ABOVE) FOR THREE PHASE PAD DETAILS
UGS-033 & UGS-035 (1500 KVA & ABOVE FOR THREE PHASE PAD DETAILS

GrandBridge ENERGY

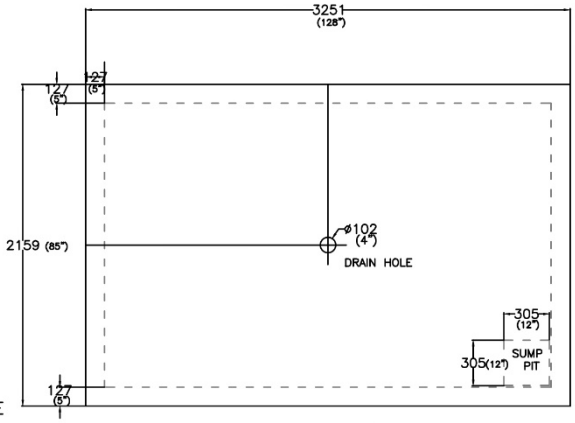
TITLE: TYPICAL THREE PHASE PADMOUNT TRANSFORMER INSTALLATION DETAIL

DATE:	SCALE:	W.O.No.:	DRAWN BY:
NOV.16/93	N.T.S.		R.S.

DESIGNED BY | APPROVED BY P.ENG. | DRAWING No. UGS-031



PADMOUNT FOUNDATION LID



PADMOUNT FOUNDATION FLOOR

MAXIMUM TRANSFORMER WEIGHT MOUNTED ON FOUNDATION SHOULD NOT EXCEED 8,150 Kg.

NOTES:

1. MINIMUM COMPRESSIVE STRENGTH OF CONCRETE AT 28 DAYS (UNLESS NOTED OTHERWISE ON DRAWINGS SHALL BE AS FOLLOWS:
   356MPa WITH 6% ± 1% AIR ENTRAINMENT (CLASS "C–1") FOR CONCRETE EXPOSED TO WEATHER WITH A MAX. WATER/CEMENT RATIO OF 0.40 AND A MIN. CEMENT CONTENT OF 350kg/m3
2. CALCIUM CHLORIDE ADMIXTURES SHALL NOT BE USED.
3. ALL REINFORCING BARS SHALL BE NEW DEFORMED "HI–BOND" FUSION BONDED CONFORMING WITH CSA STANDARD G30.18 WITH A MINIMUM YIELD STRESS OF 400 MPa.
4. CONCRETE MATERIALS CONSTRUCTION AND TESTING SHALL CONFORM TO THE REQUIREMENTS OF CAN/ CSA– A23.1 AND CAN/ CSA– A23.2 LATEST EDITION
5. ALL METAL COMPONENTS AND HARDWARE HOT DIPPED GALVANIZED UNLESS OTHERWISE NOTED.
6. FOR SIZE, LOCATION AND ORIENTATION OF DUCT BANKS/ CONDUITS ENTERING MANHOLE REFER TO ELECTRICAL DRAWINGS
7. REFER TO PRECAST SUPPLIER'S DRAWINGS FOR REMAINDER OF DETAILS
8. DESIGN CRITERIA:
   CANADIAN HIGHWAY BRIDGE DESIGN CODE CSA S6.00:
   LIVE LOAD = 70% OF CL–625–ONT TRUCK.
9. 1" (25mm0 CONCRETE COVER. FOR INSIDE WALL CEILING AND FLOOR.
10. SEE UGS–033 PG.2 FOR ENCLOSURE DETAILS.
11. SEE UGS–035 FOR INSTALLATION DETAILS

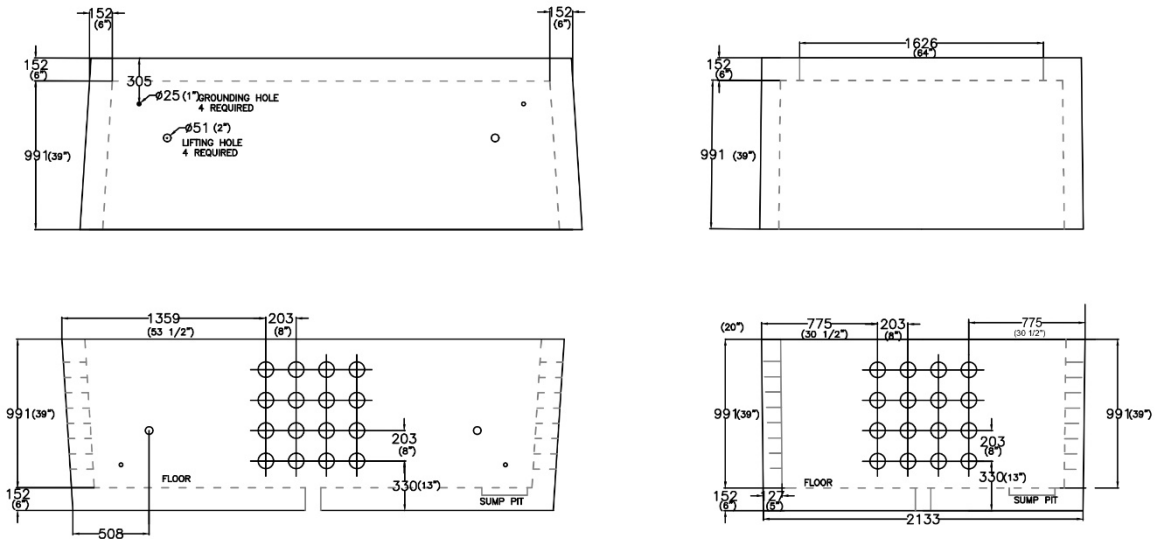
REV.	DATE			CHEK'D. BY
1.	SEPT. 22/23	GBE LOGO UPDATED	TX	

GrandBridge ENERGY

TITLE: LID AND FLOOR FOR 192C–SP TRANSFORMER ENCOSURE FOR 1500 KVA TRANSFORMER AND UP

DATE: APRIL/17	SCALE: N.T.S.	W.O.No.:	DRAWN BY:

DESIGNED BY	APPROVED BY P.ENG.	DRAWING No. UGS–033 PAGE 1 OF 2



MAXIMUM TRANSFORMER WEIGHT MOUNTED ON FOUNDATION SHOULD NOT EXCEED 8,150 Kg.

Notes:

1. MINIMUM COMPRESSIVE STRENGTH OF CONCRETE AT 28 DAYS (UNLESS NOTED OTHERWISE ON DRAWINGS SHALL BE AS FOLLOWS:
   356MPa WITH 6% ± 1% AIR ENTRAINMENT (CLASS "C–1") FOR CONCRETE EXPOSED TO WEATHER WITH A MAX. WATER/CEMENT RATIO OF 0.40 AND A MIN. CEMENT CONTENT OF 350kg/m3
2. CALCIUM CHLORIDE ADMIXTURES SHALL NOT BE USED.
3. ALL REINFORCING BARS SHALL BE NEW DEFORMED "HI–BOND" FUSION BONDED CONFORMING WITH CSA STANDARD G30.18 WITH A MINIMUM YIELD STRESS OF 400 MPa.
4. CONCRETE MATERIALS CONSTRUCTION AND TESTING SHALL CONFORM TO THE REQUIREMENTS OF CAN/ CSA– A23.1 AND CAN/ CSA– A23.2 LATEST EDITION
5. ALL METAL COMPONENTS AND HARDWARE HOT DIPPED GALVANIZED UNLESS OTHERWISE NOTED.
6. FOR SIZE, LOCATION AND ORIENTATION OF DUCT BANKS/ CONDUITS ENTERING MANHOLE REFER TO ELECTRICAL DRAWINGS
7. REFER TO PRECAST SUPPLIER'S DRAWINGS FOR REMAINDER OF DETAILS
8. DESIGN CRITERIA:
   CANADIAN HIGHWAY BRIDGE DESIGN CODE CSA S6.00:
   LIVE LOAD = 70% OF CL–625–ONT TRUCK.
9. 1" (25mm0 CONCRETE COVER. FOR INSIDE WALL CEILING AND FLOOR.
10. SEE UGS–033 Pg.1 FOR LID AND FLOOR DETAILS.
11. SEE USG–035 FOR INSTALLATION DETAILS.

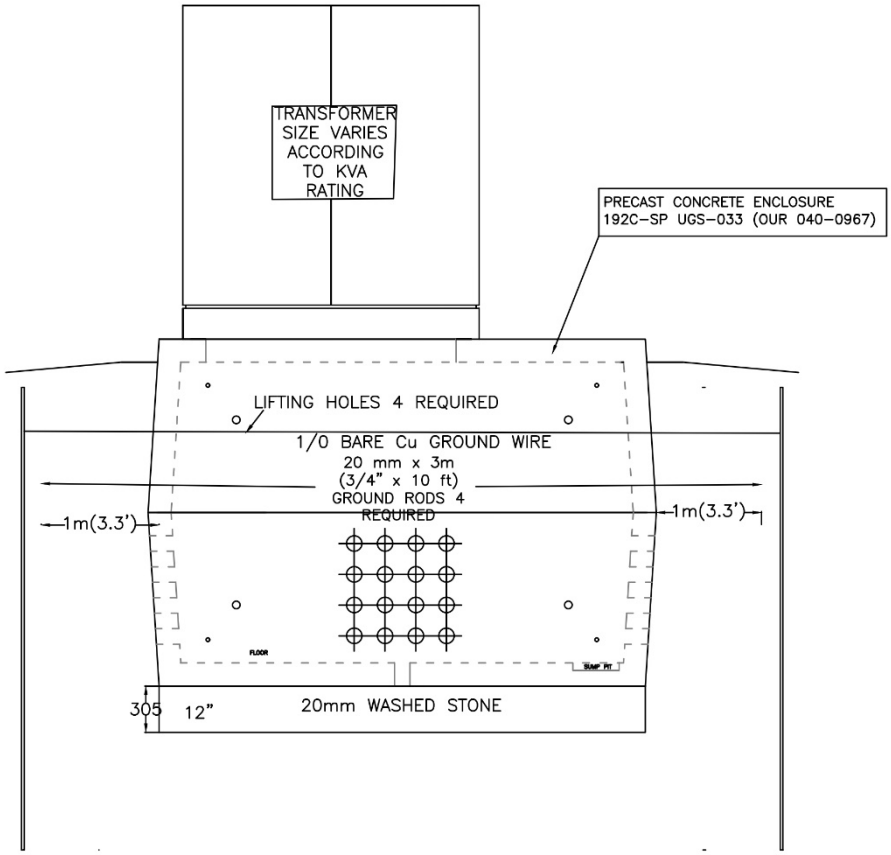
REV.	DATE			CHEK'D. BY
1.	SEPT. 22/23	GBE LOGO UPDATED	TX	

GrandBridge ENERGY

TITLE: 192C–SP TRANSFORMER ENCLOSURE FOR 1500 KVA AND UP

DATE: APRIL/17	SCALE: N.T.S.	W.O.No.:	DRAWN BY:

DESIGNED BY	APPROVED BY P.ENG.	DRAWING No. UGS–033 PAGE 2 OF 2



NOTES:

1. FOUR 20mm X 3m (3/4" X 10') COPPER CLAD GROUND RODS ARE TO BE INSTALLED 1m (3.3') FROM TRANSFORMER ENCLOSURE & DIAGONALLY INSTALLED FROM THE CORNERS.
2. 1/0 BARE Cu GROUND WIRE IS TO BE CONNECTED TO THE GROUND ROD WITH APPROVED COMPRESSION OR BOLTED JOINT CLAMPS (SIX REQUIRED)
3. 305mm OF 20mm WASHED STONE IS TO BE INSTALLED BELOW ENCLOSURE.
4. 3m (10') COILS OF CU GROUND WIRE TO BE LEFT INSIDE ENCLOSURE.
5. 20mm PLYWOOD IS TO BE SECURED ON TOP OF PAD UNTIL TRANSFORMER IS INSTALLED
6. EXCAVATION DEPTH IS TO BE 2.44m (7')
7. SEE UGS-033 FOR ENCLOSURE DETAILS.

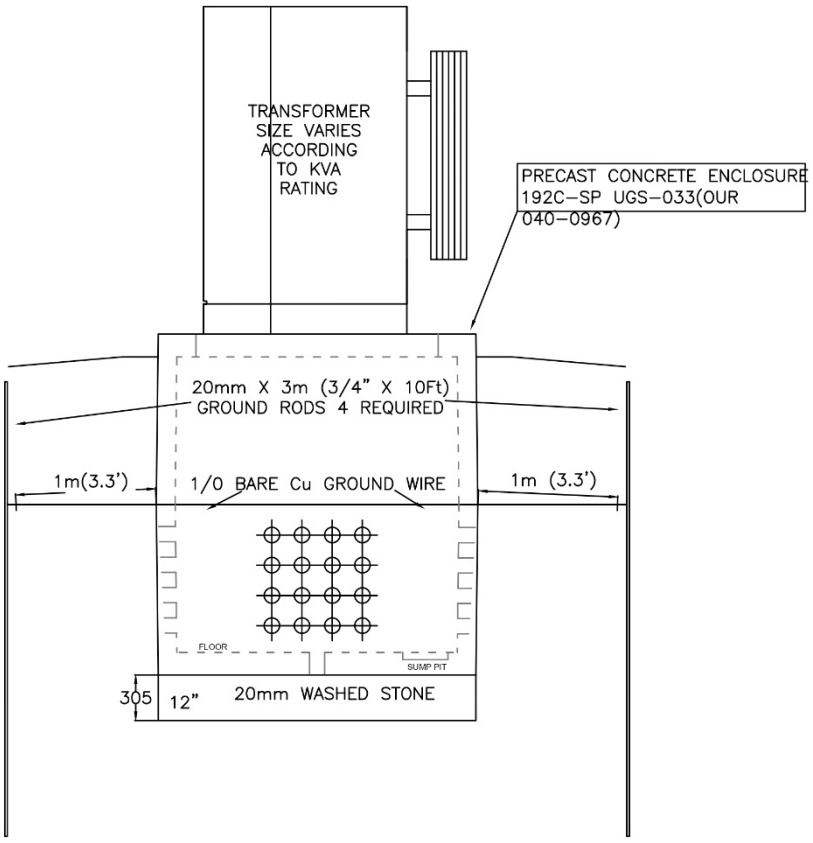
REV.	DATE			CHEK'D. BY
1.	SEPT. 29/23	GBE LOGO UPDATED TO INCLUDE COMPRESSION CLAMPS AND GROUND ROD DISTANCE	TX	

GrandBridge ENERGY

TITLE: INSTALLATION DETAIL FOR 192C-P TRANSFORMER ENCLOSURE PROFILE VIEW (LENGTH)

DATE: APRIL/17	SCALE: N.T.S.	W.O.No.:	DRAWN BY:

DESIGNED BY	APPROVED BY P.ENG.	DRAWING No. UGS-035 PAGE 1 OF 3



NOTES:

1. FOUR 20mm X 3m (3/4" X 10') COPPER CLAD GROUND RODS ARE TO BE INSTALLED 1m (3.3') FROM TRANSFORMER ENCLOSURE & DIAGONALLY INSTALLED FROM THE CORNERS.
2. 1/0 BARE Cu GROUND WIRE IS TO BE CONNECTED TO THE GROUND ROD WITH APPROVED COMPRESSION OR BOLTED JOINT CLAMPS (SIX REQUIRED)
3. 305mm of 20mm WASHED STONE IS TO BE INSTALLED BELOW ENCLOSURE.
4. 3m (10') COILS OF CU GROUND WIRE TO BE LEFT INSIDE ENCLOSURE.
5. 20mm PLYWOOD IS TO BE SECURED ON TOP OF PAD UNTIL TRANSFORMER IS INSTALLED
6. EXCAVATION DEPTH IS TO BE 2.44m (7')
7. SEE UGS–033 FOR ENCLOSURE DETAILS

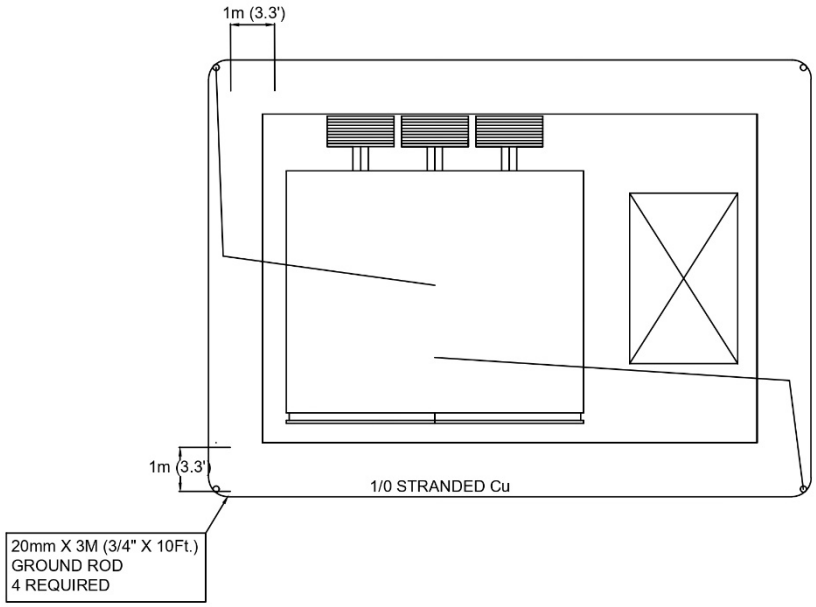
REV.	DATE		CHEK'D. BY
1.	SEPT. 29/23	GBE LOGO UPDATED TO INCLUDE COMPRESSION CLAMPS AND GROUND ROD DISTANCE	TX

GrandBridge ENERGY

TITLE: INSTALLATION DETAIL FOR 192C–P TRANSFORMER ENCLOSURE PROFILE VIEW (WIDTH)

DATE: APRIL/17	SCALE: N.T.S.	W.O.No.:	DRAWN BY:

DESIGNED BY	APPROVED BY P.ENG.	DRAWING No. UGS–035 PAGE 2 OF 3



NOTES:

1. FOUR 20mm X 3m (3/4" X 10') COPPER CLAD GROUND RODS ARE TO BE INSTALLED 1000mm (3.3') FROM TRANSFORMER ENCLOSURE & DIAGONALLY INSTALLED FROM THE CORNERS.
2. 1/0 BARE Cu GROUND WIRE IS TO BE CONNECTED TO THE GROUND ROD WITH APPROVED COMPRESSION OR BOLTED JOINT CLAMPS (SIX REQUIRED)
3. 305mm OF 20mm WASHED STONE IS TO BE INSTALLED BELOW ENCLOSURE.
4. 3m (10') COILS OF CU GROUND WIRE TO BE LEFT INSIDE ENCLOSURE.
5. 20mm PLYWOOD IS TO BE SECURED ON TOP OF PAD UNTIL TRANSFORMER IS INSTALLED
6. EXCAVATION DEPTH IS TO BE 2.44m (7')
7. SEE USG-033 FOR ENCLOSURE DETAILS

REV.	DATE			CHEK'D. BY
1.	SEPT. 29/23	GBE LOGO UPDATED TO INCLUDE COMPRESSION CLAMPS AND GROUND ROD DISTANCE	TX	

GrandBridge ENERGY

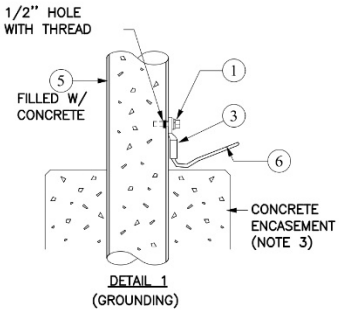
TITLE: INSTALLATION DETAIL FOR 192C–P TRANSFORMER ENCLOSURE TOP VIEW

DATE: APRIL/17	SCALE: N.T.S.	W.O.No.:	DRAWN BY:

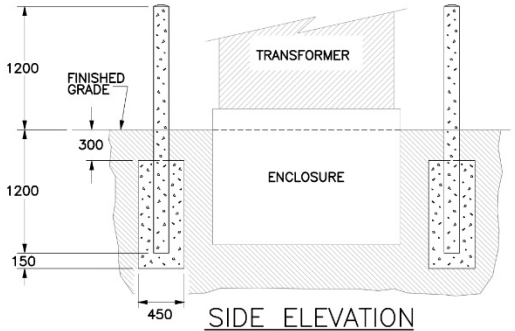
DESIGNED BY	APPROVED BY P.ENG.	DRAWING No. UGS–035 PAGE 3 OF 3

NOTES:

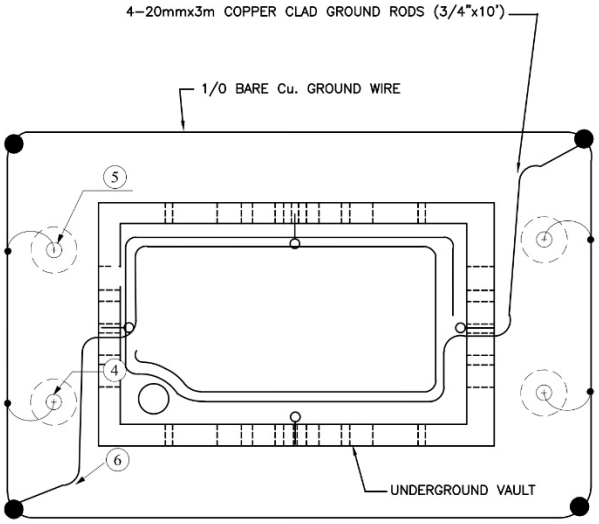
1. GUARD POSTS SHALL BE 150 mm DIA. x 2.4 m LONG x 6 mm THICK GALVANIZED STEEL PIPE FILLED WITH CONCRETE.
2. LOCATION AND NUMBER OF GUARD POSTS SHALL BE DETERMINED AND FINALIZED BY GBE INSPECTOR INSPECTOR WITH THE FOLLOWING CRITERIA:
   - 2.1. SHALL ALLOW EQUIPMENT DOORS (INCLUDING SUB–COMPARTMENT'S DOORS) TO BE OPENED THROUGH THEIR FULL RANGE
   - 2.2. SHALL ALLOW DISTRIBUTOR PERSONNEL UNIMPEDED ACCESS TO THE EQUIPMENT AND PERMIT COMPLETE AND SAFE OPERATION OF THE EQUIPMENT.
   - 2.3. 500 mm MINIMUM CLEARANCE BETWEEN THE GUARD POST'S CONCRETE ENCASEMENT AND THE UTILITY CORRIDOR.
   - 2.4. 100 mm MINIMUM CLEARANCE BETWEEN THE GUARD POST'S CONCRETE ENCASEMENT AND THE GROUND GRID.
3. THE GUARD POSTS SHALL BE CONCRETE ENCASED IN 20 MPa CONCRETE WITH 10 mm PEA GRAVEL AGGREGATE.
4. WHERE GUARD POSTS ARE INSTALLED IN BACKFILL OR DISTURBED EARTH, ENSURE BACKFILL MATERIAL IS THOROUGHLY COMPACTED.
5. GUARD POSTS SHALL BE PAINTED WITH "SAFETY–YELLOW" (MUNICIPAL STANDARD). FOR PROPER ADHESION OF PAINT, GUARD POSTS MUST BE CLEANED (FREE FROM DIRT, GREASE/OIL AND EXHAUST FUMES) AND PRIMED PRIOR TO PAINTING. PRETREATMENT PRIMER MUST BE COMPATIBLE WITH GALVANIZED COATING, SUCH AS MODIFIED ACRYLIC WATER–BORNE PRIMERS.
   FOR HIGH ADHESION OF PAINT, BRUSH OR SWEEP BLAST THE GALVANIZED POSTS IMMEDIATELY PRIOR TO PAINTING. INCORRECT TECHNIQUE OF BLASTING MAY RESULT IN DAMAGES TO THE GALVANIZED COATING. THEREFORE IT IS HIGHLY RECOMMENDED THAT A PERSON WITH EXPERTISE AND ABILITY TO FOLLOW STRICT PRETREATMENT REQUIREMENTS AND PROCEDURES BE USED.



DETAIL 1
(GROUNDING)



SIDE ELEVATION



PLAN VIEW

BILL OF MATERIALS			
ITEM #	DESCRIPTION	QTY	PART NO.
1	BOLT, HEX, WASHER, NUT, 1/2" x 1-1/2"	1/POST	002-0035
2	CEMENT, CONCRETE	VARIES	N/A
3	CONNECTOR, LUG, 1/0 AWG Cu, 2-HOLE	1/POST	012-0133
4	CONNECTOR, GROUND	1/POST	003-0252
5	BOLLARD GUARD	VARIES	N/A
6	WIRE, COPPERWELD 7#7	VARIES	070-0540

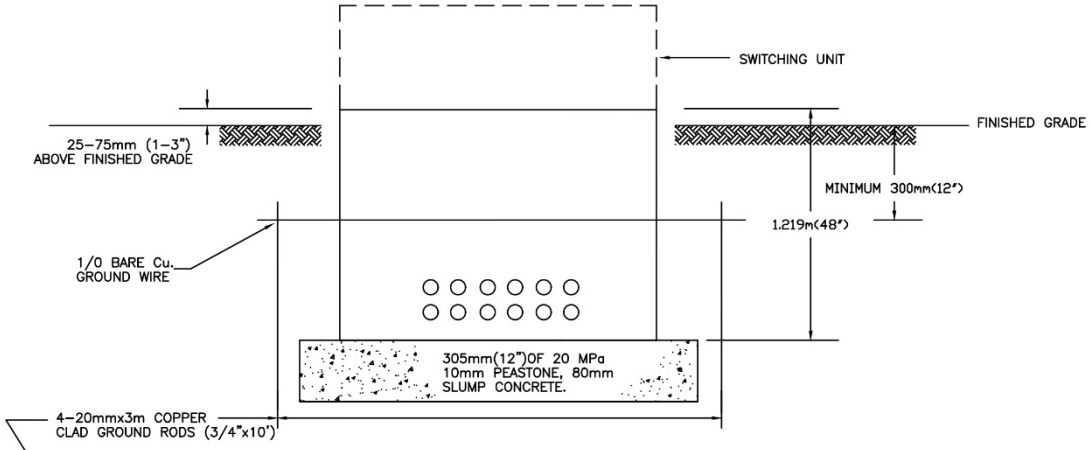
REV.	DATE			CHEK'D. BY
3.	SEPT 21/23	GBE LOGO UPDATED		RS
2.	JULY 3/19	REVISED CNDHI TO ENERGY+		STW
1.	NOV 03/16	UPDATED BOM		SJ

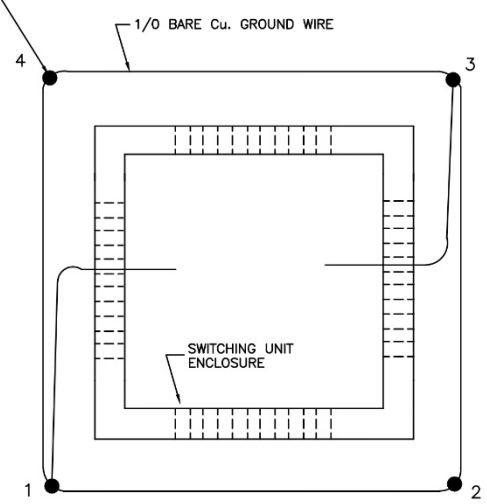
GrandBridge ENERGY

TITLE: TYPICAL BOLLARD GUARD POST INSTALLATION

DATE:	SCALE:	W.O.No.:	DRAWN BY:
SEPT/10	N.T.S.		B.GORDON

DESIGNED BY | APPROVED BY P.ENG. | DRAWING No. UGS–040





TO CONNECT GROUND WIRE:

1. CLAMP ONE END TO FIRST ROD.
2. CARRY QUARTERWAY AROUND ENCLOSURE, CLAMP TO SECOND ROD.
3. CARRY HALFWAY AROUND ENCLOSURE, CLAMP TO THIRD ROD.
4. CARRY THREE–QUARTERWAY AROUND ENCLOSURE, CLAMP TO FOURTH ROD.
5. COMPLETE LOOP AROUND ENCLOSURE; CLAMP AGAIN TO FIRST ROD AND CARRY SUFFICIENT LENGTH INTO ENCLOSURE TO LEAVE 3.6m (12') TAIL. CUT GROUND WIRE AT THIS POINT.
6. CLAMP END OF CABLE AGAIN TO THIRD ROD AND CARRY SUFFICIENT LENGTH INTO ENCLOSURE TO LEAVE 3.6m(12') TAIL. CUT WIRE GROUND AT THIS POINT.

NOTES:

1. GROUND RODS TO BE INSTALLED 1000mm(3.3') FROM ENCLOSURE AT EACH CORNER.
2. 1/0 BARE Cu. GROUND WIRE TO BE CONNECTED TO GROUND RODS WITH APPROVED COMPRESSION AND BOLTED JOINT CLAMPS.(SIX REQUIRED)
3. 3.6m(12') COILS OF Cu. GROUND WIRE TO BE LEFT INSIDE ENCLOSURE.
4. 305mm(12") OF 20 MPa 10mm PEASTONE CONCRETE, WINTER HANDLING WHEN REQUIRED, TO BE PLACED BELOW ENCLOSURE.
5. TOP OF ENCLOSURE TO BE 100mm(4") TO 150mm(6") ABOVE FINISHED GRADE.
6. PLYWOOD IS TO BE PLACED AND SECURED ON TOP OF ENCLOSURE BEFORE SWITCHING UNIT IS INSTALLED.
7. BELL ENDS ARE TO BE INSTALLED ON ALL DUCTS INSIDE ENCLOSURE.

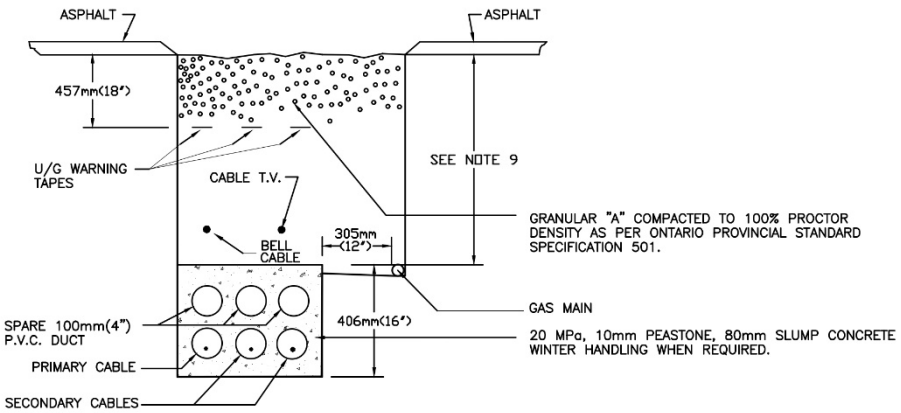
SEE DRAWING UGS–008 FOR ENCLOSURE DETAILS.

REV.	DATE			CHEK'D. BY
4.	SEPT. 21/23	GBE LOGO, COMPRESSION CLAMP ADDED	RS	
3.	JUL. 11/00	CHANGED GRADE OF ENCLOSURE FROM 4–6" to 1–3".	EV	
2.	MAY 20/99	CHANGED GRADE OF ENCLOSURE FROM 6"–9" TO 4–6". CHANGED GROUND RODS FROM 6' GALVANIZED TO 10' COPPER CLAD. ADDED AMP SHEAR–LOK CONNECTORS. ADDED NOTE ABOUT BELL ENDS.	RS	
1.	OCT. 22/97	GENERAL UPDATE	RS	

GrandBridge ENERGY

TITLE: TYPICAL THREE PHASE SWITCHING UNIT INSTALLATION.			
DATE: MAY/93	SCALE: N.T.S.	W.O.No.:	DRAWN BY: BILL J.
DESIGNED BY	APPROVED BY P.ENG.	DRAWING No. UGS–012	

TYPICAL ROAD CROSSING DUCT STRUCTURE



WARNING TAPE INFORMATION

TRENCH WIDTH	# OF WARNING TAPES	TAPE PLACEMENT
UP TO 305mm (12")	1	CENTRED ON THE TRENCH.
GREATER THAN 305mm (12") UP TO AND INCLUDING 762mm (30")	2 (OR MORE)	PLACED NO MORE THAN 76mm (3") FROM THE SIDE OF THE TRENCH AND NOT MORE THAN 305mm (12") APART.
GREATER THAN 762mm (30")	3 (OR MORE)	PLACED NO MORE THAN 76mm (3") FROM THE SIDE OF THE TRENCH AND NOT MORE THAN 305mm (12") APART.

NOTE: THE TRENCH WIDTH EXCLUDES THE ADDED WIDTH FOR JOINT USE GAS LINE INSTALLATION (IE. HYDRO PART OF TRENCH ONLY).

NOTES:

1. NUMBER OF 100mm(4") DUCTS MAY VARY AS TO THE NUMBER OF SERVICES CROSSING ROAD.
2. MAXIMUM OF ONE SECONDARY TRIPLEX CABLE PER 100mm(4") DUCT.
3. MAXIMUM OF ONE PRIMARY CABLE PER 100mm(4") DUCT.
4. MAXIMUM OF ONE STREET LIGHTING CABLE (3–#6 WIRES) PER 50mm(2") DUCT.
5. ONE SPARE 100mm (4") DUCT IS TO BE PLACED IN ALL ROAD CROSSINGS UNDER THE ROADWAY FROM 450mm (1.5') PAST EACH CURB. IN ADDITION, SPARE TRENCH DUCTS MAY PASS THROUGH THE ROAD CROSSING.
6. ALL HYDRO DUCTS TO BE ENCASED IN 100mm(4") ENVELOPE OF CONCRETE.
7. CONCRETE TO BE 20 MPa, 10mm PEASTONE, 80mm SLUMP. WINTER HANDLING WHEN REQUIRED.
8. SEE DRAWING No. UGS–014 FOR OTHER VARIATIONS OF CONCRETE ENCASED DUCTS.
9. CITY OF CAMBRIDGE AND TOWNSHIP OF NORTH DUMFRIES – MIN. 914mm (36") TO THE TOP OF CONCRETE.
BRANT COUNTY – MIN. 1000mm (39") TO MOST SHALLOW UTILITY (ie. BELL, ROGERS, HYDRO) (GAS IS NOT JOINT USE).
CITY OF BRANTFORD – MIN. 900mm (36") TO MOST SHALLOW UTILITY (ie. BELL, ROGERS, HYDRO) (GAS IS NOT JOINT USE).
FOLLOW OHSA FOR TRENCH DEPTHS/SHORING ETC.

REV.	DATE			CHEK'D. BY
7.	SEPT. 21/23	GBE LOGO UPDATED	RS	
6.	JAN. 12/18	REVISED MINIMUM COVER FOR ADDITION OF BRANT COUNT AND CITY OF BRANTFORD.	STW	
5.	NOV. 24/06	ADDED WARNING TAPE INFORMATION. REMOVED FLOWABLE FILL FOR REGION.	RS	
4.	APR. 11/03	Revised power cable configuration installation	EV	
3.	MAY 10/00	ADDED JOINT USE TRENCH WITH GAS.	RS	
2.	MAY 20/99	MINOR UPDATE.	RS	
1.	OCT. 22/97	GENERAL UPDATE	RS	

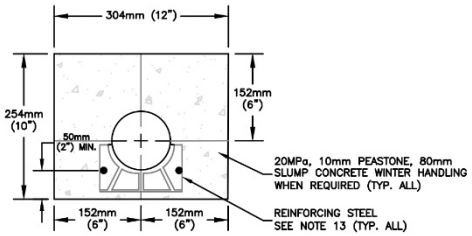
GrandBridge ENERGY

TITLE: HYDRO CROSSING UNDER ROADWAY– CONCRETE ENCASED DUCT STRUCTURE.

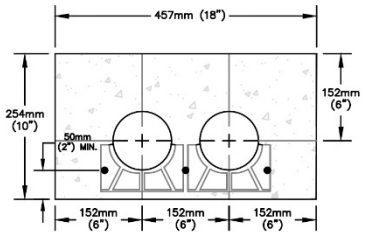
DATE: MAY/93	SCALE: N.T.S.	W.O.No.:	DRAWN BY: BILL J.
DESIGNED BY	APPROVED BY P.ENG.	DRAWING No. UGS–013	

NOTES

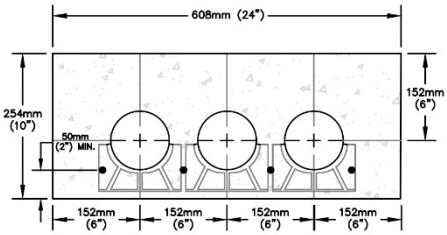
1. DUCT BANK TO HAVE COVER AS SPECIFIED ON DRAWINGS UGS–013 & UGS–015 & TO BE GRADED TOWARDS THE CURB.
2. DUCT TO BE 100mm(4") DB2/ES2 TYPE II PVC PER CSA 22.2 NO.211.1 (LATEST REVISION)
3. ALL DUCT CONNECTIONS SHALL BE SOLVENT WELDED (GLUED) AS PER DUCT MANUFACTURER'S RECOMMENDATIONS. WAIT MINIMUM 30 MINUTES BEFORE POURING CONCRETE AFTER APPLYING SOLVENT.
4. ENDS OF DUCTS TO BE CAPPED & MARKED WITH MARKING DISC.
5. CONCRETE TO BE 20MPa, 10mm PEASTONE, 80mm SLUMP.
6. ALL DUCTS TO BE ENCASED WITH MIN. 100mm(4") CONCRETE.
7. ALL BOTTOM DUCTS TO HAVE A MIN. 50mm(2") CONC. UNDERNEATH.
8. SPACERS TO BE PLACED UNDER EACH DUCT LAYER WITH MAX. CENTER TO CENTER DISTANCE OF 3.0m (10').
9. DUCT JOINTS TO BE STAGGERED A MIN. OF 152mm(6") & LOCKED WITH AN APPROVED COUPLING.
10. BELL ENDS ARE TO BE USED FOR EACH TERMINATION IN PULLING PITS OR CONCRETE ENCLOSURES.
11. EACH DUCT TO BE CLEANED & 3/4", 2,500 Lbs. POLYESTER MULE/PULLING TAPE INSTALLED CONTINUOUSLY – (DO NOT TIE TAPE END TO END OR KNOT TOGETHER).
12. CABLE TIES SHALL BIND DUCTS & SPACERS EVERY 2.0m (6'). DUCT BANK IS TO BE ANCHORED TO PREVENT FLOATING.
13. DUCTBANK SHALL BE REINFORCED WITH NON PRE–STRESSED 15mm (5/8") DEFORMED STEEL REINFORCING BARS. GRADE 400 AND CONFORMING WITH C.S.A. G30.18 (LATEST REVISION). REINFORCING BARS SHALL BE INSTALLED CONTINUOUSLY, MINIMUM 300mm OVERLAP AND TIED.



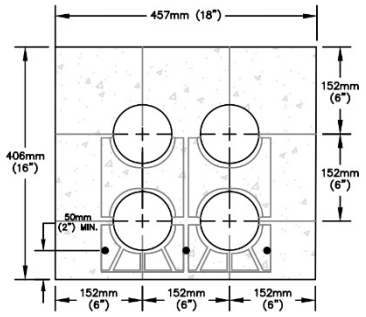
1 DUCT – 1W1H



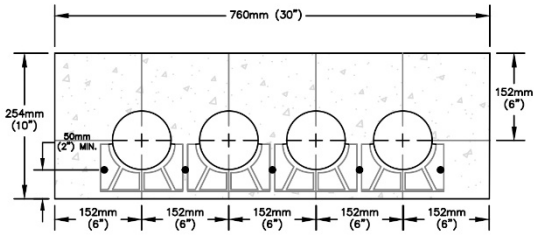
2 DUCTS – 2W1H



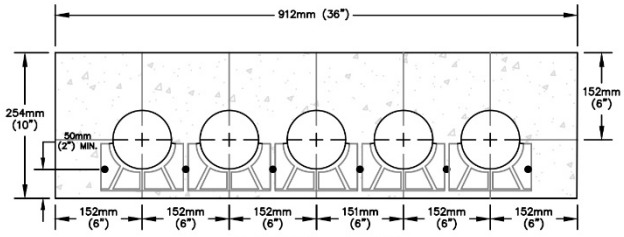
3 DUCTS – 3W1H



4 DUCTS – 2W2H



4 DUCTS – 4W1H



5 DUCTS – 5W1H

0	JUN. 23/15	ADD REINFORCEMENT BARS TO STANDARD DETAIL		SF

GrandBridge ENERGY

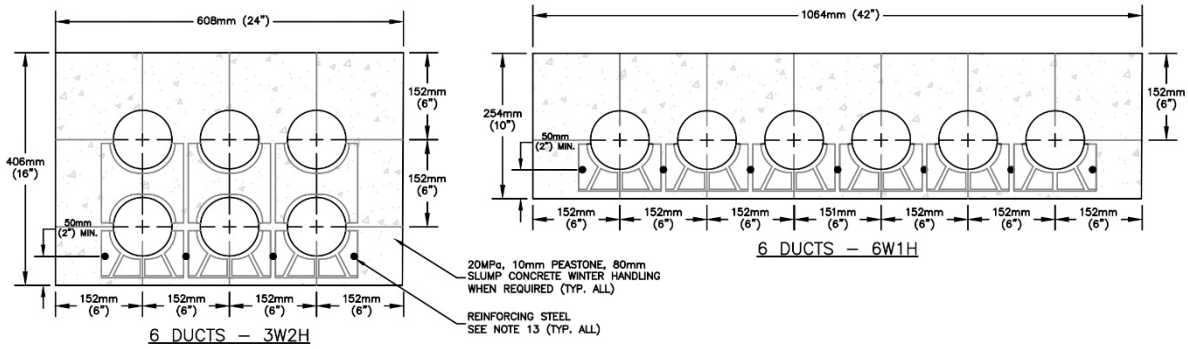
TITLE: TYPICAL CONCRETE ENCASED DUCT STRUCTURES WITH REINFORCEMENT – 1 TO 5 DUCTS

DATE:	SCALE:	W.O.No.:	DRAWN BY:
JUNE/23	N.T.S.		S. FREIHAUT

S. FREIHAUT	P.Eng.	DRAWING No.
DESIGNED BY	APPROVED BY P.ENG.	UGS–014–A

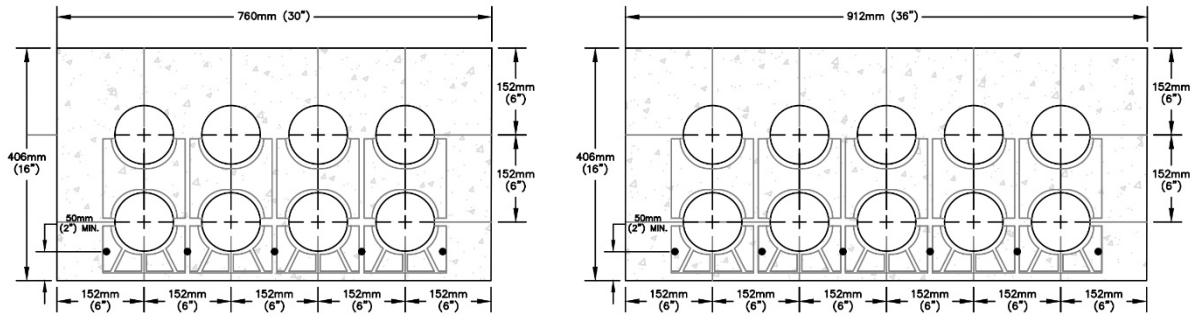
NOTES

1. DUCT BANK TO HAVE COVER AS SPECIFIED ON DRAWINGS UGS–013 & UGS–015 & TO BE GRADED TOWARDS THE CURB.
2. DUCT TO BE 100mm(4") DB2/ES2 TYPE II PVC PER CSA 22.2 NO.211.1 (LATEST REVISION)
3. ALL DUCT CONNECTIONS SHALL BE SOLVENT WELDED (GLUED) AS PER DUCT MANUFACTURER'S RECOMMENDATIONS. WAIT MINIMUM 30 MINUTES BEFORE POURING CONCRETE AFTER APPLYING SOLVENT.
4. ENDS OF DUCTS TO BE CAPPED & MARKED WITH MARKING DISC.
5. CONCRETE TO BE 20MPa, 10mm PEASTONE, 80mm SLUMP.
6. ALL DUCTS TO BE ENCASED WITH MIN. 100mm(4") CONCRETE.
7. ALL BOTTOM DUCTS TO HAVE A MIN. 50mm(2") CONC. UNDERNEATH.
8. SPACERS TO BE PLACED UNDER EACH DUCT LAYER WITH MAX. CENTER TO CENTER DISTANCE OF 3.0m (10').
9. DUCT JOINTS TO BE STAGGERED A MIN. OF 152mm(6") & LOCKED WITH AN APPROVED COUPLING.
10. BELL ENDS ARE TO BE USED FOR EACH TERMINATION IN PULLING PITS OR CONCRETE ENCLOSURES.
11. EACH DUCT TO BE CLEANED & 3/4", 2,500 Lbs. POLYESTER MULE/PULLING TAPE INSTALLED CONTINUOUSLY – (DO NOT TIE TAPE END TO END OR KNOT TOGETHER).
12. CABLE TIES SHALL BIND DUCTS & SPACERS EVERY 2.0m (6'). DUCT BANK IS TO BE ANCHORED TO PREVENT FLOATING.
13. DUCTBANK SHALL BE REINFORCED WITH NON PRE–STRESSED 15mm (5/8") DEFORMED STEEL REINFORCING BARS. GRADE 400 AND CONFORMING WITH C.S.A. G30.18 (LATEST REVISION). REINFORCING BARS SHALL BE INSTALLED CONTINUOUSLY, MINIMUM 300mm OVERLAP AND TIED.



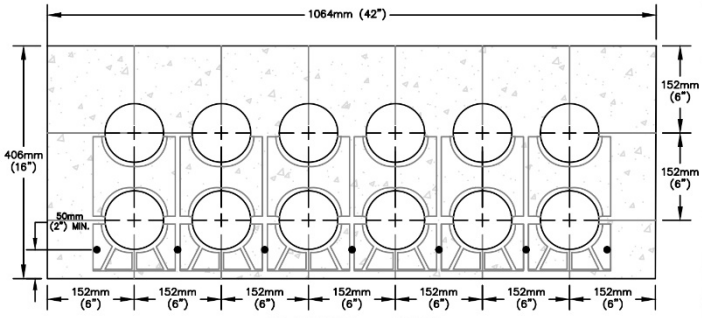
6 DUCTS – 3W2H

6 DUCTS – 6W1H



8 DUCTS – 4W2H

10 DUCTS – 5W2H



12 DUCTS – 6W2H

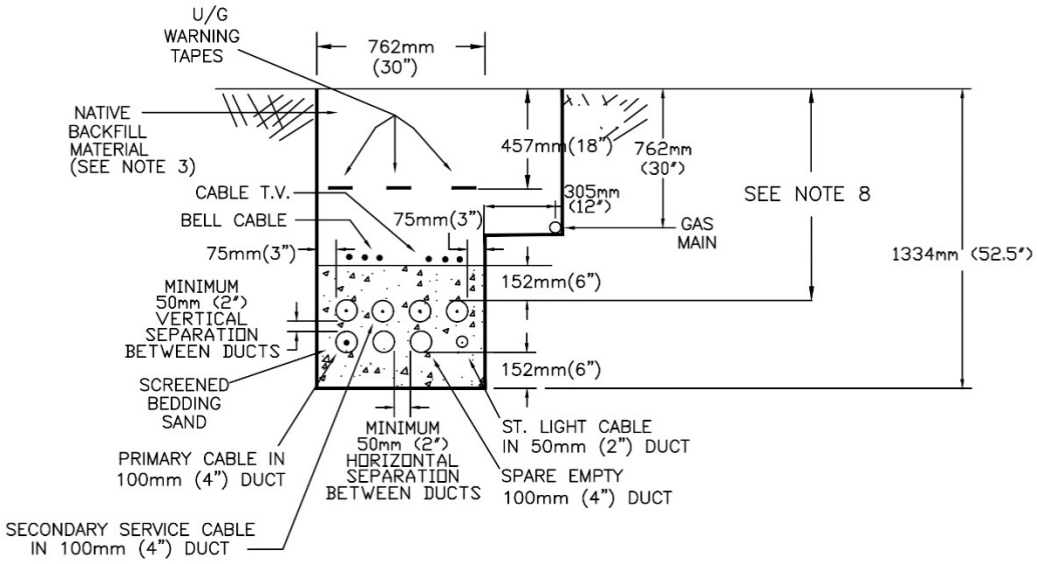
0	JUN. 23/15	ADD REINFORCEMENT BARS TO STANDARD DETAIL		SF

GrandBridge ENERGY

TITLE: TYPICAL CONCRETE ENCASED DUCT STRUCTURES WITH REINFORCEMENT – 6 TO 12 DUCTS

DATE:	SCALE:	W.O.No.:	DRAWN BY:
JUNE/23	N.T.S.		S. FREIHAUT

S. FREIHAUT	P.Eng.	DRAWING No.
DESIGNED BY	APPROVED BY P.ENG.	UGS–014–B



WARNING TAPE INFORMATION

TRENCH WIDTH	# OF WARNING TAPES	TAPE PLACEMENT
UP TO 305mm (12")	1	CENTRED ON THE TRENCH.
GREATER THAN 305mm (12") UP TO AND INCLUDING 762mm (30")	2 (OR MORE)	PLACED NO MORE THAN 76mm (3") FROM THE SIDE OF THE TRENCH AND NOT MORE THAN 305mm (12") APART.
GREATER THAN 762mm (30")	3 (OR MORE)	PLACED NO MORE THAN 76mm (3") FROM THE SIDE OF THE TRENCH AND NOT MORE THAN 305mm (12") APART.

NOTE: THE TRENCH WIDTH EXCLUDES THE ADDED WIDTH FOR JOINT USE GAS LINE INSTALLATION (IE. HYDRO PART OF TRENCH ONLY).

NOTES

1) DEPTH OF ALL DUCTS TO BE AS INDICATED IN DETAIL/NOTES.
2) ALL DUCTS TO HAVE 152mm(6") OF CLEAN BEDDING SAND BELOW AND 152mm(6") ABOVE DUCTS.
3) NATIVE BACKFILL MATERIAL TO BE COMPACTED TO 98% PROCTOR DENSITY AS PER ONTARIO PROVINCIAL STANDARD SPECIFICATION 501.
4) SAND SHALL BE SCREENED BEDDING APPROVED BY GBE.
5) ALL CABLES ARE TO BE INSTALLED IN DIRECT BURIED DUCT (1 CABLE PER DUCT, 100mm DUCT FOR PRIMARY AND SECONDARY, 50mm DUCT FOR STREET LIGHTING).
6) ONE SPARE 100mm DUCT IS TO BE PLACED IN ALL TRENCHES. IN ADDITION, ONE SPARE 100mm DUCT IS TO BE PLACED FOR EACH PRIMARY CABLE IN THE TRENCH.
7) ALL DUCT CONNECTIONS SHALL BE SOLVENT WELDED (GLUED) AS PER DUCT MANUFACTURER'S RECOMMENDATIONS. 8)CITY OF CAMBRIDGE AND TOWNSHIP OF NORTH DUMFRIES –MIN. 914mm (36") TO THE TOP OF GBE DUCT. BRANT COUNTY – MIN. 1000mm (39") TO MOST SHALLOW UTILITY (ie. BELL, ROGERS, HYDRO) (GAS IS NOT JOINT USE). CITY OF BRANTFORD – MIN. 900mm (36") TO MOST SHALLOW UTILITY (ie. BELL, ROGERS, HYDRO) (GAS IS NOT JOINT USE).

REV.	DATE			CHEK'D. BY
7.	SEPT. 21/23	GBE LOGO UPDATED	RS	
6.	JAN. 12/18	REVISED DEPTH OF DUCTS FOR ADDITION OF BRANT COUNTY AND CITY OF BRANTFORD.	STW	
5.	NOV. 24/06	ADDED WARNING TAPE INFORMATION.	RS	
4.	APR. 11/03	Revised Sand Specification and Gas Plant Depth	EV	
3.	NOV. 22/00	REVISED GAS LOCATION	ST	
2.	MAY 10/00	ADDED JOINT USE TRENCH WITH GAS.	RS	
1.	OCT. 22/97	COMPLETE UPDATE	RS	

GrandBridge ENERGY

TITLE: TYPICAL TRENCH SECTIONS SHOWING HYDRO, BELL, CABLE T.V. & GAS

DATE: MAY/93	SCALE: N.T.S.	W.O.No.:	DRAWN BY: S. TILLEY
ENGINEERING DESIGNED BY		APPROVED BY P.ENG.	DRAWING No. UGS–015