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SERVICE CONDUIT SIZES AND SPECIFICATIONS
UNDERGROUND

I. GENERAL REQUIREMENTS

A. Conduit provided by the Customer shall meet the following specifications:

1. Straight Lengths: PVC, DB-120, 400,000 psi minimum modulus (500,000 not acceptable), rated for 90°C cable, meeting the requirements of ASTM F512, latest edition or EPC-40-PVC (schedule 40), meeting the requirements of NEMA TC-2, latest edition.

2. Elbows and Fittings: EPC-40-PVC (schedule 40), three-foot radius, rated for 90°C cable, meeting the requirements of NEMA TC-2, latest edition.

B. Size, number of conduits, and encasement requirements are shown on the SRP design.

C. Maximum change in direction without elbow shall not exceed 5 degrees in 20 feet.

D. Customer shall be responsible for repairing new and existing conduit damaged prior to SRP installing cable. Conduits will be accepted following installation of cable. Do not use metal materials to tie or rack conduits.

E. The portion of conduit installed through an exterior building wall, floor, or roof shall have external seals on the outside surface of the conduit at the point of entry to the building intended to limit the likelihood of the entrance of gas into the building.

F. The table below outlines the service conduit requirements from a transformer or j-box to the Customer’s SES.

<table>
<thead>
<tr>
<th>Service Entrance Ampacity</th>
<th>1Ø, 3 Wire</th>
<th>3Ø, 4 Wire</th>
<th>2400/4160</th>
<th>7200/12470</th>
</tr>
</thead>
<tbody>
<tr>
<td>225 or less</td>
<td>1-2.5&quot; *</td>
<td>1-2.5&quot;</td>
<td>3-3&quot;</td>
<td>3-3&quot;</td>
</tr>
<tr>
<td>320/400</td>
<td>1-4&quot; **</td>
<td>1-4&quot;</td>
<td>3-3&quot;</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>2-4&quot; ***</td>
<td>2-4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>2-4&quot;</td>
<td>3-4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,000</td>
<td></td>
<td>4-4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,200</td>
<td></td>
<td>5-4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,600</td>
<td></td>
<td>7-4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,000</td>
<td></td>
<td>10-4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,500</td>
<td></td>
<td>13-4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,000</td>
<td></td>
<td>19-4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,600</td>
<td></td>
<td>25-4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4,000 (120/208 V Only)</td>
<td></td>
<td>30-4&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 2" conduit may be used if existing.
** 2.5" or 3" conduit may be used for wall mounted residential single meter installations, as specified by SRP.
*** 2-3" conduit may be used for residential single meter installations.
NOTES

1. A single, three-phase transformer may serve up to four separate commercial SES in the same trench when the total number of service conduits does not exceed 13.

2. The service trenches from multiple three-phase transformers shall be separated by at least 6’ of undisturbed earth.

3. Except at the transformer, three-phase service conduits shall be separated from primary conduits by at least 6’ of undisturbed earth. Contact Distribution Design when appropriate trench separation is unobtainable.

4. Service risers shall be rigid or intermediate metal, or approved fiberglass, installed per service riser requirements on page 3-1.

5. Exposed accessible conduits entering an SES shall be rigid or intermediate metal or approved fiberglass. The transition to buried PVC shall occur at 12” to 36” upon entering earth. Customer shall be responsible for bonding and maintaining all metal conduit.

6. All requirements on page 3-1 apply.

7. The number of conduits in above table is based upon 100% of the SES ampacity, assuming 80% load factor. If load factor is greater, contact Distribution Design.

8. Trenches containing 13 or more service conduits shall be racked with spacers and encased as follows:
   A. Encased in 2” of controlled low strength material (1 ½ sacks cement per cubic yard).
      See page 6-18 and 6-19 for backfilling requirements
   B. Conduits shall be distributed over 5 vertical columns. Horizontal and vertical spacing between conduits shall be 2”. Place spacers at 6’ intervals. See Contractor-Supplied Material for available spacers or contractor may provide their own that meet distribution and spacing requirements.

9. Install end bell fittings as per this page at conduit stub ups at SES. Install temporary conduit plugs (no duct tape) tied to a flat pull tape at all stub-up locations.
**PVC Straight and Elbow Bellend End**

<table>
<thead>
<tr>
<th>Conduit Diameter</th>
<th>Minimum Socket Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1/2&quot;</td>
<td>2 3/8&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>2 7/8&quot;</td>
</tr>
</tbody>
</table>

**Couplings**

Shall not be less than the inside diameter of the DB120 straight conduit it connects.

<table>
<thead>
<tr>
<th>Conduit Coupling Diameter</th>
<th>Coupling SRP Material Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1/2&quot;</td>
<td>5034166</td>
</tr>
<tr>
<td>3&quot;</td>
<td>5034168</td>
</tr>
</tbody>
</table>

Socket depth shall be 2 1/2" minimum for all sizes of conduit per Tri-utility conduit spec 7.8

**End Bell Fitting**

Conduit stub up must be spaced minimum 3/4" apart to install end bell fitting.

**Reducer at Pull Fitting**

3" x 2.5" reducer at pull section only zinc plated (provided by customer)

3" conduit from stub-out (provided by customer)
Required Conduit Configuration to fit Riser Boots
(The quadrant configuration for the pole riser will be specified by the Designer)

1-4"
OR
1-3"
OR
1-2.5"

2-4"

3-3"
OR
3-2.5"

4-2.5"

36" MIN. SECONDARY
48" MIN. PRIMARY

FLUSH TO POLE
PLUMB AND SECURED
CONDUIT STUB-UP
(TAPE
(NON-METALLIC)
STRAIGHT
CONDUIT
COUPLING
24" HAND-DIG ONLY

24" HAND-DIG ONLY

CONDUIT STUB-UP
PLUMB AND SECURED
FLUSH TO POLE

FINAL GRADE

48" MIN. PRIMARY
36" MIN. SECONDARY

DO NOT DISTURB
COMPACITION/ SOIL IN THIS AREA

PRIMARY CONDUIT/ SECONDARY CONDUIT
36" RADIUS 90° ELBOW (BELOW GRADE)

24" HAND-DIG ONLY WITHIN 24"
OF POLE LOCATION

HAND-DIG only with in 24"
NOTES
1. Refer to Blue Stake Law and OSHA requirements before excavating.
2. Securely cover or barricade all open trenches and excavations per OSHA requirements before leaving job site.
3. Customer shall install trench and conduit per the work order drawings and/or specifications provided by the SRP Design resource.
4. Excavating under SRP pad-mounted equipment or pull-boxes is prohibited (j-boxes are excluded).
5. Carefully excavate in a safe and prudent manner with hand tools within shaded area.
6. For exposed conduit or direct-buried cable, customer shall protect as necessary to avoid damage.
7. Contact SRP prior to any excavation near SRP poles.
NOTES

This buried electronic marker is to be used for marking the location of connection points, t-taps, mole assemblies, conduit stub-outs or other locations which may need to be located at some time in the future.

NOTES

1. Bury at least 8" above energized conductor. Closer distance will cause the marker to be ineffective at 4’ or greater depth.

2. The marker is to be buried flat and level.

3. Cover with at least 4" of select back fill to prevent accidental movement or damage during back fill. For service conduit, it may be in bottom of trench.

4. Care should be taken to ensure that cable, tin foil, or other extraneous metal does not get discarded into the trench prior to back fill. Metal in close proximity will render the marker ineffective.

5. For permanent installation with a buried j-box, drill two holes in lid and secure marker to lid with nylon cable tie.
NOTES

1. Spool duct stub-outs shall be installed straight and at required specified depth.

2. Two or more spool ducts shall have duct spacers installed. Where 3’ or more of spooled duct is exposed in bore pit, two sets of duct spacers shall be installed as shown and arranged with specified conduit racking.

3. Spool duct stub-outs shall be capped with PVC conduit caps, but not glued.

4. Stub-out pit may be back filled if required, but must have electronic marker and a red flag over end of conduit.

5. With black felt tip pen, write the device conduit is from and phase.

6. Spool duct shall have approved 2,500 pound, continuous (no tied pieces), non-conductive, pre-lubricated, flat pull tape, free moving and not glued to duct.
I. Purpose & General Requirements

A. As of September 2004, SRP requires reports documenting 100% compliance of subgrade compaction for Customer-installed SRP distribution facilities. The reporting is for commercial and residential underground utility installations and is to be performed by consulting engineering test firms hired by Customers or their contractors (Customer-provided excavations and trenches only). This will include density/compaction testing below SRP utility equipment (transformers, switchgear, etc.), verification of compacted separation between utilities in joint use trenches, and cover compaction.

B. This document defines the requirements to ensure SRP facilities installed by others meet all SRP requirements and industry standards in relation to compacted subgrade. In accordance with SRP Appendix B (page 6-17), the subsurface beneath all SRP utility equipment (transformers, switchgear, etc.) must be compacted to prevent settlement. In addition, electric industry codes provide minimum compacted separation requirements for joint use trench installations. The Customer/developer shall hire a consulting engineering test firm to perform all required field and laboratory testing. Typically, many of these same tests need to be performed for street and municipal utility construction associated with the development work. The Customer/developer must submit test results to SRP for review and approval. Test result documentation from the consulting engineering test firm must be sealed by one of the firm’s registered professional civil engineers and affirm that the installations tested meet all SRP requirements.

C. Only technicians qualified in soils material testing, following accepted ASTM, test methods shall perform testing. The consulting engineering test firm must verify that their field personnel understand code and SRP requirements.

D. At SRP’s discretion, spot field checks of Customer-performed work will be done by SRP to verify test accuracy.

E. Customers may request SRP to perform testing with direct costs paid by the Customer. These costs will vary depending upon the scope of the work, and may include one or more site visits and one laboratory Standard Proctor test.

II. Requirements for SRP Utility Equipment

All fill below and around foundation pads for pad-mounted electric utility equipment (transformers, switches, fuses, etc.) shall meet either of the two following requirements (flow chart noting the testing and inspection process is provided in Appendix B):

A. Slurried Backfill: ½-sack cement-controlled, low-strength material (CLSM) may be placed in lieu of compacted backfill. CLSM shall meet the material requirements of MAG Section 728 and the placement requirements of MAG Section 604. CLSM should be used where no future excavation into compacted backfill for additional electric installations is anticipated. The finished surface shall be level and not vary by more than a quarter inch across the specified grade. Under no circumstance shall CLSM unconfined compressive strength exceed 100 psi at 28 days.
COMPACATION REQUIREMENTS

The Customer/developer shall submit to SRP a legible weightmaster’s certificate (delivery ticket) with test data. The delivery ticket shall include:

- Date
- Truck number
- Name of CLSM supplier
- Name of contractor
- Job destination
- Number of cubic yards in batch
- Type of cement
- Supplier’s mix design code number
- Ticket serial number
- Time the transit mixer was loaded and the amount of water added at any time after

B. Compacted Backfill: Backfill (typically native soil) shall be compacted to at least 95% of maximum standard Proctor density and within 2% of optimum moisture content. Testing shall be as noted in Table 1. This compaction requirement shall be for soils and fills disturbed to the full depth below and within one foot outside pad area in contact with the soil. Fill soils shall be compacted as well as practical in window areas between and around conduits. Compacted soil base must be at final blue top elevation prior to testing if the Customer intends to place the concrete utility fixture pad. Aggregate backfills shall not be used under pads.

<table>
<thead>
<tr>
<th>Type of Tests Required</th>
<th>Specification</th>
<th>Sampling Point</th>
<th>Minimum Sampling Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proctor Density</td>
<td>ASTM D698</td>
<td>In place</td>
<td>Once per soil type</td>
</tr>
<tr>
<td>Compaction</td>
<td>ASTM D1556, ASTM D2922/3017</td>
<td>Once per soil type, min. one test per pad*</td>
<td></td>
</tr>
</tbody>
</table>

* Each lift must be tested if compaction quality below final grade is suspect. Field technician shall inspect below top lift (probe or other method) and PE must verify minimum compaction compliance to full depth of compacted fill.

C. Compaction test reports shall be provided for all industrial, commercial and residential utility pad installations. Testing includes sampling of soil and performing a laboratory Standard Proctor test (this determines the maximum density for the specific soil) and field sand cone or nuclear gauge density tests. Each 12-inch lift of compacted soil or fill at pads shall be tested.

Only SRP electrical conduits shall be below equipment pads.
III. **Joint Gas/Electric Trench Construction (Shelf or Step-Type Trenches)**

Code and industry standards require that there be at least one foot of compacted separation cover between underground gas and electric conduits. This separation cover must be with “well tamped earth” that will not significantly compress or consolidate over time. Tests performed by SRP have determined that the optimal relative density of the separation soil is at least 85% of maximum Standard Proctor density. For standard rectangular-shaped trenches, the separation is vertical and must be accomplished by compacting native soil or placing a granular slurry backfill. Minimum clearance between utilities is 12 inches and must be maintained. Requirements for joint electric gas installations are shown on pages 5-1 and 5-4, and in Appendix B.

Shelf or step-type trenches that utilize undisturbed native soils to provide the minimum vertical separation distance may also be used. The electric conduits are placed within the lower excavated trench “step” and are backfilled level with the “shelf” with native soil using customary methods such as water settling. This backfill is not tested, but must be firm so that there is a stable surface for placement of communication conduit. The gas conduit is then set on the “shelf” portion of the trench, resting on undisturbed native soil that is presumed to have a relative density of at least 85% of maximum Standard Proctor density. Requirements are shown in Appendix B.

A. Limitations for use of shelf or step-type trenches are as follows:

1. Space from the top of the uppermost electric conduit to the bottom of the shelf must be at least 12 inches.
2. Depth of the trench at the bottom of the step must not exceed 60 inches.
3. Gas conduit must be placed upon the shelf portion of the trench.
4. Soils must be cohesive – able to have a clean step and shelf cut while maintaining shape and stability throughout the conduit installation process.
5. Low plasticity and non-plastic silts, sands, gravels and fractured rock are not acceptable subsurface conditions for shelf or step-type trenches. The soil types acceptable include:
   - Clays
   - Silty, sandy or gravelly clays
   - Clayey sands, clayey silts or clayey gravels
   - Cemented soils

B. Soil conditions shall be reviewed during the pre-construction meeting to determine whether SRP will allow this type of trench construction. It is the trenching contractor’s responsibility to provide a stable shelf that does not ravel or collapse during trench work.
C. Unless a shelf or step-type trench is pre-approved by SRP for the joint gas/electric installation, compacted separation cover (defined as the backfill within one foot above the top of electric conduit) shall be utilized and tested as noted below. Under no circumstance will electric cable be installed within conduit until minimum compacted separation cover is verified and sealed by the Customer’s consulting engineering test firm. A flow chart noting the testing and inspection process is provided in Appendix B:

D. Backfill shall be compacted to at least 85% of maximum Standard Proctor density and within 2% of optimum moisture content. Testing shall be as noted in Table 2. This table applies to all primary and secondary within public utility easements and ROW.

<table>
<thead>
<tr>
<th>Type of Tests Required</th>
<th>Specification</th>
<th>Sampling Point</th>
<th>Minimum Sampling Frequency (in PUE and ROW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proctor Density</td>
<td>ASTM D698</td>
<td>In place</td>
<td>Once per soil type</td>
</tr>
</tbody>
</table>
| Compaction             | ASTM D1556, ASTM D2922/3017 | In place       | • 1 for each 500’ of main line trench  
• 1 for every 4 street crossings  
• Visually examine all trenches to verify compaction has been done |

E. Compaction test reports shall be provided for all joint gas/electric trench construction unless a shelf or step-type trench is used. Testing shall include sampling of soil, performing a lab Standard Proctor test, and performing field sand cone or nuclear gauge density tests. Cover thickness shall be verified by the testing.

F. If the compaction testing is not properly coordinated with backfill operations, Customers or their contractors must excavate excess backfill to within 12 inches of the top of the conduit so that the consulting engineering test firm may test minimum compacted separation cover. The standard was created so that gas could be installed above electric without SRP involvement once the separation soil was properly in place.

IV. Electric Only Trench Construction

A. Backfill and compaction requirements for electric conduits (no joint gas installation) are provided on pages 6-19 and 6-20. No reports or documentation is required by SRP for these types of installations. Testing and documentation may be required by local agencies for work done within public easements or the ROW.

B. Backfill within six inches of conduit shall have no solid material with sharp edges greater than 1½ inches in maximum dimension and contain more than 50% passing the 3/8 inch sieve. The balance of the trench backfill shall have no solid material with sharp edges greater than four inches in maximum dimension and contain more than 50% passing the 3/8 inch sieve.
C. The degree of compaction shall meet the minimum requirements of pages 6-19 and 6-20, or as required by local municipal standards, if greater.

V. Compliance Reporting

A. Customers or their contractors must submit all required documents verifying compliance with the standards herein prior to placement of SRP’s electric utility equipment or installation or electric cable within conduits.

1. For utility equipment, the following submittals must be provided:
   a) If backfill is compacted, submit field and laboratory density test results for all required locations per Section B and with all information for utility equipment noted in Figure 2 of Appendix A. Include a sketch noting the location of all tests (or detailed written description including equipment number); along with a material testing report cover letter sealed by a registered professional civil engineer representing the Customer’s consulting engineering test firm, in accordance with the example in Appendix A.
   b) If CLSM backfill is used, submit all weightmaster’s certificates (delivery tickets). Include a sketch referencing the location of placed backfill and the related delivery ticket numbers.

2. For joint gas/electric trenches, the following submittals must be provided:
   a) Submit field and laboratory density test results for all required locations per number III. and with all information for joint trench work noted in Figure 3 of Appendix A. Include a sketch noting the location of all tests (or detailed written description identifying test location) along with a material testing report cover letter sealed by a registered professional civil engineer representing the Customer’s consulting engineering test firm in accordance with the example in Appendix A (not required for shelf or step-type installations).
   b) Periodic submittal of required results may be provided for review as the work completed while the total project is underway. These pre-submittal reports shall contain the same information as completed final reports, but are valid only for the utility equipment pads and joint-trench lengths noted in the report. Wire and concrete pad installations may proceed for utility equipment pads and joint-trench lengths that meet compaction requirements and have been approved.
APPENDIX A
CUSTOMER-INSTALLED SRP DISTRIBUTION FACILITIES
FORMS AND SUBMITTALS

I. Utility Equipment Testing – Compaction
   A. All test results shall be provided and shall be sealed by a registered professional civil
      engineer. For compacted backfill below utility fixtures, the following submittals must be
      provided:
      1. Field and laboratory density test results (including Standard Proctor Test results) for all
         locations with all information as noted in Figure 2.
      2. A sketch noting the location of all tests. NOTE: A markup of job plans is acceptable.
      3. A material testing report cover letter sealed by a registered professional civil engineer
         representing the Customer’s consulting engineering test firm in accordance with
         Figure 1.
   B. All compaction test failures will be re-tested per ASTM D1556. Any resulting failure will be
      re-worked before re-tests are performed. Gauges used per ASTM D2922/3017 shall be
      calibrated against ASTM D1556 at least every 10 tests. Rock correction shall be used for
      any material greater than 4.75mm to obtain maximum proctor density.

II. Joint Gas/Electric Trench Testing
   A. All test results shall be provided and shall be sealed by a registered professional civil
      engineer. For joint gas/electric installations, with the exception of shelf or step-type
      installations, the following submittals must be provided:
      1. Field and laboratory density test results (including Standard Proctor Test results) for all
         locations with all information as noted in Figure 3.
      2. A sketch noting the location of all tests. NOTE: A markup of job plans is acceptable.
      3. A material testing report cover letter sealed by a registered professional civil engineer
         representing the Customer’s consulting engineering test firm in accordance with
         Figure 1.
   B. All compaction test failures will be re-tested per ASTM D1556. Any resulting failure will be
      re-worked before re-tests are performed. Gauges used per ASTM D2922/3017 shall be
      calibrated against ASTM D1556 at least every 10 tests. Rock correction shall be used for
      any material greater than 4.75mm to obtain maximum proctor density.

III. Electric Only Trench Testing
    No SRP reporting or submittal requirements necessary.
Figure 1: Example – Material Testing Report Cover Letter

(Consulting engineering test firm letterhead with name and address)

(Date of report)

SRP
Manager, Homebuilder Management Center, MS XCT330
P.O. Box 52025
Phoenix, AZ 85072-2025

Project: (Project name)
(Project location)
(Project number)

Re: Materials Testing
(Type of testing - i.e., Transformer pads, Trench backfill)

In accordance with the request of the (Customer/developer name), we have completed the materials testing at the subject project.

To the best of my knowledge and belief, the materials were found to be substantially in conformance with the latest SRP standard specifications for distribution facilities construction. Sampling, laboratory and field-testing were in accordance with the latest SRP schedule of minimum level of testing.

Attached find the laboratory and field-test performed on this work.

Respectfully submitted,
(Company name)

(Signed and sealed by Civil Engineer registered in the State of Arizona)
Figure 2: Example – Field Density Test Results

(Consulting engineering test firm letterhead with name and address)

<table>
<thead>
<tr>
<th>Date Test Taken</th>
<th>Pad Location</th>
<th>% Moisture</th>
<th>Dry Density (PCF)</th>
<th>% Compaction</th>
<th>Test</th>
<th>Lift Tested</th>
<th>Depth of Backfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Taken</td>
<td>Plan Station or Residential Address</td>
<td></td>
<td></td>
<td></td>
<td>N-S-P</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Location of test should be easily located on the approved plans. All stationing should follow approved plan stationing. Note test number on sketch or job plans and submit with test results.


Test Methods: ASTM: D-2922  D-3017  D-1556  D-698

Deficiency Report: Date Notified: ________________ Date Cleared: ________________

Customer Notified of Deficiency: Yes  No

Corrective Action Taken: ______________________________________________________
____________________________________________________________________________
____________________________________________________________________________
Figure 3: Example – Trench Construction Verification List

(Consulting engineering test firm letterhead with name and address)

Developer: _____________________________________________________________
Project: _____________________________________________________________
Location: _____________________________________________________________
City: _____________________________________________________________
Material: _____________________________________________________________
Contractor: _____________________________________________________________
Sampled by: _____________________________________________________________

<table>
<thead>
<tr>
<th>Date</th>
<th>Test Taken</th>
<th>Test Location</th>
<th>Depth to Top of Compacted Separation Cover</th>
<th>Depth to Top of Conduit</th>
<th>Conduit Condition</th>
<th>% Moisture</th>
<th>Dry Density (PCF)</th>
<th>% Compaction</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Test Taken</td>
<td>Plan Station</td>
<td></td>
<td></td>
<td></td>
<td>R-D</td>
<td></td>
<td>N-S-P</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes
(1) Location of test should be easily located on the approved plans. All stationing should follow approved plan stationing. Note test number on sketch or job plans and submit with test results.
(2) Depth to top of compacted separation cover – depth to top of conduit ≥ 12 inches.
(3) Depth to top of conduit ≥ 48 inches.

Conduit Condition: R – Round, D – Deformed
Test Methods: ASTM: D-2922  D-3017  D-1556  D-698
Deficiency Report: Date Notified: ________________  Date cleared:
Customer Notified of Deficiency:  Yes  No
Corrective Action Taken: ______________________________________________________
I. Backfill Around and Under Pad-Mounted Utility Equipment

- Excavate Trench: Remove all loose soil and deleterious material below and within one foot outside pad area.
- Install and stub up conduit.

SRP Conduit Inspection

Fail

Pass

Backfill with Native Soil \(^{(A)}\)

- Sample soil for maximum density determination.
- Perform in-place compaction test by certified lab technician.

Submit field and laboratory test/verifications to SRP sealed by Registered Professional Civil Eng.

Fail

Pass

- Remove backfill & re-compact
- Perform Proctor to verify compaction
- Verify compaction for full depth
- Verify pad at final grade
- Have RPCE seal field & lab results

SRP Inspection

Backfill with 1/2 Sack CLSM \(^{(B)}\)

- Strength > 100 psi: remove slurry
- Strength < 25 psi: remove slurry
- Submit slurry delivery ticket
- Verify pad at final grade
- Pad not level: grade as required

Submit slurry delivery ticket verifying CLSM to SRP

Fail

Pass

A. Place in maximum one-foot compacted lifts in accordance with ASTM D698 to at least 95% of maximum dry density and within 2% of optimum moisture content for all disturbed soils, and fill below and within one foot outside pad area in contact with the soil. Compact as well as practical in window areas between and around conduits. Pad must be at final blue top grade prior to testing. Aggregate backfills shall not be used under pads.

B. CLSM per the material requirements of MAG Section 728 (< 100 psi) and placed per the requirements of MAG Section 604. Finished surface shall be at final grade, level and not vary by more than ¼-inch across the specified grade.
II. Joint Gas – Electric Trench Construction

A. 12-inch minimum compacted separation lift in accordance with ASTM D698 to at least 85% of maximum dry density and within 2% of optimum moisture content. Verify minimum 12-inch compacted separation, minimum 48-inch depth of cover and condition of conduit after compaction. Verify all gas lines are at least 24 inches from any electrical device.

B. Verify minimum 12-inch separation in lower shelf, minimum 48-inch depth of cover, maximum 60-inch conduit depth and condition of conduit after compaction. Verify all gas lines are properly placed on shelf and are at least 24 inches from any electrical device.
SOIL TYPES, BACKFILL MATERIAL AND COMPACtion REQUIREMENTS

This information is to be superseded by any conflicting information that may be published in the SRP Excavation Safety Resource Manual. Contact SRP Safety Services for a copy of this manual.

NOTES

1. Measure trench depths from final grade stakes. Follow all trench depths specified on a job drawing. See clearance section for minimum cover and separation requirements.

2. Shore or slope trench walls as required by the latest revision of the Excavation Safety Manual.

3. The bottom of the trench shall be smooth and free of aggregate protruding more than $3/8$" above the bottom. If this condition cannot be obtained, cover the bottom of the trench with a level layer of sand with a grain size less than $3/8$" in diameter to cover all protrusions.

4. BACKFILL AND COMPACtion FOR CONDUIT IN NATIVE SOIL: Within 6" of the conduit, backfill material shall be free of broken concrete, paving, wood, glass or other solid material greater than 1½". This backfill shall contain more than 50% fines of a size that is $3/8$" or smaller. The balance of the trench backfill shall be free of solid material greater than 4" in maximum dimension and shall contain more than 50% fines of a size that is $3/8$" or smaller.

COMPACted FILLS

<table>
<thead>
<tr>
<th>MATERIAL ITEM #</th>
<th>MATERIAL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000113</td>
<td>GRANULAR</td>
<td>Well graded unwashed sand and gravel used in compacted subgrades for pavements and general backfill.</td>
</tr>
<tr>
<td></td>
<td>MAG Aggregate Base Coarse (ABC)</td>
<td></td>
</tr>
<tr>
<td>SAND</td>
<td>Soil mostly made of particles less than $3/16$&quot; in size, but containing little or no silt or clay.</td>
<td></td>
</tr>
<tr>
<td>NATIVE SOIL</td>
<td>Soil placed by nature that has not been altered by man and meets requirements of Note 4.</td>
<td></td>
</tr>
</tbody>
</table>

5. Use other backfill if it is more economical. Notify Civil Inspectors at least 48 hours prior to start of work to arrange for compaction testing.

6. Compact backfill to at least the percentage of maximum density listed in the following MAG Specification (as determined by ASTM D698), unless otherwise specified.

Contact the municipality concerned for repair requirements when a trench will be under pavement. The following table applies when there are no supplemental municipal requirements.
## SOIL TYPES, BACKFILL MATERIAL AND COMPACTION REQUIREMENTS

<table>
<thead>
<tr>
<th>MAG SPECIFICATION 601-2</th>
<th>FROM SURFACE TO 2' BELOW SURFACE</th>
<th>FROM 2' BELOW SURFACE TO TRENCH BOTTOM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.</strong> Under or within 2' existing or proposed pavement, curb, gutter or sidewalk</td>
<td>Native…………………….95%</td>
<td>All 95%</td>
</tr>
<tr>
<td></td>
<td>Granular……………………100%</td>
<td></td>
</tr>
<tr>
<td><strong>B.</strong> On any utility easement street, road or alley ROW outside limits of A</td>
<td>90%</td>
<td>90%*</td>
</tr>
<tr>
<td><strong>C.</strong> Around and under any structures or pad-mounted equipment or exposed utilities</td>
<td>95%</td>
<td>95%</td>
</tr>
<tr>
<td><strong>D.</strong> All other areas</td>
<td>80%</td>
<td>80%</td>
</tr>
</tbody>
</table>

* Applicable from 1’ above conduit, 85% below.

**NOTE:** Do not use machine compaction within 6” of cable or conduit.

### SLURRY BACKFILL MIXES (NO COMPACTION REQUIRED)

<table>
<thead>
<tr>
<th>MAT. ITEM #</th>
<th>ABBREV.</th>
<th>SLURRY TYPE</th>
<th>DESCRIPTION</th>
<th>COARSE AGGREGATE ASTM C33</th>
<th>FINE AGG.</th>
<th>SLUMP RANGE</th>
<th>MIN. CEMENT CONTENT (LBS/ CU. YD.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000100</td>
<td>ASB</td>
<td>Aggregate Slurry Backfill</td>
<td>Washed gravel and sand or clean ABC, no cement, backfill around wood and concrete transmission line poles and in trenches (no loads).</td>
<td>NO. 67 [3/4&quot; (19mm) NOM. MAX.]</td>
<td>NOTES 11 &amp; 12</td>
<td>6&quot;-9*</td>
<td>NONE</td>
</tr>
<tr>
<td>0000104</td>
<td>CLSM ½ SACK</td>
<td>Controlled Low Strength Material w/ ½ Sack Cement PCY</td>
<td>Washed gravel and sand or clean ABC, with cement, trench backfill (low load areas-streets and lots).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0000105</td>
<td>CLSM 1 SACK</td>
<td>Controlled Low Strength Material w/ 1 Sack Cement PCY</td>
<td>Washed gravel and sand or clean ABC, with cement, trench backfill in low load areas (streets and lots). Use in lieu of CLSM ½ Sack as required by cities.</td>
<td></td>
<td></td>
<td></td>
<td>MIXES IN ACCORDANCE WITH MAG 728 (13)</td>
</tr>
<tr>
<td>0000106</td>
<td>CLSM 1 ½ SACK</td>
<td>Controlled Low Strength Material w/ 1 ½ Sack Cement PCY</td>
<td>Washed gravel and sand or clean ABC, with cement, structural backfill under foundations and as thermal fill and/or mechanical protection of duct banks.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>000109</td>
<td>DBS</td>
<td>Duct Bank Backfill w/ Sand Slurry</td>
<td>Grout for pumping around conduits placed in pipe sleeves.</td>
<td></td>
<td></td>
<td></td>
<td>NONE</td>
</tr>
</tbody>
</table>

**NOTE: 11**

6" - 9"
7. When trenching in an area where many undercrossings of other utility lines or conflicts are encountered, installation of conduit under all of the conflicts is more difficult. Wider trenches should be used for these installations.

8. Water flooding of trenches, in order to provide compaction, is only allowed provided the volume of water does not saturate the backfill, water pressure does not displace the backfill, and is pre-approved by ESE. Standing water is an indication of saturation.

9. Trench spoil shall be placed 6' to 10' from edge of a trench. If not possible, trench spoil may be placed on one side of the trench, within 4' of the edge, provided the opposite side of the trench is level, without obstructions, and accessible by persons and equipment.

10. If compaction is uneconomical around or under structures, pad-mounted equipment or exposed utilities, CLSM ½ Sack (0000104) may be used.

11. Fine aggregates (sand) shall be in accordance with ASTM C33.

12. Fine aggregates 45-50% of the total aggregate weight.

13. Purchaser may request material at lower slumps.

14. A standard sack of cement is considered to weigh 94 pounds and is one cubic foot volume.