

8.0 GENERAL PROCEDURE FOR INSTALLING CABLES

THESE NOTES ARE FOR INSTALLING POWER, CONTROL AND INSTRUMENTATION CABLES AND SHALL BE USED WITH CONTRACT SPECIFICATIONS: 3240-504 - INSTALLATION OF INSULATED ELECTRICAL CABLE, 3240-505 - ELECTRICAL CABLE TERMINATION, CABLE AND RACEWAY SYSTEM REPORT, WPPS-3240-85016, AND CONTRACT DRAWINGS.

- 8.01 A CABLE PULL CARD SHALL BE ISSUED TO CONTRACTOR FOR EACH CABLE. THE FOLLOWING INFORMATION SHALL BE PRINTED ON THE CARD:
  - a - DATE CARD ISSUED
  - b - CABLE REPORT IDENTIFICATION
  - c - CABLE NUMBER AND SEPARATION CODE
  - d - CABLE & CONDUIT LIST REVISION NUMBER
  - e - CABLE B/M NUMBER, SIZE AND NUMBER OF CONDUCTORS
  - f - ONE WAY CIRCUIT LENGTH
  - g - MANUFACTURER'S RECOMMENDED MAXIMUM PULLING TENSION AND SIDE WALL PRESSURE
  - h - CABLE ORIGIN, DESTINATION AND ROUTING

THE CONTRACTOR SHALL FILL IN THE FOLLOWING INFORMATION IN THE SPACES PROVIDED ON THE CARD:

- a - DATE CABLE INSTALLED
- b - REEL DATA
- c - MAXIMUM CALCULATED PULLING TENSION AND SIDE WALL PRESSURE FOR CABLES INSTALLED BY A PULLING MACHINE (PER PARA. 8.03c)
- d - MAXIMUM PULLING TENSION MEASURED
- e - METHOD OF CABLE PULLING
- g - ACTUAL CABLE LENGTH
- h - NAME OF INSTALLER.

AN ADDITIONAL SPACE SHALL BE PROVIDED ON THE CARD FOR QC INSPECTOR NAME AND SIGNATURE.

8.02 IN ADDITION TO THE REQUIREMENTS OF SPECIFICATION 3240-504, CONTRACTOR SHALL OBSERVE THE FOLLOWING WHILE INSTALLING CABLES.

- A - PULLING EYES OR BASKET-WEAVE GRIP SHALL BE USED DEPENDING UPON THE ANTICIPATED PULLING TENSION AND THE TYPE OF CABLE. WHEN PULLING BY GRIP, SUFFICIENT CABLE SHALL BE PULLED BEYOND THE SPLICE TERMINATION POINT TO PERMIT CUTTING OFF ANY CABLE SUBJECTED TO THE GRIP.
- B - WHILE PULLING CABLES IN A CONDUIT AND/OR DUCT, MANUFACTURER RECOMMENDED QTY OF THE LUBRICANT TYPE SPECIFIED FOR THE CABLE TYPE SHALL BE USED TO REDUCE FRICTION. SEE ATTACHMENT #1 TO SPECIFICATION 504.
- C - SHEAVES AND ROLLERS SHALL BE USED WHEN INSTALLING CABLES IN TRAYS. IN STRAIGHT RUNS, SUFFICIENT NUMBERS OF ROLLERS SHALL BE USED TO PRECLUDE CABLE DRAG ON TRAYS. SHARP BENDS SHALL BE AVOIDED BY USING A SUFFICIENT NUMBER OF SHEAVE ASSEMBLIES SUCH THAT THE EFFECTIVE CABLE BEND RADIUS CONFORMS TO THE CONTOUR OF THE TRAY.
- D - IN HIGHLY CONGESTED MANHOLES, CABLES SHALL BE PULLED MAKING USE OF A FEEDING TUBE TO PREVENT DAMAGE TO CABLES
- E - ONCE A PULL HAS COMMENCED IN A CONDUIT, THE ENTIRE PULL SHALL BE COMPLETED WITHOUT ANY STOPS.
- F - CONTRACTOR SHALL ENSURE THAT THERE IS SLACK AT ALL TIMES BETWEEN THE REEL AND THE POINT WHERE THE CABLE ENTERS THE RACEWAY BY TURNING THE REEL AS NECESSARY. REELS SHALL BE PREPARED IN A MANNER THAT CABLE MAY BE UNREELLED AND PULLED WITHOUT SUBJECTING CABLE TO A REVERSE BEND.

G - WHEN INSTALLING SHIELDED CABLES, SPECIAL CARE SHALL BE EXERCISED NOT TO EXERT PULL ON THE SHIELD. SUFFICIENT NUMBER OF PULLEYS SHALL BE USED, ADJUSTED TO THE RECOMMENDED BENDING RADIUS, AND THE PULLEYS SHALL BE ANCHORED. FOR THE FORCES INVOLVED, TENSION EXPERIENCED SHALL BE CONTINUOUSLY MONITORED BY A DYNAMOMETER TO CATCH ANY HANG UP BEFORE ANY DAMAGE CAN OCCUR.

- H - ALL CABLES SHALL BE RUN DIRECT, FROM TERMINAL TO TERMINAL, WITHOUT INTERMEDIATE SPLICES IN PULL POINTS SUCH AS PULLBOXES, PULL SLEEVES, ETC.
- I - CABLES SHALL BE INSTALLED IN TRAYS IN AN ORDERLY MANNER AND ALL CABLE CROSSINGS AVOIDED. PARTICULAR CARE SHALL BE EXERCISED AT TRAY JUNCTIONS TO PREVENT CABLES FROM PILING UP.
- J - CABLE LENGTHS CONTAINED IN CABLE LIST C-15 (WPPS-3240-85016) ARE APPROXIMATE AND ARE NOT TO BE USED AS CUTTING LENGTHS.
- K - SLACK SHALL BE ALLOWED FOR TRAINING OR RACKING CABLES IN MANHOLES, HANDHOLES, PANELS, JUNCTION BOXES ETC.
- L - THE INSTALLATION AND TERMINATION OF LIGHTING CABLES SHALL BE IN ACCORDANCE WITH THE LIGHTING NOTES AND SPECIFICATION 3240-507.

8.03 THE FOLLOWING LIMITS SHALL BE CONSIDERED BEFORE CABLE INSTALLATION:

- A - THE MAXIMUM NUMBER AND SIZE OF CABLES TO BE INSTALLED IN CONDUITS SHALL CONFORM TO THE PERCENT FILL RECOMMENDED BY THE NATIONAL ELECTRICAL CODE.
- B - THE CABLE PULLING TENSION AND THE SIDEWALL PRESSURE AT EACH BEND IN A CONDUIT OR DUCT RUN MUST BE CALCULATED IF THE CABLE IS PULLED BY A PULLING MACHINE. NO CALCULATIONS ARE REQUIRED IF THE CABLE IS PULLED BY HAND. BOTH THE PULLING TENSION AND THE SIDEWALL PRESSURE SHALL NOT EXCEED THE MAXIMUM ALLOWABLE LIMITS FOR THE CABLE TYPE AND GRIPPING METHOD USED.
- C - CABLE PULLING TENSION AND SIDE WALL PRESSURE:
  - 1 - WHEN PULLING 3 OR MORE SINGLE CONDUCTOR CABLES OR ANY NUMBER OF MULTICONDUCTOR CABLES WITH THE CONDUCTORS ATTACHED TO THE PULLING LINE BY USING PULLING EYES OR BY FORMING A LOOP BY THE CONDUCTOR ITSELF, THE MAXIMUM PULLING TENSION APPLIED SHALL NOT EXCEED 60 PERCENT OF THE SUM OF THE RECOMMENDED MANUFACTURER PULLING TENSION OF THE CABLES. THE MANUFACTURER'S RECOMMENDED PULLING TENSIONS ARE SHOWN ON DWG. WPPS - 3240-85016.
  - 2 - WHEN NON METALLIC SHEATED CABLES ARE GRIPPED BY A BASKET WEAVE GRIP, THE MAXIMUM PULLING TENSION APPLIED SHALL BE LIMITED TO THE LESSOR OF 1000 POUNDS OR 60 PERCENT OF THE SUM OF THE RECOMMENDED MANUFACTURER'S PULLING TENSION OF THE CABLES ENCLOSED BY THE GRIP.
  - 3 - FOR CABLES INSTALLED IN CONDUITS OR WITH SINGLE WHEEL/SHEAVE, THE MAXIMUM SIDE WALL PRESSURE SHALL NOT EXCEED 500LB/FT. (EXCEPT FOR CABLE GROUPS D06, D87, D88 AND D90 FOR WHICH THE LIMIT SHALL BE 300 LB/FT.
  - 4 - FOR CABLES INSTALLED IN TRAYS USING COMMERCIALY AVAILABLE GANG ROLLERS/SHEAVE ASSEMBLIES, THE MAXIMUM PULLING TENSION OUT OF THE BEND, MEASURED IN POUNDS, SHALL NOT EXCEED 300 TIMES THE EFFECTIVE RADIUS IN FEET OF THE GANGROLLER/SHEAVE ASSEMBLY WHEN THE GANG ROLLER OR SHEAVE ASSEMBLY IS ADJUSTED TO THE RADIUS OF THE TRAY.
- D - THE EFFECTIVE RADIUS OF THE GANG ROLLER/SHEAVE ASSEMBLIES SHALL BE NOT LESS THAN 12 INCHES FOR POWER, CONTROL AND INSTRUMENTATION CABLES (600 VCLTS AND BELOW) AND NOT LESS THAN 24 INCHES FOR THE 5 AND 15KV CABLES, AND IN NO CASE LESS THAN THE BENDING RADIUS RECOMMENDED BY THE MANUFACTURER OF THE CABLE.
- E - BENDING RADIUS: THE MANUFACTURER'S RECOMMENDED VALUE FOR THE MINIMUM BENDING RADIUS TO WHICH A CABLE MAY BE BENT DURING INSTALLATION AND FOR PERMANENT TRAINING SHALL NOT BE EXCEEDED. THE MINIMUM RADIUS RECOMMENDED REFER TO THE INNER SURFACE OF THE CABLE AND NOT TO THE AXIS OF THE CABLE. (SEE TABLE B, SH. 5 FOR PERMANENT TRAINING RADIUS. THE VALUE OF MIN. BENDING RADIUS DURING INSTALLATION FOR CLASS X & V CABLES SHALL BE THE SAME AS TRAINING RADIUS SHOWN ON TABLE B, FOR ALL OTHER CABLES, THE MIN. BENDING RADIUS SHALL BE TWO (2) TIMES THE VALUE OF THE TRAINING RADIUS SHOWN ON TABLE B.
- F - WHEN A CONDUIT CONTAINS THREE OR MORE IDENTICAL CABLES, THE RATIO OF THE CONDUIT INSIDE DIAMETER TO THE CABLE DIAMETER SHALL BE LESS THAN 2.8 OR LARGER THAN 3.1 TO AVOID CABLE JAMMING OR THE JAMMING RATIO SHALL BE  $2.8 \leq \frac{D}{d} \leq 3.1$  WHERE D IS THE CONDUIT INSIDE DIAMETER AND d IS THE CABLE DIAMETER.

8.04 - CALCULATING THE EXPECTED PULLING TENSIONS. PULLING TENSION SHALL BE CALCULATED USING THE CABLE PULLING CHART ON SH. 12. THIS CHART IS A COMPOSITE SET OF GRAPHS BASED ON MATHEMATICAL RELATIONS FOR CALCULATING PULLING TENSIONS.

THE FOLLOWING DATA SHALL BE ESTABLISHED BY THE CONTRACTOR PRIOR TO USING THE CHART.

- A - CO-EFFICIENT OF FRICTION: USE MANUFACTURER'S RECOMMENDED VALUE BASED ON THE CONDUIT OR DUCT MATERIAL FOR THE SPECIFIC CABLE JACKET MATERIAL. (SEE TABLE 1 SH. 11F)
- B - ARRANGEMENT & DIMENSIONS OF THE CONDUIT OR DUCT RUN: OBTAIN FROM REFERENCE DRAWINGS AND OTHER GUIDELINES, IN THESE NOTES.

DCN-ED-79.95 INCORPORATED IN REV. 5

5-7-82		SP	EBASCO SERVICES INCORPORATED	WASHINGTON PUBLIC POWER SUPPLY SYSTEM		WPPS-3240
2-17-81		SP	DIV. ELEC. DR. E.M.	NUCLEAR PROJECTS NO 3 & 5		D-8029
8-22-80		SP	CH. R. ABRAMOWITZ	GENERAL NOTES, SYMBOLS AND REFERENCE DRAWINGS		SHEET 11
4-10-79		HC	DATE FEB.-24, 1977	APERTURE CARD		
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