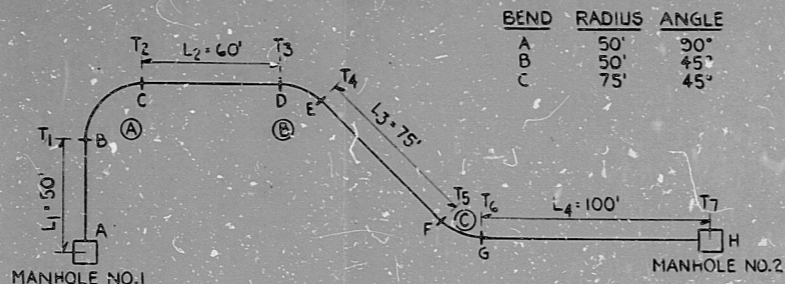


C - CABLE TYPE, OD, NUMBER, WEIGHT SHALL BE OBTAINED FROM CABLE PULL CARD AND REPORT C15. (WPPS-3240-85016)

D - CABLE OCCUPANCY FACTORS SHALL BE USED IN CALCULATING PULLING TENSION, WHEN PULLING TWO OR THREE CABLES. CALCULATE THE RATIO OF THE INNER DUCT DIAMETER TO SINGLE CABLE DIAMETER (ALL CABLES OF SAME SIZE) AND DETERMINE THE OCCUPANCY FACTOR FROM FIG. 2 SHEET 11F. WHEN PULLING CABLES OF DIFFERENT SIZES OR MORE THAN THREE CABLES USE A CABLE OCCUPANCY FACTOR OF 1.3

THE PROCEDURE FOR USING THE CABLE PULLING CHART IS EXPLAINED BY WAY OF THE FOLLOWING TYPICAL EXAMPLE:

THE PROBLEM



THREE - 1/C 500 KCMIL, COPPER CONDUCTOR, 5KV SHIELDED, TRIPLEXED, FORMATION, CABLES ARE TO BE PULLED INTO A CONDUIT WITH AN INSIDE DIAMETER OF 4 INCHES. EACH CONDUCTOR HAS A PULLING EYE ATTACHED. THE WEIGHT OF EACH CONDUCTOR IS 2.22 LB/FT WITH AN OUTSIDE DIAMETER OF 1.44 INCHES. THE VALUE OF V IS READ OFF THE CURVE OF V IN FIG. 2 SHEET 11F OPPOSITE D/3 = 4/1.44 = 2.78 AND IS FOUND TO BE 1.20. COEFFICIENT OF SLIDING FRICTION FOR WELL LUBRICATED SYSTEM IS 0.25.

SOLUTION:

REFER TO CABLE PULLING CHART ON SHEET 12.

- (1) ON THE UPPER LEFT HAND OF THE CHART AT F=0.25 DRAW A HORIZONTAL LINE EXTENDING TO THE DIAGONAL CORRESPONDING TO V = 1.2.
- (2) SINCE THERE ARE ONLY TWO DIFFERENT ANGLES OF BENDS FOR THIS RUN (90° AND 45°); FROM THE INTERSECTION POINT OBTAINED IN STEP 1, DRAW A VERTICAL LINE DOWNWARD UNTIL IT INTERSECTS THE CURVES CORRESPONDING TO 90° AND 45°.
- (3) FROM EACH OF THE TWO INTERSECTION POINTS OBTAINED IN STEP 2 DRAW A HORIZONTAL LINE TO THE RIGHT EXTENDING ACROSS THE CHART. LABEL THESE LINES 90° AND 45° RESPECTIVELY.
- (4) STARTING AT MANHOLE NO. 1, A STRAIGHT RUN OF 50 FEET IS FIRST ENCOUNTERED IN THE PULLING SEQUENCE. ON THE ZERO DEGREE LINE AT THE SECTION LABELED EQUIVALENT STRAIGHT PULLING LENGTH DRAW A LINE TO THE 50-FOOT MARK. LABEL THIS POINT B. FROM POINT B DRAW A VERTICAL LINE UPWARDS TO THE 90° LINE DRAWN IN STEP 3.
- (5) FROM THE INTERSECTION POINT OBTAINED IN STEP 4, DRAW A LINE PARALLEL TO THE DIAGONALS IN THE SOUTHEAST DIRECTION DOWN TO THE ZERO DEGREE LINE. LABEL THE INTERSECTION POINT C. THE READING AT POINT C IS THE EQUIVALENT PULLING LENGTH UP TO POINT C IN THE RUN. FROM POINT C DRAW A VERTICAL LINE DOWNWARDS.
- (6) FROM POINT C ADD A STRAIGHT LENGTH OF 60 FEET ALONG THE ZERO DEGREE LINE, MARK POINT D WHICH CORRESPONDS TO THE START OF THE SECOND BEND. FROM POINT D DRAW A VERTICAL LINE UPWARDS TO THE 45° LINE DRAWN IN STEP 3.
- (7) FROM THE INTERSECTION POINT OBTAINED IN STEP 6, DRAW A LINE PARALLEL TO THE DIAGONALS DOWN TO THE ZERO DEGREE LINE. LABEL THE INTERSECTION POINT E. THE READING AT POINT E IS THE EQUIVALENT PULLING LENGTH UP TO POINT E IN THE RUN. FROM POINT E DRAW A VERTICAL LINE DOWNWARDS.
- (8) FROM POINT E, ALONG THE ZERO LINE ADD A STRAIGHT LENGTH OF 75 FEET, MARK POINT F WHICH CORRESPONDS TO THE START OF THE THIRD BEND. FROM POINT F DRAW A VERTICAL LINE UPWARDS TO THE 45° DEGREE LINE DRAWN IN STEP 3.
- (9) FROM THE INTERSECTION POINT OBTAINED IN STEP 8, DRAW A LINE PARALLEL TO THE DIAGONALS DOWN TO THE ZERO DEGREE LINE. LABEL THE INTERSECTION POINT G. THE READING AT POINT G IS THE EQUIVALENT PULLING LENGTH UP TO POINT G IN THE RUN. FROM POINT G DRAW A VERTICAL LINE DOWNWARDS.

(10) FROM POINT G, ALONG THE ZERO DEGREE LINE ADD A STRAIGHT LENGTH OF 100 FEET. MARK THIS POINT H WHICH CORRESPONDS TO THE END OF THE RUN. FROM POINT H DRAW A VERTICAL LINE DOWNWARDS.

(11) AT THE MID RIGHT-HAND SIDE OF THE CHART A V = 1.2, DRAW A HORIZONTAL LINE UNTIL IT INTERSECTS THE F = 0.25 LINE. FROM THE POINT OF INTERSECTION, DRAW A VERTICAL LINE DOWN TO THE LINE CORRESPONDING TO W = 3 X 2.22 = 6.66 LB.

(12) FROM THE LAST INTERSECTION POINT OBTAINED IN STEP 11, DRAW A HORIZONTAL LINE X - Y TO THE LEFT UNTIL IT INTERSECTS THE VERTICAL LINE AT POINT H. AT THE INTERSECTION READ THE TOTAL PULLING TENSION FROM THE DIAGONAL PASSING THROUGH THE INTERSECTION POINT. THE READING IS 840 LB.

(13) THE PULLING TENSION AT ANY POINT ALONG THE RUN CAN BE READ OFF THE DIAGONAL PASSING THROUGH THE INTERSECTION OF THE HORIZONTAL LINE X - Y DRAWN IN STEP 12 AND A VERTICAL LINE FROM THE POINT WHERE THE PULLING TENSION IS TO BE DETERMINED. FOR EXAMPLE THE TENSION AT POINT E IS READ FROM THE DIAGONAL PASSING THROUGH Z AS 355 LB.

8.05 CALCULATING THE SIDE WALL PRESSURE: CALCULATE THE SIDE WALL PRESSURE AT EACH BEND USING THE FOLLOWING FORMULAS, WHERE T IS THE CORRESPONDING PULLING TENSION OUT OF THE BEND

NO. OF CABLES IN CONDUIT/DUCT	SIDE WALL PRESSURE IN LB/FT
1 **	T/R
2 *	$\frac{\sqrt{2}C}{2}(T_p)$
3 TRIPLEXED FORMATION *	$\frac{\sqrt{3}}{2}(T_p)$
3 RANDOM LAY *	$\frac{1}{3}(3VC-2)(T_p)$
4 TO 8	T/1.3R
9 OR MORE	T/2.3R

* CABLES ARE OF SAME SIZE AND WEIGHT.
** USE SAME FORMULA FOR TWO OR THREE CABLES OF RANDOM SIZE AND WEIGHT.

WHERE P IS THE SIDE WALL PRESSURE IN LB/FT.
T = TOTAL PULLING TENSION OUT OF THE BEND IN LBS.
V, Vc, Vt = RESPECTIVE OCCUPANCY FACTOR

PRC
APERTURE
CARD

NUCLEAR SAFETY RELATED WPPSS QUALITY CLASS I, II & G

5				
4				
3				
2	5-7-82	SP	CH	CHU
1	8-22-80	SP	CH	CHU
REV.	DATE	BY	APPROVED	

EBASCO SERVICES INCORPORATED

DIV. ELECT. DR. E.M.
CH. H. CHU
DATE APR 10, 1979

WASHINGTON PUBLIC POWER
SUPPLY SYSTEM
NUCLEAR PROJECTS NO. 3 & 5
GENERAL NOTES, SYMBOLS AND
REFERENCE DRAWINGS

WPPS-3240
D-5023
SHEET 11A

DCN-ED-95
INCORPORATED IN REV. 2

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