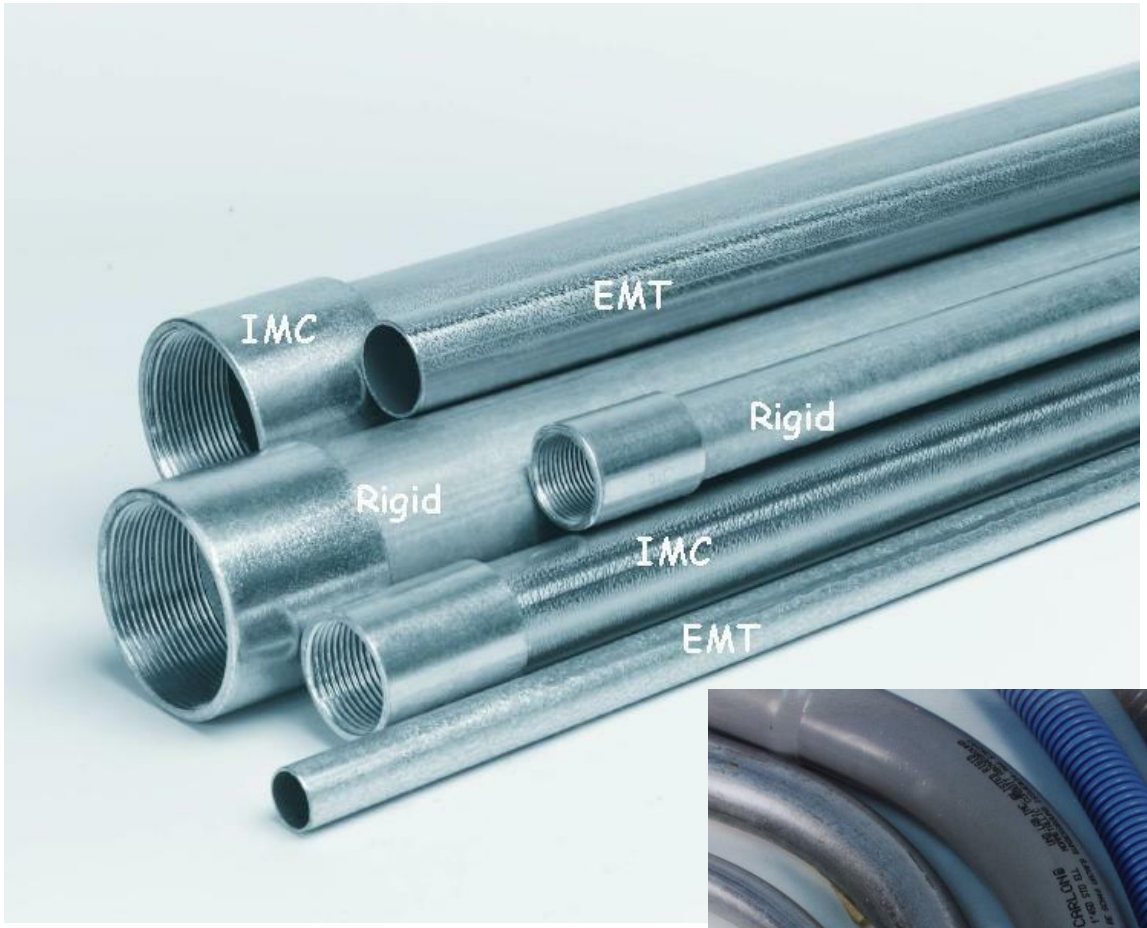
SIERRA COLLEGE

Conduit

Lesson Plan

- Conduit

Conduit Discussion



Conduit Discussion

- Conduit comes in various configuration
  - EMT – Electrical Metallic Tubing
    - Thin wall conduit
    - 40% thinner than rigid
    - Lighter, easier to bend, & no threading
  - RMC – Rigid Metal Conduit
    - Heavy duty
    - Requires threading-like plumbing
    - Generally used for service entrance risers.
  - IMC – Intermediate Metal Conduit
    - Between RMC and EMT
    - Can be threaded
  - PVC – Polyvinylchloride
    - Cheaper alternative
    - High coefficient of thermal expansion
  - FMC – Flexible Metal Conduit
  - LFMC – Liquidtight Flexible Metal Conduit
  - FMT, LFNMC, ENT

Conduit Discussion

- Conduit comes in various sizes
  - ½”, ¾”, 1”, 1-¼”, 1-½”, 2”, 2-½”, 3”, 4”
  - For the “same size” conduit- EMT, IMC and RMC may have a different inside area
- Per NEC
  - Min size = ½ inch
  - Permitted usages vary for each type
  - Article 358: EMT
- Support requirements (RMC, EMT, IMC)
  - Securely fastened every 3m (10ft)
  - Within 0.9m (3ft) from every junction box, outlet, transition, direction change
  - Should follow horizontal and vertical lines, smooth transitions
  - No more than 4 quarter bends between pull points

Conduit Discussion

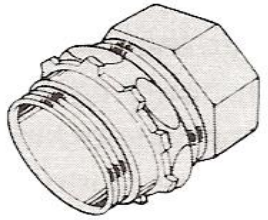
ONE HOLE PUSH-ON CONDUIT STRAP

TWO HOLE CONDUIT STRAP

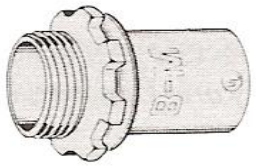
NAIL-UP CONDUIT STRAP

Conduit Discussion

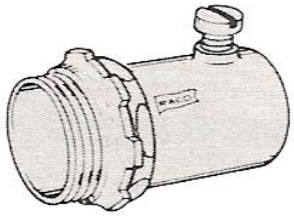
- EMT must be firmly secured to electrical boxes using compression, indenter, or screw set connectors.
  - Compression – firmly secures the conduit by utilizing a nut that compresses a tapered metal ring into the conduit.
    - Can be reused several times
  - Indenter – Use of a special tool to make an indention (swaging)
  - Set Screw – used to connect two runs of conduit together and maintain a smooth inside run.



COMPRESSION



INDENTER



SET SCREW

Conduit Discussion

- NEC Chapter 9, Table 1: Percent of Cross Section of Conduit

Number of Conductors	All Conductor Types
1	53
2	31
Over 2	40

- NEC Chapter 9, Table 4: Cross sectional area of EMT Conduit

Article 358 — Electrical Metallic Tubing (EMT)

Metric Designator	Trade Size	Nominal Internal Diameter		Total Area 100%		2 Wires 31%		Over 2 Wires 40%		1 Wire 53%		60%	
		mm	in.	mm²	in.²	mm²	in.²	mm²	in.²	mm²	in.²	mm²	in.²
16	½	15.8	0.622	196	0.304	61	0.094	78	0.122	104	0.161	118	0.182
21	¾	20.9	0.824	343	0.533	106	0.165	137	0.213	182	0.283	206	0.320
27	1	26.6	1.049	556	0.864	172	0.268	222	0.346	295	0.458	333	0.519
35	1¼	35.1	1.380	968	1.496	300	0.464	387	0.598	513	0.793	581	0.897
41	1½	40.9	1.610	1314	2.036	407	0.631	526	0.814	696	1.079	788	1.221
53	2	52.5	2.067	2165	3.356	671	1.040	866	1.342	1147	1.778	1299	2.013
63	2½	69.4	2.731	3783	5.858	1173	1.816	1513	2.343	2005	3.105	2270	3.515
78	3	85.2	3.356	5701	8.846	1767	2.742	2280	3.538	3022	4.688	3421	5.307
91	3½	97.4	3.834	7451	11.545	2310	3.579	2980	4.618	3949	6.119	4471	6.927
103	4	110.1	4.334	9521	14.753	2951	4.573	3808	5.901	5046	7.819	5712	8.852

Conduit Discussion

- NEC Chapter 9, Table 5: Dimensions of insulated wires

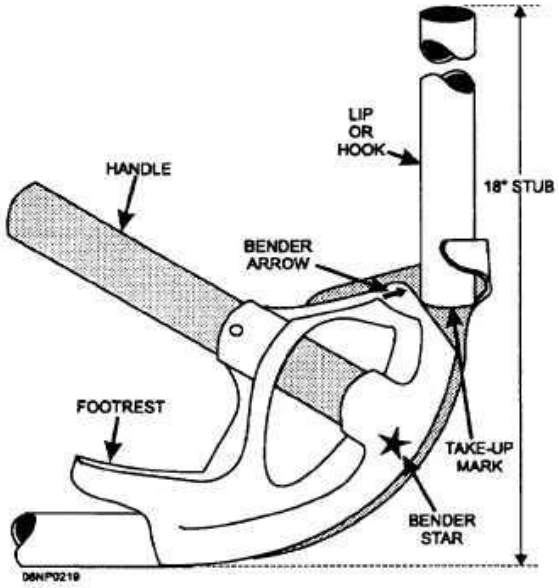
Type	Size (AWG or kcmil)	Approximate Diameter		Approximate Area	
		mm	in.	mm²	in.²
THHN, THWN, THWN-2	14	2.819	0.111	6.258	0.0097
	12	3.302	0.130	8.581	0.0133
	10	4.166	0.164	13.61	0.0211
	8	5.486	0.216	23.61	0.0366
	6	6.452	0.254	32.71	0.0507
	4	8.230	0.324	53.16	0.0824
	3	8.941	0.352	62.77	0.0973
	2	9.754	0.384	74.71	0.1158
	1	11.33	0.446	100.8	0.1562
	1/0	12.34	0.486	119.7	0.1855
	2/0	13.51	0.532	143.4	0.2223
	3/0	14.83	0.584	172.8	0.2679
	4/0	16.31	0.642	208.8	0.3237
	250	18.06	0.711	256.1	0.3970
	300	19.46	0.766	297.3	0.4608

- How many 10AWG THWN-2 conductors can be run through ¾ inch EMT?

0.213 / 0.0211 = 10 conductors

Conduit Discussion

Conduit Bender



- Stub in – 90 degree bend
- Run – the complete path between two points
- Rise – distance the conduit will stub up
- Offset bend – allows run to change plane but same direction
- Kick – bend less than 45 degrees that changes direction
- Back to back bend – 90 degree bend off another bend
- Box offset - offset that allows conduit to align with box opening
- Dog leg – Mistake in bends when legs do not line up

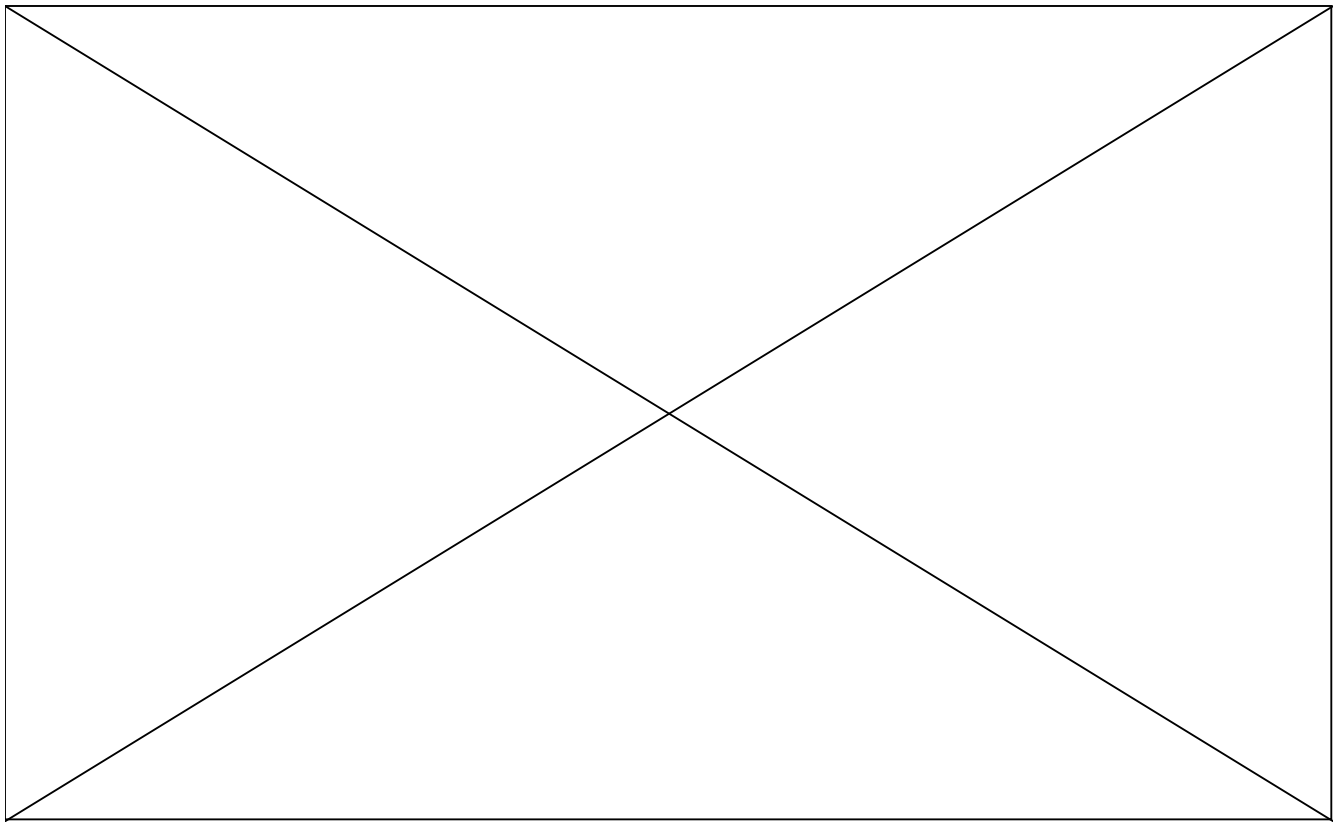
Conduit Discussion

- Take-up is the length of pipe to remove from desired height to make the a stub
  - 5 inch for ½ inch bender
  - 6 inch for ¾ inch bender
  - 8 inch for 1 inch bender

- Offset chart is used to calculated proper lengths for various bends
  - 30 degree = 2X length
  - 30 degree = ¼ X shrink

Offset Depth Inches	Degree of Bend 22-1/2°		30°		45°		60°	
2″	5-1/4″	3/8″						
3″	7-3/4″	9/16″	6″	3/4″				
4″	10-1/2″	3/4″	8″	1″				
5″	13″	15/16″	10″	1-1/4″	7″	1-7/8″		
6″	15-1/2″	1-1/8″	12″	1-1/2″	8-1/2″	2-1/4″	7-1/4″	3″
7″	18-1/4″	1-5/16″	14″	1-3/4″	9-3/4″	2-5/8″	8-3/8″	3-1/2″
8″	20-3/4″	1-1/2″	16″	2″	11-1/4″	3″	9-5/8″	4″
9″	23-1/2″	1-3/4″	18″	2-1/4″	12-1/2″	3-3/8″	10-7/8″	4-1/2″
10″	26″	1-7/8″	20″	2-1/2″	14″	3-3/4″	12″	5″

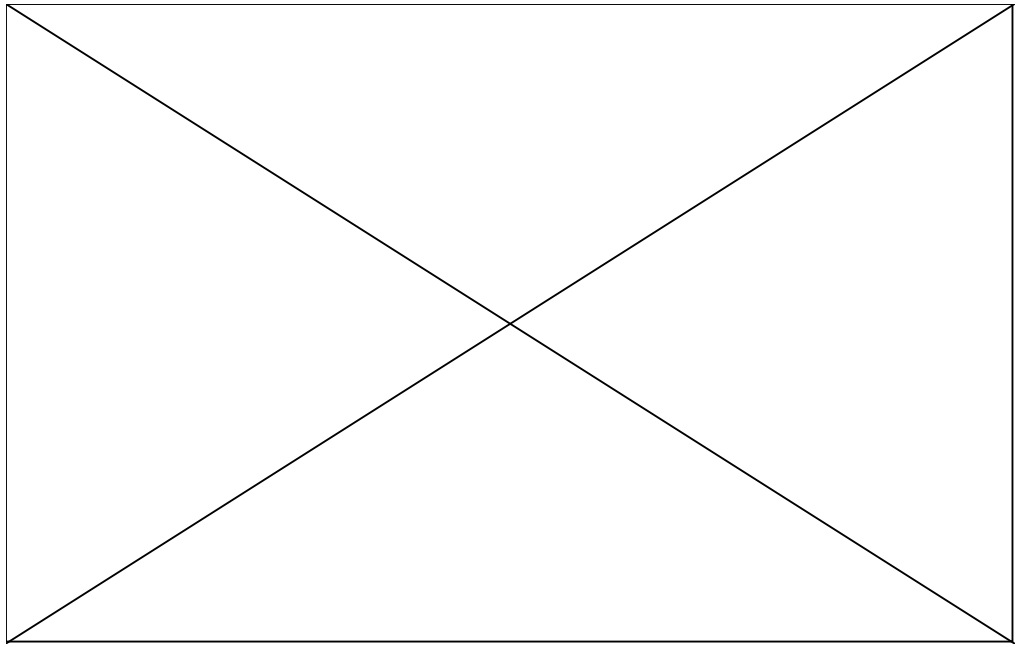
Conduit Bend: 90 degree stub and back to back



Video Link: **Haywood Community College 90 degree stub up conduit bend into a back to back**

http://www.youtube.com/watch?v=Ws1QifXhh4U&feature=player_embedded

Conduit Bend: 30 offset



Video Link: **Haywood Community College Conduit Bending off set bend**

http://www.youtube.com/watch?v=8zY91dJYFRk&feature=player_embedded

Conduit Exercise

Every get a 10ft piece of ½ in EMT

- Bend a 12” stub in
- Bend a 24” back to back from the first stub
- Cut and file the tube so that you have two 12” back to back stubs

Using remaining piece of ½ in EMT

- Bend a 30 degree 5” offset