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Book1_02	Flux , Type Corrosive and Non Corrosive , Multi Core Solder
Book1_03	Wires , 3 Types Single Strand , Insulated , Multi strand Insulated Resistance of lengths (Info only)
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Book1_06	STRIPBOARD LOOM connecting to Vero Pins.
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Book1_21	3 Digit numbers shorthand calculations
Book1_22	Transformers , Cells , Earth , Wires , Switch
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Book1_27	PCB types and Component Mounting , Heat Sinks & Shunts
Book1_28	KNOTS Clove Hitch and the Wire Plait
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Book1_31	Quality , ISO9000 , Checking techniques 100% , Batch , Random.
Book1_32	Ohms Law , Voltage , Current , Resistance and Power
Book1_33	Ohms Law , Calculation summary.
Book1_34	Ohms Law , $V/I=R$, Power Triangles , Practice calculations
Book1_35	Ohms Law , Resistors in Parallel the Proof
Book1_36	Ohms Law , Resistors in Series the Proof
Book1_37	Loom skills , Continuous Knot Lacing.
Book1_38	Switches , Schematic presentation Symbols , Operation of the Relay

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Book3_03	Using the Oscilloscope questions.
Book3_04	Digital Arithmetic practice.
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Book3_07	Capacitor Practice calculations.
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Book4_02	General Purpose Log Sheet
Book4_03	USEFUL.TXT (Computer or Maths information)
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Book4_10	Your main life Goals.
Book4_11	Basic CV letter layout.
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Book5_05	Metric Multipliers Practice Calculations (With Answers)
Book5_06	Using the Oscilloscope questions (Number 2) (With Answers).
Book5_07	Capacitor Practice calculations (With Answers).
Book5_08	Inductor Practice calculations (With Answers).
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SOLDER

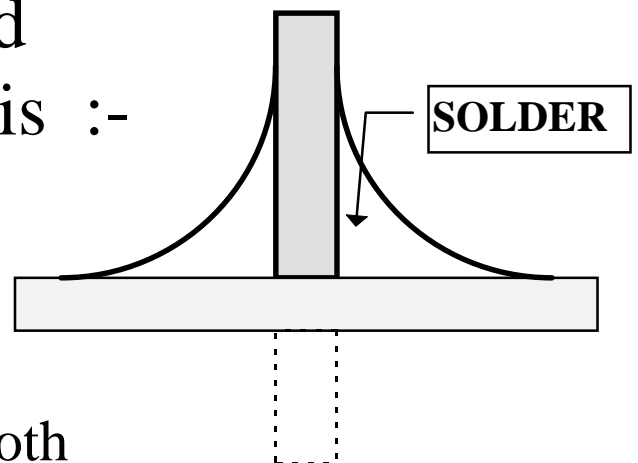
An Alloy of

Tin = 60%

&

Lead = 40%

The Good Soldered
Connection is :-



1. SHINY & Bright
2. CONCAVE & Smooth
3. No Spikes Lumps , Bumps or Holes

FLUX

Two Types

Corrosive (Used for Plumbing)

CLEANS

and also ↓

Non Corrosive (Electrical Work)

AIDS HEAT TRANSFER

PREVENTS OXIDISATION

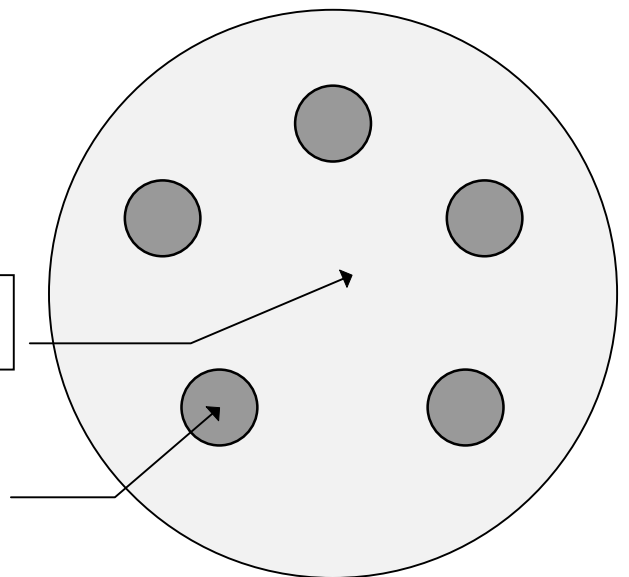
MULTI - CORE SOLDER

How Do We
Apply the Flux ?

Example of
5 Core
Solder

SOLDER

FLUX
CORE



WIRES.

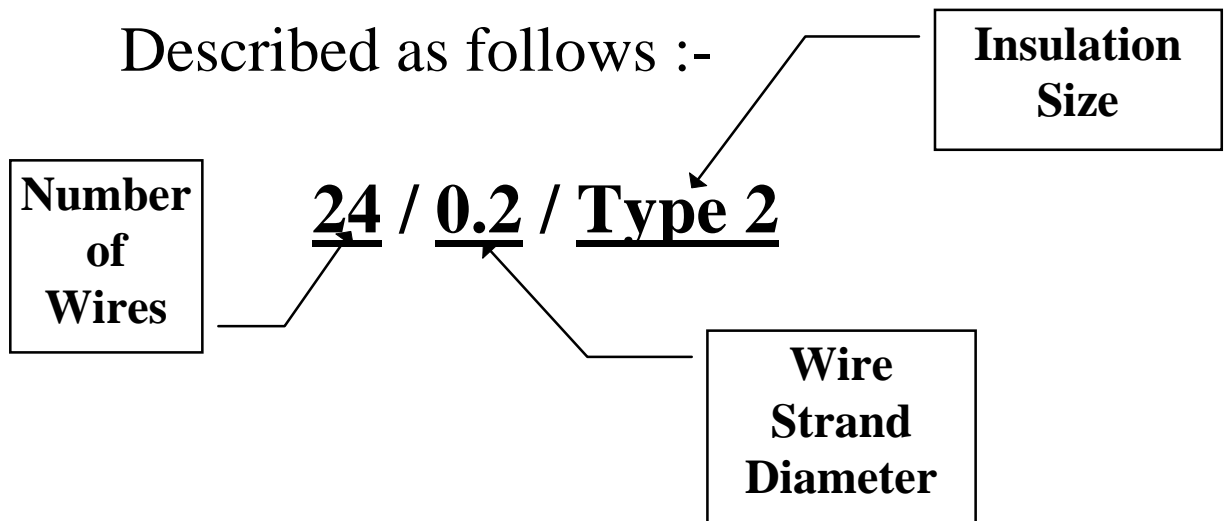
Three Types

Single Strand Bare.

Single Strand Insulated.

Multi-Strand Insulated.

Described as follows :-

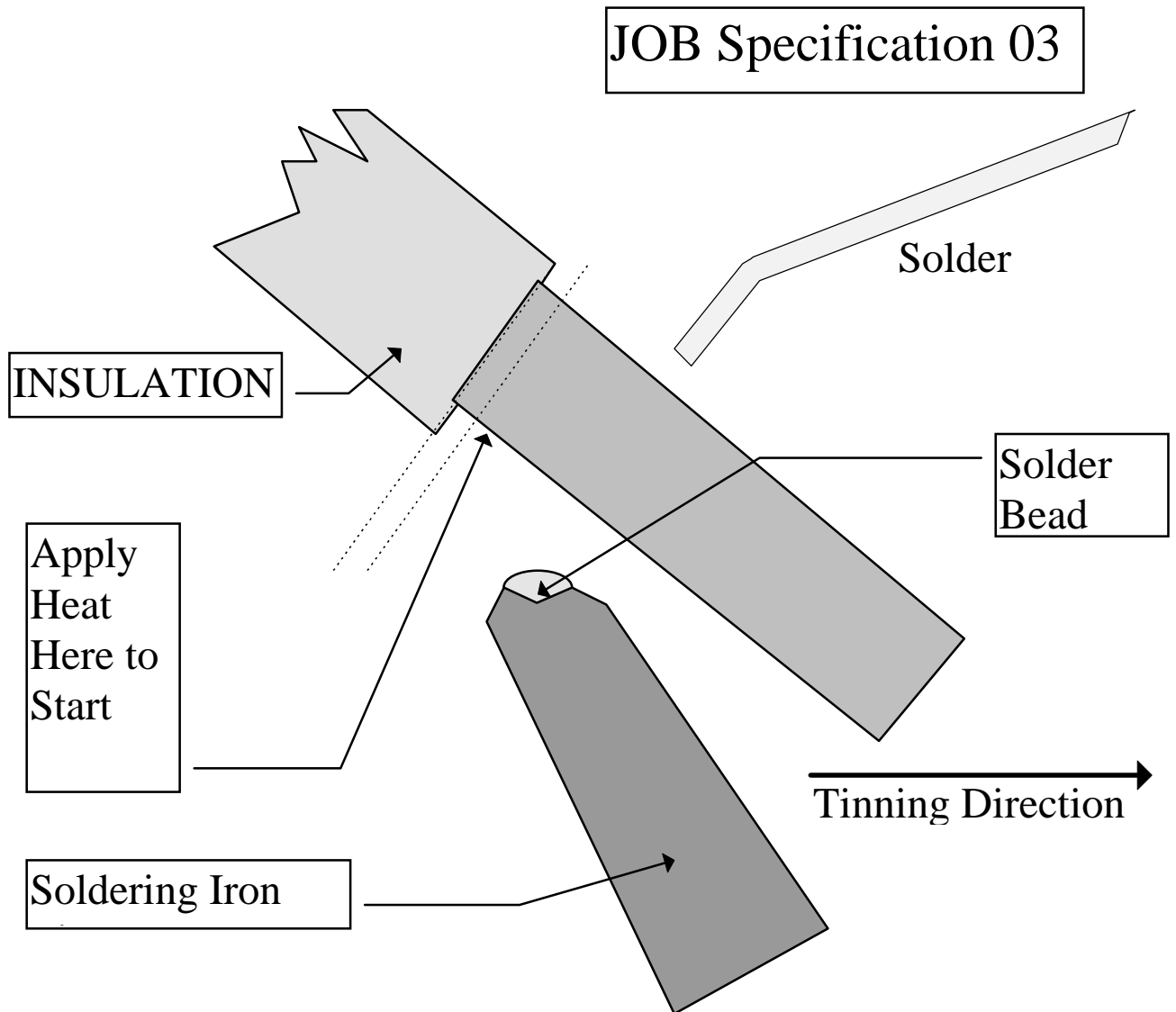


Information Only

0.20mm	Strand \cong	92.2 Ω /Km	\cong	0.2A
0.28mm	Strand \cong	64.1 Ω /Km		
0.50mm	Strand \cong	36.0 Ω /Km		

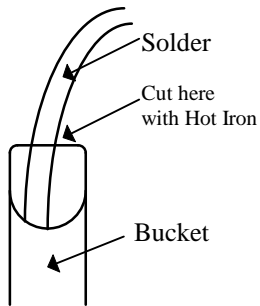
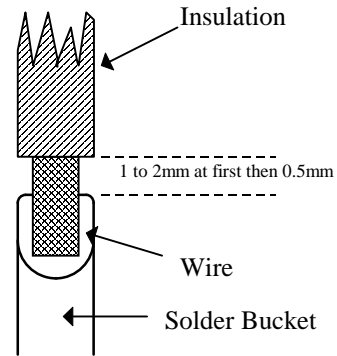
TINNING.

1. Twist Wires , After removing the Insulation.
2. Coat wires with solder.
3. Ensure Individual strands can still be seen.
4. Ensure Insulation is **NOT** Damaged.
5. Cut wire to size.

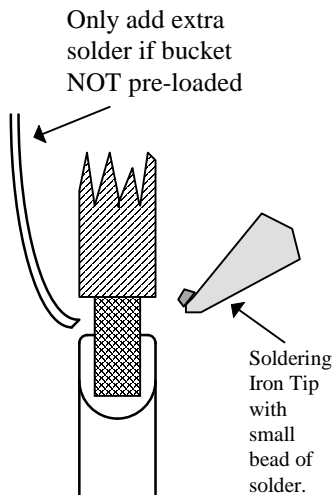


Solder Bucket

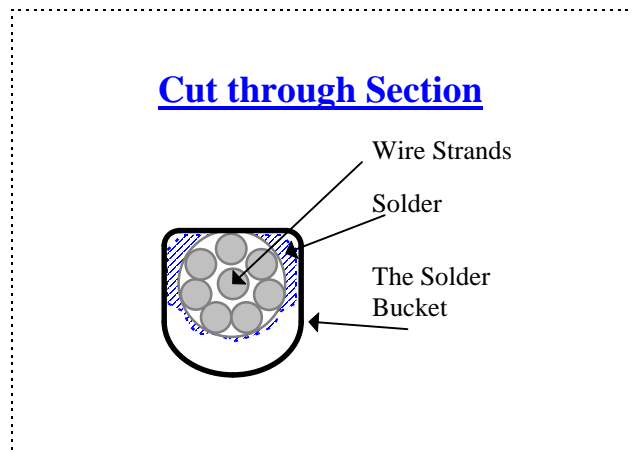
(1) Cut Wire to Size.



(2) Prepare Bucket with correct amount of Solder.



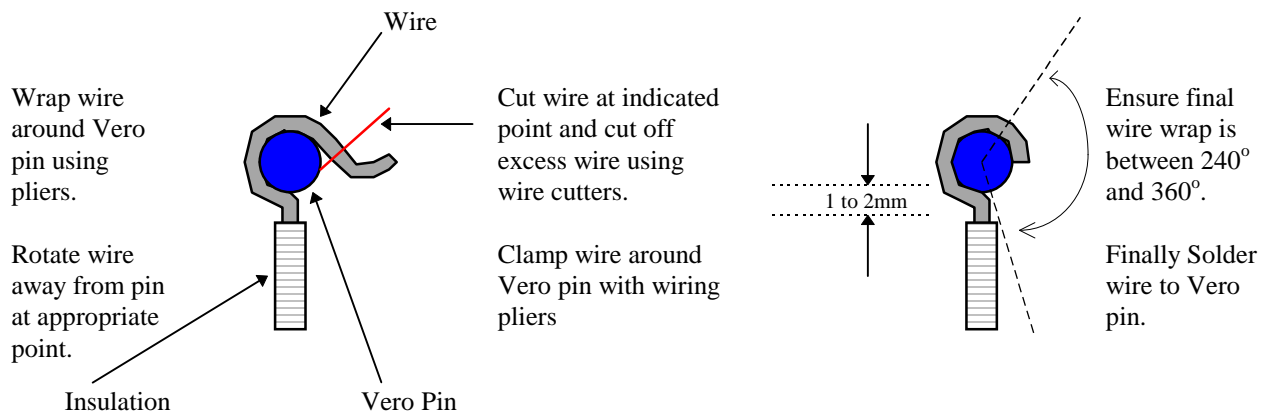
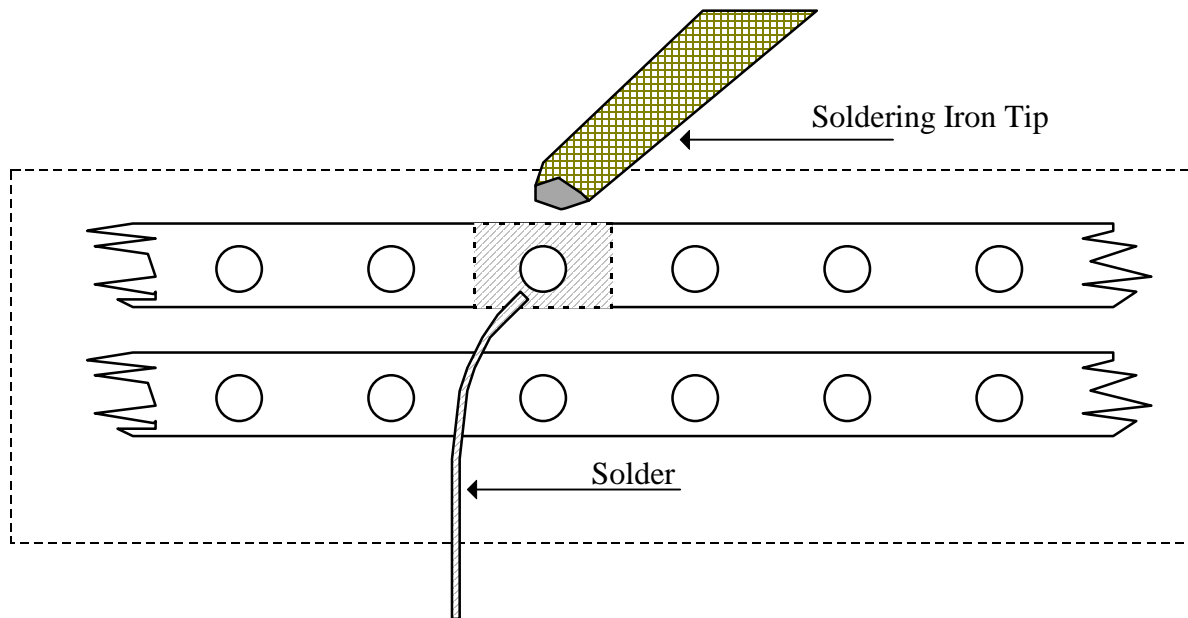
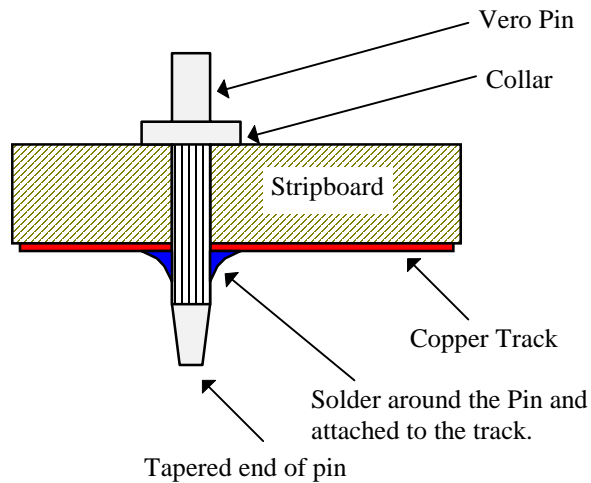
(3) Apply Heat.



- (A) Ensure wire is correctly tinned.
- (B) Ensure bucket is clean.
- (C) Ensure wire is still visible after heat and solder have been applied.

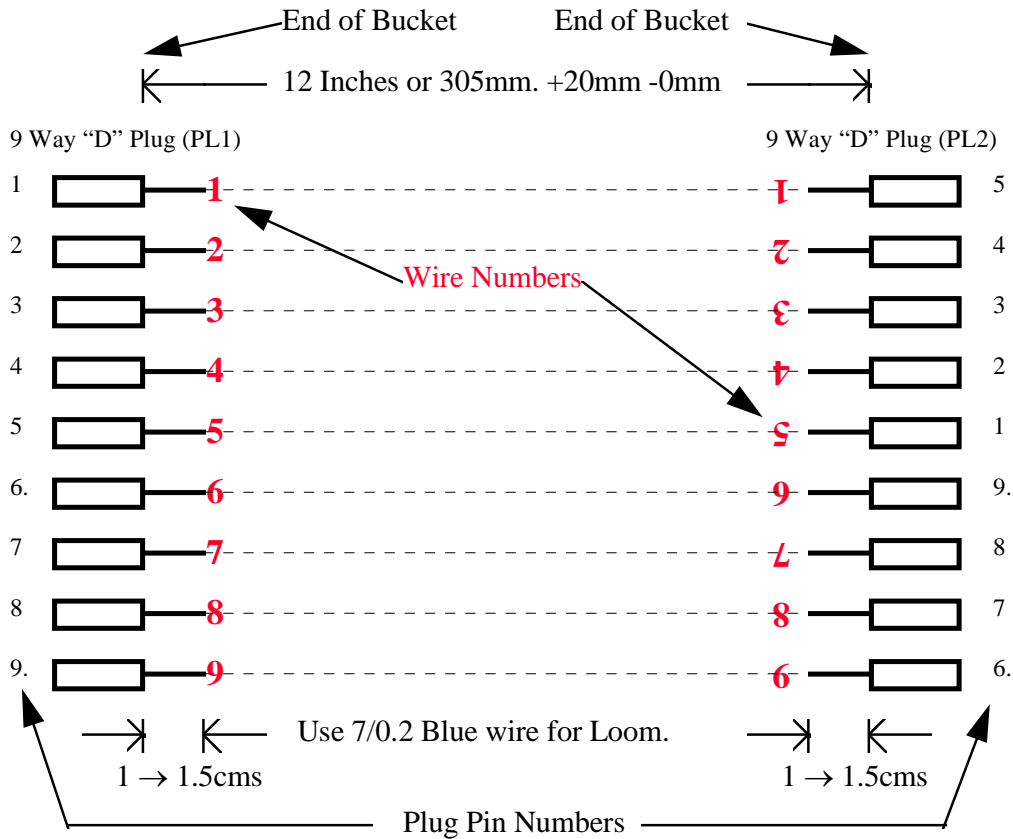
JOB 04 Specification

STRIPBOARD Soldering.



JOB 06 Specification Part 1

SLEEVING EXERCISE

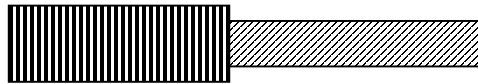


- 1) All wires to remain parallel.
- 2) Bind with lacing cord using spot ties every 1.5 to 2 cms
- 3) Sleeves Read from END to MIDDLE and correct way up when viewed from LHS.

JOB 09 Specification.

Tinning and Joining Exercise.

Tinning Exercise



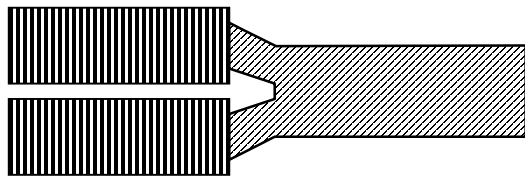
Tin to about 0.5mm from Insulation

TWIST
TIN
TRIM

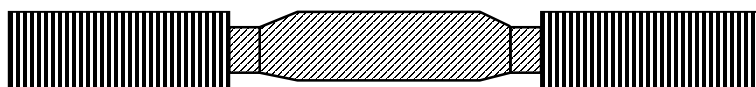
Use Various Wire Sizes

7/0.2 24/0.2
32/0.2
64/0.2

Joining Exercise



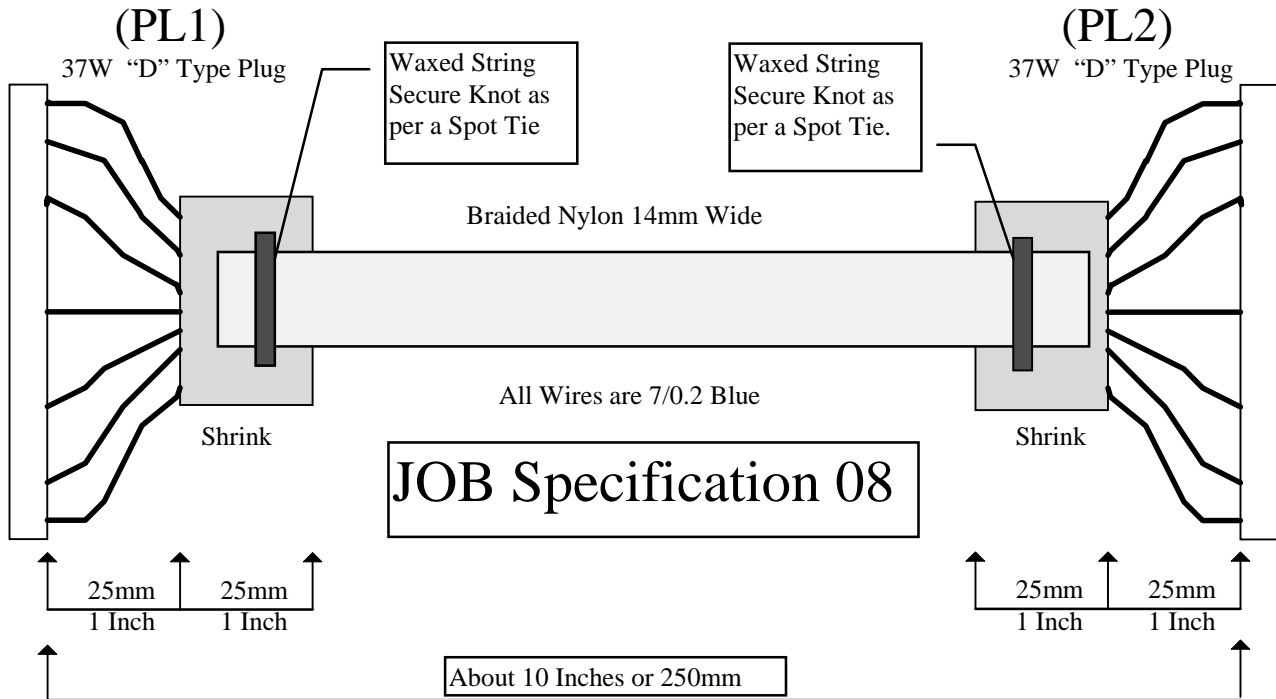
Tin to about 1mm from Insulation



Tin to about 0.5mm from Insulation

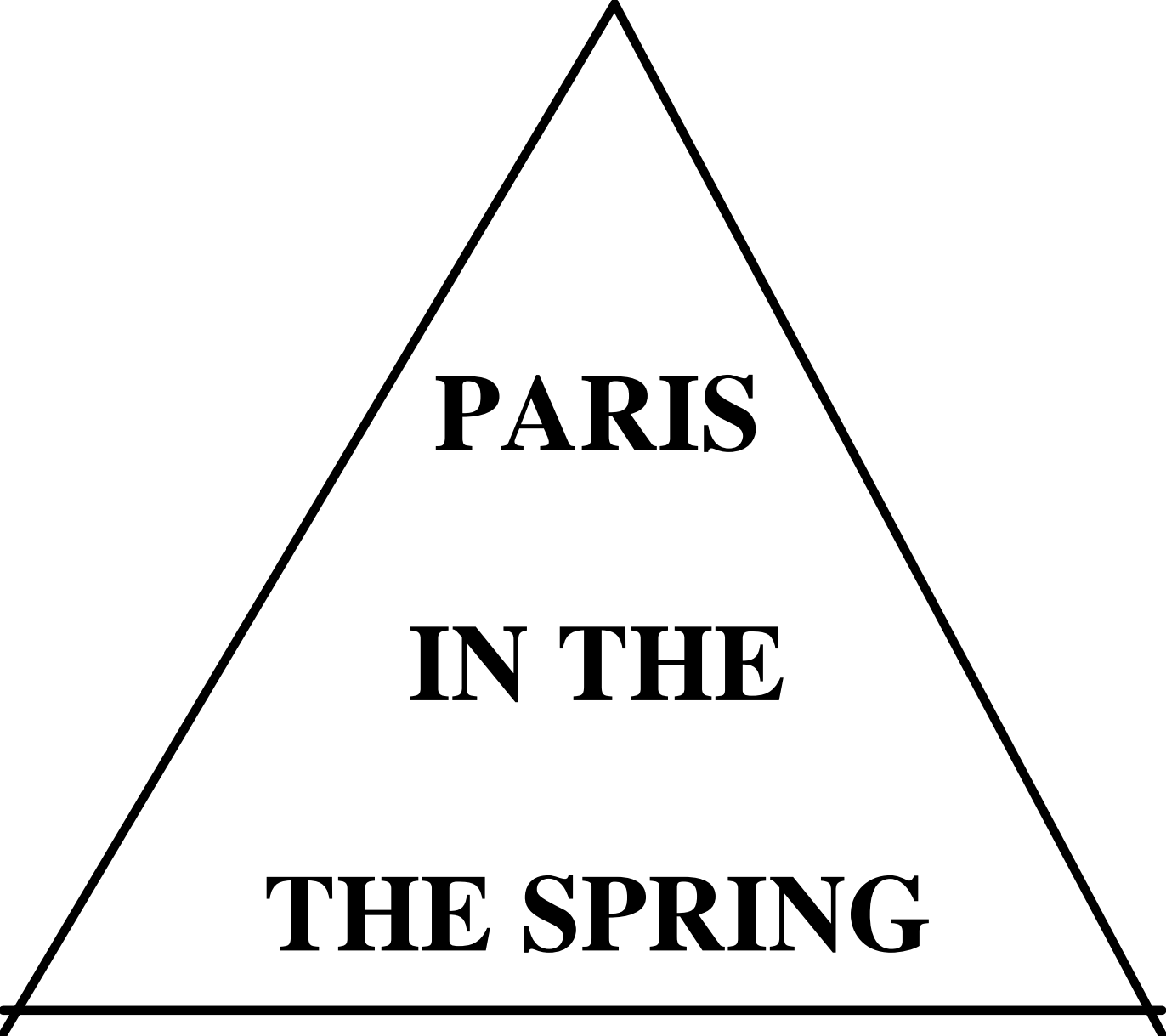
JOB 03 Specification Part 2

37 WAY LOOM.



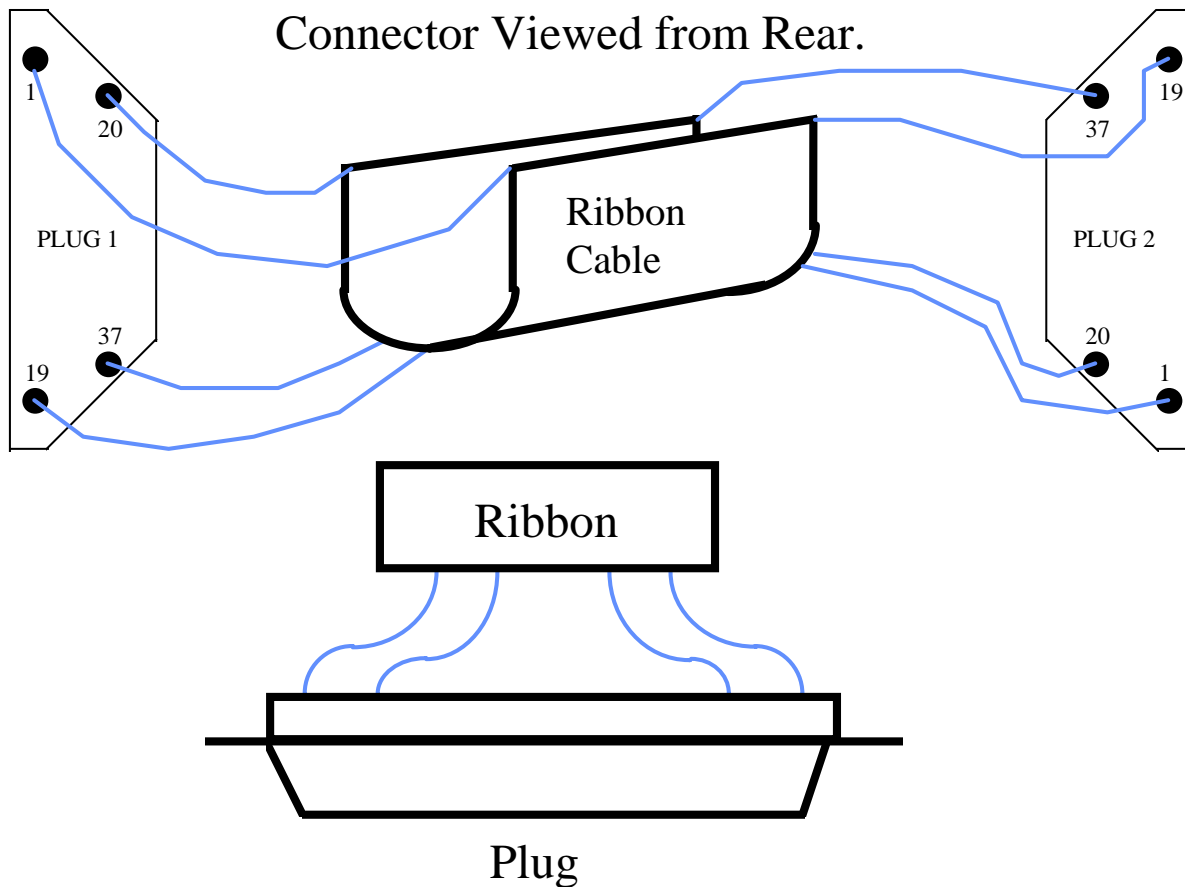
All Wire Pin to Pin e.g. 1 to 1 etc.

1. Wire 37 Way. Tape Ends To Grip Bundle Together.
2. Feed on Braiding , Tie with Waxed String.
3. Stretch , Release & Trim Braid.
4. Feed on Heat Shrink for **Both** Ends.
5. Secure Soldered End.
6. Solder Free End , Adjust Length for even termination.
7. Secure Braiding and Heat Shrink.



PARIS
IN THE
THE SPRING

RIBBON CABLE LOOM



- 1) Connect Pins 1,19,20 and 37 first to set your anchor points and to prepare for even wire termination distribution.
- 2) Use Ribbon cable folded. Fan out wires approximately 4 → 5 cms from either end of cable.
- 3) All wires are Point to Point so that :-
Pin 1 → Pin 19 Pin 20 → Pin 37.
Note All Pins are facing each other as per the wiring schedule.

JOB Specification 23 & 32

SOLDER.

LEAD	100%	63%	50%	40%	30%	0%
TIN	0%	37%	50%	60%	70%	100%
LIQUID	450°F 232°C	359°F	414°F	460°F 238°C	496°F 258°C	620°F 327°C
SOLID	450°F	359°F	359°F	359°F 180°C	359°F	620°F
PLASTI C RANGE	0°F	0°F	55°F	101°F	137°F	0°F

The Above information is for background ONLY.

Soldering Iron Tip Numbers.

TIP No.7 = 700°F > 350°C

TIP No.6 = 600°F < 350°C

Note The Larger the TIP the Better the Heat Transfer.

SWG:: Standard Wire Gauge.
Larger Number = Thinner wires

EDUCATION

- 1) **A RELATIVELY PERMANENT CHANGE IN ATTITUDE FOR THE REST OF YOUR LIFE.**
- 2) **LEARNING IS A VOLUNTARY PROCESS.**
- 3) **QUALITY BEFORE SPEED**
BS 5750 ISO 9000 EU 9000

PLAN
AHEAD
D

COLOUR CODE

Wire code	Value	Name	Link Word	Colour	Value
K				Pink	
B	0	Zero	<i>Zerro</i>	Black	0
N	1	One	<i>Bun</i>	Brown	1
R	2	Two	<i>Shoe</i>	Red	2
O	3	Three	<i>Tree</i>	Orange	3
Y	4	Four	<i>Door</i>	Yellow	4
G	5	Five	<i>Alive</i>	Green	5
U	6	Six	<i>Sex</i>	Blue	6
P	7	Seven	<i>Heaven</i>	Violet Purple	7
S	8	Eight	<i>Gate</i>	Grey Slate	8
W	9	Nine	<i>Line</i> <i>Wine</i>	White	9

**Bye Bye Rosie Off You Go Bt Via Great
Western.**

Note The Wire code letters are for information purposes only.

RESISTORS.

Symbol

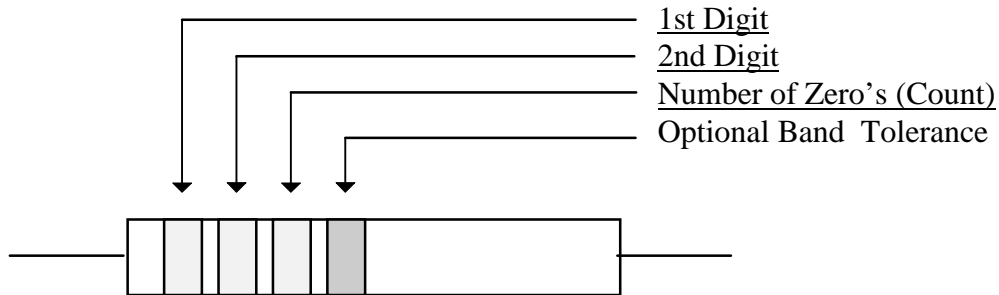


or

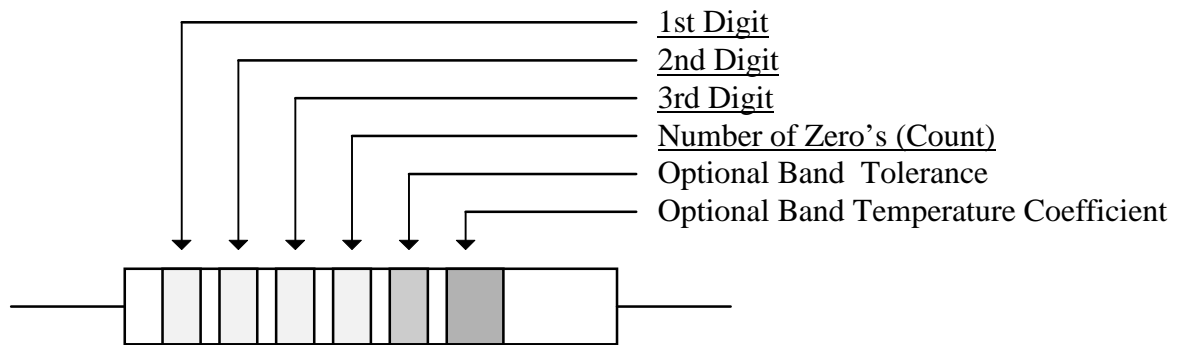


Value Measured in OHMs Ω

Values Type 1



Values Type 2



Tolerance

Brown = 1% = F

Green = 0.5%

Blue = 0.25%

Violet = 0.1%

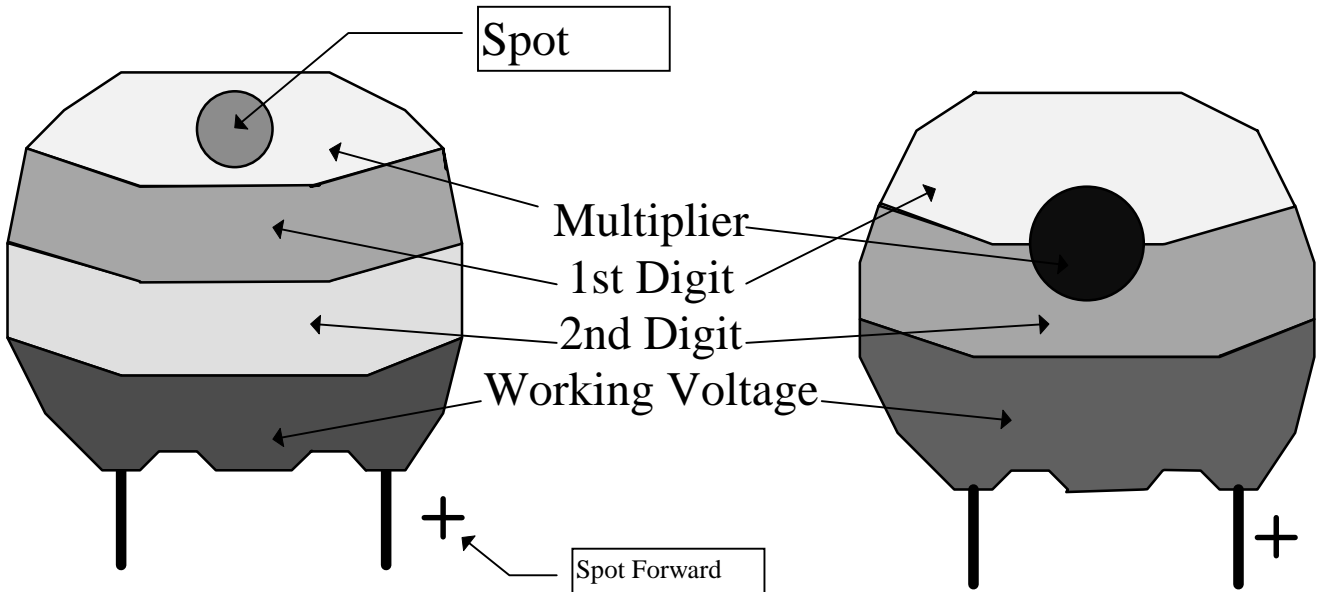
None = 20% = M

Silver = 10% = K

Gold = 5% = J

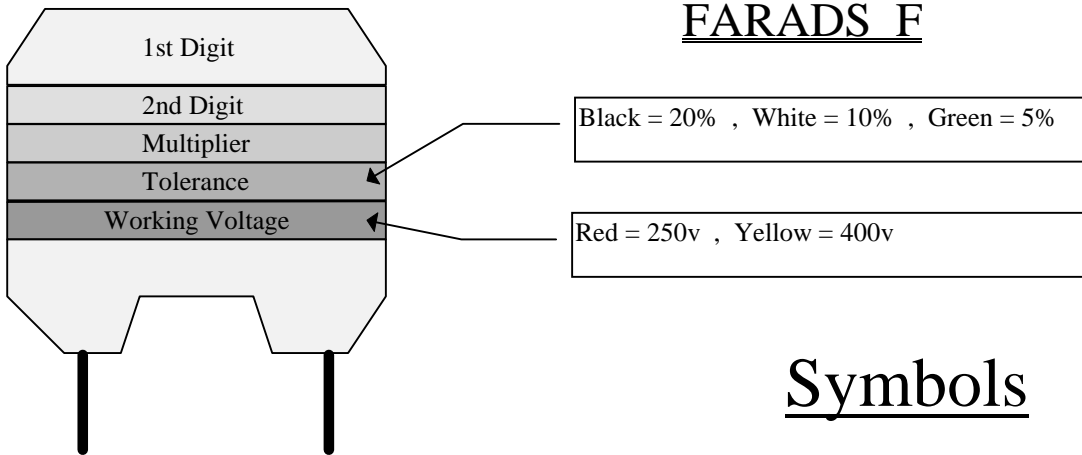
Red = 2% = G

CAPACITORS.



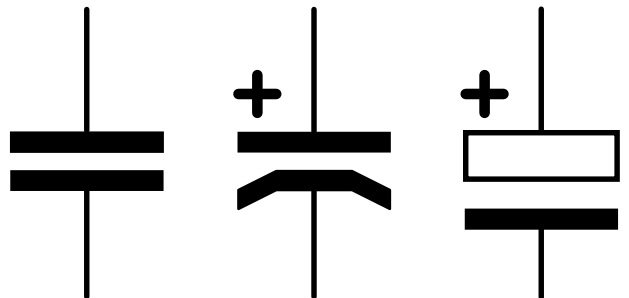
Values in μF

Values measured in
FARADS F



Value in pF

Symbols



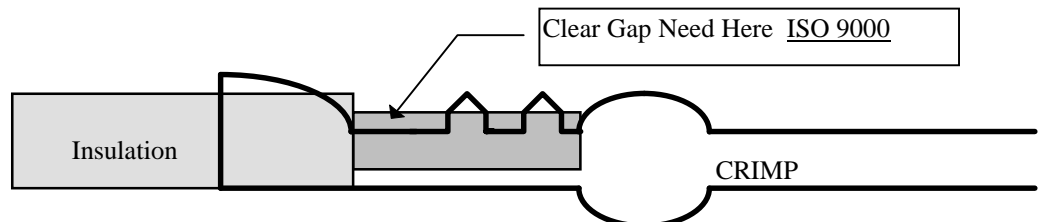
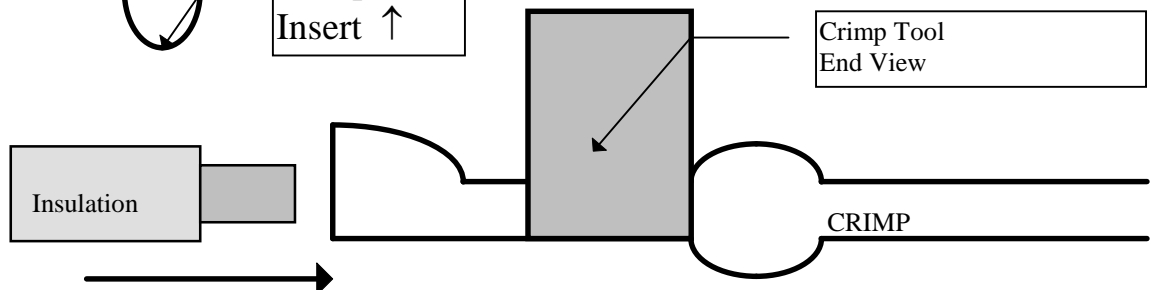
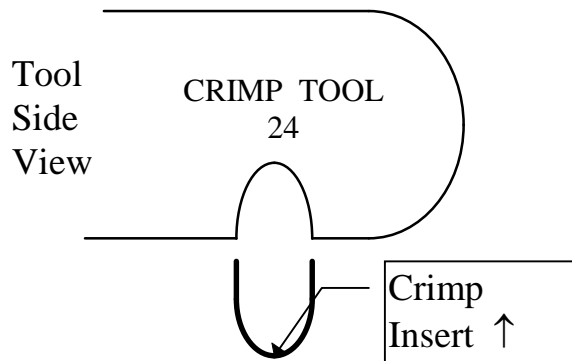
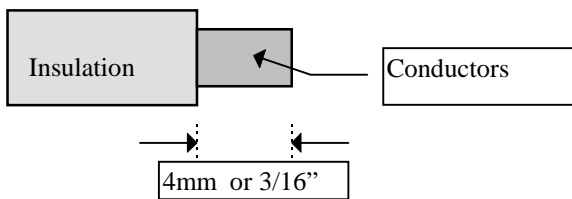
CRIMPS.

A Mechanical Crushed Electrical Connection

QM Crimps Size 24

Using 7/0.2 Wire Stripped ONLY
DO NOT TIN

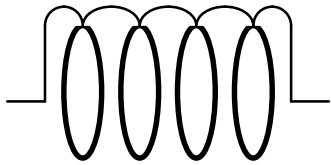
1. Place Crimp in Tool.
2. Clamp/Crush Wire.



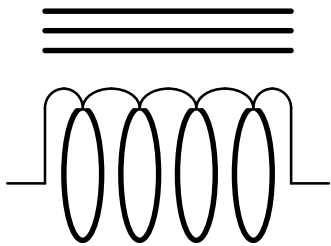
3. Insert in the "INS" Jaws and clamp the Insulation to the Crimp.

INDUCTORS.

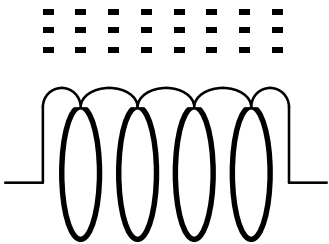
SYMBOLS



AIR Core



IRON Core



FERRITE Core

Values measured in
HENRYS H

NUMBERS

10^9	One Thousand Million	G	Giga
10^6	One Million	M	Mega
10^3	One Thousand	K	Kilo
10^0	One		Units
10^{-3}	One Thousandth	m	Milli
10^{-6}	One Millionths	μ	Micro
10^{-9}	One Thousandth Millionth	n	Nano
10^{-12}	One Millionth Millionth	p	Pico

$$1\text{K} = 1,000 = 1,000,000\text{m}$$

Moving \uparrow times a 1000 , Moving \downarrow divide by 1000

THREE CHARACTER/DIGIT CODE

This is a common used shorthand.

This system uses the first two digits of a number and either a count of the number of zero's that follow the two numbers or a standard metric multiplier letter.

Example

5600000 Translates to 5,600,000 or 5.6million this can also be written as 5.6M

Note that the decimal point could be easily missed or erased so the metric multiplier letter is used to replace the decimal point.

e.g. 5M6

Alternatively

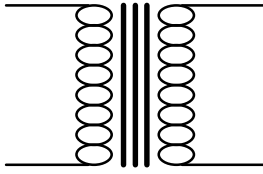
5600000 translates to 5 , 6 and 5 zero's giving the three digit code 565

<u>Number</u>		<u>3 Character</u>		<u>3 Digit Option</u>
2700	=	2K7	=	272
27000	=	27K	=	273
270000	=	270K or 0.27M or M27		

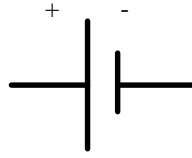
Examples

100Ω	Resistor	=	100	
10Ω	Resistor	=	10R	or 10Ω
1Ω	Resistor	=	1Ω0	or 1R0
1000Ω	Resistor	=	1K0	
1000pF	Capacitor	=	1nF	or 102
22μF	Capacitor	=	22μ	
2.2μ	Capacitor	=	2μ2	

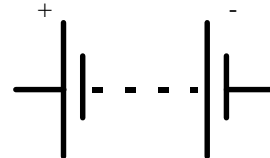
Circuit Symbols.



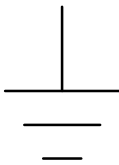
Transformer



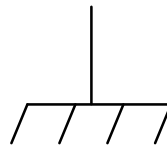
Cell



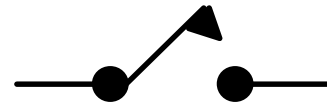
Battery



Earth



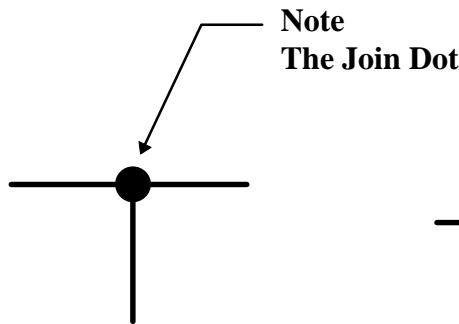
Chassis



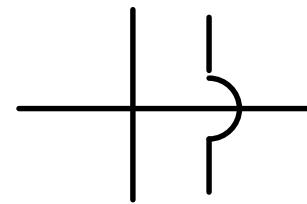
Switch



Connecting
Wire

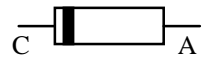


Wires
Joined



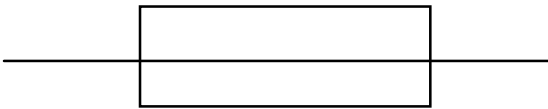
Wires
Crossing

Circuit Symbols.

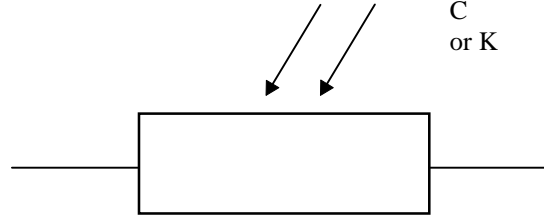


A = Anode
= Positive
+ End

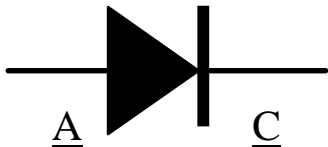
C or K = Cathode
= Negative
- End



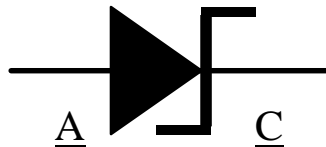
Fuse



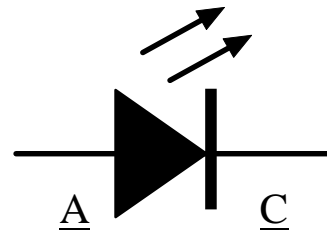
Light Dependant Resistor (LDR)



Diode

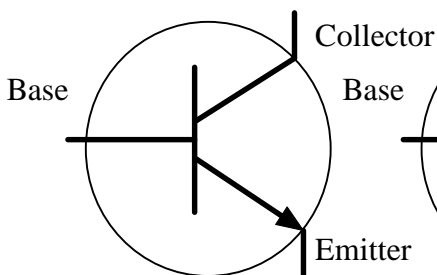


Zenner Diode

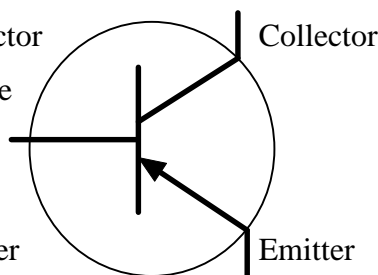


LED Light Emitting Diode

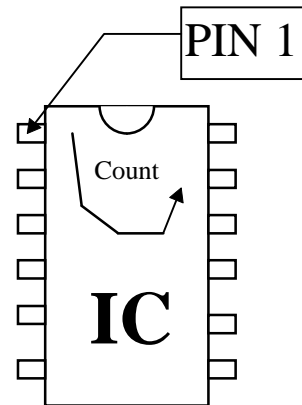
TRANSISTORS



NPN



PNP



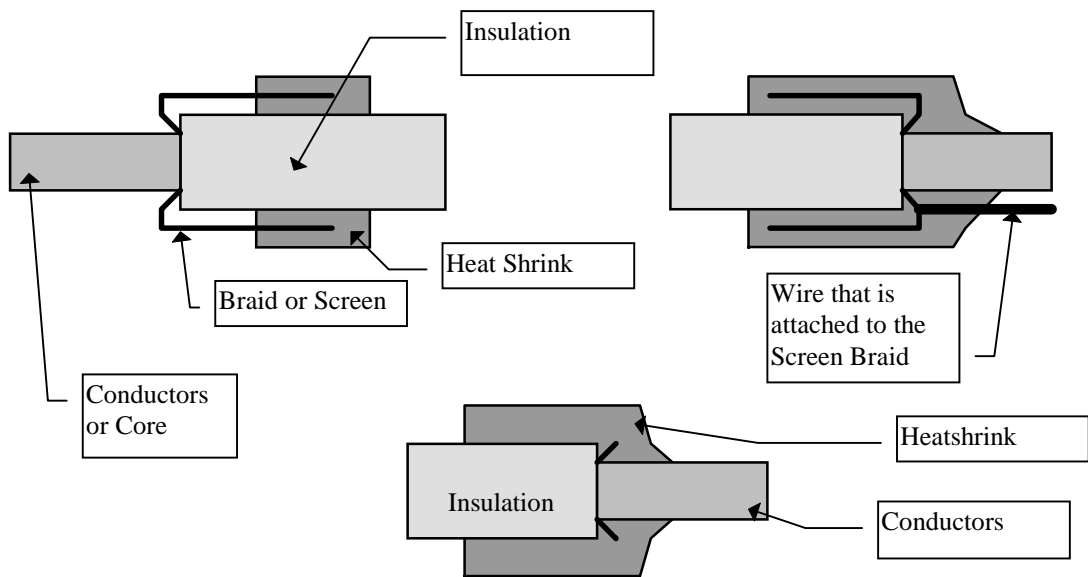
DIL
IC

Dual In Line
Integrated Circuit

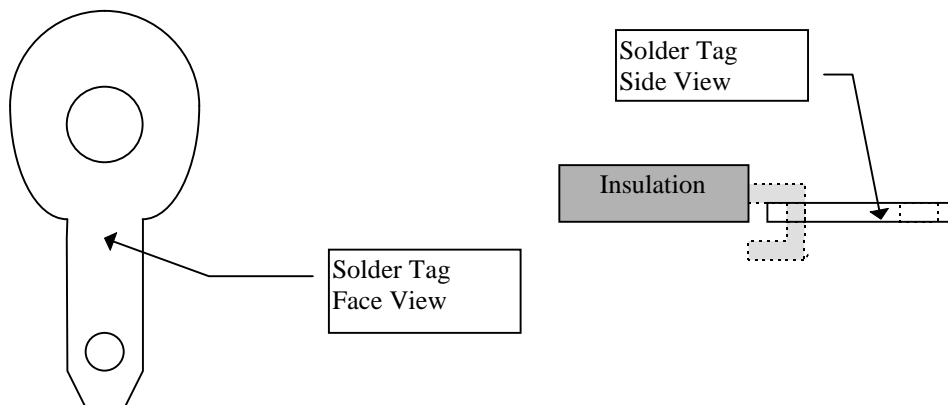
LOOMS.

Note that a PLUG = PINS

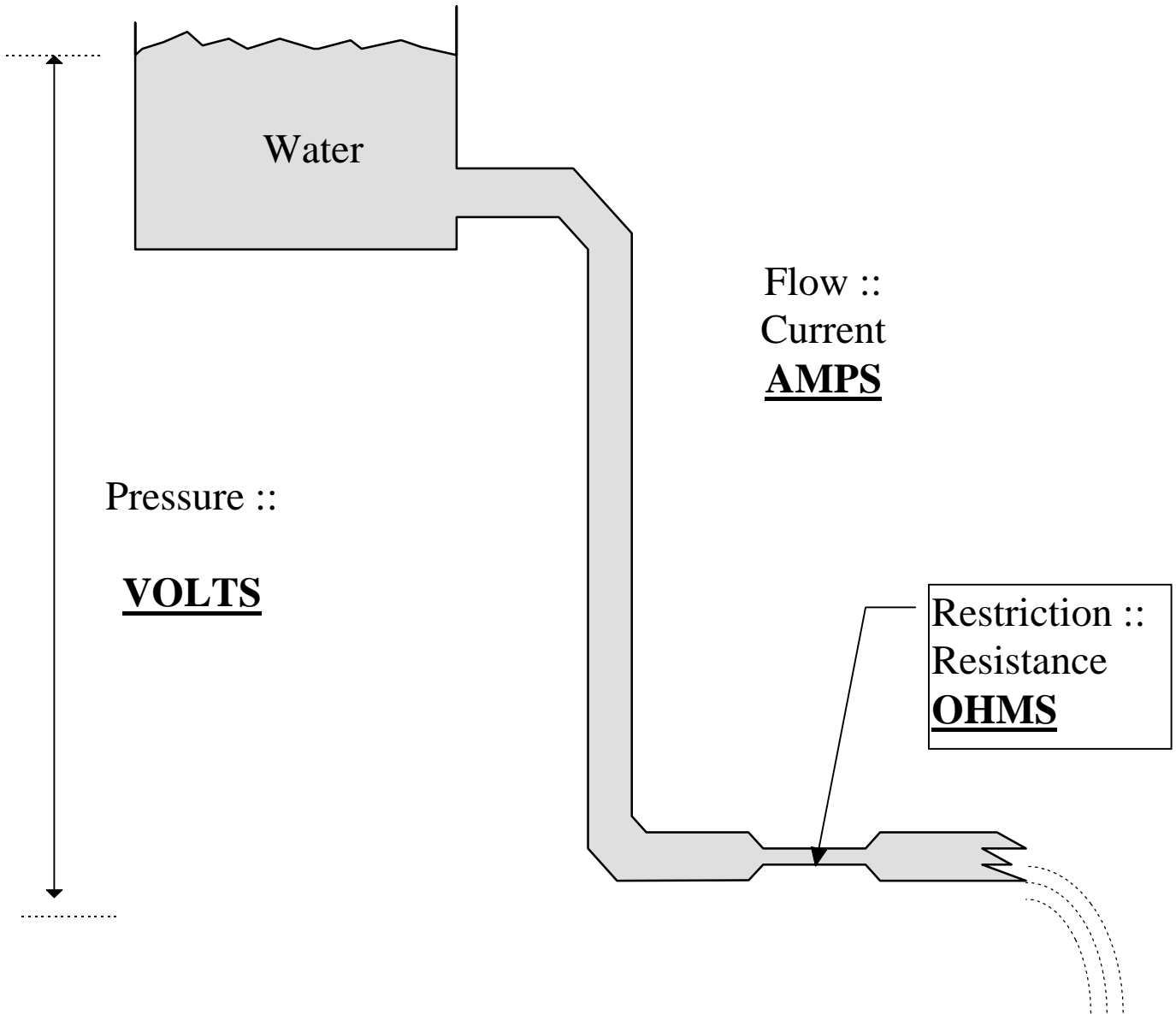
Various methods of terminating a Screened Cable



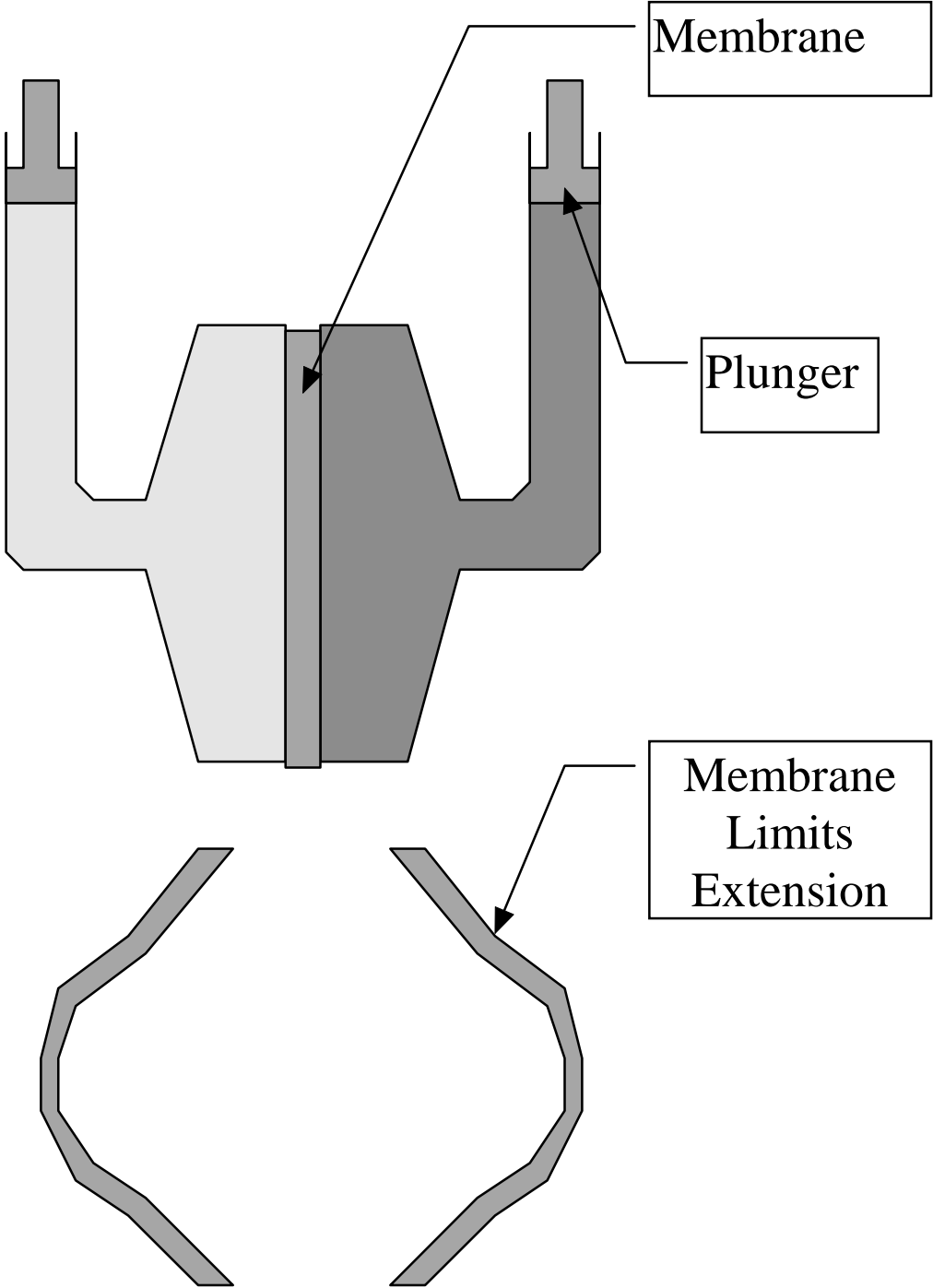
The Solder Tag.



VOLTS Etc.

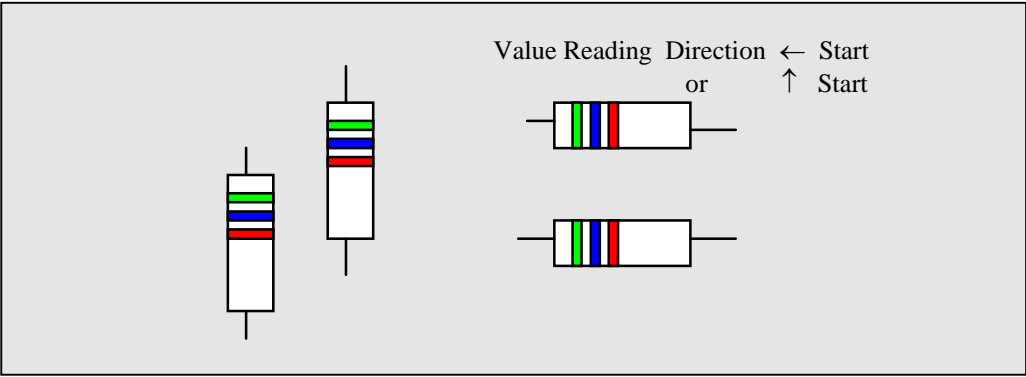
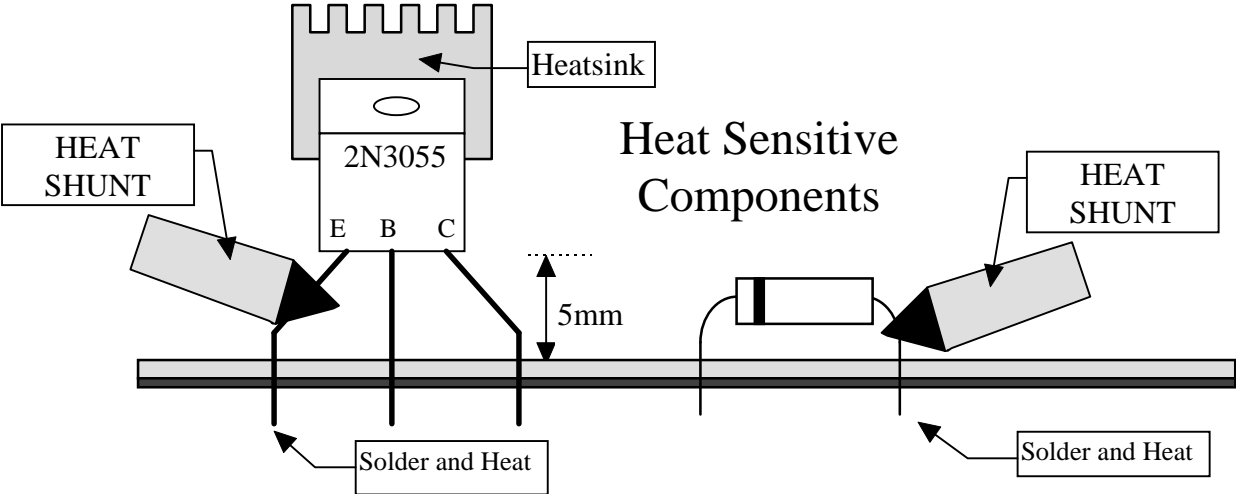
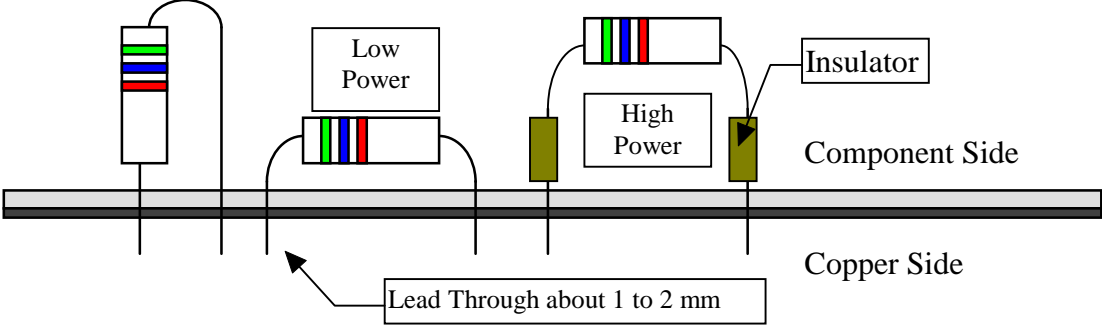


ENERGY TRANSFER.

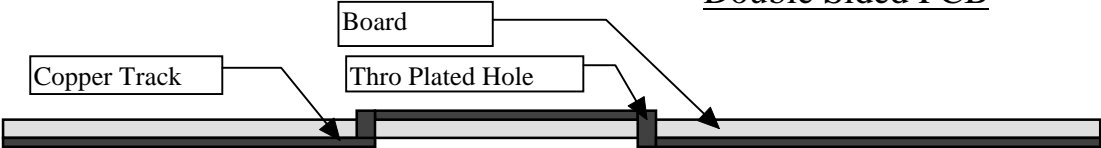


PCB Printed Circuit Board.

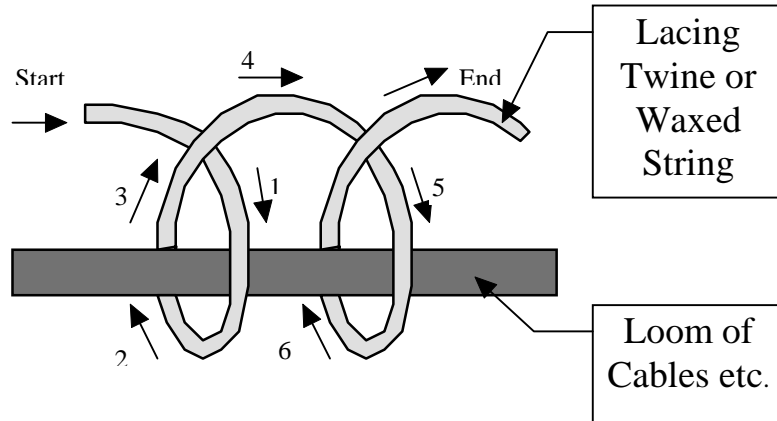
Single Sided PCB



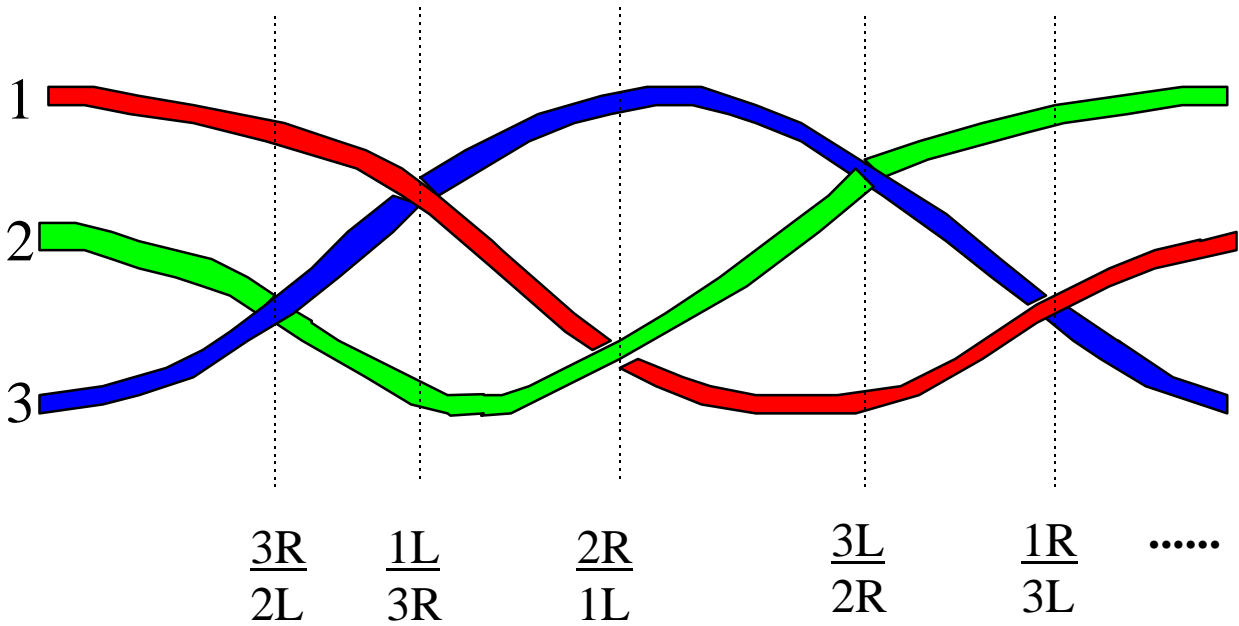
Double Sided PCB



KNOTS

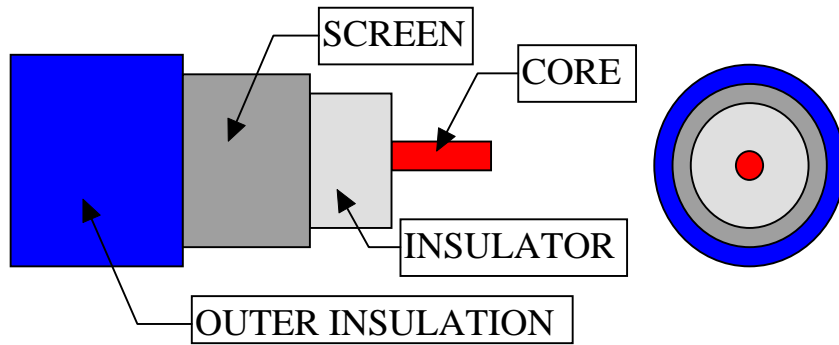


The Clove Hitch



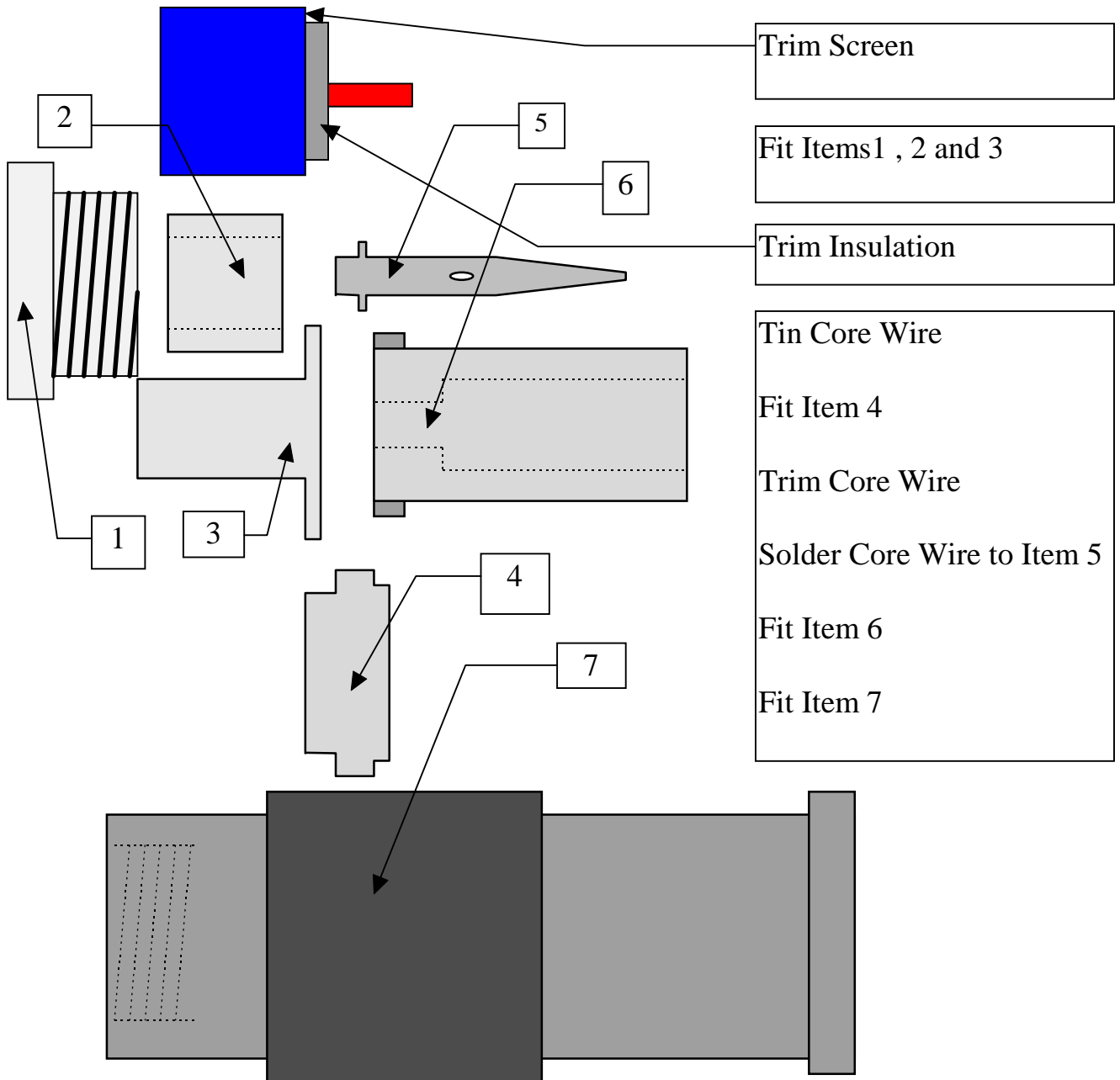
The Wire Plait

COAXIAL CABLE.



Side View of Cable.

End View of Cable.



QUALITY

ISO 9000

The Quality System.

Consists of :-

ISO 9001

Document Control.

ISO 9002

The Processes.

Other Systems

BS5750

EU9000

Checking

Techniques

Sample

Random Grab of Items.

Batch

A Group of product Items

e.g. $\sqrt{\text{ITEMS}}$

100%

Everthing (as per course)

OHMS LAW

$$R = \frac{V}{A} = \frac{\text{VOLTAGE}}{\text{CURRENT}} = \text{RESISTANCE}$$

<u>Symbol</u>	<u>Measurement</u>	<u>Units</u>	
V	Voltage	Volts	V
I	Current	Amps	A
Ω	Resistance	Ohms	R

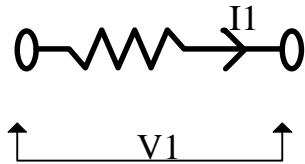
POWER

$$\text{POWER} = \text{VOLTAGE} * \text{CURRENT}$$

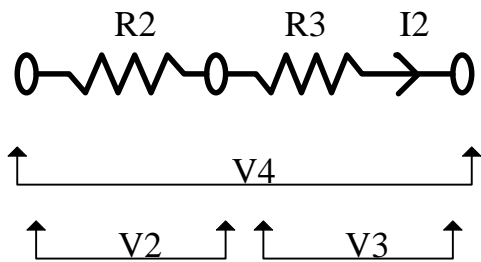
$$W = V * A$$

<u>Symbol</u>	<u>Measurement</u>	<u>Units</u>	
V	Voltage	Volts	V
I	Current	Amps	A
W	Power	Watts	W

RESISTORS

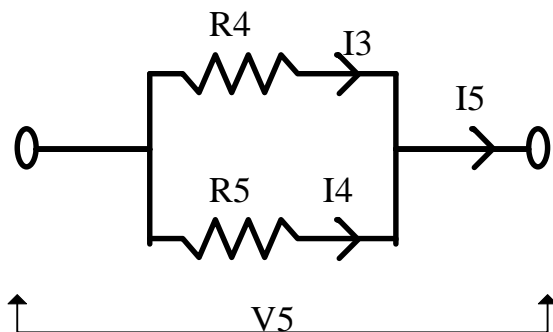


$$\frac{V1}{I1} = R1$$



$$R(\text{total}) = R2 + R3$$

$$V4 = V2 + V3$$



$$\frac{1}{R(\text{total})} = \frac{1}{R4} + \frac{1}{R5}$$

$$I5 = I3 + I4$$

CALCULATIONS

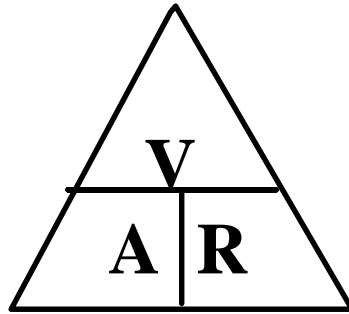
$$\frac{V}{A} = R$$

or

$$V = A * R$$

or

$$\frac{V}{R} = A$$



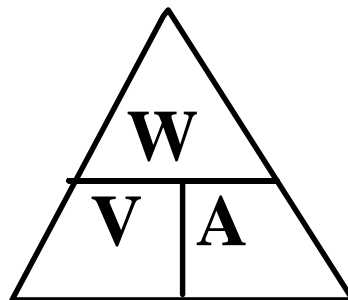
$$\frac{W}{V} = A$$

or

$$W = V * A$$

or

$$\frac{W}{A} = V$$

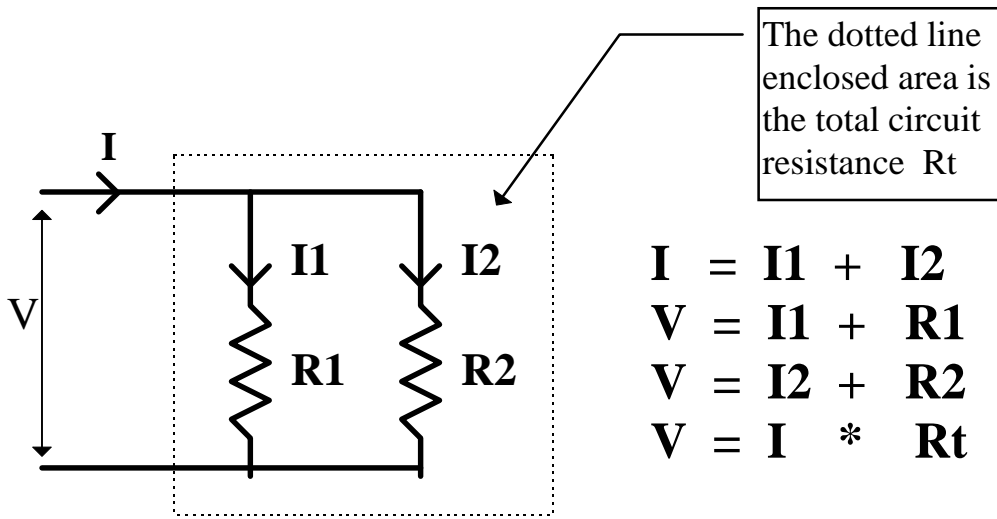


Exercises

- 1) Define W in terms of R
- 2) What is the resistance of two lamps in Parallel 60W + 100W in a mains circuit.

Mains Voltage is assumed to be 240vac.

PROOF.



$$\begin{aligned}
 \mathbf{I} &= \mathbf{I1} + \mathbf{I2} \\
 \mathbf{V} &= \mathbf{I1} + \mathbf{R1} \\
 \mathbf{V} &= \mathbf{I2} + \mathbf{R2} \\
 \mathbf{V} &= \mathbf{I} * \mathbf{Rt}
 \end{aligned}$$

This Gives

$$\frac{V}{R} = I, \quad \frac{V}{R1} = I1, \quad \frac{V}{R2} = I2$$

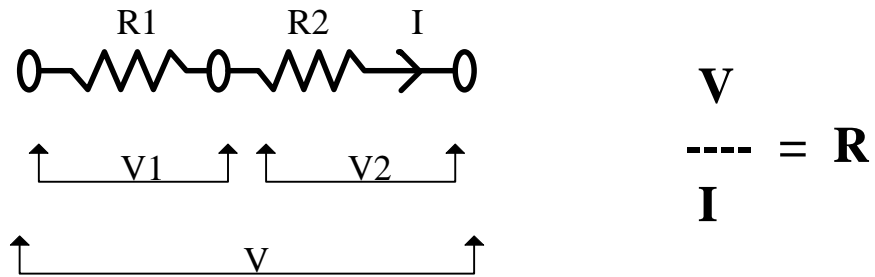
Therefore If $\mathbf{I = I1 + I2}$ **THEN**

$$\frac{V}{R} = \frac{V}{R1} + \frac{V}{R2} \dots\dots\dots \text{(and Dividing)}$$

(by V gives)

$$\frac{1}{R} = \frac{1}{R1} + \frac{1}{R2} \dots\dots\dots \text{etc}$$

PROOF.



As “I” is Common through both R1 & R2

$$\therefore V = V1 + V2$$

$$V1 = I * R1$$

$$V2 = I * R2$$

$$V = I * R(\text{Total})$$

$$\therefore I * R(\text{Total}) = I * R1 + I * R2$$

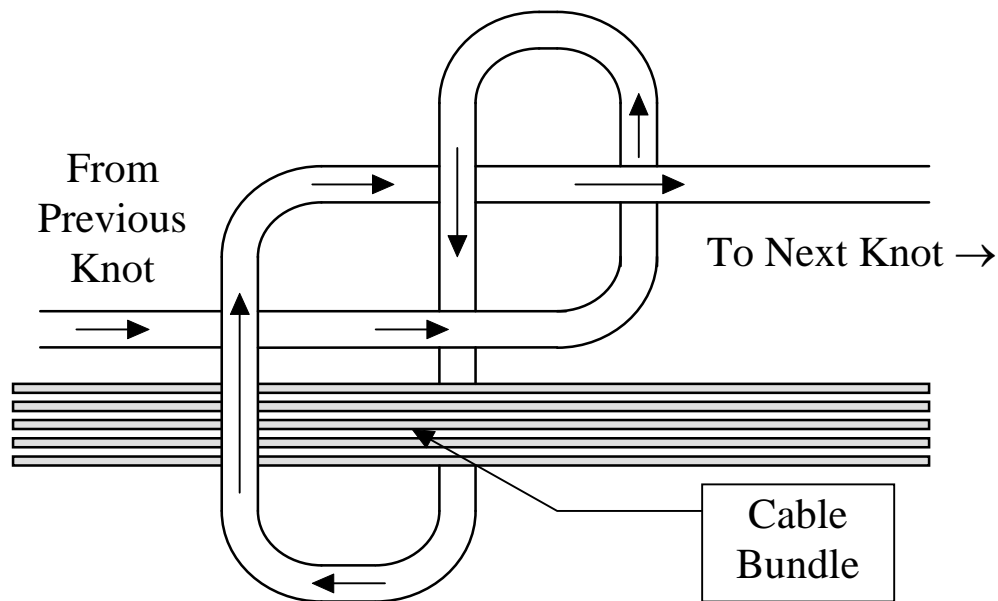
Now divide through by “I” gives

$$I * R(\text{Total}) = I * R1 + I * R2$$

giving :-

$$R(\text{Total}) = R1 + R2 + \dots \text{ etc}$$

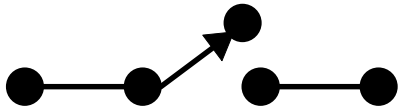
LOOM LACING KNOTS.



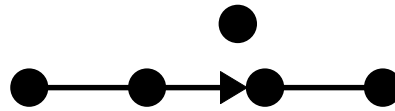
1. Start with Clove Hitch Plus and Extra Hitch.
2. Lace Bundle.
3. Lock Bundle with Reversed Lacing Knot.

SWITCHES & RELAYS.

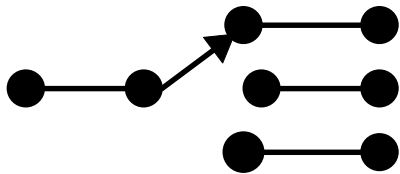
Contacts



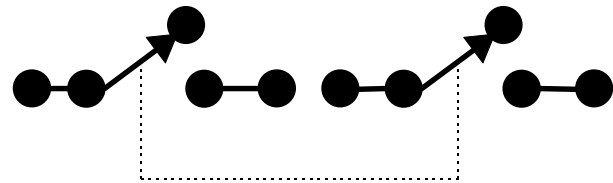
NO = Normally Open.



NC = Normally Closed.



Single Pole 3 Way



2 Pole 2 Way (Ganged)

The Relay

