

**LESSON PLAN**

Date \_\_\_\_\_

Trade:- Welder

Name \_\_\_\_\_

Unit/Lesson:- Thirty and Thirty one

Subject:- Wire feed system: Types, uses, limitations, care and maintenance. Welding wires used in CO<sub>2</sub> welding, diameter designation as per specification.

Types of shielding gases and gas mixtures used in MIG/MAG welding and its application.

Flux cored arc welding: description, advantages, welding wires, coding as per AWS.

**Motivation:-** In previous lesson we read about all type filler wire transfer on the metal as like spray transfer, globular transfer and dip transfer.

**PREPARATION**

1) (Materials, Tools, Models, Charts and other aids)

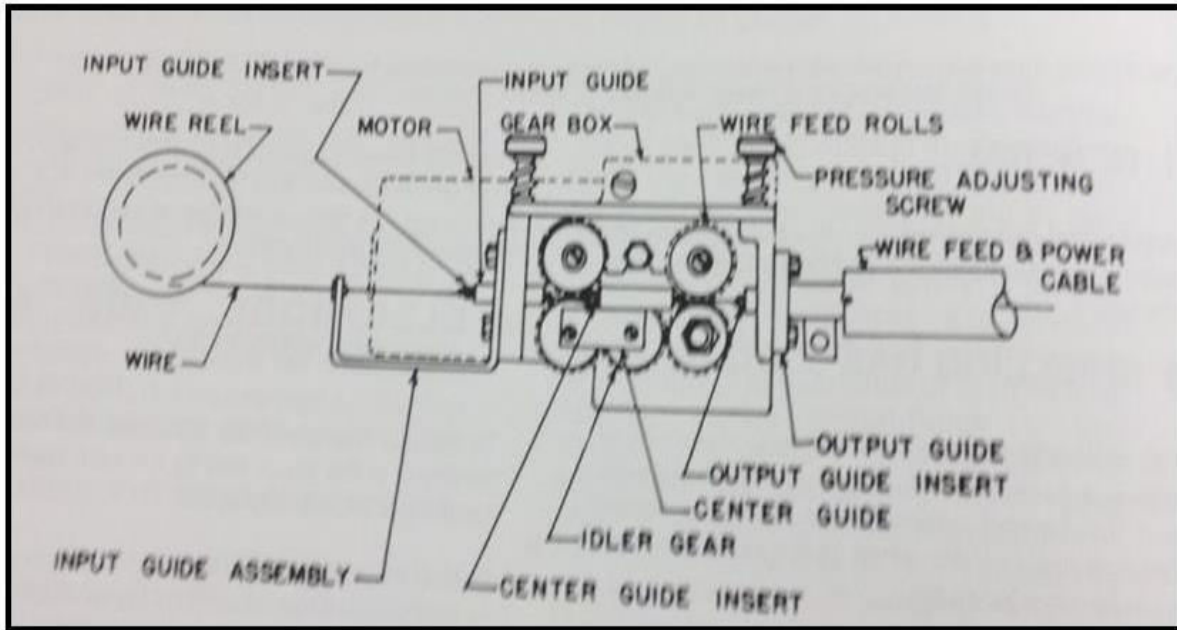
2) **INTRODUCTION:-** To day we discuss about welding wire used in MIG welding and detailed study about welding wires and shielding gases and gases mixtures.

**II PRESENTATION:-**

| Topic                            | Information Point  | Spot Hints                   |             |                              |           |                 |                       |           |               |                   |           |                 |                     |           |               |                   |  |
|----------------------------------|--|------------------------------|-------------|------------------------------|-----------|-----------------|-----------------------|-----------|---------------|-------------------|-----------|-----------------|---------------------|-----------|---------------|-------------------|--|
| Welding wire used in co2 welding | In co2 welding consumable wire use for welding . Welding wires also carry current for welding and filler materials.  |                              |             |                              |           |                 |                       |           |               |                   |           |                 |                     |           |               |                   |  |
| Size                             | Available in different diameter . Diameter of welding wires start from 0.8 mm to 2.4 mm  |                              |             |                              |           |                 |                       |           |               |                   |           |                 |                     |           |               |                   |  |
|                                  | <table border="1"> <thead> <tr> <th>For Wire Size</th> <th>Multiply by</th> <th>Ex. Using 1/8 in. (125 amps)</th> </tr> </thead> <tbody> <tr> <td>0.023 in.</td> <td>3.5 in. per amp</td> <td>3.5 x 125 = 437.5 IPM</td> </tr> <tr> <td>0.030 in.</td> <td>2 in. per amp</td> <td>2 x 125 = 250 IPM</td> </tr> <tr> <td>0.035 in.</td> <td>1.6 in. per amp</td> <td>1.6 x 125 = 200 IPM</td> </tr> <tr> <td>0.045 in.</td> <td>1 in. per amp</td> <td>1 x 125 = 125 IPM</td> </tr> </tbody> </table> | For Wire Size                | Multiply by | Ex. Using 1/8 in. (125 amps) | 0.023 in. | 3.5 in. per amp | 3.5 x 125 = 437.5 IPM | 0.030 in. | 2 in. per amp | 2 x 125 = 250 IPM | 0.035 in. | 1.6 in. per amp | 1.6 x 125 = 200 IPM | 0.045 in. | 1 in. per amp | 1 x 125 = 125 IPM |  |
| For Wire Size                    | Multiply by  | Ex. Using 1/8 in. (125 amps) |             |                              |           |                 |                       |           |               |                   |           |                 |                     |           |               |                   |  |
| 0.023 in.                        | 3.5 in. per amp  | 3.5 x 125 = 437.5 IPM        |             |                              |           |                 |                       |           |               |                   |           |                 |                     |           |               |                   |  |
| 0.030 in.                        | 2 in. per amp  | 2 x 125 = 250 IPM            |             |                              |           |                 |                       |           |               |                   |           |                 |                     |           |               |                   |  |
| 0.035 in.                        | 1.6 in. per amp  | 1.6 x 125 = 200 IPM          |             |                              |           |                 |                       |           |               |                   |           |                 |                     |           |               |                   |  |
| 0.045 in.                        | 1 in. per amp  | 1 x 125 = 125 IPM            |             |                              |           |                 |                       |           |               |                   |           |                 |                     |           |               |                   |  |

| Gas Mixtures           | There are three gases and their mixture used in GMAW but in some condition O <sub>2</sub> also use in mixture .Argon ,Helium and Co <sub>2</sub>  |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
|------------------------|---|----------|--------------|-------------|--------------------------|--|--|----------|---|---|---|------------------------|-----|-----|------|---------------|-----|-----|-----|-------------|------|------|------|---------------------|---------------|----------|-------|-------------|----------------------------------|--|--|----------|---|---|---|------------------------|-----|-----|--------------|---------------|-----|-----|-----|-------------|------|------|------|---------------------|---------------|----------|-------|-------------|---|--|--|----------|---|---|---|------------------------|-----|-----|--------------|---------------|-----|-----|-----|-------------|------|------|------|---------------------|---------------|----------|-------|
|                        | Table 4. Experimental test conditions for stainless steel gas metal arc welding   |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
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| Gas mixture            | Ar + 5% CO <sub>2</sub>   |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Test nr.               | 1   | 2        | 3            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Wire feed rate (m/min) | 5.0   | 7.0      | 9.0          |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Intensity (A)          | 92  | 182      | 211          |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Voltage (V)            | 18.9  | 25.0     | 30.2         |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Transfer mode          | Short-circuit   | Globular | Spray        |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Gas mixture            | Ar + 18% He + 1% CO <sub>2</sub>  |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Test nr.               | 1   | 2        | 3            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Wire feed rate (m/min) | 5.0   | 7.0      | 9.0          |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Intensity (A)          | 133   | 171      | 199          |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Voltage (V)            | 18.8  | 25.0     | 29.9         |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Transfer mode          | Short-circuit   | Globular | Spray        |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Gas mixture            | Ar + 5% He + 2% CO <sub>2</sub> + 2% N <sub>2</sub>   |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Test nr.               | 1   | 2        | 3            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Wire feed rate (m/min) | 6.0   | 7.0      | 9.8          |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Intensity (A)          | 109   | 185      | 226          |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Voltage (V)            | 19.1  | 25.2     | 30.8         |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Transfer mode          | Short-circuit   | Globular | Spray        |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
|                        | Table 3. Experimental test conditions for mild steel gas metal arc welding  |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
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| Gas mixture            | Ar + 10% CO <sub>2</sub>  |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Test nr.               | 1   | 2        | 3            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Wire feed rate (m/min) | 4.0   | 6.3      | 11.2         |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Intensity (A)          | 102   | 137      | 194          |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Voltage (V)            | 17.8  | 20.0     | 32.4         |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Metal transfer mode    | Short-circuit   | Globular | Spray        |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Gas mixture            | Ar + 18% CO <sub>2</sub>  |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Test nr.               | 1   | 2        | 3            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Wire feed rate (m/min) | 4.0   | 6.3      | Not attained |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Intensity (A)          | 92  | 122      | -            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Voltage (V)            | 17.7  | 19.9     | -            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Metal transfer mode    | Short-circuit   | Globular | Spray        |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Gas mixture            | CO <sub>2</sub>   |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Test nr.               | 1   | 2        | 3            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Wire feed rate (m/min) | 5.0   | 7.5      | Not attained |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Intensity (A)          | 64  | 129      | -            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Voltage (V)            | 18.7  | 21.1     | -            |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Metal transfer mode    | Short-circuit   | Globular | Spray        |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| Wire feed system       | Wire feed system is a very important part of mig welding. Wire feed system play two role in mig process. It supply current and filler wire both.  |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |
| parts                  | Wire Role, DC Motor (To push filler wire) , wire roller , Current and wire speed adjustment switch.   |          |              |             |                          |  |  |          |   |   |   |                        |     |     |      |               |     |     |     |             |      |      |      |                     |               |          |       |             |                                  |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |             |   |  |  |          |   |   |   |                        |     |     |              |               |     |     |     |             |      |      |      |                     |               |          |       |

# INTERNAL DIAGRAM OF WIRE FEED SYSTEM



| Types   | 1 Pull type 2 Push type  |   |                    |       |       |                 |                 |                 |                |                 |                    |                    |                    |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
|---|--|---|--------------------|-------|-------|-----------------|-----------------|-----------------|----------------|-----------------|--------------------|--------------------|--------------------|--|--------------------|---|----|----|---|---|-----------------|-----------------|-----------------|----------------|-----------------|----|----|----|---------|------|--------------------|--------------------|-------|-------|--|--|--|--|------|--------------------|--------------------|--------------------|---------|--------------------|--------------------|--------------------|--|--|--|--|--|--|--|---|---|---|---------|--------------------|--------------------|--------------------|--|--|--|--|--|--|--|---|---|---|---------|--------------------|--------------------|--------------------|--|--|--|--|--|--|--|---|---|--------------------|---------|--------------------|--------------------|--------------------|--|--|--|--|--|--|--|---|---|---|---------|--------------------|--------------------|--------------------|---|---|--|--|--|--|---|---|---|---|---------|---------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|
| Safety  | <ol style="list-style-type: none"> <li>1. Do not over press the roller</li> <li>2. Keep neat and clean</li> <li>3. Lubricant moving parts time to time</li> </ol>  |   |                    |       |       |                 |                 |                 |                |                 |                    |                    |                    |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| Flux<br>Cored arc<br>welding                                      | In this process arc striking between flux cored wire and job.<br>This process done with and without shielding gas.   |   |                    |       |       |                 |                 |                 |                |                 |                    |                    |                    |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| Types   | <ol style="list-style-type: none"> <li>1. Self shielded flux cored wire</li> <li>2. Flux cored with gas shield</li> </ol>  |   |                    |       |       |                 |                 |                 |                |                 |                    |                    |                    |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| Size of<br>wire   | 1.6 mm, 2.0 mm, 2.4mm , and 3.2 mm diameter,shielding gas= Pure co2 ,<br>argon 5% , argon 20 %   |   |                    |       |       |                 |                 |                 |                |                 |                    |                    |                    |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
|   | <table border="1"> <thead> <tr> <th colspan="13">GMAW Carbon Steel Electrode Chemical Compositions, Weight Percent</th> </tr> <tr> <th>AWS classification</th> <th>C</th> <th>Mn</th> <th>Si</th> <th>P</th> <th>S</th> <th>Ni<sup>a</sup></th> <th>Cr<sup>b</sup></th> <th>Mo<sup>c</sup></th> <th>V<sup>c</sup></th> <th>Cu<sup>b</sup></th> <th>Ti</th> <th>Zr</th> <th>Al</th> </tr> </thead> <tbody> <tr> <td>ER70S-2</td> <td>0.07</td> <td>0.90<br/>to<br/>1.40</td> <td>0.40<br/>to<br/>0.70</td> <td>0.025</td> <td>0.035</td> <td></td> <td></td> <td></td> <td></td> <td>0.50</td> <td>0.05<br/>to<br/>0.15</td> <td>0.02<br/>to<br/>0.12</td> <td>0.05<br/>to<br/>0.15</td> </tr> <tr> <td>ER70S-3</td> <td>0.06<br/>to<br/>0.15</td> <td>0.90<br/>to<br/>1.40</td> <td>0.45<br/>to<br/>0.70</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>ER70S-4</td> <td>0.07<br/>to<br/>0.15</td> <td>1.00<br/>to<br/>1.50</td> <td>0.65<br/>to<br/>0.85</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>ER70S-5</td> <td>0.07<br/>to<br/>0.19</td> <td>0.90<br/>to<br/>1.40</td> <td>0.30<br/>to<br/>0.60</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>—</td> <td>—</td> <td>0.50<br/>to<br/>0.90</td> </tr> <tr> <td>ER70S-6</td> <td>0.07<br/>to<br/>0.15</td> <td>1.40<br/>to<br/>1.85</td> <td>0.80<br/>to<br/>1.15</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>ER70S-7</td> <td>0.07<br/>to<br/>0.15</td> <td>1.50<br/>to<br/>2.00</td> <td>0.50<br/>to<br/>0.80</td> <td>↓</td> <td>↓</td> <td></td> <td></td> <td></td> <td></td> <td>↓</td> <td>—</td> <td>—</td> <td>—</td> </tr> <tr> <td>ER70S-G</td> <td colspan="12">No chemical requirements<sup>c</sup></td> </tr> </tbody> </table> <p>a. These elements may be present but are not intentionally added.<br/> b. The maximum weight percent of copper in the rod or electrode due to any coating plus the residual copper content in the steel shall be 0.50.<br/> c. For this classification, there are no chemical requirements for the elements listed, with the exception that there shall be no intentional addition of Ni, Cr, Mo, or V.</p> | GMAW Carbon Steel Electrode Chemical Compositions, Weight Percent |                    |       |       |                 |                 |                 |                |                 |                    |                    |                    |  | AWS classification | C | Mn | Si | P | S | Ni <sup>a</sup> | Cr <sup>b</sup> | Mo <sup>c</sup> | V <sup>c</sup> | Cu <sup>b</sup> | Ti | Zr | Al | ER70S-2 | 0.07 | 0.90<br>to<br>1.40 | 0.40<br>to<br>0.70 | 0.025 | 0.035 |  |  |  |  | 0.50 | 0.05<br>to<br>0.15 | 0.02<br>to<br>0.12 | 0.05<br>to<br>0.15 | ER70S-3 | 0.06<br>to<br>0.15 | 0.90<br>to<br>1.40 | 0.45<br>to<br>0.70 |  |  |  |  |  |  |  | — | — | — | ER70S-4 | 0.07<br>to<br>0.15 | 1.00<br>to<br>1.50 | 0.65<br>to<br>0.85 |  |  |  |  |  |  |  | — | — | — | ER70S-5 | 0.07<br>to<br>0.19 | 0.90<br>to<br>1.40 | 0.30<br>to<br>0.60 |  |  |  |  |  |  |  | — | — | 0.50<br>to<br>0.90 | ER70S-6 | 0.07<br>to<br>0.15 | 1.40<br>to<br>1.85 | 0.80<br>to<br>1.15 |  |  |  |  |  |  |  | — | — | — | ER70S-7 | 0.07<br>to<br>0.15 | 1.50<br>to<br>2.00 | 0.50<br>to<br>0.80 | ↓ | ↓ |  |  |  |  | ↓ | — | — | — | ER70S-G | No chemical requirements <sup>c</sup> |  |  |  |  |  |  |  |  |  |  |  |  |
| GMAW Carbon Steel Electrode Chemical Compositions, Weight Percent |  |   |                    |       |       |                 |                 |                 |                |                 |                    |                    |                    |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| AWS classification  | C  | Mn  | Si                 | P     | S     | Ni <sup>a</sup> | Cr <sup>b</sup> | Mo <sup>c</sup> | V <sup>c</sup> | Cu <sup>b</sup> | Ti                 | Zr                 | Al                 |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| ER70S-2   | 0.07   | 0.90<br>to<br>1.40  | 0.40<br>to<br>0.70 | 0.025 | 0.035 |                 |                 |                 |                | 0.50            | 0.05<br>to<br>0.15 | 0.02<br>to<br>0.12 | 0.05<br>to<br>0.15 |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| ER70S-3   | 0.06<br>to<br>0.15   | 0.90<br>to<br>1.40  | 0.45<br>to<br>0.70 |       |       |                 |                 |                 |                |                 | —                  | —                  | —                  |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| ER70S-4   | 0.07<br>to<br>0.15   | 1.00<br>to<br>1.50  | 0.65<br>to<br>0.85 |       |       |                 |                 |                 |                |                 | —                  | —                  | —                  |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| ER70S-5   | 0.07<br>to<br>0.19   | 0.90<br>to<br>1.40  | 0.30<br>to<br>0.60 |       |       |                 |                 |                 |                |                 | —                  | —                  | 0.50<br>to<br>0.90 |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| ER70S-6   | 0.07<br>to<br>0.15   | 1.40<br>to<br>1.85  | 0.80<br>to<br>1.15 |       |       |                 |                 |                 |                |                 | —                  | —                  | —                  |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| ER70S-7   | 0.07<br>to<br>0.15   | 1.50<br>to<br>2.00  | 0.50<br>to<br>0.80 | ↓     | ↓     |                 |                 |                 |                | ↓               | —                  | —                  | —                  |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| ER70S-G   | No chemical requirements <sup>c</sup>  |   |                    |       |       |                 |                 |                 |                |                 |                    |                    |                    |  |                    |   |    |    |   |   |                 |                 |                 |                |                 |    |    |    |         |      |                    |                    |       |       |  |  |  |  |      |                    |                    |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |                    |         |                    |                    |                    |  |  |  |  |  |  |  |   |   |   |         |                    |                    |                    |   |   |  |  |  |  |   |   |   |   |         |                                       |  |  |  |  |  |  |  |  |  |  |  |  |

| TYPICAL OPERATING PROCEDURES                            |                                |                                   |                    |                           |                                |                                  |                   |  |       |
|---|--------------------------------|-----------------------------------|--------------------|---------------------------|--------------------------------|----------------------------------|-------------------|--|-------|
| Diameter, Polarity<br>Shielding Gas                     | CTWD <sup>(1)</sup><br>mm (in) | Wire Feed Speed<br>m/min (in/min) | Voltage<br>(volts) | Approx. Current<br>(amps) | Melt-Off Rate<br>kg/hr (lb/hr) | Deposition Rate<br>kg/hr (lb/hr) | Efficiency<br>(%) |  |       |
| 0.045 in (1.1 mm),<br>DC+<br>75% Ar/25% CO <sub>2</sub> | 25 (1)                         | <b>All Position</b>               |                    |                           |                                |                                  |                   |  | 86-88 |
|   |                                | 4.4 (175)                         | 20-25              | 120-150                   | 1.8 (4.0)                      | 1.6 (3.5)                        |                   |  |       |
|   |                                | 6.4 (250)                         | 21-26              | 135-165                   | 2.6 (5.7)                      | 2.3 (5.0)                        |                   |  |       |
|   |                                | 7.6 (300)                         | 22-27              | 150-180                   | 3.1 (6.8)                      | 2.7 (6.0)                        |                   |  |       |
|   |                                | 8.9 (350)                         | 23-28              | 175-205                   | 3.6 (8.0)                      | 3.2 (7.0)                        |                   |  |       |
|   |                                | 10.2 (400)                        | 24-29              | 190-220                   | 4.1 (9.1)                      | 3.6 (8.0)                        |                   |  |       |
|   |                                | 11.4 (450)                        | 25-30              | 215-235                   | 4.7 (10.3)                     | 4.1 (9.0)                        |                   |  |       |
|   |                                | <b>Flat &amp; Horizontal</b>      |                    |                           |                                |                                  |                   |  |       |
|   |                                | 12.7 (500)                        | 26-31              | 230-260                   | 5.2 (11.4)                     | 4.5 (10.0)                       |                   |  |       |
|   |                                | 14.0 (550)                        | 27-32              | 250-280                   | 5.7 (12.5)                     | 5.0 (10.9)                       |                   |  |       |
| 15.2 (600)  | 27-33                          | 270-300                           | 6.2 (13.7)         | 5.4 (11.9)                |                                |                                  |                   |  |       |
| 0.052 in (1.3 mm),<br>DC+<br>75% Ar/25% CO <sub>2</sub> | 25 (1)                         | <b>All Position</b>               |                    |                           |                                |                                  |                   |  | 86-88 |
|   |                                | 3.8 (150)                         | 20-25              | 140-170                   | 2.0 (4.5)                      | 1.8 (3.9)                        |                   |  |       |
|   |                                | 5.1 (200)                         | 21-26              | 150-180                   | 2.7 (6.0)                      | 2.4 (5.2)                        |                   |  |       |
|   |                                | 6.4 (250)                         | 22-27              | 175-205                   | 3.4 (7.5)                      | 2.9 (6.5)                        |                   |  |       |
|   |                                | 7.6 (300)                         | 23-28              | 200-230                   | 4.1 (9.0)                      | 3.5 (7.8)                        |                   |  |       |
|   |                                | 8.9 (350)                         | 24-29              | 220-250                   | 4.7 (10.5)                     | 4.1 (9.1)                        |                   |  |       |
|   |                                | 9.5 (375)                         | 25-30              | 240-270                   | 5.1 (11.2)                     | 4.4 (9.8)                        |                   |  |       |
|   |                                | <b>Flat &amp; Horizontal</b>      |                    |                           |                                |                                  |                   |  |       |
|   |                                | 10.8 (425)                        | 27-31              | 260-290                   | 5.8 (12.7)                     | 5.0 (11.1)                       |                   |  |       |
|   |                                | 12.1 (475)                        | 28-33              | 280-310                   | 6.4 (14.2)                     | 5.6 (12.4)                       |                   |  |       |
| 12.7 (500)  | 29-35                          | 310-340                           | 6.8 (15.0)         | 5.9 (13.0)                |                                |                                  |                   |  |       |
| 1/16 in (1.6 mm),<br>DC+<br>75% Ar/25% CO <sub>2</sub>  | 25 (1)                         | <b>All Position</b>               |                    |                           |                                |                                  |                   |  | 86-88 |
|   |                                | 3.2 (125)                         | 20-25              | 180-210                   | 2.4 (5.3)                      | 2.1 (4.6)                        |                   |  |       |
|   |                                | 4.4 (175)                         | 21-26              | 200-230                   | 3.3 (7.4)                      | 2.9 (6.4)                        |                   |  |       |
|   |                                | 5.1 (200)                         | 22-27              | 220-250                   | 3.8 (8.4)                      | 3.3 (7.3)                        |                   |  |       |
|   |                                | 5.7 (225)                         | 23-28              | 250-280                   | 4.3 (9.5)                      | 3.7 (8.2)                        |                   |  |       |
|   |                                | 6.4 (250)                         | 24-29              | 270-300                   | 4.8 (10.5)                     | 4.2 (9.2)                        |                   |  |       |
|   |                                | 7.6 (300)                         | 25-31              | 300-330                   | 5.7 (12.6)                     | 5.0 (11.0)                       |                   |  |       |
|   |                                | <b>Flat &amp; Horizontal</b>      |                    |                           |                                |                                  |                   |  |       |
|   |                                | 8.3 (325)                         | 25-32              | 320-350                   | 6.2 (13.7)                     | 5.4 (11.9)                       |                   |  |       |
|   |                                | 8.9 (350)                         | 26-33              | 350-380                   | 6.7 (14.7)                     | 5.8 (12.8)                       |                   |  |       |
| 10.2 (400)  | 28-35                          | 390-420                           | 7.6 (16.8)         | 6.6 (14.6)                |                                |                                  |                   |  |       |

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer on pg. 9. <sup>(4)</sup>Ac-Welded with 100% CO<sub>2</sub> & Ar-Welded 75% Argon / 25% CO<sub>2</sub>.  
<sup>(5)</sup>To estimate ESO, subtract 1/4 in (6.0 mm) from CTWD. <sup>(6)</sup>When welding under CO<sub>2</sub>, increase voltage by 1 Volt.

## AWS Classification Designators Carbon Steel

Examples: E70T-5C, E71T-9M-JH4

**EXXT-XX-JXHX**

Mandatory Designators:

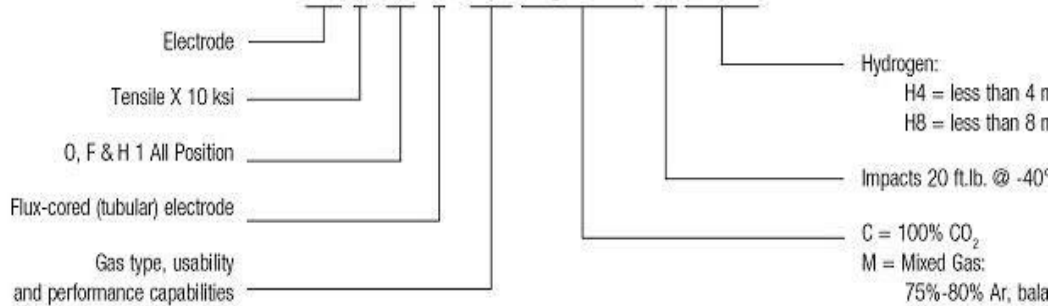
- Current Carrying Electrode
- Minimum Tensile Strength  
(“X” x 10 ksi; “7” = 70 ksi or 70,000 psi)
- Welding Position  
(“0” = Flat & Horizontal Only, “1” = All Position)
- Tubular Electrode (Flux Cored)
- Usability  
(Specifies Requirements for Polarity and General Operating Characteristics)
- Shielding Gas Type  
(“M” = 75 – 80% Ar / Balance CO<sub>2</sub> Mixed Gas, “C” = 100% CO<sub>2</sub>, Blank = No Shielding Gas)

Optional Supplemental Designators:

- Improved Toughness  
(“J” = Electrode Will Produce Welds with CVN Values of at Least 20 ft-lbf @ -40°F (27 J @ -40°C))
- Supplemental Mechanical Property Requirements  
(“D” or “Q” = Will Meet Requirements When Welded with High Heat Input and Low Heat Input Procedures)
- Diffusible Hydrogen Levels  
(“H4”, “H8”, “H16” = There Will Be a Maximum of 4 ml (or 8 or 16) Hydrogen per 100 grams Weld Metal)

Here some example of AWS Coding.

# E70T-1C/MJH8



| Type                                 | AWS Class    | Current Type                                  | Welding Position                                       | Weld Results  |
|--------------------------------------|--------------|---|--|---|
| Mild Steel                           | E6010        | DCR   | F, V, OH, H  | Fast freeze, deep penetrating, flat beads, all- purpose welding   |
|                                      | E6011        | DCR, AC                                       | F, V, OH, H  |   |
|                                      | E6012        | DCS, AC                                       | F, V, OH, H  | Fill-freeze, low penetration, for poor fit-up, good bead contour, minimum spatter   |
|                                      | E6013        | DCR, DCS, AC                                  | F, V, OH, H  |   |
|                                      | E6014        | DCS, AC                                       | F, V, OH, H  |   |
|                                      | E6020        | DCR, DCS, AC                                  | F, H   | Fast-fill, high deposition, deep groove welds, single pass  |
|                                      | E6024        | DCR, DCS, AC                                  | F, H   |   |
|                                      | E6027        | DCR, DCS, AC                                  | F, H   | Iron powder, high deposition, deep penetration  |
|                                      | 57014        | DCR, DCS, AC                                  | F, V, OH, H  | Iron powder, low penetration, high speed  |
| E7024                                | DCR, DCS, AC | F, H  | Iron powder, high deposition, single and multiple pass |   |
| Low Hydrogen                         | E6015        | DCR   | F, V, OH, H  | Welding of high-sulphur and high-carbon steels that tend to develop porosity and crack under weld deposit   |
|                                      | E6016        | DCR, AC                                       | F, V, OH, H  |   |
|                                      | E6018        | DCR, AC                                       | F, V, OH, H  |   |
|                                      | E7016        | DCR, AC                                       | F, V, OH, H  |   |
|                                      | E7018        | DCR, AC                                       | F, V, OH, H  |   |
|                                      | E7028        | DCR, AC                                       | F, H   |   |
| Stainless Steel                      | E308-15, 16  | DC, AC  | F, V, OH, H  | Welding stainless steel 301, 302, 303 304, 308  |
|                                      | E309-15, 16  | DC, AC  | F, V, OH, H  | Welding 309 alloy at elevated temperature application and dissimilar metals   |
|                                      | E310-15, 16  | DC, AC  | F, V, OH, H  | Welding type 310 and 314 stainless steel where high corrosion and elevated temperatures are required  |
|                                      | E316-15, 16  | DC, AC  | F, V, OH, H  | Welding type 316 stainless steel and welds of highest quality. Contains less carbon to minimize carbon transfer in the weld. Type 316 reduces pitting corrosion |
|                                      | E347-15, 16  | DC, AC  | F, V, OH, H  | For welding all grades of stainless steels  |
| Low Alloy                            | E7011-A1     | DCR, AC                                       | F, V, OH, H  | For welding carbon moly steels  |
|                                      | E7020-A1     | DCR, DCS, AC                                  | F<br>2   |   |
|                                      | E8018-C3     | DCR, AC                                       | F, V, OH, H  | For low alloy, high-tensile strength  |
|                                      | E10013-G     | DCS, AC                                       | F, V, OH, H  | For low alloy, high-tensile steels  |
| DCR—Direct Current Reverse Polarity  |              | AC—Alternating Current                        |  |   |
| DCS—Direct Current Straight Polarity |              | F—flat, V—vertical, OH—overhead, H—horizontal |  |   |

Different metals Electrode coding and Applications.

| Typical Welding Parameters of Mild & Low Alloy TIG, MIG |                  |             |             |              |  |
|---|------------------|-------------|-------------|--------------|--|
| Process   | Diameter of Wire |             | Voltage (V) | Amperage (A) | Shielding Gas  |
|   | Inches           | Millimeters |             |              |  |
| TIG (GTAW)  | .035             | 0.9         | 10 – 12     | 50 – 70      | 100% Argon   |
|   | .045             | 1.14        | 10 – 12     | 70 – 100     |  |
|   | 1/16             | 1.6         | 12 – 15     | 100 – 125    |  |
|   | 3/32             | 2.4         | 15 – 20     | 125 – 175    |  |
|   | 1/8              | 3.2         | 15 – 20     | 175 – 250    |  |
| MIG (GMAW)<br>Spray Transfer                            | .035             | 0.9         | 28 – 32     | 165 – 200    | 98% Argon + 2%<br>Oxygen<br>or<br>75% Argon + 25%<br>CO <sup>2</sup> |
|   | .045             | 1.14        | 30 – 34     | 180 – 220    |  |
|   | 1/16             | 1.6         | 30 – 34     | 230 – 260    |  |
| MIG (GMAW)<br>Short Circuiting<br>Transfer              | .035             | 0.9         | 22 – 25     | 100 – 140    | 100% CO <sup>2</sup>   |
|   | .045             | 1.14        | 23 – 26     | 120 – 150    | 75% Argon + 25%<br>CO <sup>2</sup>                                   |

See picture for some parameters.

Questions:- 1. What is the importance of gas mixtures in CO<sub>2</sub>

2 How many type wire size used in Co<sub>2</sub>

3 describe the wire feeder system with part diagram.

Assignment:-

Welding wires used in CO<sub>2</sub> welding, diameter designation as per specification.

Various gases and gas mixtures used in MIG/MAG welding and Its application. Wire feed system: Types, uses, limitations, care and maintenance. Flux cored arc welding: description , advantages, welding wires , diameters and specification.

Checked By \_\_\_\_\_

Instructor \_\_\_\_\_