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| <b>No. Cert. :</b> | <b>61349</b> |
| Fecha :            | 05/01/17     |
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| INFORMACIÓN GENERAL                                                                                                                                                                                                                       |            |         |         |       | PROPIEDADES MECANICAS                                      |        |        |        |                          |       |         |                                     |                  |          |                    |       |        |                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------|---------|-------|------------------------------------------------------------|--------|--------|--------|--------------------------|-------|---------|-------------------------------------|------------------|----------|--------------------|-------|--------|--------------------------|
| COLADA                                                                                                                                                                                                                                    | DIAMETRO   | ESPESOR | GRADO   |       | L. E.                                                      | U. T.  | Elong. | DUREZA | ORIENTACIÓN              |       |         | RESISTENCIA AL IMPACTO "CHARPY" (J) |                  |          |                    |       |        |                          |
| NO.                                                                                                                                                                                                                                       | (exterior) | (pared) | (acero) |       | (PSI)                                                      | (PSI)  | %      | Hrb.   | DE PROBETA               |       |         | Orient.                             | Lect. Individual |          |                    | Prom. | % A.D. |                          |
| 162225                                                                                                                                                                                                                                    | 8.625"     | 0.322"  | B/X42   |       | 51,500                                                     | 61,700 | 41.50  | 78     | 2.25" X 1.5"-TRANS. MAT. |       |         | MAT.                                | N/A              | N/A      | N/A                | N/A   | N/A    |                          |
|                                                                                                                                                                                                                                           |            |         |         |       |                                                            |        |        |        |                          |       |         |                                     |                  |          |                    |       |        | 2.25" X 1.5"-TRANS. SOLD |
|                                                                                                                                                                                                                                           |            |         |         |       |                                                            |        |        |        | ZAC                      | N/A   | N/A     | N/A                                 | N/A              | N/A      |                    |       |        |                          |
|                                                                                                                                                                                                                                           |            |         |         |       |                                                            |        |        |        |                          |       |         |                                     |                  |          | CRITERIO:          |       | N/A    |                          |
| TEMPERATURA DE PRUEBA:                                                                                                                                                                                                                    |            |         |         |       |                                                            |        |        |        |                          |       |         | N/A                                 |                  |          |                    |       |        |                          |
| Análisis Químico                                                                                                                                                                                                                          |            |         |         |       | Proveedor de Acero : ALTOS HORNOS DE MEXICO S.A.B. DE C.V. |        |        |        |                          |       |         |                                     |                  |          | Carbón Equivalente |       |        |                          |
| C                                                                                                                                                                                                                                         | Mn         | P       | S       | Si    | Cu                                                         | Ni     | Cr     | V      | Mo                       | Ti    | Al      | Nb                                  | Espec.           | Obtenida | Fórmula            |       |        |                          |
| 0.124                                                                                                                                                                                                                                     | 0.803      | 0.013   | 0.013   | 0.209 | 0.012                                                      | 0.022  | 0.024  | 0.003  | 0.008                    | 0.002 | 0.045   | 0.000                               | 0.43             | 0.27     | CD (IIW)           |       |        |                          |
| Análisis Metalográfico                                                                                                                                                                                                                    |            |         |         |       | Tamaño de Grano:                                           |        |        |        | N/A                      |       | Método: |                                     | N/A              |          |                    |       |        |                          |
| Números de Serie : N02861141A, N02861141B, N02861143A, N02861143B, N02861144A, N02861144B, N02861145A, N02861145B, N02861146A, N02861146B, N02861147A, N02861147B, N02861148A, N02861148B, N02861152A, N02861152B, N02861154A, N02861154B |            |         |         |       |                                                            |        |        |        |                          |       |         |                                     |                  |          |                    |       |        |                          |
| 18 Tramos de Tubo con 110.56 MTS                                                                                                                                                                                                          |            |         |         |       |                                                            |        |        |        |                          |       |         |                                     |                  |          |                    |       |        |                          |

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| INFORMACIÓN GENERAL                                   |            |         |         |       | PROPIEDADES MECANICAS                                      |        |        |        |                          |         |       |                                     |                    |          |          |       |        |     |
|-------------------------------------------------------|------------|---------|---------|-------|------------------------------------------------------------|--------|--------|--------|--------------------------|---------|-------|-------------------------------------|--------------------|----------|----------|-------|--------|-----|
| COLADA                                                | DIAMETRO   | ESPESOR | GRADO   |       | L. E.                                                      | U. T.  | Elong. | DUREZA | ORIENTACIÓN              |         |       | RESISTENCIA AL IMPACTO "CHARPY" (J) |                    |          |          |       |        |     |
| NO.                                                   | (exterior) | (pared) | (acero) |       | (PSI)                                                      | (PSI)  | %      | Hrb.   | DE PROBETA               |         |       | Orient.                             | Lect. Individual   |          |          | Prom. | % A.D. |     |
| 258740                                                | 8.625"     | 0.322"  | B/X42   |       | 55,000                                                     | 66,100 | 42     | 79     | 2.25" X 1.5"-TRANS. MAT. |         |       | MAT.                                | N/A                | N/A      | N/A      | N/A   | N/A    |     |
|                                                       |            |         |         |       |                                                            |        |        |        | 2.25" X 1.5"-TRANS. SOLD |         |       | SOLD.                               | N/A                | N/A      | N/A      | N/A   | N/A    | N/A |
|                                                       |            |         |         |       |                                                            |        |        |        |                          |         |       | ZAC                                 | N/A                | N/A      | N/A      | N/A   | N/A    | N/A |
|                                                       |            |         |         |       |                                                            |        |        |        |                          |         |       | CRITERIO:                           | N/A                |          |          | N/A   | N/A    |     |
|                                                       |            |         |         |       |                                                            |        |        |        |                          |         |       | TEMPERATURA DE PRUEBA:              |                    |          |          |       | N/A    |     |
| Análisis Químico                                      |            |         |         |       | Proveedor de Acero : ALTOS HORNOS DE MEXICO S.A.B. DE C.V. |        |        |        |                          |         |       |                                     | Carbón Equivalente |          |          |       |        |     |
| C                                                     | Mn         | P       | S       | Si    | Cu                                                         | Ni     | Cr     | V      | Mo                       | Ti      | Al    | Nb                                  | Espec.             | Obtenida | Fórmula  |       |        |     |
| 0.127                                                 | 0.800      | 0.008   | 0.007   | 0.214 | 0.017                                                      | 0.027  | 0.018  | 0.003  | 0.010                    | 0.002   | 0.052 | 0.000                               | 0.43               | 0.27     | CD (IIW) |       |        |     |
| Análisis Metalográfico                                |            |         |         |       | Tamaño de Grano:                                           |        |        | N/A    |                          | Método: |       | N/A                                 |                    |          |          |       |        |     |
| Números de Serie : N02859933A, N02859939A, N02859939B |            |         |         |       |                                                            |        |        |        |                          |         |       |                                     |                    |          |          |       |        |     |
| 3 Tramos de Tubo con 18.47 MTS                        |            |         |         |       |                                                            |        |        |        |                          |         |       |                                     |                    |          |          |       |        |     |

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| INFORMACIÓN GENERAL                                                                       |            |         |         |       | PROPIEDADES MECANICAS                                      |           |                            |        |                     |         |       |                                     |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
|-------------------------------------------------------------------------------------------|------------|---------|---------|-------|------------------------------------------------------------|-----------|----------------------------|--------|---------------------|---------|-------|-------------------------------------|--------------------|----------|----------|-------|--------|----|---------------------|------|-------|-----|-----|-----|-----|-----|
| COLADA                                                                                    | DIAMETRO   | ESPEJOR | GRADO   |       | L. E.                                                      | U. T.     | Elong.                     | DUREZA | ORIENTACIÓN         |         |       | RESISTENCIA AL IMPACTO "CHARPY" (J) |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
| NO.                                                                                       | (exterior) | (pared) | (acero) |       | (PSI)                                                      | (PSI)     | %                          | Hrb.   | DE PROBETA          |         |       | Orient.                             | Lect. Individual   |          |          | Prom. | % A.D. |    |                     |      |       |     |     |     |     |     |
| 261647                                                                                    | 8.625"     | 0.322"  | B/X42   |       | 54,200                                                     | 63,800    | 46.50                      | 81     | 2.25" X 1.5"-TRANS. | MAT.    | MAT.  | N/A                                 | N/A                | N/A      | N/A      | N/A   |        |    |                     |      |       |     |     |     |     |     |
|                                                                                           |            |         |         |       |                                                            |           |                            |        |                     |         |       |                                     |                    |          |          |       | 70,800 | 87 | 2.25" X 1.5"-TRANS. | SOLD | SOLD. | N/A | N/A | N/A | N/A | N/A |
|                                                                                           |            |         |         |       |                                                            |           |                            |        |                     |         |       |                                     |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
|                                                                                           |            |         |         |       |                                                            |           |                            |        |                     |         |       |                                     |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
|                                                                                           |            |         |         |       |                                                            |           |                            |        |                     |         |       |                                     |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
| ZAC                                                                                       | N/A        | N/A     | N/A     | N/A   | N/A                                                        |           |                            |        |                     |         |       |                                     |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
|                                                                                           |            |         |         |       |                                                            | CRITERIO: | N/A                        |        |                     | N/A     | N/A   |                                     |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
|                                                                                           |            |         |         |       |                                                            |           | TEMPERATURA DE PRUEBA: N/A |        |                     |         |       |                                     |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
| Análisis Químico                                                                          |            |         |         |       | Proveedor de Acero : ALTOS HORNOS DE MEXICO S.A.B. DE C.V. |           |                            |        |                     |         |       |                                     | Carbón Equivalente |          |          |       |        |    |                     |      |       |     |     |     |     |     |
| C                                                                                         | Mn         | P       | S       | Si    | Cu                                                         | Ni        | Cr                         | V      | Mo                  | Ti      | Al    | Nb                                  | Espec.             | Obtenida | Fórmula  |       |        |    |                     |      |       |     |     |     |     |     |
| 0.128                                                                                     | 0.813      | 0.018   | 0.009   | 0.219 | 0.011                                                      | 0.025     | 0.028                      | 0.004  | 0.009               | 0.002   | 0.041 | 0.000                               | 0.43               | 0.27     | CD (IIW) |       |        |    |                     |      |       |     |     |     |     |     |
| Análisis Metalográfico                                                                    |            |         |         |       | Tamaño de Grano:                                           |           |                            | N/A    |                     | Método: |       | N/A                                 |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
| Números de Serie : N02861051A, N02861051B, N02861140A, N02861172A, N02861172B, N02861173B |            |         |         |       |                                                            |           |                            |        |                     |         |       |                                     |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |
| 6 Tramos de Tubo con 37.10 MTS                                                            |            |         |         |       |                                                            |           |                            |        |                     |         |       |                                     |                    |          |          |       |        |    |                     |      |       |     |     |     |     |     |

## CERTIFICADO DE CALIDAD

| INFORMACIÓN GENERAL |            |         |         |  | PROPIEDADES MECANICAS |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|---------------------|------------|---------|---------|--|-----------------------|--------|--------|--------|--------------------------|--|--|-------------------------------------|------------------|-----|-------|--------|-----|--|--|--|
| COLADA              | DIAMETRO   | ESPESOR | GRADO   |  | L. E.                 | U. T.  | Elong. | DUREZA | ORIENTACIÓN              |  |  | RESISTENCIA AL IMPACTO "CHARPY" (J) |                  |     |       |        |     |  |  |  |
| NO.                 | (exterior) | (pared) | (acero) |  | (PSI)                 | (PSI)  | %      | Hrb.   | DE PROBETA               |  |  | Orient.                             | Lect. Individual |     | Prom. | % A.D. |     |  |  |  |
| 352905              | 8.625"     | 0.322"  | B/X42   |  | 55,000                | 67,600 | 42.50  | 78     | 2.25" X 1.5"-TRANS. MAT. |  |  | MAT.                                | N/A              | N/A | N/A   | N/A    | N/A |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        | 85     | 2.25" X 1.5"-TRANS. SOLD |  |  | SOLD.                               | N/A              | N/A | N/A   | N/A    | N/A |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |
|                     |            |         |         |  |                       |        |        |        |                          |  |  |                                     |                  |     |       |        |     |  |  |  |

ESTE CERTIFICADO AMPARA :

| Resumen por Partida                                   | Prueba Hidrost. (P.S.I.) |          | Tratamiento Térmico |           | Método de Inspección No-Destructiva |                           | Prueba de     |
|-------------------------------------------------------|--------------------------|----------|---------------------|-----------|-------------------------------------|---------------------------|---------------|
|                                                       | Presión                  | Duración | Tipo                | T.°C min. | Tipo                                | Indicadores de Referencia | Aplastamiento |
| 50 Tramos de Tubo con 307.37 mtos. de 8.625" x 0.322" | 3,000                    | 10 seg.  | Normalizado         | 800       | Ultrasonido                         | N10                       | Aceptado      |

TUBERÍA LAGUNA S.A. DE C.V.

**NO AMPARA EL USO INADECUADO DE LA TUBERIA**

FAC-38 REV-"4"

  
**JUAN PABLO ARREDONDO MARTINEZ**  
**GERENTE DE ASEGURAMIENTO DE CALIDAD**