Holing and Slotting of Casing

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Determining holes per foot

N.B. The technical data contained within these pages was correct at the time of publication but should not be used as operational guidelines.
For operational guidelines please refer to the operation and maintenance manual supplied with the equipment.
Elmar reserves the right to change, alter, modify or improve specifications at any time without prior notice.
Holing and Slotting of Casing

NOV Elmar has the capability at its Aberdeen facility for precision machining and quick delivery of Slotted, Holed or Plugged Casing.

CASING MACHINES

Slotting Machines

- Specially designed multi-spindle milling machines are used to manufacture NOV Elmar slotted liners.
- Circular milling saws cut the slots with continuous application of coolant to maintain the pipe’s metallurgical integrity.

Hydraulic Handling System

- With health and safety a priority this roller system has been designed to feed both slotting and drilling machines resulting in increased efficiency while greatly reducing potential safety risks.
Holing and Slotting of Casing

Elmar holed liners are manufactured on specially-designed multi-spindle drilling machines.

- The holes are drilled using high quality drill bits and the CNC control allows high positional accuracy. Coolant is continuously applied to maintain the pipe’s metallurgical integrity.

HOLING MACHINES

**Holing Machines**

- Elmar holed liners are manufactured on specially-designed multi-spindle drilling machines.

**Deburring**

- A deburring service is offered for both slotted and holed casing.

- Our facility has capacity to de-burr pipes from 2 3/8” O.D. to 12” O.D. The O.D. and I.D. are washed with 3,000 psi jets of water, a degreaser is used if required. Hard sand stones remove rust and burrs from the inside of pipes up to 50ft long. Box and pin caps are cleaned with 3,000 psi jets of water on the I.D and O.D.

**Pipe Coating**

- A pipe coating service is available with the ability to coat pipe up to 50ft long internally and externally with a capacity of 100 pipes per day.

**Banding**

- Pipe is supplied in bundles, banded or with slings as required.

**QA Certification**

- Lloyd’s accredited to BS EN ISO 9001: 2008
Slotted Casing

Slot Width and Length
As a guide the following are the standard slot widths and lengths commonly used:

<table>
<thead>
<tr>
<th>Slot Width and Length</th>
<th>1.5” Long</th>
<th>2.0” to 2.5” Long</th>
<th>2.5” Long</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.012” wide</td>
<td>0.024” wide</td>
<td>0.078” wide</td>
<td></td>
</tr>
<tr>
<td>0.025” wide</td>
<td>0.029” wide</td>
<td>0.129” wide</td>
<td></td>
</tr>
<tr>
<td>0.040” wide</td>
<td>0.038” wide</td>
<td>0.250” wide</td>
<td></td>
</tr>
<tr>
<td>0.048” wide</td>
<td>0.058” wide</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Slot Patterns
- Staggered pattern (Elmar preferred option)
- Straight or parallel pattern
- Hi density pattern

Slot Sizes
- Elmar provides a range of slot sizes to suit the majority of customers’ requirements.

Straight Slots or Keystone Slots
- Minimum Slot Width = 0.012”
- Maximum Slot Width = 0.250”

Casing Sizes
- Casing up to a maximum diameter of 14” can be slotted.
Slotting Design & Calculation

**Straight Slot**
- This is the most common type of slot manufactured. It has straight sides, equal width through the wall of the casing and is normally used in consolidated formations or when slots of 0.030” or wider are specified.
- Straight slots are very resistant to wear and are more economic than keystone.

**Keystone Slot**
- The slot is narrow at the liner surface and of increasing width with depth into the casing material.
- The narrow slot width at the surface of the liner allows sand grains to bridge across the opening. Sand grains that do enter the slot will pass completely through without clogging.

**Determining Slots Per Foot**
- To achieve a required percentage of open area on the pipe surface, the preferred slot size should be selected from the formulation evaluation. The number of slots per foot of pipe can then be calculated using the following formula and tables.

**Calculation of Required Slots/Foot**
- After selecting the open area, the slot size and the diameter of the liner, the number of slots per foot can be determined from the following formula:

\[
N = \frac{(12 \times 3.14 \times D \times C)}{(100 \times W \times L)}
\]

where

- \(N\) = Required slots/foot
- \(D\) = Outside diameter of the liner (inches)
- \(C\) = Required open area (percent of surface area)
- \(W\) = Selected slot width (inches)
- \(L\) = Length of slot (inches)

For example, if an open area of 3% is required with 4.5” diameter liner and a slot width of 0.020” wide x 1.5” long has been selected to control the formation, then the number of slots to be cut in the liner is:

\[
N = \frac{(12 \times 3.14 \times 4.5 \times 3)}{(100 \times 0.020 \times 1.5)} = 169.646
\]

This figure is then rounded to either the nearest multiple of 4 or the nearest multiple of 8 depending on the slotting pattern being cut.

Because the slots are cut by a circular blade, the slot is always longer at the O.D. than it is at the I.D. When specifying the slot length the value used always applies to the length at the I.D.
Percentage of Open Area Per Square Foot

3.5” Slotted Liner

4.5” Slotted Liner

5.5” Slotted Liner

7” Slotted Liner

Elmar Product Line
Holed Casing

Elmar preferred patterns.

Perforated Casing

- Elmar provides casing with a range of hole sizes and hole patterns to suit the majority of customers’ requirements.

Hole Sizes

- Our standard hole diameter sizes; 9.5mm, 13mm, 14mm, 15mm, 19mm and 25mm. Other hole sizes can be achieved. Please contact your completions team for details.

Casing Sizes

- Casing up to a maximum diameter of 9 5/8" can be holed.

The Elmar preferred patterns have the holes arranged in spirals around the pipe. The spacing between the start and the end of one full spiral is defined as the pitch (see above diagrams).
Holed Casing Calculation

Determining Holes Per Foot

To achieve a required percentage of open area on the pipe surface, the preferred hole diameter should be selected. The number of holes per foot of pipe can then be calculated using the following formula:

\[
N = \frac{(12 \times D \times C)}{(25 \times d^2)}
\]

where

- \(N\) = Required holes/foot
- \(D\) = Outside diameter of the liner (inches)
- \(C\) = Required open area (percent of surface area)
- \(d\) = Diameter of hole (inches)

For example, if an open area of 3.0% is required with 4.5" diameter liner and a hole diameter of 0.5" then the number of holes to be drilled in the liner is:

\[
N = \frac{(12 \times 4.5 \times 3)}{(25 \times 0.5^2)} = 25.92
\]

For spirals on a 6" pitch, round this to the nearest number divisible by 2 (2 Spirals per foot). In this example = 26 HPF

For spirals on a 4" pitch, round this to the nearest number divisible by 3 (3 Spirals per foot). In this example = 24 or 27 HPF

For spirals on a 2" pitch, round this to the nearest number divisible by 6 (6 Spirals per foot). In this example = 24 or 30 HPF

For spirals on a 3" pitch, round this to the nearest number divisible by 4 (4 Spirals per foot). In this example = 24 or 28 HPF

Having determined the amount of holes per foot required, it is necessary to choose a preferred pattern. Ideally this would be one that would provide evenly spaced holes.