

## **API Ballot 4436**

<b>Work Item Number</b>	1062
<b>Title of Work Item</b>	Straightness Requirements for drill pipe and tubulars
<b>Ballot Revision Level</b>	0
<b>Type of Ballot</b> (Initial, Comment, Comment resolution (reference API ballot#), 1 <sup>st</sup> Re-ballot, 2 <sup>nd</sup> Re-ballot, etc.)	Initial Letter ballot (vote and comment)
<b>API Document Modified</b>	API 5CRA
<b>API Document, API Modifying Document(s) and Revision Level(s)</b>	First Edition, February 2010, Errata, August 2011, Reaffirmed, April 2015
<b>Revision Key</b>	Current API document Text = black Deletions = <del>red strikethrough</del> , Additions = red with gray highlight

### **Work Item Charge:**

Review the straightness and straightening requirements in API Specifications 5CT, 5CRA, and 5DP with the following goals to be achieved, if possible:

1. Clarify and/or remove ambiguous wording (i.e., incidental to normal straightening operations and light gag-press straightening).
2. Simplify and establish consistent straightening requirements for all specifications within scope.
3. Improve the approach and application of straightening requirements as needed.

**Ballot Rationale:** Current text within the specification contains inconsistent and ambiguous wording regarding straightening that allows for various interpretations and application of requirements.

**Ballot Text:** below

NOTE See the ballot email notification for additional information regarding this ballot.

## 6.4 Straightening

~~For group 1 martensitic material and for group 2 material delivered in the solution-annealed condition, the pipe shall not be subjected to either tensile or expansion cold-working except for that which is incidental to normal straightening operations, and to no, that is more than 3 % plastic strain, after the final heat treatment operation.~~

~~Group 1 pipes shall be hot rotary straightened, when necessary, after heat treatment, at 400°C (750°F) minimum at the end of rotary straightening, unless a higher minimum temperature is specified in the purchase agreement. If hot rotary straightening is not possible, the pipe may be cold rotary straightened, provided it is then stress-relieved at 510°C (950°F) or higher.~~

~~Light gag-press straightening shall be permitted, providing that the plastic strain does not exceed 3 %.~~

**6.4.1** When straightening is necessary after heat treatment, Group 1 products may be hot rotary straightened or cold straightened. If hot rotary straightened, the minimum temperature at the exit of rotary straightening shall be 400°C (750°F), unless a higher minimum temperature is specified on the purchase agreement. If cold rotary straightened, then the product shall be stress relieved after straightening. The minimum stress relieving temperature shall be 510°C (950°F). For gag straightening see 6.4.3.

**6.4.2** When straightening is necessary for Group 2, 3, and 4 products, the product may be rotary or gag straightened utilizing the straightening process parameters established during validation of the product (see 6.5).

**6.4.3** When gag straightening is used for Group 1 products, stress relieving after straightening is required only if the maximum fiber strain is greater than the value established by the manufacturer during process validation (see 6.5). The amount of fiber strain shall be calculated using the following formula:

$$\varepsilon = 6Dy/L^2$$

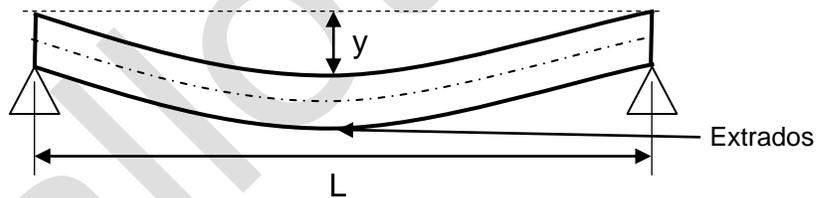
where (see Figure D.xx),

$\varepsilon$  = outer fiber strain

D = pipe diameter

L = distance between straightener pipe supports

y = the maximum deflection distance



**Figure D.xx – Gag Straightening Fiber Strain Factors**

## 6.5 Processes Requiring Validation

**6.5.1** Final operations performed during product manufacturing that affect attribute compliance as required in this International Standard (except chemical composition and dimensions) shall have their processes validated.

Those processes requiring validation are:

- non-destructive examination (see 9.16.8);
- final heat treatment (including final heat treatment before any cold hardening);
- cold hardening (if applicable);
- cold straightening (if applicable).

**6.5.2** Validation of cold hardening and cold straightening shall address the range of product manufactured and the method used. Validation shall include verification of mechanical properties at the middle and both ends. Validation of gag straightening shall also include validation of mechanical properties in the tension region of the extrados with the highest possible induced fiber strain (see Figure D.xx).