

# DIN EN 1594:2013-12 (E)

## Gas infrastructure - Pipelines for maximum operating pressure over 16 bar - Functional requirements

---

| <b>Contents</b>    |  | <b>Page</b> |
|--------------------|--|-------------|
| Foreword .....     |  | 5           |
| Introduction ..... |  | 6           |
| <b>1</b>           | <b>Scope .....</b>   | <b>7</b>    |
| <b>2</b>           | <b>Normative references .....</b>  | <b>10</b>   |
| <b>3</b>           | <b>Terms, definitions, symbols and abbreviations .....</b>   | <b>11</b>   |
| <b>4</b>           | <b>Quality and management systems .....</b>  | <b>16</b>   |
| <b>5</b>           | <b>Safety and the environment .....</b>  | <b>16</b>   |
| 5.1                | General .....  | 16          |
| 5.2                | Appropriate safety measures .....  | 16          |
| 5.3                | Routing considerations .....   | 17          |
| 5.4                | Line valve spacing .....   | 18          |
| <b>6</b>           | <b>Pressure safety .....</b>   | <b>18</b>   |
| 6.1                | Pressure levels .....  | 18          |
| 6.2                | Normal operation .....   | 19          |
| 6.3                | Requirements for installation of pressure safety devices .....   | 19          |
| 6.4                | Pipeline with DP equal to or less than 40 bar and hoop stress equal to or less than 0,45<br>Rt 0,5 ..... | 19          |
| 6.5                | Pipeline with DP equal to or less than 24 bar and hoop stress equal to or less than 0,30<br>Rt 0,5 ..... | 19          |
| <b>7</b>           | <b>Design .....</b>  | <b>20</b>   |
| 7.1                | General .....  | 20          |
| 7.2                | Wall thickness determination .....   | 21          |
| 7.3                | Additional design requirements .....   | 22          |
| 7.4                | Analysis of stress and strain .....  | 24          |
| 7.5                | Design report .....  | 26          |
| 7.6                | Land management and geotechnical studies .....   | 27          |
| 7.7                | Depth of cover .....   | 27          |
| 7.8                | Casing pipes .....   | 28          |
| 7.9                | Station design .....   | 28          |
| 7.10               | Pipeline components .....  | 30          |
| 7.11               | Pigging suitability .....  | 30          |
| 7.12               | Arrangements for venting .....   | 30          |
| 7.13               | Corrosion protection .....   | 31          |
| 7.14               | Grid connections .....   | 33          |
| <b>8</b>           | <b>Materials and components .....</b>  | <b>33</b>   |
| 8.1                | General .....  | 33          |
| 8.2                | Pipes .....  | 37          |
| 8.3                | Fittings .....   | 37          |
| 8.4                | Flanged connections .....  | 37          |
| 8.5                | Insulating connections .....   | 38          |
| 8.6                | Valves .....   | 38          |
| 8.7                | External and internal coatings .....   | 38          |

|  |  |    |
|--|--|----|
| 8.8  | End preparation .....  | 38 |
| 9  | Construction .....   | 38 |
| 9.1  | General .....  | 38 |
| 9.2  | Execution of work .....  | 39 |
| 9.3  | Special crossings .....  | 46 |
| 9.4  | Cleaning .....   | 50 |
| 9.5  | Testing .....  | 51 |
| 9.6  | Acceptance .....   | 52 |
| 10   | Operation and maintenance .....  | 53 |
| 10.1   | General .....  | 53 |
| 10.2   | Organisation .....   | 54 |
| 10.3   | Operating and maintenance instructions .....                               | 54 |
| 10.4   | Emergency plan .....   | 55 |
| 10.5   | Records and documentation .....  | 55 |
| 10.6   | Commissioning .....  | 56 |
| 10.7   | Decommissioning .....  | 56 |
| 10.8   | Recommissioning .....  | 56 |
| 10.9   | Maintenance, modification and repair .....                                 | 56 |
| 10.10  | Abandonment .....  | 59 |
| Annex A (informative) Settlement areas .....             |  | 60 |
| A.1  | General .....  | 60 |
| A.2  | Procedure .....  | 60 |
| A.3  | Construction settlement .....  | 60 |
| A.4  | Strength calculation .....   | 61 |
| A.5  | Monitoring .....   | 65 |
| A.6  | Action in the event of the allowable/limit values being exceeded .....     | 65 |
| A.7  | Bibliography .....   | 65 |
| Annex B (informative) Mining subsidence .....            |  | 66 |
| B.1  | General .....  | 66 |
| B.2  | Procedure .....  | 66 |
| B.3  | Strength calculation .....   | 66 |
| B.4  | Action in the event of the allowable/limit values being exceeded .....     | 67 |
| B.5  | Monitoring .....   | 67 |
| B.6  | Bibliography .....   | 67 |
| Annex C (informative) Frost heave .....                  |  | 68 |
| C.1  | General .....  | 68 |
| C.2  | Procedure .....  | 68 |
| C.3  | Strength calculation .....   | 68 |
| C.4  | Other possible measures .....  | 68 |
| C.5  | Bibliography .....   | 69 |
| Annex D (informative) Landslide areas .....              |  | 70 |
| D.1  | General .....  | 70 |
| D.2  | Procedure .....  | 70 |
| D.3  | Strength calculation .....   | 71 |
| D.4  | Possible action to prevent the allowable/limit values being exceeded ..... | 71 |
| D.5  | Monitoring .....   | 72 |
| D.6  | Bibliography .....   | 72 |
| Annex E (informative) Areas with high seismic risk ..... |  | 74 |
| E.1  | General .....  | 74 |
| E.2  | Procedure .....  | 74 |

|  |                              |           |
|--|------------------------------|-----------|
| E.3  | Strength calculation .....   | 75        |
| E.4  | Bibliography .....           | 76        |
| <b>Annex F (informative) Soil mechanics parameters .....</b>   |                              | <b>78</b> |
| F.1  | Parameters .....             | 78        |
| F.2  | Soil engineering study ..... | 79        |
| F.3  | Bibliography .....           | 79        |
| <b>Annex G (informative) Bored/jacked crossings .....</b>  |                              | <b>81</b> |
| G.1  | General .....                | 81        |
| G.2  | Strength calculation .....   | 81        |
| G.3  | Bibliography .....           | 85        |
| <b>Annex H (informative) Allowable pulsation and vibration levels .....</b>  |                              | <b>86</b> |
| H.1  | Introduction .....           | 86        |
| H.2  | Pulsations .....             | 86        |
| H.3  | Pipe vibrations .....        | 86        |
| H.4  | Induced effects .....        | 87        |
| H.5  | Bibliography .....           | 87        |
| <b>Annex I (informative) Allowable vibration levels from construction work - blasting .....</b>                          |                              | <b>88</b> |
| I.1  | General .....                | 88        |
| I.2  | Procedure .....              | 88        |
| I.3  | Strength calculation .....   | 88        |
| I.4  | Bibliography .....           | 90        |
| <b>Annex J (informative) Significant technical changes between this European Standard and the previous edition .....</b> |                              | <b>91</b> |
| <b>Bibliography .....</b>  |                              | <b>93</b> |