|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **人孔起吊配件设计计算** | | | | 计算单位 |  | | | |
| 计算依据 | | | | | *注1* | | | |
| **计 算 条 件** | | | | | **简 图** | | | |
| 设计温度, t | | | ℃ | **$$001** | $18  $09  $08  $10  A  B  D  吊环  吊钩  吊臂  轴套  $28 | | | |
| 起吊(人孔盖)重量, m0 | | | kg | **$$002** |
| 吊 臂 | 材料标准号 | | **$$003** | |
| 材料牌号/名称 | | **$$004** | |
| 外直径, db | | mm | **$$005** |
| 厚度, δbn | | mm | **$$006** |
| 腐蚀裕量, Cb2 | | mm | **$$007** |
| 曲率半径, Rb | | mm | **$$008** |
| 长度, Sb | | mm | **$$009** |
| 高度, Lb | | mm | **$$010** |
| 吊 钩 | 材料标准号 | | **$$011** | |
| 材料牌号/名称 | | **$$012** | |
| 无螺纹部分最小直径, dh | | mm | **$$013** |
| 腐蚀裕量, Ch2 | | mm | **$$014** |
| 螺栓规格 | | **$$015** | |
| 吊 环 | 材料标准号 | | **$$016** | |
| 材料牌号/名称 | | **$$017** | |
| 水平长度, Lr | | mm | **$$018** |
| 直径, dr | | mm | **$$019** |
| 腐蚀裕量, Cr2 | | mm | **$$020** |
| 与人孔盖焊缝角高, hr | | mm | **$$021** |
| 连接焊缝单侧长度, Lrw | | mm | **$$022** |
| 轴 套 | 材料标准号 | | **$$023** | |
| 材料牌号/名称 | | **$$024** | |
| 外直径, ds | | mm | **$$025** |
| 名义厚度, δsn | | mm | **$$026** |
| 腐蚀裕量, Cs2 | | mm | **$$027** |
| 单侧连接焊缝长度, Ls | | mm | **$$028** |
| 焊缝角高, hs | | mm | **$$029** |
| **材 料 特 性** | | | | | | | | |
| 吊臂 | 密度, ρb | | kg/m³ | **$$030** | 吊钩 | 密度, ρh | kg/m³ | **$$044** |
| 材料负偏差, Cb1 | | mm | **$$031** | 材料负偏差, Ch1 | mm | **$$045** |
| 设计温度许用应力, [σ]bt | | MPa | **$$033** | 设计温度许用应力, [σ]ht | MPa | **$$047** |
| 设计温度弹性模量, Ebt | | 103MPa | **$$036** | 设计温度弹性模量, Eht | 103MPa | **$$050** |
| 吊环 | 密度, ρr | | kg/m³ | **$$037** | 轴 套 | 密度, ρs | kg/m³ | **$$051** |
| 材料负偏差, Cr1 | | mm | **$$038** | 材料负偏差, Cs1 | mm | **$$052** |
| 设计温度许用应力, [σ]rt | | MPa | **$$040** | 设计温度许用应力, [σ]st | MPa | **$$054** |
| 设计温度弹性模量, Ert | | 103MPa | **$$043** | 设计温度弹性模量, Est | 103MPa | **$$057** |
| **过 程 参 数** | | | | | | | | |
| 动载综合系数, Kd | | / | | Kd = 1.65 | | | | **1.65** |
| 重力加速度, g | | | N/kg | g = 9.8 | | | | **9.8** |
| 起吊设计载荷, F | | | N | F = Kd·m0·g | | | | **$$060** |
| 吊 钩 | 螺纹小径, dhmin | | mm | 查 GB/T 196 | | | | **$$061** |
| 厚度附加量, Ch | | mm | Ch = 2Ch2 + Ch1 | | | | **$$062** |
| 有效直径, dhe | | mm | dhe = min{dhmin-2Ch2, dh – Ch} | | | | **$$063** |
| 吊 臂 | 厚度附加量, Cb | | mm | Cb = Cb2 + Cb1 | | | | **$$064** |
| 有效厚度, δbe | | mm | δbe = δbn – Cb | | | | **$$065** |
| 计算外直径, dbo | | mm | dbo = db - 2Cb | | | | **$$066** |
| 计算内直径, dbi | | mm | dbi = db - 2δbn | | | | **$$067** |
| 截面积, A | | mm2 |  | | | | **$$068** |
| 管状断面系数, K | | / |  | | | | **$$069** |
| 吊环 | 直径附加量, Cr | | mm | Cr = 2Cr2 + Cr1 | | | | **$$070** |
| 有效直径, dre | | mm | dre = dr - Cr | | | | **$$071** |
| 轴 套 | 厚度附加量, Cs | | mm | Cs = Cs2 + Cs1 | | | | **$$072** |
| 有效厚度, δse | | mm | δse = δsn – Cs | | | | **$$073** |
| 截面积, As | | mm2 |  | | | | **$$074** |
| **吊 钩 强 度 计 算 及 校 核** | | | | | | | | |
| 吊钩拉应力, σhc | | | MPa |  | | | | **$$075** |
| 吊钩应力校核 | | | / | σhc ≤ [σ]ht | | | | **$$076** |
| **吊 臂 强 度 计 算 及 校 核** | | | | | | | | |
| AD段 | F引起的轴向压应力, σbxc | | MPa |  | | | | **$$077** |
| 弯矩引起的  a点内侧压缩应力, σbmc | | MPa |  | | | | **$$078** |
| 弯矩引起的  a点外侧拉应力, σbmt | | MPa |  | | | | **$$079** |
| a点内侧总应力, σbxcmc | | MPa |  | | | | **$$080** |
| a点内侧总应力校核 | | / | |σbxcmc| ≤ [σ]bt | | | | **$$081** |
| a点外侧总应力, σbxcmt | | MPa |  | | | | **$$082** |
| a点外侧总应力校核 | | / | |σbxcmt| ≤ [σ]bt | | | | **$$083** |
| AB段 | 系数, θ2 | | / |  | | | | **$$084** |
| 最大应力, σbab | | MPa |  | | | | **$$085** |
| 应力校核 | | / | |σbab| ≤ [σ]bt | | | | **$$086** |
| **吊 环 强 度 计 算 及 校 核** | | | | | | | | |
| 吊环最大应力, σrc | | | MPa |  | | | | **$$087** |
| 吊环应力校核 | | | / | σrc ≤ [σ]rt | | | | **$$088** |
| **吊 环 与 人 孔 盖 连 接 焊 缝 计 算 及 校 核** | | | | | | | | |
| 焊缝计算应力, σrwc | | | MPa |  | | | | **$$089** |
| 焊缝应力校核 | | | / | σrwc ≤ [σ]rt | | | | **$$090** |
| **轴 套 计 算 及 校 核** | | | | | | | | |
| 计算应力, σsc | | | MPa |  | | | | **$$091** |
| 应力校核 | | | / | σsc ≤ [σ]st | | | | **$$092** |
| **轴 套 连 接 焊 缝 校 核** | | | | | | | | |
| 计算剪应力, τswc | | | MPa |  | | | | **$$093** |
| 许用剪应力, [τ]st | | | MPa | [τ]st = 0.6[σ]st | | | | **$$094** |
| 剪应力校核 | | | / | τswc ≤ [τ]st | | | | **$$095** |

注1: 赖祥凤. 人孔起吊配件的计算及选择［J］.石油和化工设备, 2016, (8): 34-36.

注2：AB段应力根据长杆Secant公式计算.