门式刚架计算书

目 录

[1. 设计依据 3](#_Toc3250)

[2. 计算软件信息 3](#_Toc11489)

[3. 结构计算简图 3](#_Toc29826)

[4. 结构计算信息 3](#_Toc15169)

[5. 结构基本信息 5](#_Toc2961)

[6. 荷载与效应组合 7](#_Toc29864)

[1. 各工况荷载表 7](#_Toc5186)

[2. 荷载效应组合表 9](#_Toc10758)

[7. 地震计算信息 13](#_Toc15222)

[1. 左地震 13](#_Toc15777)

[2. 右地震 13](#_Toc18333)

[8. 内力计算结果 14](#_Toc7271)

[1. 单工况内力 14](#_Toc6462)

[9. 节点位移 16](#_Toc30407)

[10. 构件设计结果汇总 18](#_Toc20719)

[11. 构件设计结果 19](#_Toc23901)

[12. 荷载与计算结果简图 68](#_Toc19920)

[1. 结构简图 68](#_Toc18421)

[2. 荷载简图 70](#_Toc4349)

[3. 应力比图 76](#_Toc433)

[4. 内力图 79](#_Toc13730)

[5. 位移图 106](#_Toc2902)

[6. 挠度图 115](#_Toc27280)

[7. 计算长度系数图 119](#_Toc19726)

**1. 设计依据**

《建筑结构荷载规范》(GB 50009-2012);

《建筑抗震设计规范》(GB 50011-2010);

《钢结构设计标准》(GB 50017-2017);

《门式刚架轻型房屋钢结构技术规范》(GB 51022-2015);

《建筑结构可靠性设计统一标准》(GB 50068-2018)

《工程结构通用规范》(GB 55001-2021)

《建筑与市政工程抗震通用规范》(GB 55002-2021)

《钢结构通用规范》(GB 55006-2021)

**2. 计算软件信息**

本工程计算软件为PKPM钢结构设计软件 2021 V1.2.0版 。

计算日期为 2025年10月14日12时23分59秒。

**3. 结构计算简图**



图1-1 结构简图

**4. 结构计算信息**

结构类型: 门式刚架轻型房屋钢结构

设计规范: 按《门式刚架轻型房屋钢结构技术规范》（GB 51022-2015）计算

结构重要性系数: 1.00

节点总数: 12

柱数: 7

梁数: 4

支座约束数: 5

标准截面总数: 10

荷载分项系数：

恒载: 1.30

活载: 1.50

风载: 1.50

地震: 1.40

吊车: 1.50

重力荷载分项系数: 1.30

活荷载计算信息: 考虑活荷载不利布置

考虑结构使用年限的活荷载调整系数：1.00

风荷载计算信息: 计算风荷载

钢材: Q355

梁柱自重计算信息: 柱梁自重都计算

恒载作用下柱的轴向变形: 考虑

梁柱自重计算增大系数: 1.20

梁刚度增大系数: 1.00

钢结构净截面面积与毛截面面积比: 0.92

门式刚架梁平面内的整体稳定性: 按压弯构件验算

程序自动确定允许的长细比

钢梁(恒+活)容许挠跨比: l /180

柱顶容许水平位移/柱高: l /60

地震影响系数取值依据: 10抗规(2010版)

特征周期(s):0.35

水平地震影响系数最大值αmax:0.0400

地震作用计算: 计算水平地震作用

计算振型数：3

地震烈度：6.00

场地土类别：Ⅱ类

附加重量节点数：0

设计地震分组：第一组

周期折减系数:0.80

地震力计算方法：振型分解法

结构阻尼比：0.050

按GB50011-2010 地震效应增大系数:1.050

防火设计计算信息：考虑防火设计

建筑耐火等级：二级

**5. 结构基本信息**

**节点坐标**

| 节点号 | X | Y | 节点号 | X | Y |
| --- | --- | --- | --- | --- | --- |
| 1 | 0.00 | 7.00 | 2 | 24.60 | 7.00 |
| 3 | 5.00 | 7.40 | 4 | 18.63 | 7.48 |
| 5 | 12.30 | 7.98 | 6 | -0.10 | 8.50 |
| 7 | 24.70 | 8.50 | 8 | 0.00 | 0.00 |
| 9 | 5.00 | 0.00 | 10 | 12.30 | 0.00 |
| 11 | 18.63 | 0.00 | 12 | 24.60 | 0.00 |

**柱关联号**

| 柱号 | 节点Ⅰ | 节点Ⅱ | 柱号 | 节点Ⅰ | 节点Ⅱ |
| --- | --- | --- | --- | --- | --- |
| 1 | 8 | 1 | 2 | 9 | 3 |
| 3 | 10 | 5 | 4 | 11 | 4 |
| 5 | 12 | 2 | 6 | 1 | 6 |
| 7 | 2 | 7 |  |  |  |

**梁关联号**

| 梁号 | 节点Ⅰ | 节点Ⅱ | 梁号 | 节点Ⅰ | 节点Ⅱ |
| --- | --- | --- | --- | --- | --- |
| 1 | 1 | 3 | 2 | 3 | 5 |
| 3 | 4 | 2 | 4 | 5 | 4 |

**柱节点偏心 (m)**

| 节点号 | 柱偏心值 | 节点号 | 柱偏心值 | 节点号 | 柱偏心值 |
| --- | --- | --- | --- | --- | --- |
| 1 | -0.100 | 2 | 0.100 | 3 | 0.000 |
| 4 | 0.000 | 5 | 0.000 | 6 | 0.000 |
| 7 | 0.000 | 8 | 0.000 | 9 | 0.000 |
| 10 | 0.000 | 11 | 0.000 | 12 | 0.000 |

**标准截面信息**

| 截面号 | 截面信息 |
| --- | --- |
| 1 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(200~400)\*150\*150\*6\*8\*8 |
| 2 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=350\*150\*150\*6\*8\*8 |
| 3 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=200\*180\*180\*6\*8\*8 |
| 4 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=300\*200\*200\*6\*10\*10 |
| 5 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=300\*200\*200\*6\*8\*8 |
| 6 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(450~350)\*180\*180\*6\*10\*10 |
| 7 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=350\*180\*180\*6\*10\*10 |
| 8 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(350~450)\*180\*180\*6\*10\*10 |
| 9 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(400~350)\*180\*180\*6\*10\*10 |
| 10 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(350~400)\*180\*180\*6\*10\*10 |

**柱布置截面号,约束信息,截面布置角度**

| 柱号 | 标准截面号 | 约束信息 | 截面布置角度 |
| --- | --- | --- | --- |
| 1 | 4 | I端铰接 | 0 |
| 2 | 5 | 两端铰接 | 90 |
| 3 | 4 | I端铰接 | 0 |
| 4 | 5 | 两端铰接 | 90 |
| 5 | 4 | I端铰接 | 0 |
| 6 | 3 | 两端刚接 | 0 |
| 7 | 3 | 两端刚接 | 0 |

**梁布置截面号,约束信息**

| 梁号 | 标准截面号 | 约束信息 |
| --- | --- | --- |
| 1 | 7 | 两端刚接 |
| 2 | 7 | 两端刚接 |
| 3 | 7 | 两端刚接 |
| 4 | 7 | 两端刚接 |

**截面特性**

| 截面号 | Xc (mm) | Yc (mm) | Ix (cm4) | Iy (cm4) | A (cm2) |
| --- | --- | --- | --- | --- | --- |
| 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 90.0 | 100.0 | 2967.2 | 777.9 | 39.8 |
| 4 | 100.0 | 150.0 | 9510.9 | 1333.8 | 56.8 |
| 5 | 100.0 | 150.0 | 7968.1 | 1067.2 | 49.0 |
| 6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7 | 90.0 | 175.0 | 12203.9 | 972.6 | 55.8 |
| 8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| 截面号 | ix (cm) | iy (cm) | W1x (cm3) | W2x (cm3) | W1y (cm3) | W2y (cm3) |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 8.6 | 4.4 | 296.7 | 296.7 | 86.4 | 86.4 |
| 4 | 12.9 | 4.8 | 634.1 | 634.1 | 133.4 | 133.4 |
| 5 | 12.7 | 4.7 | 531.2 | 531.2 | 106.7 | 106.7 |
| 6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7 | 14.8 | 4.2 | 697.4 | 697.4 | 108.1 | 108.1 |
| 8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**防火材料信息**

| 序号 | 名称 | 热传导系数(W/(m\*℃)) | 密度(kg/m^3) | 比热(J/(kg\*℃) | 类型 |
| --- | --- | --- | --- | --- | --- |
| 1 | 防火涂料1 | 0.100 | 680.00 | 1000.00 | 非膨胀 |
| 2 | 防火涂料2 | 0.100 | 680.00 | 1000.00 | 膨胀 |

**6. 荷载与效应组合**

## **1. 各工况荷载表**

**节点荷载**

| 工况 | 节点号 | 弯矩 | 垂直力 | 水平力 |
| --- | --- | --- | --- | --- |
| -- | -- | -- | -- | -- |

**柱荷载**

| 工况 | 柱号 | 荷载类型 | 荷载值 | 荷载参数1 | 荷载参数2 |
| --- | --- | --- | --- | --- | --- |
| 左风1 | 1 | 1 | 0.79 | 0.00 | 0.00 |
| 5 | 1 | 1.11 | 0.00 | 0.00 |
| 6 | 1 | 2.40 | 0.00 | 0.00 |
| 7 | 1 | 2.40 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | -1.11 | 0.00 | 0.00 |
| 5 | 1 | -0.79 | 0.00 | 0.00 |
| 6 | 1 | -2.40 | 0.00 | 0.00 |
| 7 | 1 | -2.40 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 1.46 | 0.00 | 0.00 |
| 5 | 1 | 0.46 | 0.00 | 0.00 |
| 6 | 1 | 2.40 | 0.00 | 0.00 |
| 7 | 1 | 2.40 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | -0.46 | 0.00 | 0.00 |
| 5 | 1 | -1.46 | 0.00 | 0.00 |
| 6 | 1 | -2.40 | 0.00 | 0.00 |
| 7 | 1 | -2.40 | 0.00 | 0.00 |

**梁荷载**

| 工况 | 连续数 | 荷载个数 | 荷载类型 | 荷载值1 | 荷载参数1 | 荷载值2 | 荷载参数2 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 恒荷载 | 1 | 1 | 1 | 1.80 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 1.80 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 1.80 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 1.80 | 0.00 | 0.00 | 0.00 |
| 活荷载 | 1 | 1 | 1 | 2.00 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 2.00 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 2.00 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 2.00 | 0.00 | 0.00 | 0.00 |
| 左风1 | 1 | 1 | 1 | -2.31 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.31 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.31 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.31 | 0.00 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | 1 | -1.31 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.31 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.31 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.31 | 0.00 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 1 | -1.64 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.64 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.65 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.65 | 0.00 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | 1 | -0.65 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.65 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.64 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.64 | 0.00 | 0.00 | 0.00 |

## **2. 荷载效应组合表**

**(1)柱内力的组合值**

| 柱内力的组合 | |
| --- | --- |
| (1)1.3恒+1.5活1 | (2)1.3恒+1.5活2 |
| (3)1.3恒+1.5活3 | (4)1.3恒+1.5活4 |
| (5)1.0恒+1.5活1 | (6)1.0恒+1.5活2 |
| (7)1.0恒+1.5活3 | (8)1.0恒+1.5活4 |
| (9)1.3恒+1.5左风1 | (10)1.3恒+1.5右风1 |
| (11)1.3恒+1.5左风2 | (12)1.3恒+1.5右风2 |
| (13)1.0恒+1.5左风1 | (14)1.0恒+1.5右风1 |
| (15)1.0恒+1.5左风2 | (16)1.0恒+1.5右风2 |
| (17)1.3恒+1.5活1+0.9左风1 | (18)1.3恒+1.5活1+0.9右风1 |
| (19)1.3恒+1.5活1+0.9左风2 | (20)1.3恒+1.5活1+0.9右风2 |
| (21)1.3恒+1.5活2+0.9左风1 | (22)1.3恒+1.5活2+0.9右风1 |
| (23)1.3恒+1.5活2+0.9左风2 | (24)1.3恒+1.5活2+0.9右风2 |
| (25)1.3恒+1.5活3+0.9左风1 | (26)1.3恒+1.5活3+0.9右风1 |
| (27)1.3恒+1.5活3+0.9左风2 | (28)1.3恒+1.5活3+0.9右风2 |
| (29)1.3恒+1.5活4+0.9左风1 | (30)1.3恒+1.5活4+0.9右风1 |
| (31)1.3恒+1.5活4+0.9左风2 | (32)1.3恒+1.5活4+0.9右风2 |
| (33)1.0恒+1.5活1+0.9左风1 | (34)1.0恒+1.5活1+0.9右风1 |
| (35)1.0恒+1.5活1+0.9左风2 | (36)1.0恒+1.5活1+0.9右风2 |
| (37)1.0恒+1.5活2+0.9左风1 | (38)1.0恒+1.5活2+0.9右风1 |
| (39)1.0恒+1.5活2+0.9左风2 | (40)1.0恒+1.5活2+0.9右风2 |
| (41)1.0恒+1.5活3+0.9左风1 | (42)1.0恒+1.5活3+0.9右风1 |
| (43)1.0恒+1.5活3+0.9左风2 | (44)1.0恒+1.5活3+0.9右风2 |
| (45)1.0恒+1.5活4+0.9左风1 | (46)1.0恒+1.5活4+0.9右风1 |
| (47)1.0恒+1.5活4+0.9左风2 | (48)1.0恒+1.5活4+0.9右风2 |
| (49)1.3恒+1.05活1+1.5左风1 | (50)1.3恒+1.05活1+1.5右风1 |
| (51)1.3恒+1.05活1+1.5左风2 | (52)1.3恒+1.05活1+1.5右风2 |
| (53)1.3恒+1.05活2+1.5左风1 | (54)1.3恒+1.05活2+1.5右风1 |
| (55)1.3恒+1.05活2+1.5左风2 | (56)1.3恒+1.05活2+1.5右风2 |
| (57)1.3恒+1.05活3+1.5左风1 | (58)1.3恒+1.05活3+1.5右风1 |
| (59)1.3恒+1.05活3+1.5左风2 | (60)1.3恒+1.05活3+1.5右风2 |
| (61)1.3恒+1.05活4+1.5左风1 | (62)1.3恒+1.05活4+1.5右风1 |
| (63)1.3恒+1.05活4+1.5左风2 | (64)1.3恒+1.05活4+1.5右风2 |
| (65)1.0恒+1.05活1+1.5左风1 | (66)1.0恒+1.05活1+1.5右风1 |
| (67)1.0恒+1.05活1+1.5左风2 | (68)1.0恒+1.05活1+1.5右风2 |
| (69)1.0恒+1.05活2+1.5左风1 | (70)1.0恒+1.05活2+1.5右风1 |
| (71)1.0恒+1.05活2+1.5左风2 | (72)1.0恒+1.05活2+1.5右风2 |
| (73)1.0恒+1.05活3+1.5左风1 | (74)1.0恒+1.05活3+1.5右风1 |
| (75)1.0恒+1.05活3+1.5左风2 | (76)1.0恒+1.05活3+1.5右风2 |
| (77)1.0恒+1.05活4+1.5左风1 | (78)1.0恒+1.05活4+1.5右风1 |
| (79)1.0恒+1.05活4+1.5左风2 | (80)1.0恒+1.05活4+1.5右风2 |
| (81)1.3恒+0.65活1+1.4左地震 | (82)1.3恒+0.65活1+1.4右地震 |
| (83)1.3恒+0.65活2+1.4左地震 | (84)1.3恒+0.65活2+1.4右地震 |
| (85)1.3恒+0.65活3+1.4左地震 | (86)1.3恒+0.65活3+1.4右地震 |
| (87)1.3恒+0.65活4+1.4左地震 | (88)1.3恒+0.65活4+1.4右地震 |
| (89)1.0恒+0.5活1+1.4左地震 | (90)1.0恒+0.5活1+1.4右地震 |
| (91)1.0恒+0.5活2+1.4左地震 | (92)1.0恒+0.5活2+1.4右地震 |
| (93)1.0恒+0.5活3+1.4左地震 | (94)1.0恒+0.5活3+1.4右地震 |
| (95)1.0恒+0.5活4+1.4左地震 | (96)1.0恒+0.5活4+1.4右地震 |

**(2)梁内力的组合值**

| 梁内力组合 | |
| --- | --- |
| (1)1.3恒+1.5活1 | (2)1.3恒+1.5活2 |
| (3)1.3恒+1.5活3 | (4)1.3恒+1.5活4 |
| (5)1.0恒+1.5活1 | (6)1.0恒+1.5活2 |
| (7)1.0恒+1.5活3 | (8)1.0恒+1.5活4 |
| (9)1.3恒+1.5左风1 | (10)1.3恒+1.5右风1 |
| (11)1.3恒+1.5左风2 | (12)1.3恒+1.5右风2 |
| (13)1.0恒+1.5左风1 | (14)1.0恒+1.5右风1 |
| (15)1.0恒+1.5左风2 | (16)1.0恒+1.5右风2 |
| (17)1.3恒+1.5活1+0.9左风1 | (18)1.3恒+1.5活1+0.9右风1 |
| (19)1.3恒+1.5活1+0.9左风2 | (20)1.3恒+1.5活1+0.9右风2 |
| (21)1.3恒+1.5活2+0.9左风1 | (22)1.3恒+1.5活2+0.9右风1 |
| (23)1.3恒+1.5活2+0.9左风2 | (24)1.3恒+1.5活2+0.9右风2 |
| (25)1.3恒+1.5活3+0.9左风1 | (26)1.3恒+1.5活3+0.9右风1 |
| (27)1.3恒+1.5活3+0.9左风2 | (28)1.3恒+1.5活3+0.9右风2 |
| (29)1.3恒+1.5活4+0.9左风1 | (30)1.3恒+1.5活4+0.9右风1 |
| (31)1.3恒+1.5活4+0.9左风2 | (32)1.3恒+1.5活4+0.9右风2 |
| (33)1.0恒+1.5活1+0.9左风1 | (34)1.0恒+1.5活1+0.9右风1 |
| (35)1.0恒+1.5活1+0.9左风2 | (36)1.0恒+1.5活1+0.9右风2 |
| (37)1.0恒+1.5活2+0.9左风1 | (38)1.0恒+1.5活2+0.9右风1 |
| (39)1.0恒+1.5活2+0.9左风2 | (40)1.0恒+1.5活2+0.9右风2 |
| (41)1.0恒+1.5活3+0.9左风1 | (42)1.0恒+1.5活3+0.9右风1 |
| (43)1.0恒+1.5活3+0.9左风2 | (44)1.0恒+1.5活3+0.9右风2 |
| (45)1.0恒+1.5活4+0.9左风1 | (46)1.0恒+1.5活4+0.9右风1 |
| (47)1.0恒+1.5活4+0.9左风2 | (48)1.0恒+1.5活4+0.9右风2 |
| (49)1.3恒+1.05活1+1.5左风1 | (50)1.3恒+1.05活1+1.5右风1 |
| (51)1.3恒+1.05活1+1.5左风2 | (52)1.3恒+1.05活1+1.5右风2 |
| (53)1.3恒+1.05活2+1.5左风1 | (54)1.3恒+1.05活2+1.5右风1 |
| (55)1.3恒+1.05活2+1.5左风2 | (56)1.3恒+1.05活2+1.5右风2 |
| (57)1.3恒+1.05活3+1.5左风1 | (58)1.3恒+1.05活3+1.5右风1 |
| (59)1.3恒+1.05活3+1.5左风2 | (60)1.3恒+1.05活3+1.5右风2 |
| (61)1.3恒+1.05活4+1.5左风1 | (62)1.3恒+1.05活4+1.5右风1 |
| (63)1.3恒+1.05活4+1.5左风2 | (64)1.3恒+1.05活4+1.5右风2 |
| (65)1.0恒+1.05活1+1.5左风1 | (66)1.0恒+1.05活1+1.5右风1 |
| (67)1.0恒+1.05活1+1.5左风2 | (68)1.0恒+1.05活1+1.5右风2 |
| (69)1.0恒+1.05活2+1.5左风1 | (70)1.0恒+1.05活2+1.5右风1 |
| (71)1.0恒+1.05活2+1.5左风2 | (72)1.0恒+1.05活2+1.5右风2 |
| (73)1.0恒+1.05活3+1.5左风1 | (74)1.0恒+1.05活3+1.5右风1 |
| (75)1.0恒+1.05活3+1.5左风2 | (76)1.0恒+1.05活3+1.5右风2 |
| (77)1.0恒+1.05活4+1.5左风1 | (78)1.0恒+1.05活4+1.5右风1 |
| (79)1.0恒+1.05活4+1.5左风2 | (80)1.0恒+1.05活4+1.5右风2 |
| (81)1.3恒+0.65活1+1.4左地震 | (82)1.3恒+0.65活1+1.4右地震 |
| (83)1.3恒+0.65活2+1.4左地震 | (84)1.3恒+0.65活2+1.4右地震 |
| (85)1.3恒+0.65活3+1.4左地震 | (86)1.3恒+0.65活3+1.4右地震 |
| (87)1.3恒+0.65活4+1.4左地震 | (88)1.3恒+0.65活4+1.4右地震 |
| (89)1.0恒+0.5活1+1.4左地震 | (90)1.0恒+0.5活1+1.4右地震 |
| (91)1.0恒+0.5活2+1.4左地震 | (92)1.0恒+0.5活2+1.4右地震 |
| (93)1.0恒+0.5活3+1.4左地震 | (94)1.0恒+0.5活3+1.4右地震 |
| (95)1.0恒+0.5活4+1.4左地震 | (96)1.0恒+0.5活4+1.4右地震 |

**(3)柱偶然组合值**

| 柱偶然组合 | |
| --- | --- |
| (1)1.0恒+0.5活1 | (2)1.0恒+0.5活2 |
| (3)1.0恒+0.5活3 | (4)1.0恒+0.5活4 |
| (5)0.9恒+0.5活1 | (6)0.9恒+0.5活2 |
| (7)0.9恒+0.5活3 | (8)0.9恒+0.5活4 |
| (9)1.0恒+0.4左风1 | (10)1.0恒+0.4右风1 |
| (11)1.0恒+0.4左风2 | (12)1.0恒+0.4右风2 |
| (13)0.9恒+0.4左风1 | (14)0.9恒+0.4右风1 |
| (15)0.9恒+0.4左风2 | (16)0.9恒+0.4右风2 |

**(4)梁偶然组合值**

| 梁偶然组合 | |
| --- | --- |
| (1)1.0恒+0.5活1 | (2)1.0恒+0.5活2 |
| (3)1.0恒+0.5活3 | (4)1.0恒+0.5活4 |
| (5)0.9恒+0.5活1 | (6)0.9恒+0.5活2 |
| (7)0.9恒+0.5活3 | (8)0.9恒+0.5活4 |
| (9)1.0恒+0.4左风1 | (10)1.0恒+0.4右风1 |
| (11)1.0恒+0.4左风2 | (12)1.0恒+0.4右风2 |
| (13)0.9恒+0.4左风1 | (14)0.9恒+0.4右风1 |
| (15)0.9恒+0.4左风2 | (16)0.9恒+0.4右风2 |

**(3)抗风柱的内力基本组合**

| 抗风柱的内力基本组合 | |
| --- | --- |
| (1)1.3恒+1.05活1+1.5左风1 | (2)1.3恒+1.5活1+0.9左风1 |
| (3)1.3恒+1.05活1+1.5右风1 | (4)1.3恒+1.5活1+0.9右风1 |
| (5)1.3恒+1.05活1+1.5左风2 | (6)1.3恒+1.5活1+0.9左风2 |
| (7)1.3恒+1.05活1+1.5右风2 | (8)1.3恒+1.5活1+0.9右风2 |
| (9)1.3恒+1.05活1+1.5左风3 | (10)1.3恒+1.5活1+0.9左风3 |
| (11)1.3恒+1.05活1+1.5右风3 | (12)1.3恒+1.5活1+0.9右风3 |

**7. 地震计算信息**

## **1. 左地震**

**地震力计算质量集中信息**

| 质量集中节点号 | 质量重量(KN) |
| --- | --- |
| 1 | 88.518 |
| 6 | 0.282 |
| 7 | 0.282 |

水平地震标准值作用底层剪力： 1.511

底层最小地震剪力(抗震规范5.2.5条): 0.713

各质点地震力调整系数: 1.000

地震力调整后剪重比： 0.017

**周期(已乘折减系数)**

| 振型号 | 周期(s) |
| --- | --- |
| 1 | 0.908 |
| 2 | 0.016 |
| 3 | 0.015 |

## **2. 右地震**

**地震力计算质量集中信息**

| 质量集中节点号 | 质量重量(KN) |
| --- | --- |
| 2 | 88.518 |
| 6 | 0.282 |
| 7 | 0.282 |

水平地震标准值作用底层剪力： 1.511

底层最小地震剪力(抗震规范5.2.5条): 0.713

各质点地震力调整系数: 1.000

地震力调整后剪重比： 0.017

**周期(已乘折减系数)**

| 振型号 | 周期(s) |
| --- | --- |
| 1 | 0.908 |
| 2 | 0.016 |
| 3 | 0.015 |

**8. 内力计算结果**

## **1. 单工况内力**

**柱内力**

| 工况 | 单元 | I端N(kN) | I端V(kN) | I端M(kN.m) | II端N(kN) | II端V(kN) | II端M(kN.m) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 恒荷载 | 1 | 17.1 | -2.1 | 0.0 | -13.3 | 2.1 | -15.0 |
| 2 | 3.4 | 0.0 | 0.0 | -0.0 | 0.0 | 0.0 |
| 3 | 36.1 | -0.0 | 0.0 | -31.9 | 0.0 | -0.0 |
| 4 | 3.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 17.1 | 2.1 | 0.0 | -13.3 | -2.1 | 15.0 |
| 6 | 0.6 | 0.0 | 0.0 | -0.0 | -0.0 | 0.0 |
| 7 | 0.6 | -0.0 | -0.0 | -0.0 | 0.0 | 0.0 |
| 左风1 | 1 | -17.0 | 8.9 | 0.0 | 17.0 | -3.3 | 42.8 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | -24.4 | 4.1 | 0.0 | 24.4 | -4.1 | 33.1 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | -3.1 | 6.5 | 0.0 | 3.1 | 1.2 | 18.4 |
| 6 | -0.0 | 3.6 | 2.7 | 0.0 | -0.0 | 0.0 |
| 7 | 0.0 | 3.6 | 2.7 | -0.0 | -0.0 | -0.0 |
| 右风1 | 1 | -3.1 | -6.5 | 0.0 | 3.1 | -1.3 | -18.4 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | -24.4 | -4.1 | 0.0 | 24.4 | 4.1 | -33.0 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | -17.0 | -8.9 | 0.0 | 17.0 | 3.3 | -42.7 |
| 6 | -0.0 | -3.6 | -2.7 | 0.0 | 0.0 | -0.0 |
| 7 | -0.0 | -3.6 | -2.7 | 0.0 | -0.0 | 0.0 |
| 左风2 | 1 | -12.9 | 10.3 | 0.0 | 12.9 | -0.1 | 36.7 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | -16.2 | 4.2 | 0.0 | 16.2 | -4.2 | 33.3 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 1.0 | 5.2 | 0.0 | -1.0 | -1.9 | 24.8 |
| 6 | -0.0 | 3.6 | 2.7 | 0.0 | 0.0 | -0.0 |
| 7 | 0.0 | 3.6 | 2.7 | -0.0 | -0.0 | 0.0 |
| 右风2 | 1 | 1.0 | -5.2 | 0.0 | -1.0 | 1.9 | -24.8 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | -16.2 | -4.2 | 0.0 | 16.2 | 4.2 | -33.3 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | -12.9 | -10.3 | 0.0 | 12.9 | 0.1 | -36.7 |
| 6 | 0.0 | -3.6 | -2.7 | -0.0 | 0.0 | -0.0 |
| 7 | -0.0 | -3.6 | -2.7 | 0.0 | -0.0 | 0.0 |
| 左地震 | 1 | -0.5 | 0.5 | -0.0 | 0.5 | -0.5 | 3.5 |
| 2 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 |
| 3 | -0.0 | 0.6 | -0.0 | 0.0 | -0.6 | 4.6 |
| 4 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 |
| 5 | 0.5 | 0.5 | -0.0 | -0.5 | -0.5 | 3.5 |
| 6 | -0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 0.0 |
| 7 | 0.0 | 0.0 | 0.0 | -0.0 | -0.0 | -0.0 |
| 右地震 | 1 | 0.5 | -0.5 | -0.0 | -0.5 | 0.5 | -3.5 |
| 2 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 |
| 3 | 0.0 | -0.6 | -0.0 | -0.0 | 0.6 | -4.6 |
| 4 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 |
| 5 | -0.5 | -0.5 | -0.0 | 0.5 | 0.5 | -3.5 |
| 6 | 0.0 | -0.0 | -0.0 | -0.0 | 0.0 | -0.0 |
| 7 | -0.0 | -0.0 | -0.0 | 0.0 | 0.0 | 0.0 |

**梁内力**

| 工况号 | 单元号 | I端N(kN) | I端V(kN) | I端M(kN.m) | II端N(kN) | II端V(kN) | II端M(kN.m) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 恒荷载 | 1 | 3.1 | 12.6 | 15.0 | -2.2 | -0.9 | 18.8 |
| 2 | 2.2 | 0.9 | -18.8 | -0.9 | 16.0 | -36.5 |
| 3 | 2.0 | 1.3 | -18.6 | -3.1 | 12.6 | -15.0 |
| 4 | 0.9 | 16.0 | 36.5 | -2.0 | -1.3 | 18.6 |
| 左风1 | 1 | -1.1 | -17.0 | -45.5 | 1.1 | 5.4 | -10.6 |
| 2 | -1.1 | -5.4 | 10.6 | 1.1 | -11.5 | 11.8 |
| 3 | -5.1 | -5.1 | 14.0 | 5.1 | -2.7 | -21.1 |
| 4 | -5.1 | -13.4 | -44.9 | 5.1 | 5.1 | -14.0 |
| 右风1 | 1 | -5.1 | -2.7 | 21.1 | 5.1 | -3.8 | -18.4 |
| 2 | -5.1 | 3.8 | 18.4 | 5.1 | -13.4 | 44.8 |
| 3 | -1.1 | 3.1 | 14.8 | 1.1 | -17.0 | 45.4 |
| 4 | -1.1 | -11.5 | -11.8 | 1.1 | -3.1 | -14.8 |
| 左风2 | 1 | 2.4 | -13.2 | -39.4 | -2.4 | 4.9 | -6.0 |
| 2 | 2.4 | -4.9 | 6.0 | -2.4 | -7.1 | 2.2 |
| 3 | -1.6 | -5.0 | 9.2 | 1.6 | 1.1 | -27.5 |
| 4 | -1.6 | -9.1 | -35.5 | 1.6 | 5.0 | -9.2 |
| 右风2 | 1 | -1.6 | 1.1 | 27.5 | 1.6 | -4.4 | -13.8 |
| 2 | -1.6 | 4.4 | 13.8 | 1.6 | -9.1 | 35.5 |
| 3 | 2.4 | 3.3 | 10.0 | -2.4 | -13.2 | 39.4 |
| 4 | 2.4 | -7.1 | -2.2 | -2.4 | -3.3 | -10.0 |
| 左地震 | 1 | -0.2 | -0.5 | -3.5 | 0.2 | 0.5 | 1.2 |
| 2 | 0.1 | -0.5 | -1.2 | -0.1 | 0.5 | -2.3 |
| 3 | 0.2 | -0.5 | 0.8 | -0.2 | 0.5 | -3.5 |
| 4 | -0.1 | -0.5 | -2.3 | 0.1 | 0.5 | -0.8 |
| 右地震 | 1 | 0.2 | 0.5 | 3.5 | -0.2 | -0.5 | -1.2 |
| 2 | -0.1 | 0.5 | 1.2 | 0.1 | -0.5 | 2.3 |
| 3 | -0.2 | 0.5 | -0.8 | 0.2 | -0.5 | 3.5 |
| 4 | 0.1 | 0.5 | 2.3 | -0.1 | -0.5 | 0.8 |

**9. 节点位移**

**恒荷载工况下节点位移（mm）**

| 节点号 | X向位移 | Y向位移 |
| --- | --- | --- |
| 1 | 0.01 | 0.09 |
| 2 | -0.01 | 0.09 |
| 3 | 0.67 | 8.45 |
| 4 | -0.67 | 8.52 |
| 5 | -0.00 | 0.23 |
| 6 | 2.69 | 0.09 |
| 7 | -2.69 | 0.09 |
| 13 | 0.00 | 0.01 |
| 14 | 0.00 | 0.01 |

**活荷载工况下节点位移（mm）**

| 节点号 | X向位移 | Y向位移 |
| --- | --- | --- |
| 1 | 0.01 | 0.07 |
| 2 | -0.01 | 0.07 |
| 3 | 0.57 | 10.11 |
| 4 | -0.58 | 10.42 |
| 5 | -0.00 | 0.19 |
| 6 | 2.31 | 0.07 |
| 7 | -2.31 | 0.07 |
| 13 | 0.00 | -0.00 |
| 14 | 0.00 | -0.00 |

**节点侧向（水平向）位移(mm)**

| 工况 | 节点 | δx | 节点 | δx |
| --- | --- | --- | --- | --- |
| 左风1 | 1 | 48.16 | 2 | 48.21 |
| 3 | 47.78 | 4 | 48.75 |
| 5 | 48.17 | 6 | 50.22 |
| 7 | 54.29 | 8 | 0.00 |
| 9 | 0.00 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 | 14 | 0.00 |
| 右风1 | 1 | -48.13 | 2 | -48.08 |
| 3 | -48.74 | 4 | -47.61 |
| 5 | -48.08 | 6 | -54.19 |
| 7 | -50.13 | 8 | 0.00 |
| 9 | 0.00 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 | 14 | 0.00 |
| 左风2 | 1 | 48.46 | 2 | 48.44 |
| 3 | 48.22 | 4 | 48.83 |
| 5 | 48.43 | 6 | 50.95 |
| 7 | 54.13 | 8 | 0.00 |
| 9 | 0.00 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 | 14 | 0.00 |
| 右风2 | 1 | -48.44 | 2 | -48.46 |
| 3 | -48.91 | 4 | -48.14 |
| 5 | -48.43 | 6 | -54.13 |
| 7 | -50.95 | 8 | 0.00 |
| 9 | 0.00 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 | 14 | 0.00 |
| 左地震 | 1 | 5.70 | 2 | 5.70 |
| 3 | 5.75 | 4 | 5.75 |
| 5 | 5.70 | 6 | 6.30 |
| 7 | 6.30 | 8 | 0.00 |
| 9 | 0.00 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 | 14 | 0.00 |
| 右地震 | 1 | -5.70 | 2 | -5.70 |
| 3 | -5.75 | 4 | -5.75 |
| 5 | -5.70 | 6 | -6.30 |
| 7 | -6.30 | 8 | 0.00 |
| 9 | 0.00 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 | 14 | 0.00 |

**10. 构件设计结果汇总**

**钢柱验算结果**

| 柱号 | 应力比 | 剪应力比 | 平面内稳定 | 平面外稳定 | 腹板高厚比 | 翼缘宽厚比 | 平面内长细比 | 平面外长细比 | 质量(kg) | 状态 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0.41 | 0.05 | 0.45 | 0.59 | 46.67 | 9.70 | 131.48 | 144.45 | 312.1 | 通过 |
| 2 | 0.00 | - | 0.02 | 0.00 | 47.33 | 12.13 | 158.63 | 58.05 | 284.9 | 通过 |
| 3 | 0.37 | 0.03 | 0.42 | 0.64 | 46.67 | 9.70 | 126.64 | 164.76 | 356.0 | 通过 |
| 4 | 0.00 | - | 0.02 | 0.00 | 47.33 | 12.13 | 160.30 | 58.67 | 287.9 | 通过 |
| 5 | 0.41 | 0.05 | 0.45 | 0.59 | 46.67 | 9.70 | 131.48 | 144.45 | 312.1 | 通过 |
| 6 | 0.05 | 0.03 | 0.05 | 0.02 | 30.67 | 10.88 | 34.84 | 33.95 | 47.0 | 通过 |
| 7 | 0.05 | 0.03 | 0.05 | 0.02 | 30.67 | 10.88 | 34.84 | 33.95 | 47.0 | 通过 |

**钢梁验算结果**

| 梁号 | 应力比 | 剪应力比 | 平面内(上端)稳定 | 平面外(下端)稳定 | 腹板高厚比 | 翼缘宽厚比 | 质量(kg) | 状态 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0.39 | 0.10 | 0.36 | 0.67 | 55.00 | 8.70 | 219.7 | 通过 |
| 2 | 0.49 | 0.12 | 0.45 | 0.56 | 55.00 | 8.70 | 320.8 | 通过 |
| 3 | 0.39 | 0.10 | 0.36 | 0.55 | 55.00 | 8.70 | 262.6 | 通过 |
| 4 | 0.49 | 0.12 | 0.45 | 0.71 | 55.00 | 8.70 | 277.9 | 通过 |

**11. 构件设计结果**

**1. 钢 柱 1
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=17.01, Ly=7.00; 长细比：λx=131.5,λy=144.5

构件长度=7.00; 计算长度系数: Ux=2.43 Uy=1.00

抗震等级: 四级

截面参数: B1=200, B2=200, H=300, Tw=6, T1=10, T2=10

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 244.366196(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 21.29 | -2.52 | -17.66 | -16.42 | 2.52 |
| 2 | 0.00 | 39.58 | -5.80 | -40.58 | -34.71 | 5.80 |
| 3 | 0.00 | 39.69 | -5.53 | -38.74 | -34.82 | 5.53 |
| 4 | 0.00 | 21.18 | -2.79 | -19.50 | -16.31 | 2.79 |
| 5 | 0.00 | 16.17 | -1.88 | -13.18 | -12.42 | 1.88 |
| 6 | 0.00 | 34.46 | -5.16 | -36.09 | -30.71 | 5.16 |
| 7 | 0.00 | 34.57 | -4.89 | -34.25 | -30.82 | 4.89 |
| 8 | 0.00 | 16.06 | -2.14 | -15.01 | -12.31 | 2.14 |
| 9 | 0.00 | -3.32 | 10.56 | 44.71 | 8.19 | -2.22 |
| 10 | 0.00 | 17.50 | -12.55 | -47.03 | -12.63 | 0.89 |
| 11 | 0.00 | 2.81 | 12.74 | 35.53 | 2.05 | 2.59 |
| 12 | 0.00 | 23.68 | -10.52 | -56.69 | -18.81 | 5.67 |
| 13 | 0.00 | -8.44 | 11.20 | 49.20 | 12.19 | -2.86 |
| 14 | 0.00 | 12.37 | -11.91 | -42.55 | -8.63 | 0.25 |
| 15 | 0.00 | -2.31 | 13.38 | 40.02 | 6.05 | 1.95 |
| 16 | 0.00 | 18.55 | -9.88 | -52.20 | -14.81 | 5.03 |
| 17 | 0.00 | 5.98 | 5.48 | 20.83 | -1.11 | -0.47 |
| 18 | 0.00 | 18.47 | -8.38 | -34.22 | -13.60 | 1.39 |
| 19 | 0.00 | 9.66 | 6.79 | 15.33 | -4.79 | 2.41 |
| 20 | 0.00 | 22.18 | -7.17 | -40.01 | -17.31 | 4.26 |
| 21 | 0.00 | 24.27 | 2.21 | -2.08 | -19.40 | 2.80 |
| 22 | 0.00 | 36.76 | -11.66 | -57.13 | -31.89 | 4.66 |
| 23 | 0.00 | 27.95 | 3.52 | -7.58 | -23.08 | 5.68 |
| 24 | 0.00 | 40.47 | -10.44 | -62.92 | -35.60 | 7.53 |
| 25 | 0.00 | 24.38 | 2.47 | -0.24 | -19.51 | 2.54 |
| 26 | 0.00 | 36.87 | -11.40 | -55.29 | -32.00 | 4.40 |
| 27 | 0.00 | 28.06 | 3.78 | -5.75 | -23.19 | 5.42 |
| 28 | 0.00 | 40.58 | -10.18 | -61.08 | -35.71 | 7.27 |
| 29 | 0.00 | 5.87 | 5.22 | 19.00 | -1.00 | -0.21 |
| 30 | 0.00 | 18.36 | -8.65 | -36.05 | -13.49 | 1.65 |
| 31 | 0.00 | 9.55 | 6.53 | 13.49 | -4.68 | 2.67 |
| 32 | 0.00 | 22.07 | -7.43 | -41.84 | -17.20 | 4.52 |
| 33 | 0.00 | 0.86 | 6.12 | 25.32 | 2.89 | -1.11 |
| 34 | 0.00 | 13.34 | -7.74 | -29.73 | -9.60 | 0.75 |
| 35 | 0.00 | 4.54 | 7.43 | 19.82 | -0.79 | 1.77 |
| 36 | 0.00 | 17.05 | -6.53 | -35.52 | -13.31 | 3.62 |
| 37 | 0.00 | 19.14 | 2.85 | 2.41 | -15.40 | 2.16 |
| 38 | 0.00 | 31.63 | -11.02 | -52.64 | -27.89 | 4.02 |
| 39 | 0.00 | 22.83 | 4.16 | -3.10 | -19.08 | 5.04 |
| 40 | 0.00 | 35.34 | -9.80 | -58.43 | -31.60 | 6.89 |
| 41 | 0.00 | 19.25 | 3.11 | 4.24 | -15.51 | 1.90 |
| 42 | 0.00 | 31.74 | -10.75 | -50.80 | -28.00 | 3.76 |
| 43 | 0.00 | 22.93 | 4.42 | -1.26 | -19.19 | 4.78 |
| 44 | 0.00 | 35.45 | -9.54 | -56.59 | -31.71 | 6.63 |
| 45 | 0.00 | 0.75 | 5.86 | 23.49 | 3.00 | -0.85 |
| 46 | 0.00 | 13.23 | -8.01 | -31.56 | -9.49 | 1.01 |
| 47 | 0.00 | 4.43 | 7.17 | 17.98 | -0.68 | 2.03 |
| 48 | 0.00 | 16.94 | -6.79 | -37.35 | -13.20 | 3.88 |
| 49 | 0.00 | -3.96 | 10.74 | 45.96 | 8.83 | -2.39 |
| 50 | 0.00 | 16.86 | -12.37 | -45.78 | -11.99 | 0.71 |
| 51 | 0.00 | 2.18 | 12.92 | 36.78 | 2.69 | 2.41 |
| 52 | 0.00 | 23.04 | -10.34 | -55.44 | -18.17 | 5.49 |
| 53 | 0.00 | 8.85 | 8.45 | 29.92 | -3.98 | -0.10 |
| 54 | 0.00 | 29.66 | -14.66 | -61.82 | -24.79 | 3.00 |
| 55 | 0.00 | 14.98 | 10.63 | 20.75 | -10.11 | 4.70 |
| 56 | 0.00 | 35.84 | -12.64 | -71.47 | -30.97 | 7.79 |
| 57 | 0.00 | 8.92 | 8.63 | 31.21 | -4.05 | -0.29 |
| 58 | 0.00 | 29.74 | -14.48 | -60.54 | -24.87 | 2.82 |
| 59 | 0.00 | 15.06 | 10.81 | 22.03 | -10.19 | 4.52 |
| 60 | 0.00 | 35.92 | -12.45 | -70.19 | -31.05 | 7.60 |
| 61 | 0.00 | -4.03 | 10.55 | 44.68 | 8.90 | -2.21 |
| 62 | 0.00 | 16.78 | -12.55 | -47.07 | -11.91 | 0.90 |
| 63 | 0.00 | 2.10 | 12.74 | 35.50 | 2.77 | 2.59 |
| 64 | 0.00 | 22.96 | -10.53 | -56.72 | -18.09 | 5.68 |
| 65 | 0.00 | -9.08 | 11.38 | 50.45 | 12.83 | -3.04 |
| 66 | 0.00 | 11.73 | -11.73 | -41.30 | -7.99 | 0.07 |
| 67 | 0.00 | -2.95 | 13.56 | 41.27 | 6.69 | 1.77 |
| 68 | 0.00 | 17.92 | -9.70 | -50.95 | -14.17 | 4.85 |
| 69 | 0.00 | 3.72 | 9.09 | 34.41 | 0.02 | -0.74 |
| 70 | 0.00 | 24.54 | -14.02 | -57.33 | -20.79 | 2.36 |
| 71 | 0.00 | 9.86 | 11.27 | 25.24 | -6.11 | 4.06 |
| 72 | 0.00 | 30.72 | -11.99 | -66.99 | -26.97 | 7.14 |
| 73 | 0.00 | 3.80 | 9.27 | 35.70 | -0.05 | -0.93 |
| 74 | 0.00 | 24.61 | -13.83 | -56.05 | -20.87 | 2.18 |
| 75 | 0.00 | 9.93 | 11.45 | 26.52 | -6.19 | 3.88 |
| 76 | 0.00 | 30.80 | -11.81 | -65.70 | -27.05 | 6.96 |
| 77 | 0.00 | -9.16 | 11.20 | 49.17 | 12.90 | -2.85 |
| 78 | 0.00 | 11.66 | -11.91 | -42.58 | -7.91 | 0.26 |
| 79 | 0.00 | -3.02 | 13.38 | 39.99 | 6.77 | 1.95 |
| 80 | 0.00 | 17.84 | -9.89 | -52.23 | -14.09 | 5.04 |
| 81 | 0.00 | 21.14 | -1.97 | -13.76 | -16.27 | 1.97 |
| 82 | 0.00 | 22.47 | -3.37 | -23.60 | -17.60 | 3.37 |
| 83 | 0.00 | 29.07 | -3.38 | -23.69 | -24.20 | 3.38 |
| 84 | 0.00 | 30.40 | -4.79 | -33.52 | -25.53 | 4.79 |
| 85 | 0.00 | 29.12 | -3.27 | -22.89 | -24.25 | 3.27 |
| 86 | 0.00 | 30.45 | -4.68 | -32.73 | -25.58 | 4.68 |
| 87 | 0.00 | 21.10 | -2.08 | -14.55 | -16.23 | 2.08 |
| 88 | 0.00 | 22.43 | -3.48 | -24.39 | -17.56 | 3.48 |
| 89 | 0.00 | 16.11 | -1.35 | -9.45 | -12.37 | 1.35 |
| 90 | 0.00 | 17.44 | -2.76 | -19.29 | -13.69 | 2.76 |
| 91 | 0.00 | 22.21 | -2.44 | -17.08 | -18.46 | 2.44 |
| 92 | 0.00 | 23.54 | -3.85 | -26.92 | -19.79 | 3.85 |
| 93 | 0.00 | 22.24 | -2.35 | -16.47 | -18.50 | 2.35 |
| 94 | 0.00 | 23.57 | -3.76 | -26.31 | -19.83 | 3.76 |
| 95 | 0.00 | 16.07 | -1.44 | -10.06 | -12.33 | 1.44 |
| 96 | 0.00 | 17.40 | -2.84 | -19.90 | -13.66 | 2.84 |

强度计算控制组合号: 56, M=0.00, N=35.84, M=-71.47, N=-30.97

强度计算应力比 =0.409

抗剪强度计算控制组合号: 54, V=-14.66

抗剪强度计算应力比 =0.050

平面内稳定计算最大应力对应组合号: 56, M=0.00, N=35.84, M=-71.47, N=-30.97

平面内稳定计算最大应力 (N/mm\*mm) =138.30

平面内稳定计算最大应力比 =0.453

临界弯矩Mcr(kN\*m) =213.12

平面外稳定计算最大应力比 =0.589

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

强度计算应力比 =0.409 < 1.0

抗剪强度计算应力比 =0.050 < 1.0

平面内稳定计算最大应力 < f=305.00

平面外稳定计算最大应力比 < 1.0

腹板高厚比 H0/TW=46.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =9.70 < [B/T]=12.20

压杆,平面内长细比 λ=131. ≤ [λ]=180

压杆,平面外长细比 λ=144. ≤ [λ]=180

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | 柱 下 端 | | | 柱 上 端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 16.78 | -2.05 | -14.37 | -13.03 | 2.05 |
| 2 | 0.00 | 22.87 | -3.14 | -22.00 | -19.13 | 3.14 |
| 3 | 0.00 | 22.91 | -3.06 | -21.39 | -19.16 | 3.06 |
| 4 | 0.00 | 16.74 | -2.14 | -14.98 | -12.99 | 2.14 |
| 5 | 0.00 | 15.07 | -1.84 | -12.87 | -11.70 | 1.84 |
| 6 | 0.00 | 21.16 | -2.93 | -20.51 | -17.79 | 2.93 |
| 7 | 0.00 | 21.20 | -2.84 | -19.90 | -17.83 | 2.84 |
| 8 | 0.00 | 15.03 | -1.93 | -13.48 | -11.66 | 1.93 |
| 9 | 0.00 | 10.27 | 1.42 | 2.15 | -6.53 | 0.81 |
| 10 | 0.00 | 15.82 | -4.74 | -22.32 | -12.08 | 1.63 |
| 11 | 0.00 | 11.91 | 2.00 | -0.30 | -8.16 | 2.09 |
| 12 | 0.00 | 17.47 | -4.20 | -24.89 | -13.73 | 2.91 |
| 13 | 0.00 | 8.57 | 1.63 | 3.64 | -5.19 | 0.59 |
| 14 | 0.00 | 14.12 | -4.53 | -20.82 | -10.74 | 1.42 |
| 15 | 0.00 | 10.20 | 2.21 | 1.20 | -6.83 | 1.87 |
| 16 | 0.00 | 15.76 | -3.99 | -23.40 | -12.39 | 2.70 |

防火设计控制的偶然组合号: 12, M=0.00, N=17.47, M=-24.89, N=-13.73

强度计算荷载比 =0.14

平面内稳定计算荷载比 =0.16

平面外稳定计算荷载比 =0.17

无防护下钢构件最大升温(Ts): 1081.77℃ ,按临界温度法求得临界温度(Td): 644.54℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4376(m^2\*℃/w)

构件重量 (Kg)=312.15

**2. 钢 柱 2
设计结果**

截面类型=16; 布置角度=90; 计算长度：Lx=7.40, Ly=7.40; 长细比：λx=158.6,λy=58.1

构件长度=7.40; 计算长度系数: Ux=1.00 Uy=1.00

抗震等级: 四级

截面参数: B1=200, B2=200, H=300, Tw=6, T1=8, T2=8

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 283.034271(1/m)

抗风柱类型1: 仅承担山墙风荷载

抗风柱约束：面内两端铰接；面外两端铰接

山墙风压力作用，柱中最大弯矩 My1 =0.00

山墙风吸力作用，柱中最大弯矩 My2 =0.00

组合号 My(柱中) N V(柱底)

1 0.00 4.44 0.00

2 0.00 4.44 0.00

3 0.00 4.44 0.00

4 0.00 4.44 0.00

5 0.00 4.44 0.00

6 0.00 4.44 0.00

7 0.00 4.44 0.00

8 0.00 4.44 0.00

9 0.00 4.44 0.00

10 0.00 4.44 0.00

11 0.00 4.44 0.00

12 0.00 4.44 0.00

强度计算控制组合号: 1, M=0.00, N=4.44

强度计算应力比 =0.003

平面内稳定计算最大应力比 =0.016

平面外稳定计算最大应力 (N/mm\*mm) =1.22

平面外稳定计算最大应力比 =0.004

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

抗风柱挠度风吸力控制，挠度值 v (mm) 0.0

强度计算最大应力 < f=305.00

平面内稳定计算最大应力比 < 1.0

平面外稳定计算最大应力 < f=305.00

腹板高厚比 H0/TW=47.33 < [H0/TW]=250.00

翼缘宽厚比 B/T =12.12 < [B/T]=12.20

压杆,平面内长细比 λ=159. ≤ [λ]=180

压杆,平面外长细比 λ=58. ≤ [λ]=180

抗风柱的挠度 v/H=1/10000. < [v/H]=1/250.

抗风柱柱顶梁的最大竖向位移: 向下: 19mm; 向上: 0mm

钢构件防火设计结果:

|  |  |  |  |
| --- | --- | --- | --- |
| 组合 | My | N | V(柱底) |
| 1 | 0.00 | 3.42 | 0.00 |
| 2 | 0.00 | 3.08 | 0.00 |
| 3 | 0.00 | 3.42 | 0.00 |
| 4 | 0.00 | 3.08 | 0.00 |
| 5 | 0.00 | 3.42 | 0.00 |
| 6 | 0.00 | 3.08 | 0.00 |
| 7 | 0.00 | 3.42 | 0.00 |
| 8 | 0.00 | 3.08 | 0.00 |
| 9 | 0.00 | 3.42 | 0.00 |
| 10 | 0.00 | 3.08 | 0.00 |

防火设计控制的偶然组合号: 1, M=0.00, N=3.42

强度计算荷载比 =0.00

平面内稳定计算荷载比 =0.01

平面外稳定计算荷载比 =0.00

无防护下钢构件最大升温(Ts): 1081.88℃ ,按临界温度法求得临界温度(Td): 643.23℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.5066(m^2\*℃/w)

构件重量 (Kg)=284.87

**3. 钢 柱 3
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=16.39, Ly=7.98; 长细比：λx=126.6,λy=164.8

构件长度=7.98; 计算长度系数: Ux=2.05 Uy=1.00

抗震等级: 四级

截面参数: B1=200, B2=200, H=300, Tw=6, T1=10, T2=10

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 244.366196(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 67.51 | 2.75 | 21.95 | -61.96 | -2.75 |
| 2 | 0.00 | 67.51 | -2.75 | -21.95 | -61.96 | 2.75 |
| 3 | 0.00 | 88.06 | -0.00 | -0.00 | -82.51 | 0.00 |
| 4 | 0.00 | 46.96 | -0.00 | -0.00 | -41.41 | 0.00 |
| 5 | 0.00 | 56.68 | 2.75 | 21.95 | -52.40 | -2.75 |
| 6 | 0.00 | 56.68 | -2.75 | -21.95 | -52.40 | 2.75 |
| 7 | 0.00 | 77.23 | -0.00 | -0.00 | -72.95 | 0.00 |
| 8 | 0.00 | 36.13 | -0.00 | -0.00 | -31.85 | 0.00 |
| 9 | 0.00 | 10.37 | 6.22 | 49.63 | -4.82 | -6.22 |
| 10 | 0.00 | 10.40 | -6.20 | -49.51 | -4.85 | 6.20 |
| 11 | 0.00 | 22.60 | 6.25 | 49.93 | -17.05 | -6.25 |
| 12 | 0.00 | 22.60 | -6.25 | -49.93 | -17.05 | 6.25 |
| 13 | 0.00 | -0.47 | 6.22 | 49.63 | 4.74 | -6.22 |
| 14 | 0.00 | -0.44 | -6.20 | -49.51 | 4.71 | 6.20 |
| 15 | 0.00 | 11.76 | 6.25 | 49.93 | -7.49 | -6.25 |
| 16 | 0.00 | 11.76 | -6.25 | -49.93 | -7.49 | 6.25 |
| 17 | 0.00 | 45.56 | 6.48 | 51.73 | -40.01 | -6.48 |
| 18 | 0.00 | 45.58 | -0.97 | -7.76 | -40.02 | 0.97 |
| 19 | 0.00 | 52.89 | 6.50 | 51.91 | -47.34 | -6.50 |
| 20 | 0.00 | 52.89 | -1.00 | -8.01 | -47.34 | 1.00 |
| 21 | 0.00 | 45.56 | 0.98 | 7.83 | -40.01 | -0.98 |
| 22 | 0.00 | 45.58 | -6.47 | -51.65 | -40.02 | 6.47 |
| 23 | 0.00 | 52.89 | 1.00 | 8.01 | -47.34 | -1.00 |
| 24 | 0.00 | 52.89 | -6.50 | -51.91 | -47.34 | 6.50 |
| 25 | 0.00 | 66.11 | 3.73 | 29.78 | -60.56 | -3.73 |
| 26 | 0.00 | 66.13 | -3.72 | -29.71 | -60.57 | 3.72 |
| 27 | 0.00 | 73.44 | 3.75 | 29.96 | -67.89 | -3.75 |
| 28 | 0.00 | 73.44 | -3.75 | -29.96 | -67.89 | 3.75 |
| 29 | 0.00 | 25.01 | 3.73 | 29.78 | -19.46 | -3.73 |
| 30 | 0.00 | 25.03 | -3.72 | -29.71 | -19.47 | 3.72 |
| 31 | 0.00 | 32.35 | 3.75 | 29.96 | -26.79 | -3.75 |
| 32 | 0.00 | 32.35 | -3.75 | -29.96 | -26.79 | 3.75 |
| 33 | 0.00 | 34.72 | 6.48 | 51.73 | -30.45 | -6.48 |
| 34 | 0.00 | 34.74 | -0.97 | -7.76 | -30.47 | 0.97 |
| 35 | 0.00 | 42.06 | 6.50 | 51.91 | -37.79 | -6.50 |
| 36 | 0.00 | 42.06 | -1.00 | -8.01 | -37.79 | 1.00 |
| 37 | 0.00 | 34.72 | 0.98 | 7.83 | -30.45 | -0.98 |
| 38 | 0.00 | 34.74 | -6.47 | -51.65 | -30.47 | 6.47 |
| 39 | 0.00 | 42.06 | 1.00 | 8.01 | -37.79 | -1.00 |
| 40 | 0.00 | 42.06 | -6.50 | -51.91 | -37.79 | 6.50 |
| 41 | 0.00 | 55.27 | 3.73 | 29.78 | -51.00 | -3.73 |
| 42 | 0.00 | 55.29 | -3.72 | -29.71 | -51.02 | 3.72 |
| 43 | 0.00 | 62.61 | 3.75 | 29.96 | -58.33 | -3.75 |
| 44 | 0.00 | 62.61 | -3.75 | -29.96 | -58.33 | 3.75 |
| 45 | 0.00 | 14.17 | 3.73 | 29.78 | -9.90 | -3.73 |
| 46 | 0.00 | 14.19 | -3.72 | -29.71 | -9.92 | 3.72 |
| 47 | 0.00 | 21.51 | 3.75 | 29.96 | -17.24 | -3.75 |
| 48 | 0.00 | 21.51 | -3.75 | -29.96 | -17.24 | 3.75 |
| 49 | 0.00 | 24.76 | 8.14 | 64.99 | -19.20 | -8.14 |
| 50 | 0.00 | 24.78 | -4.28 | -34.14 | -19.23 | 4.28 |
| 51 | 0.00 | 36.98 | 8.18 | 65.30 | -31.43 | -8.18 |
| 52 | 0.00 | 36.98 | -4.33 | -34.57 | -31.43 | 4.33 |
| 53 | 0.00 | 24.76 | 4.29 | 34.27 | -19.20 | -4.29 |
| 54 | 0.00 | 24.78 | -8.13 | -64.87 | -19.23 | 8.13 |
| 55 | 0.00 | 36.98 | 4.33 | 34.57 | -31.43 | -4.33 |
| 56 | 0.00 | 36.98 | -8.18 | -65.30 | -31.43 | 8.18 |
| 57 | 0.00 | 39.14 | 6.22 | 49.63 | -33.59 | -6.22 |
| 58 | 0.00 | 39.17 | -6.20 | -49.51 | -33.62 | 6.20 |
| 59 | 0.00 | 51.37 | 6.25 | 49.93 | -45.82 | -6.25 |
| 60 | 0.00 | 51.37 | -6.25 | -49.93 | -45.82 | 6.25 |
| 61 | 0.00 | 10.37 | 6.22 | 49.63 | -4.82 | -6.22 |
| 62 | 0.00 | 10.40 | -6.20 | -49.51 | -4.85 | 6.20 |
| 63 | 0.00 | 22.60 | 6.25 | 49.93 | -17.05 | -6.25 |
| 64 | 0.00 | 22.60 | -6.25 | -49.93 | -17.05 | 6.25 |
| 65 | 0.00 | 13.92 | 8.14 | 64.99 | -9.65 | -8.14 |
| 66 | 0.00 | 13.95 | -4.28 | -34.14 | -9.67 | 4.28 |
| 67 | 0.00 | 26.15 | 8.18 | 65.30 | -21.87 | -8.18 |
| 68 | 0.00 | 26.15 | -4.33 | -34.57 | -21.87 | 4.33 |
| 69 | 0.00 | 13.92 | 4.29 | 34.27 | -9.65 | -4.29 |
| 70 | 0.00 | 13.95 | -8.13 | -64.87 | -9.67 | 8.13 |
| 71 | 0.00 | 26.15 | 4.33 | 34.57 | -21.87 | -4.33 |
| 72 | 0.00 | 26.15 | -8.18 | -65.30 | -21.87 | 8.18 |
| 73 | 0.00 | 28.30 | 6.22 | 49.63 | -24.03 | -6.22 |
| 74 | 0.00 | 28.33 | -6.20 | -49.51 | -24.06 | 6.20 |
| 75 | 0.00 | 40.53 | 6.25 | 49.93 | -36.26 | -6.25 |
| 76 | 0.00 | 40.53 | -6.25 | -49.93 | -36.26 | 6.25 |
| 77 | 0.00 | -0.47 | 6.22 | 49.63 | 4.74 | -6.22 |
| 78 | 0.00 | -0.44 | -6.20 | -49.51 | 4.71 | 6.20 |
| 79 | 0.00 | 11.76 | 6.25 | 49.93 | -7.49 | -6.25 |
| 80 | 0.00 | 11.76 | -6.25 | -49.93 | -7.49 | 6.25 |
| 81 | 0.00 | 55.87 | 2.01 | 16.02 | -50.31 | -2.01 |
| 82 | 0.00 | 55.87 | 0.38 | 3.00 | -50.32 | -0.38 |
| 83 | 0.00 | 55.87 | -0.38 | -3.00 | -50.31 | 0.38 |
| 84 | 0.00 | 55.87 | -2.01 | -16.02 | -50.32 | 2.01 |
| 85 | 0.00 | 64.77 | 0.81 | 6.51 | -59.22 | -0.81 |
| 86 | 0.00 | 64.78 | -0.81 | -6.51 | -59.22 | 0.81 |
| 87 | 0.00 | 46.96 | 0.81 | 6.51 | -41.41 | -0.81 |
| 88 | 0.00 | 46.97 | -0.81 | -6.51 | -41.41 | 0.81 |
| 89 | 0.00 | 42.97 | 1.73 | 13.82 | -38.70 | -1.73 |
| 90 | 0.00 | 42.98 | 0.10 | 0.81 | -38.71 | -0.10 |
| 91 | 0.00 | 42.97 | -0.10 | -0.81 | -38.70 | 0.10 |
| 92 | 0.00 | 42.98 | -1.73 | -13.82 | -38.71 | 1.73 |
| 93 | 0.00 | 49.82 | 0.81 | 6.51 | -45.55 | -0.81 |
| 94 | 0.00 | 49.83 | -0.81 | -6.51 | -45.56 | 0.81 |
| 95 | 0.00 | 36.12 | 0.81 | 6.51 | -31.85 | -0.81 |
| 96 | 0.00 | 36.13 | -0.81 | -6.51 | -31.86 | 0.81 |

强度计算控制组合号: 56, M=0.00, N=36.98, M=-65.30, N=-31.43

强度计算应力比 =0.374

抗剪强度计算控制组合号: 56, V=-8.18

抗剪强度计算应力比 =0.028

平面内稳定计算最大应力对应组合号: 56, M=0.00, N=36.98, M=-65.30, N=-31.43

平面内稳定计算最大应力 (N/mm\*mm) =126.82

平面内稳定计算最大应力比 =0.416

临界弯矩Mcr(kN\*m) =175.96

平面外稳定计算最大应力比 =0.638

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

强度计算应力比 =0.374 < 1.0

抗剪强度计算应力比 =0.028 < 1.0

平面内稳定计算最大应力 < f=305.00

平面外稳定计算最大应力比 < 1.0

腹板高厚比 H0/TW=46.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =9.70 < [B/T]=12.20

压杆,平面内长细比 λ=127. ≤ [λ]=180

压杆,平面外长细比 λ=165. ≤ [λ]=180

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | 柱 下 端 | | | 柱 上 端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 42.98 | 0.92 | 7.32 | -38.70 | -0.92 |
| 2 | 0.00 | 42.98 | -0.92 | -7.32 | -38.70 | 0.92 |
| 3 | 0.00 | 49.83 | -0.00 | -0.00 | -45.55 | 0.00 |
| 4 | 0.00 | 36.13 | -0.00 | -0.00 | -31.85 | 0.00 |
| 5 | 0.00 | 39.36 | 0.92 | 7.32 | -35.52 | -0.92 |
| 6 | 0.00 | 39.36 | -0.92 | -7.32 | -35.52 | 0.92 |
| 7 | 0.00 | 46.21 | -0.00 | -0.00 | -42.37 | 0.00 |
| 8 | 0.00 | 32.51 | -0.00 | -0.00 | -28.67 | 0.00 |
| 9 | 0.00 | 26.37 | 1.66 | 13.23 | -22.10 | -1.66 |
| 10 | 0.00 | 26.38 | -1.65 | -13.20 | -22.10 | 1.65 |
| 11 | 0.00 | 29.63 | 1.67 | 13.32 | -25.36 | -1.67 |
| 12 | 0.00 | 29.63 | -1.67 | -13.32 | -25.36 | 1.67 |
| 13 | 0.00 | 22.76 | 1.66 | 13.23 | -18.91 | -1.66 |
| 14 | 0.00 | 22.76 | -1.65 | -13.20 | -18.92 | 1.65 |
| 15 | 0.00 | 26.02 | 1.67 | 13.32 | -22.17 | -1.67 |
| 16 | 0.00 | 26.02 | -1.67 | -13.32 | -22.17 | 1.67 |

防火设计控制的偶然组合号: 12, M=0.00, N=29.63, M=-13.32, N=-25.36

强度计算荷载比 =0.08

平面内稳定计算荷载比 =0.12

平面外稳定计算荷载比 =0.16

无防护下钢构件最大升温(Ts): 1081.77℃ ,按临界温度法求得临界温度(Td): 644.77℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4374(m^2\*℃/w)

构件重量 (Kg)=355.99

**4. 钢 柱 4
设计结果**

截面类型=16; 布置角度=90; 计算长度：Lx=7.48, Ly=7.48; 长细比：λx=160.3,λy=58.7

构件长度=7.48; 计算长度系数: Ux=1.00 Uy=1.00

抗震等级: 四级

截面参数: B1=200, B2=200, H=300, Tw=6, T1=8, T2=8

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 283.034271(1/m)

抗风柱类型1: 仅承担山墙风荷载

抗风柱约束：面内两端铰接；面外两端铰接

山墙风压力作用，柱中最大弯矩 My1 =0.00

山墙风吸力作用，柱中最大弯矩 My2 =0.00

组合号 My(柱中) N V(柱底)

1 0.00 4.49 0.00

2 0.00 4.49 0.00

3 0.00 4.49 0.00

4 0.00 4.49 0.00

5 0.00 4.49 0.00

6 0.00 4.49 0.00

7 0.00 4.49 0.00

8 0.00 4.49 0.00

9 0.00 4.49 0.00

10 0.00 4.49 0.00

11 0.00 4.49 0.00

12 0.00 4.49 0.00

强度计算控制组合号: 1, M=0.00, N=4.49

强度计算应力比 =0.003

平面内稳定计算最大应力比 =0.017

平面外稳定计算最大应力 (N/mm\*mm) =1.24

平面外稳定计算最大应力比 =0.004

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

抗风柱挠度风吸力控制，挠度值 v (mm) 0.0

强度计算最大应力 < f=305.00

平面内稳定计算最大应力比 < 1.0

平面外稳定计算最大应力 < f=305.00

腹板高厚比 H0/TW=47.33 < [H0/TW]=250.00

翼缘宽厚比 B/T =12.12 < [B/T]=12.20

压杆,平面内长细比 λ=160. ≤ [λ]=180

压杆,平面外长细比 λ=59. ≤ [λ]=180

抗风柱的挠度 v/H=1/10000. < [v/H]=1/250.

抗风柱柱顶梁的最大竖向位移: 向下: 19mm; 向上: 0mm

钢构件防火设计结果:

|  |  |  |  |
| --- | --- | --- | --- |
| 组合 | My | N | V(柱底) |
| 1 | 0.00 | 3.45 | 0.00 |
| 2 | 0.00 | 3.11 | 0.00 |
| 3 | 0.00 | 3.45 | 0.00 |
| 4 | 0.00 | 3.11 | 0.00 |
| 5 | 0.00 | 3.45 | 0.00 |
| 6 | 0.00 | 3.11 | 0.00 |
| 7 | 0.00 | 3.45 | 0.00 |
| 8 | 0.00 | 3.11 | 0.00 |
| 9 | 0.00 | 3.45 | 0.00 |
| 10 | 0.00 | 3.11 | 0.00 |

防火设计控制的偶然组合号: 1, M=0.00, N=3.45

强度计算荷载比 =0.00

平面内稳定计算荷载比 =0.01

平面外稳定计算荷载比 =0.00

无防护下钢构件最大升温(Ts): 1081.88℃ ,按临界温度法求得临界温度(Td): 643.13℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.5067(m^2\*℃/w)

构件重量 (Kg)=287.88

**5. 钢 柱 5
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=17.01, Ly=7.00; 长细比：λx=131.5,λy=144.5

构件长度=7.00; 计算长度系数: Ux=2.43 Uy=1.00

抗震等级: 四级

截面参数: B1=200, B2=200, H=300, Tw=6, T1=10, T2=10

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 244.366196(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 39.68 | 5.78 | 40.45 | -34.81 | -5.78 |
| 2 | 0.00 | 21.20 | 2.54 | 17.79 | -16.33 | -2.54 |
| 3 | 0.00 | 39.69 | 5.53 | 38.74 | -34.82 | -5.53 |
| 4 | 0.00 | 21.18 | 2.79 | 19.50 | -16.31 | -2.79 |
| 5 | 0.00 | 34.55 | 5.14 | 35.96 | -30.81 | -5.14 |
| 6 | 0.00 | 16.07 | 1.90 | 13.30 | -12.33 | -1.90 |
| 7 | 0.00 | 34.57 | 4.89 | 34.25 | -30.82 | -4.89 |
| 8 | 0.00 | 16.06 | 2.14 | 15.01 | -12.31 | -2.14 |
| 9 | 0.00 | 17.49 | 12.55 | 47.10 | -12.62 | -0.91 |
| 10 | 0.00 | -3.31 | -10.53 | -44.66 | 8.18 | 2.23 |
| 11 | 0.00 | 23.68 | 10.52 | 56.69 | -18.81 | -5.67 |
| 12 | 0.00 | 2.82 | -12.74 | -35.53 | 2.05 | -2.59 |
| 13 | 0.00 | 12.37 | 11.91 | 42.61 | -8.62 | -0.27 |
| 14 | 0.00 | -8.44 | -11.17 | -49.15 | 12.18 | 2.87 |
| 15 | 0.00 | 18.55 | 9.88 | 52.20 | -14.81 | -5.03 |
| 16 | 0.00 | -2.31 | -13.38 | -40.02 | 6.05 | -1.95 |
| 17 | 0.00 | 36.85 | 11.64 | 57.04 | -31.98 | -4.66 |
| 18 | 0.00 | 24.37 | -2.21 | 1.98 | -19.50 | -2.77 |
| 19 | 0.00 | 40.56 | 10.43 | 62.79 | -35.69 | -7.51 |
| 20 | 0.00 | 28.04 | -3.53 | 7.46 | -23.17 | -5.66 |
| 21 | 0.00 | 18.37 | 8.40 | 34.38 | -13.50 | -1.42 |
| 22 | 0.00 | 5.89 | -5.44 | -20.67 | -1.02 | 0.46 |
| 23 | 0.00 | 22.08 | 7.19 | 40.13 | -17.21 | -4.28 |
| 24 | 0.00 | 9.57 | -6.77 | -15.20 | -4.70 | -2.43 |
| 25 | 0.00 | 36.86 | 11.40 | 55.33 | -31.99 | -4.41 |
| 26 | 0.00 | 24.38 | -2.45 | 0.28 | -19.51 | -2.53 |
| 27 | 0.00 | 40.58 | 10.18 | 61.08 | -35.71 | -7.27 |
| 28 | 0.00 | 28.06 | -3.78 | 5.75 | -23.19 | -5.42 |
| 29 | 0.00 | 18.35 | 8.65 | 36.09 | -13.49 | -1.66 |
| 30 | 0.00 | 5.87 | -5.20 | -18.97 | -1.00 | 0.22 |
| 31 | 0.00 | 22.07 | 7.43 | 41.84 | -17.20 | -4.52 |
| 32 | 0.00 | 9.55 | -6.53 | -13.49 | -4.68 | -2.67 |
| 33 | 0.00 | 31.72 | 11.00 | 52.55 | -27.98 | -4.01 |
| 34 | 0.00 | 19.24 | -2.85 | -2.50 | -15.50 | -2.13 |
| 35 | 0.00 | 35.44 | 9.78 | 58.30 | -31.69 | -6.87 |
| 36 | 0.00 | 22.92 | -4.17 | 2.97 | -19.17 | -5.02 |
| 37 | 0.00 | 13.25 | 7.76 | 29.89 | -9.50 | -0.78 |
| 38 | 0.00 | 0.76 | -6.08 | -25.16 | 2.98 | 1.11 |
| 39 | 0.00 | 16.96 | 6.55 | 35.64 | -13.21 | -3.64 |
| 40 | 0.00 | 4.44 | -7.41 | -19.69 | -0.70 | -1.79 |
| 41 | 0.00 | 31.74 | 10.76 | 50.84 | -27.99 | -3.77 |
| 42 | 0.00 | 19.26 | -3.09 | -4.21 | -15.51 | -1.89 |
| 43 | 0.00 | 35.45 | 9.54 | 56.59 | -31.71 | -6.63 |
| 44 | 0.00 | 22.94 | -4.42 | 1.26 | -19.19 | -4.78 |
| 45 | 0.00 | 13.23 | 8.01 | 31.60 | -9.48 | -1.02 |
| 46 | 0.00 | 0.75 | -5.84 | -23.46 | 3.00 | 0.86 |
| 47 | 0.00 | 16.94 | 6.79 | 37.35 | -13.20 | -3.88 |
| 48 | 0.00 | 4.43 | -7.17 | -17.98 | -0.68 | -2.03 |
| 49 | 0.00 | 29.72 | 14.65 | 61.79 | -24.85 | -3.01 |
| 50 | 0.00 | 8.92 | -8.43 | -29.96 | -4.05 | 0.13 |
| 51 | 0.00 | 35.91 | 12.62 | 71.39 | -31.04 | -7.77 |
| 52 | 0.00 | 15.05 | -10.64 | -20.84 | -10.18 | -4.69 |
| 53 | 0.00 | 16.79 | 12.38 | 45.93 | -11.92 | -0.74 |
| 54 | 0.00 | -4.02 | -10.69 | -45.82 | 8.89 | 2.40 |
| 55 | 0.00 | 22.97 | 10.36 | 55.52 | -18.11 | -5.51 |
| 56 | 0.00 | 2.11 | -12.91 | -36.70 | 2.76 | -2.42 |
| 57 | 0.00 | 29.73 | 14.48 | 60.60 | -24.86 | -2.84 |
| 58 | 0.00 | 8.93 | -8.60 | -31.15 | -4.06 | 0.30 |
| 59 | 0.00 | 35.92 | 12.45 | 70.19 | -31.05 | -7.60 |
| 60 | 0.00 | 15.06 | -10.81 | -22.03 | -10.19 | -4.52 |
| 61 | 0.00 | 16.78 | 12.55 | 47.13 | -11.91 | -0.91 |
| 62 | 0.00 | -4.03 | -10.52 | -44.62 | 8.90 | 2.23 |
| 63 | 0.00 | 22.96 | 10.53 | 56.72 | -18.09 | -5.68 |
| 64 | 0.00 | 2.10 | -12.74 | -35.50 | 2.77 | -2.59 |
| 65 | 0.00 | 24.60 | 14.01 | 57.31 | -20.85 | -2.37 |
| 66 | 0.00 | 3.79 | -9.07 | -34.45 | -0.05 | 0.77 |
| 67 | 0.00 | 30.79 | 11.98 | 66.90 | -27.04 | -7.13 |
| 68 | 0.00 | 9.92 | -11.28 | -25.32 | -6.18 | -4.05 |
| 69 | 0.00 | 11.66 | 11.74 | 41.45 | -7.92 | -0.10 |
| 70 | 0.00 | -9.14 | -11.33 | -50.31 | 12.89 | 3.04 |
| 71 | 0.00 | 17.85 | 9.72 | 51.04 | -14.11 | -4.87 |
| 72 | 0.00 | -3.01 | -13.55 | -41.18 | 6.76 | -1.78 |
| 73 | 0.00 | 24.61 | 13.84 | 56.11 | -20.86 | -2.19 |
| 74 | 0.00 | 3.81 | -9.24 | -35.64 | -0.06 | 0.94 |
| 75 | 0.00 | 30.80 | 11.81 | 65.70 | -27.05 | -6.96 |
| 76 | 0.00 | 9.93 | -11.45 | -26.52 | -6.19 | -3.88 |
| 77 | 0.00 | 11.65 | 11.91 | 42.64 | -7.91 | -0.27 |
| 78 | 0.00 | -9.15 | -11.16 | -49.11 | 12.90 | 2.87 |
| 79 | 0.00 | 17.84 | 9.89 | 52.23 | -14.09 | -5.04 |
| 80 | 0.00 | -3.02 | -13.38 | -39.99 | 6.77 | -1.95 |
| 81 | 0.00 | 30.44 | 4.78 | 33.47 | -25.57 | -4.78 |
| 82 | 0.00 | 29.11 | 3.38 | 23.63 | -24.24 | -3.38 |
| 83 | 0.00 | 22.44 | 3.38 | 23.65 | -17.57 | -3.38 |
| 84 | 0.00 | 21.10 | 1.97 | 13.81 | -16.23 | -1.97 |
| 85 | 0.00 | 30.45 | 4.68 | 32.73 | -25.58 | -4.68 |
| 86 | 0.00 | 29.11 | 3.27 | 22.89 | -24.24 | -3.27 |
| 87 | 0.00 | 22.43 | 3.48 | 24.39 | -17.56 | -3.48 |
| 88 | 0.00 | 21.09 | 2.08 | 14.55 | -16.22 | -2.08 |
| 89 | 0.00 | 23.57 | 3.84 | 26.88 | -19.83 | -3.84 |
| 90 | 0.00 | 22.24 | 2.43 | 17.04 | -18.49 | -2.43 |
| 91 | 0.00 | 17.41 | 2.76 | 19.33 | -13.67 | -2.76 |
| 92 | 0.00 | 16.08 | 1.36 | 9.49 | -12.33 | -1.36 |
| 93 | 0.00 | 23.58 | 3.76 | 26.32 | -19.83 | -3.76 |
| 94 | 0.00 | 22.24 | 2.35 | 16.47 | -18.49 | -2.35 |
| 95 | 0.00 | 17.41 | 2.84 | 19.90 | -13.66 | -2.84 |
| 96 | 0.00 | 16.07 | 1.44 | 10.06 | -12.33 | -1.44 |

强度计算控制组合号: 51, M=0.00, N=35.91, M=71.39, N=-31.04

强度计算应力比 =0.409

抗剪强度计算控制组合号: 49, V=14.65

抗剪强度计算应力比 =0.050

平面内稳定计算最大应力对应组合号: 51, M=0.00, N=35.91, M=71.39, N=-31.04

平面内稳定计算最大应力 (N/mm\*mm) =138.21

平面内稳定计算最大应力比 =0.453

临界弯矩Mcr(kN\*m) =213.12

平面外稳定计算最大应力比 =0.589

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

强度计算应力比 =0.409 < 1.0

抗剪强度计算应力比 =0.050 < 1.0

平面内稳定计算最大应力 < f=305.00

平面外稳定计算最大应力比 < 1.0

腹板高厚比 H0/TW=46.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =9.70 < [B/T]=12.20

压杆,平面内长细比 λ=131. ≤ [λ]=180

压杆,平面外长细比 λ=144. ≤ [λ]=180

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | 柱 下 端 | | | 柱 上 端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 22.90 | 3.14 | 21.96 | -19.16 | -3.14 |
| 2 | 0.00 | 16.74 | 2.06 | 14.41 | -13.00 | -2.06 |
| 3 | 0.00 | 22.91 | 3.06 | 21.39 | -19.16 | -3.06 |
| 4 | 0.00 | 16.74 | 2.14 | 14.98 | -12.99 | -2.14 |
| 5 | 0.00 | 21.20 | 2.92 | 20.47 | -17.82 | -2.92 |
| 6 | 0.00 | 15.04 | 1.84 | 12.91 | -11.67 | -1.84 |
| 7 | 0.00 | 21.20 | 2.84 | 19.90 | -17.83 | -2.84 |
| 8 | 0.00 | 15.03 | 1.93 | 13.48 | -11.66 | -1.93 |
| 9 | 0.00 | 15.82 | 4.74 | 22.33 | -12.08 | -1.64 |
| 10 | 0.00 | 10.28 | -1.41 | -2.13 | -6.53 | -0.80 |
| 11 | 0.00 | 17.47 | 4.20 | 24.89 | -13.73 | -2.91 |
| 12 | 0.00 | 11.91 | -2.00 | 0.30 | -8.16 | -2.09 |
| 13 | 0.00 | 14.11 | 4.53 | 20.84 | -10.74 | -1.42 |
| 14 | 0.00 | 8.57 | -1.62 | -3.63 | -5.20 | -0.59 |
| 15 | 0.00 | 15.76 | 3.99 | 23.40 | -12.39 | -2.70 |
| 16 | 0.00 | 10.20 | -2.21 | -1.20 | -6.83 | -1.87 |

防火设计控制的偶然组合号: 11, M=0.00, N=17.47, M=24.89, N=-13.73

强度计算荷载比 =0.14

平面内稳定计算荷载比 =0.16

平面外稳定计算荷载比 =0.17

无防护下钢构件最大升温(Ts): 1081.77℃ ,按临界温度法求得临界温度(Td): 644.54℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4376(m^2\*℃/w)

构件重量 (Kg)=312.15

**6. 钢 柱 6
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=3.00, Ly=1.50; 长细比：λx=34.8,λy=33.9

构件长度=1.50; 计算长度系数: Ux=2.00 Uy=1.00

抗震等级: 四级

截面参数: B1=180, B2=180, H=200, Tw=6, T1=8, T2=8

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 278.112457(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 0.73 | -0.00 | 0.00 | -0.00 | 0.00 |
| 2 | -0.00 | 0.73 | -0.00 | -0.00 | -0.00 | 0.00 |
| 3 | -0.00 | 0.73 | -0.00 | -0.00 | -0.00 | 0.00 |
| 4 | 0.00 | 0.73 | -0.00 | 0.00 | 0.00 | 0.00 |
| 5 | 0.00 | 0.56 | -0.00 | 0.00 | -0.00 | 0.00 |
| 6 | -0.00 | 0.56 | -0.00 | -0.00 | -0.00 | 0.00 |
| 7 | -0.00 | 0.56 | -0.00 | -0.00 | -0.00 | 0.00 |
| 8 | -0.00 | 0.56 | -0.00 | -0.00 | 0.00 | 0.00 |
| 9 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 10 | -4.05 | 0.73 | -5.40 | -0.00 | -0.00 | 0.00 |
| 11 | 4.05 | 0.73 | 5.41 | -0.00 | -0.00 | 0.00 |
| 12 | -4.05 | 0.73 | -5.41 | -0.00 | -0.00 | 0.00 |
| 13 | 4.05 | 0.56 | 5.41 | 0.00 | -0.00 | -0.00 |
| 14 | -4.05 | 0.56 | -5.40 | -0.00 | -0.00 | 0.00 |
| 15 | 4.05 | 0.56 | 5.41 | -0.00 | -0.00 | 0.00 |
| 16 | -4.05 | 0.56 | -5.41 | -0.00 | -0.00 | 0.00 |
| 17 | 2.43 | 0.73 | 3.24 | 0.00 | -0.00 | -0.00 |
| 18 | -2.43 | 0.73 | -3.24 | -0.00 | -0.00 | 0.00 |
| 19 | 2.43 | 0.73 | 3.24 | -0.00 | 0.00 | 0.00 |
| 20 | -2.43 | 0.73 | -3.24 | -0.00 | -0.00 | 0.00 |
| 21 | 2.43 | 0.73 | 3.24 | 0.00 | -0.00 | -0.00 |
| 22 | -2.43 | 0.73 | -3.24 | -0.00 | -0.00 | 0.00 |
| 23 | 2.43 | 0.73 | 3.24 | -0.00 | -0.00 | 0.00 |
| 24 | -2.43 | 0.73 | -3.24 | -0.00 | -0.00 | 0.00 |
| 25 | 2.43 | 0.73 | 3.24 | 0.00 | -0.00 | -0.00 |
| 26 | -2.43 | 0.73 | -3.24 | -0.00 | -0.00 | 0.00 |
| 27 | 2.43 | 0.73 | 3.24 | -0.00 | -0.00 | 0.00 |
| 28 | -2.43 | 0.73 | -3.24 | -0.00 | -0.00 | 0.00 |
| 29 | 2.43 | 0.73 | 3.24 | 0.00 | 0.00 | -0.00 |
| 30 | -2.43 | 0.73 | -3.24 | -0.00 | 0.00 | 0.00 |
| 31 | 2.43 | 0.73 | 3.24 | -0.00 | 0.00 | 0.00 |
| 32 | -2.43 | 0.73 | -3.24 | -0.00 | -0.00 | 0.00 |
| 33 | 2.43 | 0.56 | 3.24 | 0.00 | -0.00 | -0.00 |
| 34 | -2.43 | 0.56 | -3.24 | -0.00 | 0.00 | 0.00 |
| 35 | 2.43 | 0.56 | 3.24 | -0.00 | 0.00 | 0.00 |
| 36 | -2.43 | 0.56 | -3.24 | -0.00 | -0.00 | 0.00 |
| 37 | 2.43 | 0.56 | 3.24 | 0.00 | -0.00 | -0.00 |
| 38 | -2.43 | 0.56 | -3.24 | -0.00 | -0.00 | 0.00 |
| 39 | 2.43 | 0.56 | 3.24 | -0.00 | -0.00 | 0.00 |
| 40 | -2.43 | 0.56 | -3.24 | -0.00 | -0.00 | 0.00 |
| 41 | 2.43 | 0.56 | 3.24 | 0.00 | -0.00 | -0.00 |
| 42 | -2.43 | 0.56 | -3.24 | -0.00 | -0.00 | 0.00 |
| 43 | 2.43 | 0.56 | 3.24 | -0.00 | -0.00 | 0.00 |
| 44 | -2.43 | 0.56 | -3.24 | -0.00 | -0.00 | 0.00 |
| 45 | 2.43 | 0.56 | 3.24 | 0.00 | 0.00 | -0.00 |
| 46 | -2.43 | 0.56 | -3.24 | -0.00 | 0.00 | 0.00 |
| 47 | 2.43 | 0.56 | 3.24 | -0.00 | 0.00 | 0.00 |
| 48 | -2.43 | 0.56 | -3.24 | -0.00 | -0.00 | 0.00 |
| 49 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 50 | -4.05 | 0.73 | -5.40 | -0.00 | 0.00 | 0.00 |
| 51 | 4.05 | 0.73 | 5.41 | -0.00 | 0.00 | 0.00 |
| 52 | -4.05 | 0.73 | -5.41 | -0.00 | -0.00 | 0.00 |
| 53 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 54 | -4.05 | 0.73 | -5.40 | -0.00 | -0.00 | 0.00 |
| 55 | 4.05 | 0.73 | 5.41 | -0.00 | -0.00 | 0.00 |
| 56 | -4.05 | 0.73 | -5.41 | -0.00 | -0.00 | 0.00 |
| 57 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 58 | -4.05 | 0.73 | -5.40 | -0.00 | -0.00 | 0.00 |
| 59 | 4.05 | 0.73 | 5.41 | -0.00 | -0.00 | 0.00 |
| 60 | -4.05 | 0.73 | -5.41 | -0.00 | -0.00 | 0.00 |
| 61 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 62 | -4.05 | 0.73 | -5.40 | -0.00 | 0.00 | 0.00 |
| 63 | 4.05 | 0.73 | 5.41 | -0.00 | 0.00 | 0.00 |
| 64 | -4.05 | 0.73 | -5.41 | -0.00 | -0.00 | 0.00 |
| 65 | 4.05 | 0.56 | 5.41 | 0.00 | -0.00 | -0.00 |
| 66 | -4.05 | 0.56 | -5.40 | -0.00 | 0.00 | 0.00 |
| 67 | 4.05 | 0.56 | 5.41 | -0.00 | 0.00 | 0.00 |
| 68 | -4.05 | 0.56 | -5.41 | -0.00 | -0.00 | 0.00 |
| 69 | 4.05 | 0.56 | 5.41 | 0.00 | -0.00 | -0.00 |
| 70 | -4.05 | 0.56 | -5.40 | -0.00 | -0.00 | 0.00 |
| 71 | 4.05 | 0.56 | 5.41 | -0.00 | 0.00 | 0.00 |
| 72 | -4.05 | 0.56 | -5.41 | -0.00 | -0.00 | 0.00 |
| 73 | 4.05 | 0.56 | 5.41 | 0.00 | -0.00 | -0.00 |
| 74 | -4.05 | 0.56 | -5.40 | -0.00 | -0.00 | 0.00 |
| 75 | 4.05 | 0.56 | 5.41 | -0.00 | -0.00 | 0.00 |
| 76 | -4.05 | 0.56 | -5.41 | -0.00 | -0.00 | 0.00 |
| 77 | 4.05 | 0.56 | 5.41 | 0.00 | 0.00 | -0.00 |
| 78 | -4.05 | 0.56 | -5.40 | -0.00 | 0.00 | 0.00 |
| 79 | 4.05 | 0.56 | 5.41 | -0.00 | 0.00 | 0.00 |
| 80 | -4.05 | 0.56 | -5.41 | -0.00 | -0.00 | 0.00 |
| 81 | 0.01 | 0.73 | 0.01 | 0.00 | -0.00 | -0.01 |
| 82 | -0.01 | 0.73 | -0.01 | -0.00 | -0.00 | 0.01 |
| 83 | 0.01 | 0.73 | 0.01 | 0.00 | -0.00 | -0.01 |
| 84 | -0.01 | 0.73 | -0.01 | -0.00 | -0.00 | 0.01 |
| 85 | 0.01 | 0.73 | 0.01 | 0.00 | -0.00 | -0.01 |
| 86 | -0.01 | 0.73 | -0.01 | -0.00 | -0.00 | 0.01 |
| 87 | 0.01 | 0.73 | 0.01 | 0.00 | -0.00 | -0.01 |
| 88 | -0.01 | 0.73 | -0.01 | -0.00 | -0.00 | 0.01 |
| 89 | 0.01 | 0.56 | 0.01 | 0.00 | -0.00 | -0.01 |
| 90 | -0.01 | 0.56 | -0.01 | -0.00 | -0.00 | 0.01 |
| 91 | 0.01 | 0.56 | 0.01 | 0.00 | -0.00 | -0.01 |
| 92 | -0.01 | 0.56 | -0.01 | -0.00 | -0.00 | 0.01 |
| 93 | 0.01 | 0.56 | 0.01 | 0.00 | -0.00 | -0.01 |
| 94 | -0.01 | 0.56 | -0.01 | -0.00 | -0.00 | 0.01 |
| 95 | 0.01 | 0.56 | 0.01 | 0.00 | -0.00 | -0.01 |
| 96 | -0.01 | 0.56 | -0.01 | -0.00 | -0.00 | 0.01 |

强度计算控制组合号: 49, M=4.05, N=0.73, M=0.00, N=-0.00

强度计算应力比 =0.049

抗剪强度计算控制组合号: 9, V=5.41

抗剪强度计算应力比 =0.028

平面内稳定计算最大应力对应组合号: 49, M=4.05, N=0.73, M=0.00, N=-0.00

平面内稳定计算最大应力 (N/mm\*mm) =13.87

平面内稳定计算最大应力比 =0.045

临界弯矩Mcr(kN\*m) =1309.58

平面外稳定计算最大应力比 =0.017

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

强度计算应力比 =0.049 < 1.0

抗剪强度计算应力比 =0.028 < 1.0

平面内稳定计算最大应力 < f=305.00

平面外稳定计算最大应力比 < 1.0

腹板高厚比 H0/TW=30.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =10.88 < [B/T]=12.20

压杆,平面内长细比 λ=35. ≤ [λ]=180

压杆,平面外长细比 λ=34. ≤ [λ]=180

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | 柱 下 端 | | | 柱 上 端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 0.56 | 0.00 | 0.00 | -0.00 | -0.00 |
| 2 | -0.00 | 0.56 | -0.00 | -0.00 | -0.00 | 0.00 |
| 3 | -0.00 | 0.56 | 0.00 | -0.00 | -0.00 | -0.00 |
| 4 | 0.00 | 0.56 | -0.00 | 0.00 | -0.00 | 0.00 |
| 5 | 0.00 | 0.51 | 0.00 | 0.00 | -0.00 | -0.00 |
| 6 | -0.00 | 0.51 | -0.00 | -0.00 | -0.00 | 0.00 |
| 7 | -0.00 | 0.51 | 0.00 | -0.00 | -0.00 | -0.00 |
| 8 | 0.00 | 0.51 | -0.00 | 0.00 | -0.00 | 0.00 |
| 9 | 1.08 | 0.56 | 1.44 | 0.00 | -0.00 | -0.00 |
| 10 | -1.08 | 0.56 | -1.44 | -0.00 | -0.00 | 0.00 |
| 11 | 1.08 | 0.56 | 1.44 | -0.00 | -0.00 | 0.00 |
| 12 | -1.08 | 0.56 | -1.44 | -0.00 | -0.00 | 0.00 |
| 13 | 1.08 | 0.51 | 1.44 | 0.00 | -0.00 | -0.00 |
| 14 | -1.08 | 0.51 | -1.44 | -0.00 | -0.00 | 0.00 |
| 15 | 1.08 | 0.51 | 1.44 | -0.00 | -0.00 | 0.00 |
| 16 | -1.08 | 0.51 | -1.44 | -0.00 | -0.00 | 0.00 |

防火设计控制的偶然组合号: 9, M=1.08, N=0.56, M=0.00, N=-0.00

强度计算荷载比 =0.01

平面内稳定计算荷载比 =0.01

平面外稳定计算荷载比 =0.00

无防护下钢构件最大升温(Ts): 1081.87℃ ,按临界温度法求得临界温度(Td): 657.00℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4843(m^2\*℃/w)

构件重量 (Kg)=47.02

**7. 钢 柱 7
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=3.00, Ly=1.50; 长细比：λx=34.8,λy=33.9

构件长度=1.50; 计算长度系数: Ux=2.00 Uy=1.00

抗震等级: 四级

截面参数: B1=180, B2=180, H=200, Tw=6, T1=8, T2=8

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 278.112457(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 0.73 | 0.00 | 0.00 | -0.00 | -0.00 |
| 2 | -0.00 | 0.73 | -0.00 | -0.00 | -0.00 | 0.00 |
| 3 | -0.00 | 0.73 | -0.00 | -0.00 | -0.00 | 0.00 |
| 4 | -0.00 | 0.73 | -0.00 | 0.00 | -0.00 | 0.00 |
| 5 | 0.00 | 0.56 | 0.00 | 0.00 | -0.00 | -0.00 |
| 6 | -0.00 | 0.56 | -0.00 | -0.00 | -0.00 | 0.00 |
| 7 | -0.00 | 0.56 | -0.00 | -0.00 | -0.00 | 0.00 |
| 8 | -0.00 | 0.56 | -0.00 | 0.00 | -0.00 | 0.00 |
| 9 | 4.05 | 0.73 | 5.41 | -0.00 | -0.00 | -0.00 |
| 10 | -4.05 | 0.73 | -5.40 | 0.00 | 0.00 | -0.00 |
| 11 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 12 | -4.05 | 0.73 | -5.41 | 0.00 | 0.00 | -0.00 |
| 13 | 4.05 | 0.56 | 5.41 | -0.00 | -0.00 | -0.00 |
| 14 | -4.05 | 0.56 | -5.40 | 0.00 | 0.00 | -0.00 |
| 15 | 4.05 | 0.56 | 5.41 | 0.00 | -0.00 | -0.00 |
| 16 | -4.05 | 0.56 | -5.41 | 0.00 | 0.00 | -0.00 |
| 17 | 2.43 | 0.73 | 3.24 | -0.00 | -0.00 | -0.00 |
| 18 | -2.43 | 0.73 | -3.24 | 0.00 | -0.00 | -0.00 |
| 19 | 2.43 | 0.73 | 3.24 | 0.00 | -0.00 | -0.00 |
| 20 | -2.43 | 0.73 | -3.24 | 0.00 | 0.00 | -0.00 |
| 21 | 2.43 | 0.73 | 3.24 | -0.00 | -0.00 | -0.00 |
| 22 | -2.43 | 0.73 | -3.24 | 0.00 | -0.00 | -0.00 |
| 23 | 2.43 | 0.73 | 3.24 | 0.00 | -0.00 | -0.00 |
| 24 | -2.43 | 0.73 | -3.24 | 0.00 | 0.00 | 0.00 |
| 25 | 2.43 | 0.73 | 3.24 | -0.00 | -0.00 | -0.00 |
| 26 | -2.43 | 0.73 | -3.24 | 0.00 | -0.00 | -0.00 |
| 27 | 2.43 | 0.73 | 3.24 | 0.00 | -0.00 | -0.00 |
| 28 | -2.43 | 0.73 | -3.24 | 0.00 | 0.00 | -0.00 |
| 29 | 2.43 | 0.73 | 3.24 | -0.00 | -0.00 | -0.00 |
| 30 | -2.43 | 0.73 | -3.24 | 0.00 | -0.00 | -0.00 |
| 31 | 2.43 | 0.73 | 3.24 | 0.00 | -0.00 | -0.00 |
| 32 | -2.43 | 0.73 | -3.24 | 0.00 | 0.00 | -0.00 |
| 33 | 2.43 | 0.56 | 3.24 | -0.00 | -0.00 | -0.00 |
| 34 | -2.43 | 0.56 | -3.24 | 0.00 | 0.00 | -0.00 |
| 35 | 2.43 | 0.56 | 3.24 | 0.00 | -0.00 | -0.00 |
| 36 | -2.43 | 0.56 | -3.24 | 0.00 | 0.00 | -0.00 |
| 37 | 2.43 | 0.56 | 3.24 | -0.00 | -0.00 | -0.00 |
| 38 | -2.43 | 0.56 | -3.24 | 0.00 | -0.00 | -0.00 |
| 39 | 2.43 | 0.56 | 3.24 | 0.00 | -0.00 | -0.00 |
| 40 | -2.43 | 0.56 | -3.24 | 0.00 | 0.00 | 0.00 |
| 41 | 2.43 | 0.56 | 3.24 | -0.00 | -0.00 | -0.00 |
| 42 | -2.43 | 0.56 | -3.24 | 0.00 | -0.00 | -0.00 |
| 43 | 2.43 | 0.56 | 3.24 | 0.00 | -0.00 | -0.00 |
| 44 | -2.43 | 0.56 | -3.24 | 0.00 | 0.00 | -0.00 |
| 45 | 2.43 | 0.56 | 3.24 | -0.00 | -0.00 | -0.00 |
| 46 | -2.43 | 0.56 | -3.24 | 0.00 | 0.00 | -0.00 |
| 47 | 2.43 | 0.56 | 3.24 | 0.00 | -0.00 | -0.00 |
| 48 | -2.43 | 0.56 | -3.24 | 0.00 | 0.00 | -0.00 |
| 49 | 4.05 | 0.73 | 5.41 | -0.00 | -0.00 | -0.00 |
| 50 | -4.05 | 0.73 | -5.40 | 0.00 | 0.00 | -0.00 |
| 51 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 52 | -4.05 | 0.73 | -5.41 | 0.00 | 0.00 | -0.00 |
| 53 | 4.05 | 0.73 | 5.41 | -0.00 | -0.00 | -0.00 |
| 54 | -4.05 | 0.73 | -5.40 | 0.00 | 0.00 | -0.00 |
| 55 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 56 | -4.05 | 0.73 | -5.41 | 0.00 | 0.00 | -0.00 |
| 57 | 4.05 | 0.73 | 5.41 | -0.00 | -0.00 | -0.00 |
| 58 | -4.05 | 0.73 | -5.40 | 0.00 | 0.00 | -0.00 |
| 59 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 60 | -4.05 | 0.73 | -5.41 | 0.00 | 0.00 | -0.00 |
| 61 | 4.05 | 0.73 | 5.41 | -0.00 | -0.00 | -0.00 |
| 62 | -4.05 | 0.73 | -5.40 | 0.00 | 0.00 | -0.00 |
| 63 | 4.05 | 0.73 | 5.41 | 0.00 | -0.00 | -0.00 |
| 64 | -4.05 | 0.73 | -5.41 | 0.00 | 0.00 | -0.00 |
| 65 | 4.05 | 0.56 | 5.41 | -0.00 | -0.00 | -0.00 |
| 66 | -4.05 | 0.56 | -5.40 | 0.00 | 0.00 | -0.00 |
| 67 | 4.05 | 0.56 | 5.41 | 0.00 | -0.00 | -0.00 |
| 68 | -4.05 | 0.56 | -5.41 | 0.00 | 0.00 | -0.00 |
| 69 | 4.05 | 0.56 | 5.41 | -0.00 | -0.00 | -0.00 |
| 70 | -4.05 | 0.56 | -5.40 | 0.00 | 0.00 | -0.00 |
| 71 | 4.05 | 0.56 | 5.41 | 0.00 | -0.00 | -0.00 |
| 72 | -4.05 | 0.56 | -5.41 | 0.00 | 0.00 | -0.00 |
| 73 | 4.05 | 0.56 | 5.41 | -0.00 | -0.00 | -0.00 |
| 74 | -4.05 | 0.56 | -5.40 | 0.00 | 0.00 | -0.00 |
| 75 | 4.05 | 0.56 | 5.41 | 0.00 | -0.00 | -0.00 |
| 76 | -4.05 | 0.56 | -5.41 | 0.00 | 0.00 | -0.00 |
| 77 | 4.05 | 0.56 | 5.41 | -0.00 | -0.00 | -0.00 |
| 78 | -4.05 | 0.56 | -5.40 | 0.00 | 0.00 | -0.00 |
| 79 | 4.05 | 0.56 | 5.41 | 0.00 | -0.00 | -0.00 |
| 80 | -4.05 | 0.56 | -5.41 | 0.00 | 0.00 | -0.00 |
| 81 | 0.01 | 0.73 | 0.01 | -0.00 | -0.00 | -0.01 |
| 82 | -0.01 | 0.73 | -0.01 | 0.00 | -0.00 | 0.01 |
| 83 | 0.01 | 0.73 | 0.01 | -0.00 | -0.00 | -0.01 |
| 84 | -0.01 | 0.73 | -0.01 | 0.00 | -0.00 | 0.01 |
| 85 | 0.01 | 0.73 | 0.01 | -0.00 | -0.00 | -0.01 |
| 86 | -0.01 | 0.73 | -0.01 | 0.00 | -0.00 | 0.01 |
| 87 | 0.01 | 0.73 | 0.01 | -0.00 | -0.00 | -0.01 |
| 88 | -0.01 | 0.73 | -0.01 | 0.00 | -0.00 | 0.01 |
| 89 | 0.01 | 0.56 | 0.01 | -0.00 | -0.00 | -0.01 |
| 90 | -0.01 | 0.56 | -0.01 | 0.00 | -0.00 | 0.01 |
| 91 | 0.01 | 0.56 | 0.01 | -0.00 | -0.00 | -0.01 |
| 92 | -0.01 | 0.56 | -0.01 | 0.00 | -0.00 | 0.01 |
| 93 | 0.01 | 0.56 | 0.01 | -0.00 | -0.00 | -0.01 |
| 94 | -0.01 | 0.56 | -0.01 | 0.00 | -0.00 | 0.01 |
| 95 | 0.01 | 0.56 | 0.01 | -0.00 | -0.00 | -0.01 |
| 96 | -0.01 | 0.56 | -0.01 | 0.00 | -0.00 | 0.01 |

强度计算控制组合号: 51, M=4.05, N=0.73, M=0.00, N=-0.00

强度计算应力比 =0.049

抗剪强度计算控制组合号: 65, V=5.41

抗剪强度计算应力比 =0.028

平面内稳定计算最大应力对应组合号: 51, M=4.05, N=0.73, M=0.00, N=-0.00

平面内稳定计算最大应力 (N/mm\*mm) =13.87

平面内稳定计算最大应力比 =0.045

临界弯矩Mcr(kN\*m) =1309.58

平面外稳定计算最大应力比 =0.017

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

强度计算应力比 =0.049 < 1.0

抗剪强度计算应力比 =0.028 < 1.0

平面内稳定计算最大应力 < f=305.00

平面外稳定计算最大应力比 < 1.0

腹板高厚比 H0/TW=30.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =10.88 < [B/T]=12.20

压杆,平面内长细比 λ=35. ≤ [λ]=180

压杆,平面外长细比 λ=34. ≤ [λ]=180

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | 柱 下 端 | | | 柱 上 端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 0.56 | 0.00 | 0.00 | -0.00 | 0.00 |
| 2 | -0.00 | 0.56 | -0.00 | -0.00 | -0.00 | 0.00 |
| 3 | -0.00 | 0.56 | -0.00 | -0.00 | -0.00 | 0.00 |
| 4 | -0.00 | 0.56 | -0.00 | 0.00 | -0.00 | 0.00 |
| 5 | 0.00 | 0.51 | 0.00 | 0.00 | -0.00 | -0.00 |
| 6 | -0.00 | 0.51 | -0.00 | -0.00 | -0.00 | 0.00 |
| 7 | -0.00 | 0.51 | -0.00 | -0.00 | -0.00 | 0.00 |
| 8 | -0.00 | 0.51 | -0.00 | 0.00 | -0.00 | 0.00 |
| 9 | 1.08 | 0.56 | 1.44 | -0.00 | -0.00 | -0.00 |
| 10 | -1.08 | 0.56 | -1.44 | 0.00 | -0.00 | -0.00 |
| 11 | 1.08 | 0.56 | 1.44 | 0.00 | -0.00 | -0.00 |
| 12 | -1.08 | 0.56 | -1.44 | 0.00 | -0.00 | -0.00 |
| 13 | 1.08 | 0.51 | 1.44 | -0.00 | -0.00 | -0.00 |
| 14 | -1.08 | 0.51 | -1.44 | 0.00 | -0.00 | -0.00 |
| 15 | 1.08 | 0.51 | 1.44 | 0.00 | -0.00 | -0.00 |
| 16 | -1.08 | 0.51 | -1.44 | 0.00 | -0.00 | -0.00 |

防火设计控制的偶然组合号: 11, M=1.08, N=0.56, M=0.00, N=-0.00

强度计算荷载比 =0.01

平面内稳定计算荷载比 =0.01

平面外稳定计算荷载比 =0.00

无防护下钢构件最大升温(Ts): 1081.87℃ ,按临界温度法求得临界温度(Td): 657.00℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4843(m^2\*℃/w)

构件重量 (Kg)=47.02

**8、 钢 梁 1
设计结果**

截面类型=16; 布置角度=0; 计算长度： Lx=12.34, Ly=6.60

构件长度=5.02; 计算长度系数: Ux=2.46 Uy=1.32

支撑长度=6.60

抗震等级: 四级

截面参数: B1=180, B2=180, H=350, Tw=6, T1=10, T2=10

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 252.329742(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 40.65 | 8.49 | 33.41 | 53.88 | -5.83 | -3.42 |
| 2 | 17.74 | 3.77 | 15.44 | 19.30 | -2.81 | -0.19 |
| 3 | 38.82 | 8.24 | 33.54 | 53.88 | -5.83 | -3.42 |
| 4 | 19.57 | 4.02 | 15.31 | 19.30 | -2.81 | -0.19 |
| 5 | 36.14 | 7.54 | 29.64 | 48.24 | -5.16 | -3.14 |
| 6 | 13.23 | 2.82 | 11.67 | 13.66 | -2.14 | 0.09 |
| 7 | 34.31 | 7.29 | 29.77 | 48.24 | -5.16 | -3.14 |
| 8 | 15.07 | 3.07 | 11.54 | 13.66 | -2.14 | 0.09 |
| 9 | -48.69 | 2.47 | -9.15 | 8.49 | -1.26 | 6.88 |
| 10 | 51.16 | -3.54 | 12.21 | -3.09 | 4.75 | -6.95 |
| 11 | -39.51 | 7.75 | -3.42 | 15.50 | -6.54 | 6.16 |
| 12 | 60.81 | 1.71 | 18.00 | 3.75 | -0.50 | -7.75 |
| 13 | -53.20 | 1.52 | -12.92 | 2.84 | -0.59 | 7.16 |
| 14 | 46.65 | -4.49 | 8.45 | -8.73 | 5.42 | -6.67 |
| 15 | -44.02 | 6.80 | -7.18 | 9.86 | -5.87 | 6.44 |
| 16 | 56.31 | 0.76 | 14.23 | -1.90 | 0.17 | -7.47 |
| 17 | -0.28 | 7.51 | 18.12 | 44.30 | -4.85 | 1.43 |
| 18 | 59.63 | 3.90 | 30.94 | 37.36 | -1.24 | -6.87 |
| 19 | 5.23 | 10.68 | 21.56 | 48.51 | -8.02 | 1.00 |
| 20 | 65.42 | 7.06 | 34.41 | 41.46 | -4.39 | -7.34 |
| 21 | -23.19 | 2.79 | 0.15 | 9.72 | -1.84 | 4.66 |
| 22 | 36.72 | -0.82 | 12.97 | 2.78 | 1.77 | -3.64 |
| 23 | -17.69 | 5.96 | 3.59 | 13.93 | -5.00 | 4.23 |
| 24 | 42.51 | 2.34 | 16.44 | 6.88 | -1.38 | -4.11 |
| 25 | -2.12 | 7.26 | 18.25 | 44.30 | -4.85 | 1.43 |
| 26 | 57.80 | 3.65 | 31.07 | 37.36 | -1.24 | -6.87 |
| 27 | 3.39 | 10.43 | 21.69 | 48.51 | -8.02 | 1.00 |
| 28 | 63.59 | 6.80 | 34.54 | 41.46 | -4.39 | -7.34 |
| 29 | -21.36 | 3.04 | 0.02 | 9.72 | -1.84 | 4.66 |
| 30 | 38.55 | -0.56 | 12.84 | 2.78 | 1.77 | -3.64 |
| 31 | -15.85 | 6.21 | 3.46 | 13.93 | -5.00 | 4.23 |
| 32 | 44.35 | 2.59 | 16.31 | 6.88 | -1.38 | -4.11 |
| 33 | -4.79 | 6.57 | 14.36 | 38.66 | -4.19 | 1.71 |
| 34 | 55.12 | 2.96 | 27.17 | 31.72 | -0.58 | -6.59 |
| 35 | 0.72 | 9.74 | 17.80 | 42.87 | -7.35 | 1.28 |
| 36 | 60.92 | 6.11 | 30.64 | 35.82 | -3.73 | -7.07 |
| 37 | -27.70 | 1.85 | -3.61 | 4.08 | -1.17 | 4.94 |
| 38 | 32.21 | -1.76 | 9.20 | -2.87 | 2.44 | -3.36 |
| 39 | -22.19 | 5.01 | -0.17 | 8.29 | -4.34 | 4.51 |
| 40 | 38.01 | 1.39 | 12.67 | 1.24 | -0.71 | -3.83 |
| 41 | -6.62 | 6.32 | 14.49 | 38.66 | -4.19 | 1.71 |
| 42 | 53.29 | 2.71 | 27.30 | 31.72 | -0.58 | -6.59 |
| 43 | -1.11 | 9.48 | 17.93 | 42.87 | -7.35 | 1.28 |
| 44 | 59.08 | 5.86 | 30.77 | 35.82 | -3.73 | -7.07 |
| 45 | -25.86 | 2.10 | -3.74 | 4.08 | -1.17 | 4.94 |
| 46 | 34.05 | -1.51 | 9.07 | -2.87 | 2.44 | -3.36 |
| 47 | -20.36 | 5.27 | -0.30 | 8.29 | -4.34 | 4.51 |
| 48 | 39.84 | 1.64 | 12.54 | 1.24 | -0.71 | -3.83 |
| 49 | -33.91 | 5.55 | 2.81 | 29.09 | -3.32 | 5.33 |
| 50 | 65.95 | -0.47 | 24.17 | 17.51 | 2.69 | -8.50 |
| 51 | -24.73 | 10.82 | 8.54 | 36.10 | -8.60 | 4.61 |
| 52 | 75.60 | 4.78 | 29.95 | 24.35 | -2.56 | -9.30 |
| 53 | -49.94 | 2.24 | -9.77 | 4.88 | -1.21 | 7.60 |
| 54 | 49.91 | -3.77 | 11.59 | -6.69 | 4.81 | -6.24 |
| 55 | -40.77 | 7.52 | -4.04 | 11.90 | -6.49 | 6.87 |
| 56 | 59.56 | 1.48 | 17.38 | 0.14 | -0.45 | -7.03 |
| 57 | -35.19 | 5.37 | 2.90 | 29.09 | -3.32 | 5.33 |
| 58 | 64.66 | -0.64 | 24.26 | 17.51 | 2.69 | -8.50 |
| 59 | -26.01 | 10.65 | 8.63 | 36.10 | -8.60 | 4.61 |
| 60 | 74.32 | 4.61 | 30.05 | 24.35 | -2.56 | -9.30 |
| 61 | -48.66 | 2.42 | -9.86 | 4.88 | -1.21 | 7.60 |
| 62 | 51.19 | -3.60 | 11.50 | -6.69 | 4.81 | -6.24 |
| 63 | -39.48 | 7.70 | -4.13 | 11.90 | -6.49 | 6.87 |
| 64 | 60.85 | 1.66 | 17.28 | 0.14 | -0.45 | -7.03 |
| 65 | -38.41 | 4.60 | -0.96 | 23.44 | -2.65 | 5.61 |
| 66 | 61.44 | -1.41 | 20.40 | 11.87 | 3.36 | -8.22 |
| 67 | -29.23 | 9.88 | 4.77 | 30.46 | -7.93 | 4.89 |
| 68 | 71.10 | 3.84 | 26.19 | 18.71 | -1.89 | -9.02 |
| 69 | -54.45 | 1.30 | -13.54 | -0.76 | -0.54 | 7.88 |
| 70 | 45.40 | -4.72 | 7.83 | -12.34 | 5.47 | -5.96 |
| 71 | -45.27 | 6.57 | -7.81 | 6.25 | -5.82 | 7.15 |
| 72 | 55.06 | 0.53 | 13.61 | -5.50 | 0.22 | -6.75 |
| 73 | -39.69 | 4.42 | -0.87 | 23.44 | -2.65 | 5.61 |
| 74 | 60.16 | -1.59 | 20.50 | 11.87 | 3.36 | -8.22 |
| 75 | -30.52 | 9.70 | 4.87 | 30.46 | -7.93 | 4.89 |
| 76 | 69.81 | 3.66 | 26.28 | 18.71 | -1.89 | -9.02 |
| 77 | -53.17 | 1.47 | -13.63 | -0.76 | -0.54 | 7.88 |
| 78 | 46.69 | -4.54 | 7.73 | -12.34 | 5.47 | -5.96 |
| 79 | -43.99 | 6.75 | -7.90 | 6.25 | -5.82 | 7.15 |
| 80 | 56.34 | 0.71 | 13.52 | -5.50 | 0.22 | -6.75 |
| 81 | 23.75 | 5.69 | 23.09 | 38.92 | -3.85 | -1.53 |
| 82 | 33.61 | 6.30 | 24.37 | 35.50 | -4.47 | -2.81 |
| 83 | 13.82 | 3.65 | 15.30 | 23.93 | -2.55 | -0.13 |
| 84 | 23.68 | 4.26 | 16.58 | 20.51 | -3.16 | -1.41 |
| 85 | 22.95 | 5.58 | 23.14 | 38.92 | -3.85 | -1.53 |
| 86 | 32.81 | 6.19 | 24.43 | 35.50 | -4.47 | -2.81 |
| 87 | 14.61 | 3.75 | 15.24 | 23.93 | -2.55 | -0.13 |
| 88 | 24.48 | 4.37 | 16.53 | 20.51 | -3.16 | -1.41 |
| 89 | 17.13 | 4.31 | 17.61 | 30.33 | -2.89 | -1.03 |
| 90 | 26.99 | 4.92 | 18.89 | 26.91 | -3.51 | -2.31 |
| 91 | 9.49 | 2.73 | 11.62 | 18.80 | -1.89 | 0.05 |
| 92 | 19.35 | 3.35 | 12.90 | 15.38 | -2.50 | -1.23 |
| 93 | 16.52 | 4.22 | 17.65 | 30.33 | -2.89 | -1.03 |
| 94 | 26.38 | 4.84 | 18.94 | 26.91 | -3.51 | -2.31 |
| 95 | 10.10 | 2.82 | 11.58 | 18.80 | -1.89 | 0.05 |
| 96 | 19.97 | 3.43 | 12.86 | 15.38 | -2.50 | -1.23 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -54.45 | -42.80 | -37.75 | -37.30 | -41.21 | -48.92 | -53.88 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 75.60 | 45.48 | 33.02 | 26.58 | 20.38 | 14.43 | 12.34 |

强度计算应力比 =0.389

抗剪强度计算应力比 =0.100

平面内稳定计算最大应力对应组合号: 1, M=40.65, N=8.49, M=53.88, N=-5.83

平面内稳定最大应力 (N/mm\*mm) =110.32

平面内稳定计算最大应力比 =0.362

临界弯矩Mcr(kN\*m) =289.60

平面外稳定计算最大应力比 =0.675

强度计算应力比 =0.389 < 1.0

抗剪强度计算应力比 =0.100 < 1.0

平面内稳定最大应力 < f=305.00

平面外稳定计算最大应力比 =0.675 < 1.0

腹板高厚比 H0/TW=55.00 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =8.70 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0.00 | 3.66 | 7.58 | 11.34 | 14.59 | 17.05 | 18.56 |

最大挠度值 =18.56 最大挠度/梁跨度 =1/663.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/13.28

变形后斜梁坡度改变率 =0.059 < 1/3

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | I端 |  |  | II端 |  |  |
| 组合 | M | N | V | M | N | V |
| 1 | 22.06 | 4.61 | 18.25 | 28.62 | -3.20 | -1.67 |
| 2 | 14.42 | 3.04 | 12.26 | 17.09 | -2.19 | -0.59 |
| 3 | 21.45 | 4.53 | 18.30 | 28.62 | -3.20 | -1.67 |
| 4 | 15.03 | 3.12 | 12.22 | 17.09 | -2.19 | -0.59 |
| 5 | 20.56 | 4.30 | 17.00 | 26.74 | -2.98 | -1.57 |
| 6 | 12.92 | 2.73 | 11.01 | 15.21 | -1.97 | -0.50 |
| 7 | 19.95 | 4.21 | 17.04 | 26.74 | -2.98 | -1.57 |
| 8 | 13.53 | 2.81 | 10.96 | 15.21 | -1.97 | -0.50 |
| 9 | -3.17 | 2.72 | 5.77 | 14.55 | -1.79 | 1.23 |
| 10 | 23.45 | 1.11 | 11.46 | 11.47 | -0.18 | -2.46 |
| 11 | -0.73 | 4.12 | 7.29 | 16.42 | -3.19 | 1.03 |
| 12 | 26.03 | 2.51 | 13.00 | 13.29 | -1.58 | -2.67 |
| 13 | -4.67 | 2.40 | 4.51 | 12.67 | -1.56 | 1.32 |
| 14 | 21.95 | 0.80 | 10.21 | 9.58 | 0.04 | -2.37 |
| 15 | -2.23 | 3.81 | 6.04 | 14.54 | -2.97 | 1.13 |
| 16 | 24.53 | 2.20 | 11.75 | 11.41 | -1.36 | -2.58 |

--- 梁的弯矩包络(偶然组合) ---

梁下部受拉:

截面 1 2 3 4 5 6 7

弯矩 -4.67 -8.04 -10.86 -14.01 -21.20 -26.07 -28.62

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 26.03 14.50 7.07 1.27 0.00 0.00 0.00

强度计算荷载比 =0.15

平面内稳定计算荷载比 =0.14

平面外稳定计算荷载比 =0.10

无防护下钢构件最大升温(Ts): 1004.15℃ ,按临界温度法求得临界温度(Td): 647.85℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2352(m^2\*℃/w)

构件重量 (Kg)=219.71

**9、 钢 梁 2
设计结果**

截面类型=16; 布置角度=0; 计算长度： Lx=12.34, Ly=7.32

构件长度=7.32; 计算长度系数: Ux=1.68 Uy=1.00

支撑长度=7.32

抗震等级: 四级

截面参数: B1=180, B2=180, H=350, Tw=6, T1=10, T2=10

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 252.329742(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -19.30 | 2.81 | 0.19 | -47.51 | -1.12 | 20.86 |
| 2 | -53.88 | 5.83 | 3.42 | -94.66 | -2.23 | 41.57 |
| 3 | -53.88 | 5.83 | 3.42 | -82.06 | -2.31 | 40.55 |
| 4 | -19.30 | 2.81 | 0.19 | -60.11 | -1.04 | 21.88 |
| 5 | -13.66 | 2.14 | -0.09 | -36.54 | -0.86 | 16.05 |
| 6 | -48.24 | 5.16 | 3.14 | -83.70 | -1.98 | 36.75 |
| 7 | -48.24 | 5.16 | 3.14 | -71.10 | -2.05 | 35.73 |
| 8 | -13.66 | 2.14 | -0.09 | -49.15 | -0.79 | 17.06 |
| 9 | -8.49 | 1.26 | -6.88 | -29.82 | 0.51 | 3.58 |
| 10 | 3.09 | -4.75 | 6.95 | 19.71 | 6.52 | 0.73 |
| 11 | -15.50 | 6.54 | -6.16 | -44.26 | -4.77 | 10.16 |
| 12 | -3.75 | 0.50 | 7.75 | 5.68 | 1.27 | 7.22 |
| 13 | -2.84 | 0.59 | -7.16 | -18.86 | 0.77 | -1.24 |
| 14 | 8.73 | -5.42 | 6.67 | 30.68 | 6.78 | -4.09 |
| 15 | -9.86 | 5.87 | -6.44 | -33.29 | -4.51 | 5.35 |
| 16 | 1.90 | -0.17 | 7.47 | 16.64 | 1.53 | 2.40 |
| 17 | -9.72 | 1.83 | -4.66 | -36.90 | -0.14 | 10.49 |
| 18 | -2.78 | -1.77 | 3.64 | -7.17 | 3.46 | 8.78 |
| 19 | -13.93 | 5.00 | -4.23 | -45.56 | -3.31 | 14.44 |
| 20 | -6.88 | 1.38 | 4.11 | -15.60 | 0.31 | 12.68 |
| 21 | -44.30 | 4.85 | -1.43 | -84.05 | -1.26 | 31.20 |
| 22 | -37.36 | 1.24 | 6.87 | -54.33 | 2.35 | 29.48 |
| 23 | -48.51 | 8.02 | -1.00 | -92.71 | -4.43 | 35.15 |
| 24 | -41.46 | 4.39 | 7.34 | -62.75 | -0.80 | 33.38 |
| 25 | -44.30 | 4.85 | -1.43 | -71.45 | -1.33 | 30.18 |
| 26 | -37.36 | 1.24 | 6.87 | -41.73 | 2.27 | 28.47 |
| 27 | -48.51 | 8.02 | -1.00 | -80.11 | -4.50 | 34.13 |
| 28 | -41.46 | 4.39 | 7.34 | -50.15 | -0.88 | 32.36 |
| 29 | -9.72 | 1.83 | -4.66 | -49.50 | -0.07 | 11.51 |
| 30 | -2.78 | -1.77 | 3.64 | -19.78 | 3.54 | 9.80 |
| 31 | -13.93 | 5.00 | -4.23 | -58.16 | -3.24 | 15.46 |
| 32 | -6.88 | 1.38 | 4.11 | -28.20 | 0.39 | 13.69 |
| 33 | -4.08 | 1.17 | -4.94 | -25.93 | 0.12 | 5.68 |
| 34 | 2.87 | -2.44 | 3.36 | 3.79 | 3.72 | 3.97 |
| 35 | -8.29 | 4.34 | -4.51 | -34.59 | -3.05 | 9.63 |
| 36 | -1.24 | 0.71 | 3.83 | -4.63 | 0.57 | 7.86 |
| 37 | -38.66 | 4.18 | -1.71 | -73.09 | -1.00 | 26.38 |
| 38 | -31.72 | 0.58 | 6.59 | -43.37 | 2.61 | 24.67 |
| 39 | -42.87 | 7.35 | -1.28 | -81.75 | -4.17 | 30.33 |
| 40 | -35.82 | 3.73 | 7.07 | -51.79 | -0.54 | 28.57 |
| 41 | -38.66 | 4.18 | -1.71 | -60.49 | -1.07 | 25.36 |
| 42 | -31.72 | 0.58 | 6.59 | -30.76 | 2.53 | 23.65 |
| 43 | -42.87 | 7.35 | -1.28 | -69.15 | -4.24 | 29.31 |
| 44 | -35.82 | 3.73 | 7.07 | -39.19 | -0.62 | 27.55 |
| 45 | -4.08 | 1.17 | -4.94 | -38.54 | 0.19 | 6.70 |
| 46 | 2.87 | -2.44 | 3.36 | -8.82 | 3.80 | 4.98 |
| 47 | -8.29 | 4.34 | -4.51 | -47.20 | -2.98 | 10.64 |
| 48 | -1.24 | 0.71 | 3.83 | -17.24 | 0.65 | 8.88 |
| 49 | -4.88 | 1.21 | -7.60 | -29.82 | 0.51 | 3.58 |
| 50 | 6.69 | -4.81 | 6.24 | 19.71 | 6.52 | 0.73 |
| 51 | -11.90 | 6.48 | -6.87 | -44.26 | -4.77 | 10.16 |
| 52 | -0.14 | 0.45 | 7.03 | 5.68 | 1.27 | 7.22 |
| 53 | -29.09 | 3.32 | -5.33 | -62.83 | -0.27 | 18.07 |
| 54 | -17.51 | -2.69 | 8.50 | -13.30 | 5.74 | 15.22 |
| 55 | -36.10 | 8.60 | -4.61 | -77.27 | -5.55 | 24.65 |
| 56 | -24.35 | 2.56 | 9.30 | -27.33 | 0.49 | 21.71 |
| 57 | -29.09 | 3.32 | -5.33 | -54.01 | -0.33 | 17.36 |
| 58 | -17.51 | -2.69 | 8.50 | -4.47 | 5.69 | 14.51 |
| 59 | -36.10 | 8.60 | -4.61 | -68.44 | -5.60 | 23.94 |
| 60 | -24.35 | 2.56 | 9.30 | -18.51 | 0.44 | 21.00 |
| 61 | -4.88 | 1.21 | -7.60 | -38.65 | 0.56 | 4.29 |
| 62 | 6.69 | -4.81 | 6.24 | 10.89 | 6.57 | 1.44 |
| 63 | -11.90 | 6.48 | -6.87 | -53.08 | -4.72 | 10.87 |
| 64 | -0.14 | 0.45 | 7.03 | -3.15 | 1.32 | 7.93 |
| 65 | 0.76 | 0.54 | -7.88 | -18.86 | 0.77 | -1.24 |
| 66 | 12.34 | -5.47 | 5.96 | 30.68 | 6.78 | -4.09 |
| 67 | -6.25 | 5.82 | -7.15 | -33.29 | -4.51 | 5.35 |
| 68 | 5.50 | -0.22 | 6.75 | 16.64 | 1.53 | 2.40 |
| 69 | -23.44 | 2.65 | -5.61 | -51.87 | -0.02 | 13.26 |
| 70 | -11.87 | -3.36 | 8.22 | -2.33 | 6.00 | 10.41 |
| 71 | -30.46 | 7.93 | -4.89 | -66.30 | -5.29 | 19.84 |
| 72 | -18.71 | 1.89 | 9.02 | -16.37 | 0.75 | 16.90 |
| 73 | -23.44 | 2.65 | -5.61 | -43.05 | -0.07 | 12.55 |
| 74 | -11.87 | -3.36 | 8.22 | 6.49 | 5.95 | 9.69 |
| 75 | -30.46 | 7.93 | -4.89 | -57.48 | -5.35 | 19.13 |
| 76 | -18.71 | 1.89 | 9.02 | -7.55 | 0.69 | 16.19 |
| 77 | 0.76 | 0.54 | -7.88 | -27.68 | 0.82 | -0.52 |
| 78 | 12.34 | -5.47 | 5.96 | 21.85 | 6.83 | -3.38 |
| 79 | -6.25 | 5.82 | -7.15 | -42.12 | -4.46 | 6.06 |
| 80 | 5.50 | -0.22 | 6.75 | 7.82 | 1.58 | 3.12 |
| 81 | -23.93 | 2.99 | 0.09 | -50.75 | -1.25 | 21.54 |
| 82 | -20.51 | 2.72 | 1.45 | -44.26 | -0.99 | 20.18 |
| 83 | -38.92 | 4.29 | 1.49 | -71.19 | -1.74 | 30.51 |
| 84 | -35.50 | 4.03 | 2.85 | -64.69 | -1.47 | 29.16 |
| 85 | -38.92 | 4.29 | 1.49 | -65.73 | -1.77 | 30.07 |
| 86 | -35.50 | 4.03 | 2.85 | -59.23 | -1.50 | 28.71 |
| 87 | -23.93 | 2.99 | 0.09 | -56.22 | -1.22 | 21.98 |
| 88 | -20.51 | 2.72 | 1.45 | -49.72 | -0.95 | 20.62 |
| 89 | -18.80 | 2.33 | -0.09 | -39.79 | -0.99 | 16.72 |
| 90 | -15.38 | 2.06 | 1.27 | -33.29 | -0.73 | 15.37 |
| 91 | -30.33 | 3.33 | 0.99 | -55.51 | -1.37 | 23.63 |
| 92 | -26.91 | 3.07 | 2.35 | -49.01 | -1.10 | 22.27 |
| 93 | -30.33 | 3.33 | 0.99 | -51.31 | -1.39 | 23.29 |
| 94 | -26.91 | 3.07 | 2.35 | -44.81 | -1.12 | 21.93 |
| 95 | -18.80 | 2.33 | -0.09 | -43.99 | -0.97 | 17.06 |
| 96 | -15.38 | 2.06 | 1.27 | -37.49 | -0.70 | 15.71 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -53.88 | -53.59 | -44.35 | -30.16 | -22.86 | -25.42 | -30.68 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 12.34 | 5.05 | 11.23 | 15.70 | 19.74 | 37.54 | 94.66 |

强度计算应力比 =0.486

抗剪强度计算应力比 =0.120

平面内稳定计算最大应力对应组合号: 1, M=-19.30, N=2.81, M=-47.51, N=-1.12

平面内稳定最大应力 (N/mm\*mm) =138.17

平面内稳定计算最大应力比 =0.453

临界弯矩Mcr(kN\*m) =222.53

平面外稳定计算最大应力比 =0.556

强度计算应力比 =0.486 < 1.0

抗剪强度计算应力比 =0.120 < 1.0

平面内稳定最大应力 < f=305.00

平面外稳定计算最大应力比 =0.556 < 1.0

腹板高厚比 H0/TW=55.00 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =8.70 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 18.56 | 18.74 | 16.71 | 12.85 | 7.94 | 3.14 | 0.00 |

最大挠度值 =18.94 最大挠度/梁跨度 =1/650.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.88

变形后斜梁坡度改变率 =0.052 < 1/3

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | I端 |  |  | II端 |  |  |
| 组合 | M | N | V | M | N | V |
| 1 | -17.09 | 2.19 | 0.59 | -36.54 | -0.86 | 16.05 |
| 2 | -28.62 | 3.20 | 1.67 | -52.26 | -1.23 | 22.95 |
| 3 | -28.62 | 3.20 | 1.67 | -48.06 | -1.26 | 22.61 |
| 4 | -17.09 | 2.19 | 0.59 | -40.74 | -0.84 | 16.39 |
| 5 | -15.21 | 1.97 | 0.50 | -32.89 | -0.77 | 14.44 |
| 6 | -26.74 | 2.98 | 1.57 | -48.61 | -1.15 | 21.34 |
| 7 | -26.74 | 2.98 | 1.57 | -44.41 | -1.17 | 21.00 |
| 8 | -15.21 | 1.97 | 0.50 | -37.09 | -0.75 | 14.78 |
| 9 | -14.55 | 1.79 | -1.23 | -31.83 | -0.43 | 11.44 |
| 10 | -11.47 | 0.18 | 2.46 | -18.62 | 1.18 | 10.68 |
| 11 | -16.42 | 3.19 | -1.03 | -35.68 | -1.83 | 13.19 |
| 12 | -13.29 | 1.58 | 2.67 | -22.36 | -0.22 | 12.41 |
| 13 | -12.67 | 1.56 | -1.32 | -28.17 | -0.34 | 9.83 |
| 14 | -9.58 | -0.04 | 2.37 | -14.96 | 1.26 | 9.07 |
| 15 | -14.54 | 2.97 | -1.13 | -32.02 | -1.75 | 11.59 |
| 16 | -11.41 | 1.36 | 2.58 | -18.71 | -0.14 | 10.80 |

--- 梁的弯矩包络(偶然组合) ---

梁下部受拉:

截面 1 2 3 4 5 6 7

弯矩 -28.62 -28.19 -22.81 -12.50 -2.53 0.00 0.00

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 0.00 0.00 0.00 8.06 22.93 52.26

强度计算荷载比 =0.27

平面内稳定计算荷载比 =0.25

平面外稳定计算荷载比 =0.23

无防护下钢构件最大升温(Ts): 1081.52℃ ,按临界温度法求得临界温度(Td): 647.85℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4485(m^2\*℃/w)

构件重量 (Kg)=320.78

**10、 钢 梁 3
设计结果**

截面类型=16; 布置角度=0; 计算长度： Lx=12.34, Ly=5.99

构件长度=5.99; 计算长度系数: Ux=2.06 Uy=1.00

支撑长度=5.99

抗震等级: 四级

截面参数: B1=180, B2=180, H=350, Tw=6, T1=10, T2=10

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 252.329742(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -18.05 | 2.57 | 2.76 | -17.86 | -3.78 | 15.34 |
| 2 | -54.36 | 5.36 | 2.45 | -40.52 | -8.48 | 33.50 |
| 3 | -54.36 | 5.36 | 2.45 | -38.82 | -8.24 | 33.54 |
| 4 | -18.05 | 2.57 | 2.76 | -19.57 | -4.02 | 15.31 |
| 5 | -12.46 | 1.96 | 2.35 | -13.36 | -2.83 | 11.58 |
| 6 | -48.78 | 4.74 | 2.05 | -36.02 | -7.53 | 29.74 |
| 7 | -48.78 | 4.74 | 2.05 | -34.31 | -7.29 | 29.77 |
| 8 | -12.46 | 1.96 | 2.35 | -15.07 | -3.07 | 11.54 |
| 9 | -3.16 | -4.98 | -5.94 | -51.22 | 3.54 | 12.21 |
| 10 | -1.95 | 1.00 | 6.44 | 48.63 | -2.44 | -9.14 |
| 11 | -10.35 | 0.26 | -5.75 | -60.81 | -1.71 | 18.00 |
| 12 | -9.22 | 6.30 | 6.69 | 39.52 | -7.75 | -3.42 |
| 13 | 2.42 | -5.59 | -6.34 | -46.72 | 4.48 | 8.44 |
| 14 | 3.63 | 0.39 | 6.03 | 53.14 | -1.50 | -12.91 |
| 15 | -4.76 | -0.35 | -6.15 | -56.31 | -0.76 | 14.23 |
| 16 | -3.63 | 5.69 | 6.29 | 44.02 | -6.80 | -7.18 |
| 17 | -5.43 | -2.00 | -1.85 | -36.88 | 0.80 | 12.87 |
| 18 | -4.70 | 1.58 | 5.57 | 23.03 | -2.79 | 0.06 |
| 19 | -9.74 | 1.14 | -1.74 | -42.64 | -2.35 | 16.35 |
| 20 | -9.06 | 4.77 | 5.73 | 17.56 | -5.97 | 3.50 |
| 21 | -41.74 | 0.78 | -2.16 | -59.54 | -3.90 | 31.03 |
| 22 | -41.01 | 4.37 | 5.27 | 0.37 | -7.49 | 18.22 |
| 23 | -46.05 | 3.92 | -2.04 | -65.30 | -7.05 | 34.51 |
| 24 | -45.37 | 7.55 | 5.42 | -5.10 | -10.67 | 21.66 |
| 25 | -41.74 | 0.78 | -2.16 | -57.83 | -3.66 | 31.07 |
| 26 | -41.01 | 4.37 | 5.27 | 2.08 | -7.25 | 18.26 |
| 27 | -46.05 | 3.92 | -2.04 | -63.59 | -6.80 | 34.54 |
| 28 | -45.37 | 7.55 | 5.42 | -3.39 | -10.43 | 21.69 |
| 29 | -5.43 | -2.00 | -1.85 | -38.59 | 0.56 | 12.84 |
| 30 | -4.70 | 1.58 | 5.57 | 21.32 | -3.03 | 0.03 |
| 31 | -9.74 | 1.14 | -1.74 | -44.35 | -2.59 | 16.31 |
| 32 | -9.06 | 4.77 | 5.73 | 15.85 | -6.21 | 3.46 |
| 33 | 0.15 | -2.61 | -2.25 | -32.38 | 1.75 | 9.10 |
| 34 | 0.88 | 0.97 | 5.17 | 27.54 | -1.84 | -3.70 |
| 35 | -4.16 | 0.53 | -2.14 | -38.13 | -1.40 | 12.58 |
| 36 | -3.48 | 4.15 | 5.33 | 22.06 | -5.02 | -0.27 |
| 37 | -36.16 | 0.17 | -2.56 | -55.04 | -2.95 | 27.27 |
| 38 | -35.43 | 3.76 | 4.87 | 4.88 | -6.54 | 14.46 |
| 39 | -40.47 | 3.31 | -2.44 | -60.79 | -6.10 | 30.74 |
| 40 | -39.79 | 6.94 | 5.02 | -0.59 | -9.72 | 17.89 |
| 41 | -36.16 | 0.17 | -2.56 | -53.33 | -2.71 | 27.30 |
| 42 | -35.43 | 3.76 | 4.87 | 6.59 | -6.30 | 14.49 |
| 43 | -40.47 | 3.31 | -2.44 | -59.08 | -5.86 | 30.77 |
| 44 | -39.79 | 6.94 | 5.02 | 1.11 | -9.48 | 17.93 |
| 45 | 0.15 | -2.61 | -2.25 | -34.09 | 1.50 | 9.07 |
| 46 | 0.88 | 0.97 | 5.17 | 25.83 | -2.09 | -3.74 |
| 47 | -4.16 | 0.53 | -2.14 | -39.84 | -1.64 | 12.54 |
| 48 | -3.48 | 4.15 | 5.33 | 20.36 | -5.27 | -0.30 |
| 49 | 1.14 | -5.03 | -5.23 | -50.06 | 3.76 | 11.52 |
| 50 | 2.35 | 0.95 | 7.15 | 49.80 | -2.22 | -9.83 |
| 51 | -6.04 | 0.21 | -5.04 | -59.65 | -1.49 | 17.31 |
| 52 | -4.91 | 6.25 | 7.41 | 40.68 | -7.52 | -4.10 |
| 53 | -24.28 | -3.09 | -5.44 | -65.92 | 0.47 | 24.23 |
| 54 | -23.07 | 2.90 | 6.93 | 33.93 | -5.51 | 2.88 |
| 55 | -31.46 | 2.16 | -5.25 | -75.51 | -4.78 | 30.02 |
| 56 | -30.33 | 8.20 | 7.19 | 24.82 | -10.81 | 8.61 |
| 57 | -24.28 | -3.09 | -5.44 | -64.73 | 0.64 | 24.26 |
| 58 | -23.07 | 2.90 | 6.93 | 35.13 | -5.34 | 2.91 |
| 59 | -31.46 | 2.16 | -5.25 | -74.32 | -4.61 | 30.05 |
| 60 | -30.33 | 8.20 | 7.19 | 26.01 | -10.65 | 8.63 |
| 61 | 1.14 | -5.03 | -5.23 | -51.26 | 3.59 | 11.49 |
| 62 | 2.35 | 0.95 | 7.15 | 48.60 | -2.39 | -9.85 |
| 63 | -6.04 | 0.21 | -5.04 | -60.85 | -1.65 | 17.28 |
| 64 | -4.91 | 6.25 | 7.41 | 39.48 | -7.69 | -4.13 |
| 65 | 6.72 | -5.64 | -5.63 | -45.56 | 4.70 | 7.75 |
| 66 | 7.93 | 0.34 | 6.75 | 54.30 | -1.28 | -13.60 |
| 67 | -0.46 | -0.40 | -5.44 | -55.15 | -0.54 | 13.54 |
| 68 | 0.67 | 5.64 | 7.00 | 45.18 | -6.58 | -7.87 |
| 69 | -18.70 | -3.70 | -5.84 | -61.42 | 1.41 | 20.46 |
| 70 | -17.48 | 2.28 | 6.53 | 38.44 | -4.57 | -0.88 |
| 71 | -25.88 | 1.55 | -5.65 | -71.01 | -3.83 | 26.25 |
| 72 | -24.75 | 7.59 | 6.79 | 29.32 | -9.87 | 4.84 |
| 73 | -18.70 | -3.70 | -5.84 | -60.22 | 1.58 | 20.49 |
| 74 | -17.48 | 2.28 | 6.53 | 39.64 | -4.40 | -0.86 |
| 75 | -25.88 | 1.55 | -5.65 | -69.81 | -3.66 | 26.28 |
| 76 | -24.75 | 7.59 | 6.79 | 30.52 | -9.70 | 4.87 |
| 77 | 6.72 | -5.64 | -5.63 | -46.75 | 4.53 | 7.73 |
| 78 | 7.93 | 0.34 | 6.75 | 53.11 | -1.45 | -13.62 |
| 79 | -0.46 | -0.40 | -5.44 | -56.34 | -0.71 | 13.52 |
| 80 | 0.67 | 5.64 | 7.00 | 43.99 | -6.75 | -7.90 |
| 81 | -20.47 | 2.92 | 1.53 | -23.74 | -4.26 | 16.55 |
| 82 | -22.59 | 2.31 | 2.83 | -13.87 | -3.65 | 15.25 |
| 83 | -36.20 | 4.13 | 1.40 | -33.56 | -6.30 | 24.42 |
| 84 | -38.33 | 3.51 | 2.69 | -23.69 | -5.69 | 23.12 |
| 85 | -36.20 | 4.13 | 1.40 | -32.82 | -6.20 | 24.43 |
| 86 | -38.33 | 3.51 | 2.69 | -22.95 | -5.58 | 23.14 |
| 87 | -20.47 | 2.92 | 1.53 | -24.48 | -4.37 | 16.53 |
| 88 | -22.59 | 2.31 | 2.83 | -14.61 | -3.75 | 15.24 |
| 89 | -15.50 | 2.32 | 1.03 | -19.40 | -3.35 | 12.88 |
| 90 | -17.63 | 1.71 | 2.32 | -9.53 | -2.74 | 11.58 |
| 91 | -27.60 | 3.25 | 0.93 | -26.95 | -4.92 | 18.93 |
| 92 | -29.73 | 2.63 | 2.22 | -17.08 | -4.30 | 17.64 |
| 93 | -27.60 | 3.25 | 0.93 | -26.38 | -4.84 | 18.94 |
| 94 | -29.73 | 2.63 | 2.22 | -16.51 | -4.22 | 17.65 |
| 95 | -15.50 | 2.32 | 1.03 | -19.97 | -3.43 | 12.86 |
| 96 | -17.63 | 1.71 | 2.32 | -10.10 | -2.82 | 11.57 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -54.36 | -53.81 | -47.27 | -39.17 | -37.66 | -40.82 | -54.30 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 7.93 | 8.93 | 15.79 | 23.00 | 30.55 | 42.06 | 75.51 |

强度计算应力比 =0.388

抗剪强度计算应力比 =0.100

平面内稳定计算最大应力对应组合号: 1, M=-18.05, N=2.57, M=-17.86, N=-3.78

平面内稳定最大应力 (N/mm\*mm) =110.19

平面内稳定计算最大应力比 =0.361

临界弯矩Mcr(kN\*m) =336.52

平面外稳定计算最大应力比 =0.549

强度计算应力比 =0.388 < 1.0

抗剪强度计算应力比 =0.100 < 1.0

平面内稳定最大应力 < f=305.00

平面外稳定计算最大应力比 =0.549 < 1.0

腹板高厚比 H0/TW=55.00 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =8.70 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 18.94 | 18.51 | 16.57 | 13.31 | 9.08 | 4.41 | 0.00 |

最大挠度值 =18.94 最大挠度/梁跨度 =1/649.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/13.28

变形后斜梁坡度改变率 =0.059 < 1/3

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | I端 |  |  | II端 |  |  |
| 组合 | M | N | V | M | N | V |
| 1 | -16.56 | 2.01 | 1.68 | -14.47 | -3.04 | 12.23 |
| 2 | -28.67 | 2.94 | 1.57 | -22.02 | -4.61 | 18.28 |
| 3 | -28.67 | 2.94 | 1.57 | -21.45 | -4.53 | 18.30 |
| 4 | -16.56 | 2.01 | 1.68 | -15.03 | -3.12 | 12.22 |
| 5 | -14.70 | 1.81 | 1.54 | -12.96 | -2.73 | 10.97 |
| 6 | -26.80 | 2.74 | 1.44 | -20.52 | -4.30 | 17.03 |
| 7 | -26.80 | 2.74 | 1.44 | -19.95 | -4.21 | 17.04 |
| 8 | -14.70 | 1.81 | 1.54 | -13.53 | -2.81 | 10.96 |
| 9 | -13.00 | 0.00 | -0.71 | -23.47 | -1.11 | 11.46 |
| 10 | -12.68 | 1.60 | 2.59 | 3.16 | -2.71 | 5.77 |
| 11 | -14.92 | 1.40 | -0.66 | -26.03 | -2.51 | 13.00 |
| 12 | -14.62 | 3.01 | 2.66 | 0.73 | -4.12 | 7.29 |
| 13 | -11.14 | -0.20 | -0.84 | -21.97 | -0.80 | 10.20 |
| 14 | -10.82 | 1.39 | 2.46 | 4.66 | -2.39 | 4.51 |
| 15 | -13.06 | 1.20 | -0.79 | -24.53 | -2.20 | 11.75 |
| 16 | -12.76 | 2.81 | 2.52 | 2.23 | -3.81 | 6.04 |

--- 梁的弯矩包络(偶然组合) ---

梁下部受拉:

截面 1 2 3 4 5 6 7

弯矩 -28.67 -28.58 -25.19 -18.50 -11.90 -8.59 -4.66

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 0.00 0.00 0.00 4.70 12.92 26.03

强度计算荷载比 =0.15

平面内稳定计算荷载比 =0.14

平面外稳定计算荷载比 =0.08

无防护下钢构件最大升温(Ts): 1004.15℃ ,按临界温度法求得临界温度(Td): 647.85℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2352(m^2\*℃/w)

构件重量 (Kg)=262.56

**11、 钢 梁 4
设计结果**

截面类型=16; 布置角度=0; 计算长度： Lx=12.34, Ly=6.35

构件长度=6.35; 计算长度系数: Ux=1.94 Uy=1.00

支撑长度=6.35

抗震等级: 四级

截面参数: B1=180, B2=180, H=350, Tw=6, T1=10, T2=10

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 252.329742(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 94.66 | 2.23 | 41.57 | 54.36 | -5.36 | -2.45 |
| 2 | 47.51 | 1.12 | 20.86 | 18.05 | -2.57 | -2.76 |
| 3 | 82.06 | 2.31 | 40.55 | 54.36 | -5.36 | -2.45 |
| 4 | 60.11 | 1.04 | 21.88 | 18.05 | -2.57 | -2.76 |
| 5 | 83.70 | 1.98 | 36.75 | 48.78 | -4.74 | -2.05 |
| 6 | 36.54 | 0.86 | 16.05 | 12.46 | -1.96 | -2.35 |
| 7 | 71.10 | 2.05 | 35.73 | 48.78 | -4.74 | -2.05 |
| 8 | 49.15 | 0.79 | 17.06 | 12.46 | -1.96 | -2.35 |
| 9 | -19.81 | -6.51 | 0.69 | 3.16 | 4.98 | 5.94 |
| 10 | 29.79 | -0.53 | 3.57 | 1.95 | -1.00 | -6.44 |
| 11 | -5.68 | -1.27 | 7.22 | 10.35 | -0.26 | 5.75 |
| 12 | 44.26 | 4.77 | 10.16 | 9.22 | -6.30 | -6.69 |
| 13 | -30.77 | -6.77 | -4.12 | -2.42 | 5.59 | 6.34 |
| 14 | 18.83 | -0.79 | -1.24 | -3.63 | -0.39 | -6.03 |
| 15 | -16.64 | -1.52 | 2.40 | 4.76 | 0.35 | 6.15 |
| 16 | 33.29 | 4.51 | 5.35 | 3.63 | -5.69 | -6.29 |
| 17 | 54.28 | -2.34 | 29.47 | 41.74 | -0.78 | 2.16 |
| 18 | 84.04 | 1.25 | 31.19 | 41.01 | -4.37 | -5.27 |
| 19 | 62.75 | 0.80 | 33.38 | 46.05 | -3.92 | 2.04 |
| 20 | 92.71 | 4.42 | 35.15 | 45.37 | -7.55 | -5.42 |
| 21 | 7.12 | -3.46 | 8.76 | 5.43 | 2.00 | 1.85 |
| 22 | 36.88 | 0.13 | 10.49 | 4.70 | -1.59 | -5.57 |
| 23 | 15.60 | -0.31 | 12.68 | 9.74 | -1.14 | 1.74 |
| 24 | 45.56 | 3.31 | 14.44 | 9.06 | -4.77 | -5.73 |
| 25 | 41.67 | -2.27 | 28.45 | 41.74 | -0.78 | 2.16 |
| 26 | 71.43 | 1.32 | 30.17 | 41.01 | -4.37 | -5.27 |
| 27 | 50.15 | 0.88 | 32.36 | 46.05 | -3.92 | 2.04 |
| 28 | 80.11 | 4.50 | 34.13 | 45.37 | -7.55 | -5.42 |
| 29 | 19.72 | -3.53 | 9.78 | 5.43 | 2.00 | 1.85 |
| 30 | 49.48 | 0.06 | 11.51 | 4.70 | -1.59 | -5.57 |
| 31 | 28.20 | -0.39 | 13.69 | 9.74 | -1.14 | 1.74 |
| 32 | 58.16 | 3.24 | 15.46 | 9.06 | -4.77 | -5.73 |
| 33 | 43.31 | -2.60 | 24.65 | 36.16 | -0.17 | 2.56 |
| 34 | 73.07 | 0.99 | 26.38 | 35.43 | -3.76 | -4.87 |
| 35 | 51.79 | 0.54 | 28.57 | 40.47 | -3.31 | 2.44 |
| 36 | 81.75 | 4.17 | 30.33 | 39.79 | -6.94 | -5.02 |
| 37 | -3.84 | -3.72 | 3.95 | -0.15 | 2.62 | 2.25 |
| 38 | 25.92 | -0.13 | 5.67 | -0.88 | -0.97 | -5.17 |
| 39 | 4.63 | -0.57 | 7.86 | 4.16 | -0.53 | 2.14 |
| 40 | 34.59 | 3.05 | 9.63 | 3.48 | -4.15 | -5.33 |
| 41 | 30.71 | -2.53 | 23.63 | 36.16 | -0.17 | 2.56 |
| 42 | 60.47 | 1.06 | 25.36 | 35.43 | -3.76 | -4.87 |
| 43 | 39.19 | 0.62 | 27.55 | 40.47 | -3.31 | 2.44 |
| 44 | 69.15 | 4.24 | 29.31 | 39.79 | -6.94 | -5.02 |
| 45 | 8.76 | -3.79 | 4.96 | -0.15 | 2.62 | 2.25 |
| 46 | 38.52 | -0.20 | 6.69 | -0.88 | -0.97 | -5.17 |
| 47 | 17.24 | -0.65 | 8.88 | 4.16 | -0.53 | 2.14 |
| 48 | 47.20 | 2.98 | 10.64 | 3.48 | -4.15 | -5.33 |
| 49 | 13.20 | -5.73 | 15.19 | 24.28 | 3.09 | 5.44 |
| 50 | 62.80 | 0.25 | 18.06 | 23.07 | -2.90 | -6.93 |
| 51 | 27.33 | -0.49 | 21.71 | 31.46 | -2.16 | 5.25 |
| 52 | 77.27 | 5.55 | 24.65 | 30.33 | -8.20 | -7.19 |
| 53 | -19.81 | -6.51 | 0.69 | -1.14 | 5.03 | 5.23 |
| 54 | 29.79 | -0.53 | 3.57 | -2.35 | -0.95 | -7.15 |
| 55 | -5.68 | -1.27 | 7.22 | 6.04 | -0.21 | 5.04 |
| 56 | 44.26 | 4.77 | 10.16 | 4.91 | -6.25 | -7.41 |
| 57 | 4.38 | -5.68 | 14.48 | 24.28 | 3.09 | 5.44 |
| 58 | 53.98 | 0.30 | 17.35 | 23.07 | -2.90 | -6.93 |
| 59 | 18.51 | -0.43 | 21.00 | 31.46 | -2.16 | 5.25 |
| 60 | 68.44 | 5.60 | 23.94 | 30.33 | -8.20 | -7.19 |
| 61 | -10.98 | -6.56 | 1.41 | -1.14 | 5.03 | 5.23 |
| 62 | 38.62 | -0.58 | 4.28 | -2.35 | -0.95 | -7.15 |
| 63 | 3.15 | -1.32 | 7.93 | 6.04 | -0.21 | 5.04 |
| 64 | 53.08 | 4.72 | 10.87 | 4.91 | -6.25 | -7.41 |
| 65 | 2.24 | -5.99 | 10.37 | 18.70 | 3.70 | 5.84 |
| 66 | 51.84 | -0.01 | 13.25 | 17.48 | -2.29 | -6.53 |
| 67 | 16.37 | -0.74 | 16.90 | 25.88 | -1.55 | 5.65 |
| 68 | 66.30 | 5.29 | 19.84 | 24.75 | -7.58 | -6.79 |
| 69 | -30.77 | -6.77 | -4.12 | -6.72 | 5.64 | 5.63 |
| 70 | 18.83 | -0.79 | -1.24 | -7.93 | -0.34 | -6.75 |
| 71 | -16.64 | -1.52 | 2.40 | 0.46 | 0.40 | 5.44 |
| 72 | 33.29 | 4.51 | 5.35 | -0.67 | -5.64 | -7.00 |
| 73 | -6.58 | -5.94 | 9.66 | 18.70 | 3.70 | 5.84 |
| 74 | 43.02 | 0.05 | 12.54 | 17.48 | -2.29 | -6.53 |
| 75 | 7.55 | -0.69 | 16.19 | 25.88 | -1.55 | 5.65 |
| 76 | 57.48 | 5.35 | 19.13 | 24.75 | -7.58 | -6.79 |
| 77 | -21.95 | -6.82 | -3.41 | -6.72 | 5.64 | 5.63 |
| 78 | 27.65 | -0.84 | -0.53 | -7.93 | -0.34 | -6.75 |
| 79 | -7.82 | -1.58 | 3.12 | 0.46 | 0.40 | 5.44 |
| 80 | 42.12 | 4.46 | 6.06 | -0.67 | -5.64 | -7.00 |
| 81 | 64.68 | 1.47 | 29.15 | 36.20 | -3.69 | -1.37 |
| 82 | 71.20 | 1.73 | 30.51 | 38.33 | -3.95 | -2.73 |
| 83 | 44.25 | 0.99 | 20.18 | 20.47 | -2.48 | -1.50 |
| 84 | 50.76 | 1.25 | 21.54 | 22.59 | -2.75 | -2.86 |
| 85 | 59.22 | 1.50 | 28.71 | 36.20 | -3.69 | -1.37 |
| 86 | 65.74 | 1.77 | 30.07 | 38.33 | -3.95 | -2.73 |
| 87 | 49.71 | 0.95 | 20.62 | 20.47 | -2.48 | -1.50 |
| 88 | 56.22 | 1.22 | 21.98 | 22.59 | -2.75 | -2.86 |
| 89 | 49.00 | 1.10 | 22.27 | 27.60 | -2.81 | -0.89 |
| 90 | 55.52 | 1.37 | 23.63 | 29.73 | -3.07 | -2.26 |
| 91 | 33.29 | 0.73 | 15.37 | 15.50 | -1.88 | -1.00 |
| 92 | 39.80 | 0.99 | 16.73 | 17.63 | -2.15 | -2.36 |
| 93 | 44.80 | 1.12 | 21.93 | 27.60 | -2.81 | -0.89 |
| 94 | 51.32 | 1.39 | 23.29 | 29.73 | -3.07 | -2.26 |
| 95 | 37.49 | 0.70 | 15.71 | 15.50 | -1.88 | -1.00 |
| 96 | 44.00 | 0.97 | 17.07 | 17.63 | -2.15 | -2.36 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -30.77 | -26.22 | -21.55 | -25.75 | -35.75 | -48.41 | -54.36 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 94.66 | 42.54 | 21.23 | 17.00 | 13.83 | 9.37 | 7.93 |

强度计算应力比 =0.486

抗剪强度计算应力比 =0.120

平面内稳定计算最大应力对应组合号: 1, M=94.66, N=2.23, M=54.36, N=-5.36

平面内稳定最大应力 (N/mm\*mm) =137.97

平面内稳定计算最大应力比 =0.452

临界弯矩Mcr(kN\*m) =307.77

平面外稳定计算最大应力比 =0.711

强度计算应力比 =0.486 < 1.0

抗剪强度计算应力比 =0.120 < 1.0

平面内稳定最大应力 < f=305.00

平面外稳定计算最大应力比 =0.711 < 1.0

腹板高厚比 H0/TW=55.00 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =8.70 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0.00 | 2.60 | 6.61 | 10.98 | 14.87 | 17.66 | 18.94 |

最大挠度值 =18.94 最大挠度/梁跨度 =1/649.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.88

变形后斜梁坡度改变率 =0.052 < 1/3

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | I端 |  |  | II端 |  |  |
| 组合 | M | N | V | M | N | V |
| 1 | 52.26 | 1.23 | 22.95 | 28.67 | -2.94 | -1.57 |
| 2 | 36.54 | 0.86 | 16.05 | 16.56 | -2.01 | -1.68 |
| 3 | 48.06 | 1.26 | 22.61 | 28.67 | -2.94 | -1.57 |
| 4 | 40.74 | 0.84 | 16.39 | 16.56 | -2.01 | -1.68 |
| 5 | 48.61 | 1.15 | 21.34 | 26.80 | -2.74 | -1.44 |
| 6 | 32.89 | 0.77 | 14.44 | 14.70 | -1.81 | -1.54 |
| 7 | 44.41 | 1.17 | 21.00 | 26.80 | -2.74 | -1.44 |
| 8 | 37.09 | 0.75 | 14.78 | 14.70 | -1.81 | -1.54 |
| 9 | 18.59 | -1.17 | 10.67 | 13.00 | -0.00 | 0.71 |
| 10 | 31.82 | 0.42 | 11.44 | 12.68 | -1.60 | -2.59 |
| 11 | 22.36 | 0.22 | 12.41 | 14.92 | -1.40 | 0.66 |
| 12 | 35.68 | 1.83 | 13.19 | 14.62 | -3.01 | -2.66 |
| 13 | 14.94 | -1.26 | 9.06 | 11.14 | 0.20 | 0.84 |
| 14 | 28.17 | 0.34 | 9.83 | 10.82 | -1.39 | -2.46 |
| 15 | 18.71 | 0.14 | 10.80 | 13.06 | -1.20 | 0.79 |
| 16 | 32.02 | 1.75 | 11.59 | 12.76 | -2.81 | -2.52 |

--- 梁的弯矩包络(偶然组合) ---

梁下部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 0.00 -0.74 -6.99 -17.92 -25.15 -28.67

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 52.26 26.00 10.75 2.82 0.00 0.00 0.00

强度计算荷载比 =0.27

平面内稳定计算荷载比 =0.25

平面外稳定计算荷载比 =0.19

无防护下钢构件最大升温(Ts): 1004.15℃ ,按临界温度法求得临界温度(Td): 647.85℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2352(m^2\*℃/w)

构件重量 (Kg)=277.94

风荷载作用下柱顶最大水平（X 向）位移:

节点( 1), 水平位移 dx=48.461(mm) =H /144.

地震荷载作用下柱顶最大水平（X 向）位移:

节点( 1), 水平位移 dx=5.704(mm) =H /1227.

梁的(恒+活)最大挠度:

梁( 3), 挠跨比 =1 /649.

风载作用下柱顶最大水平位移: H/144< 柱顶位移容许值: H/60

地震作用下柱顶最大水平位移: H/1227< 柱顶位移容许值: H/60

梁的(恒+活)最大挠跨比: 1/649< 梁的容许挠跨比: 1/180

所有钢柱的总重量 (Kg)=1647.

所有钢梁的总重量 (Kg)=1081.

钢梁与钢柱重量之和 (Kg)=2728.

**12. 荷载与计算结果简图**

## **1. 结构简图**



[图12-1 刚架简图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\刚架简图.T)

## **2. 荷载简图**



[图12-2 恒载简图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\恒载简图.T)



[图12-3 活载简图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\活载简图.T)



[图12-4 左风1简图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风1简图.T)



[图12-5 右风1简图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风1简图.T)



[图12-6 左风2简图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风2简图.T)



[图12-7 右风2简图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风2简图.T)

## **3. 应力比图**



[图12-8 应力比图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\应力比图.T)



[图12-9 荷载比图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\荷载比图.T)



[图12-10 防火图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\防火图.T)

## **4. 内力图**



[图12-11 恒载弯矩图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\恒载弯矩图.T)



[图12-12 恒载剪力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\恒载剪力图.T)



[图12-13 恒载轴力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\恒载轴力图.T)



[图12-14 活载弯矩图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\活载弯矩图.T)



[图12-15 活载剪力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\活载剪力图.T)



[图12-16 活载轴力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\活载轴力图.T)



[图12-17 左风1弯矩图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风1弯矩图.T)



[图12-18 右风1弯矩图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风1弯矩图.T)



[图12-19 左风1剪力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风1剪力图.T)



[图12-20 右风1剪力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风1剪力图.T)



[图12-21 左风1轴力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风1轴力图.T)



[图12-22 右风1轴力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风1轴力图.T)



[图12-23 左风2弯矩图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风2弯矩图.T)



[图12-24 右风2弯矩图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风2弯矩图.T)



[图12-25 左风2剪力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风2剪力图.T)



[图12-26 右风2剪力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风2剪力图.T)



[图12-27 左风2轴力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风2轴力图.T)



[图12-28 右风2轴力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风2轴力图.T)



[图12-29 左地震弯矩图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左地震弯矩图.T)



[图12-30 右地震弯矩图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右地震弯矩图.T)



[图12-31 左地震剪力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左地震剪力图.T)



[图12-32 右地震剪力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右地震剪力图.T)



[图12-33 左地震轴力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左地震轴力图.T)



[图12-34 右地震轴力图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右地震轴力图.T)



[图12-35 弯矩包络图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\弯矩包络图.T)



[图12-36 剪力包络图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\剪力包络图.T)



[图12-37 轴力包络图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\轴力包络图.T)

## **5. 位移图**



[图12-38 恒载位移图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\恒载位移图.T)



[图12-39 活载位移图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\活载位移图.T)



[图12-40 左风1位移图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风1位移图.T)



[图12-41 右风1位移图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风1位移图.T)



[图12-42 左风2位移图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左风2位移图.T)



[图12-43 右风2位移图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右风2位移图.T)



[图12-44 左地震位移图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\左地震位移图.T)



[图12-45 右地震位移图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\右地震位移图.T)



[图12-46 恒+活位移图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\恒+活位移图.T)

## **6. 挠度图**



[图12-47 (恒+活)挠度图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\(恒+活)挠度图.T)



[图12-48 (活)挠度图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\(活)挠度图.T)



[图12-49 斜梁计算坡度图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\斜梁计算坡度图.T)



[图12-50 抗风柱挠度图](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\抗风柱挠度图.T)

## **7. 计算长度系数图**



[图12-51 平面内计算长度系数](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\平面内计算长度系数.T)



[图12-52 平面外计算长度系数](F:\\项目人\\大兵\\2025\\食用菌项目\\结构计算\\维修车间\\刚架3-%2520边跨\\CalcTemp\\平面外计算长度系数.T)