门式刚架计算书

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**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22分51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 | 0.83 | 0.00 | 0.00 |
| 5 | 1 | 1.16 | 0.00 | 0.00 |
| 6 | 1 | 2.52 | 0.00 | 0.00 |
| 7 | 1 | 2.52 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | -1.16 | 0.00 | 0.00 |
| 5 | 1 | -0.83 | 0.00 | 0.00 |
| 6 | 1 | -2.52 | 0.00 | 0.00 |
| 7 | 1 | -2.52 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 1.53 | 0.00 | 0.00 |
| 5 | 1 | 0.49 | 0.00 | 0.00 |
| 6 | 1 | 2.52 | 0.00 | 0.00 |
| 7 | 1 | 2.52 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | -0.49 | 0.00 | 0.00 |
| 5 | 1 | -1.53 | 0.00 | 0.00 |
| 6 | 1 | -2.52 | 0.00 | 0.00 |
| 7 | 1 | -2.52 | 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 | 1.89 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 1.89 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 1.89 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 1.89 | 0.00 | 0.00 | 0.00 |
| 活荷载 | 1 | 1 | 1 | 2.10 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 2.10 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 2.10 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 2.10 | 0.00 | 0.00 | 0.00 |
| 左风1 | 1 | 1 | 1 | -2.43 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.43 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.38 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.38 | 0.00 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | 1 | -1.38 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.38 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.43 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.43 | 0.00 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 1 | -1.73 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.73 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.68 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.68 | 0.00 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | 1 | -0.68 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.68 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.73 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.73 | 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 | 91.973 |
| 6 | 0.282 |
| 7 | 0.282 |

水平地震标准值作用底层剪力： 1.543

底层最小地震剪力(抗震规范5.2.5条): 0.740

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 | 0.925 |
| 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 | 91.973 |
| 6 | 0.282 |
| 7 | 0.282 |

水平地震标准值作用底层剪力： 1.543

底层最小地震剪力(抗震规范5.2.5条): 0.740

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 | 0.925 |
| 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 | 17.6 | -2.2 | 0.0 | -13.8 | 2.2 | -15.5 |
| 2 | 3.4 | 0.0 | 0.0 | -0.0 | 0.0 | 0.0 |
| 3 | 37.4 | -0.0 | 0.0 | -33.1 | 0.0 | -0.0 |
| 4 | 3.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 17.6 | 2.2 | 0.0 | -13.8 | -2.2 | 15.5 |
| 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 | -17.9 | 9.3 | 0.0 | 17.9 | -3.5 | 44.9 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | -25.7 | 4.3 | 0.0 | 25.7 | -4.3 | 34.6 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | -3.3 | 6.8 | 0.0 | 3.3 | 1.3 | 19.3 |
| 6 | -0.0 | 3.8 | 2.8 | 0.0 | -0.0 | 0.0 |
| 7 | 0.0 | 3.8 | 2.8 | -0.0 | -0.0 | -0.0 |
| 右风1 | 1 | -3.3 | -6.8 | 0.0 | 3.3 | -1.3 | -19.4 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | -25.6 | -4.4 | 0.0 | 25.6 | 4.4 | -34.7 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | -17.9 | -9.3 | 0.0 | 17.9 | 3.5 | -44.9 |
| 6 | 0.0 | -3.8 | -2.8 | -0.0 | 0.0 | -0.0 |
| 7 | -0.0 | -3.8 | -2.8 | 0.0 | -0.0 | 0.0 |
| 左风2 | 1 | -13.6 | 10.9 | 0.0 | 13.6 | -0.1 | 38.5 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | -17.1 | 4.4 | 0.0 | 17.1 | -4.4 | 35.0 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 1.0 | 5.4 | 0.0 | -1.0 | -2.0 | 26.1 |
| 6 | 0.0 | 3.8 | 2.8 | -0.0 | -0.0 | 0.0 |
| 7 | 0.0 | 3.8 | 2.8 | -0.0 | 0.0 | -0.0 |
| 右风2 | 1 | 1.0 | -5.4 | 0.0 | -1.0 | 2.0 | -26.1 |
| 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | -17.1 | -4.4 | 0.0 | 17.1 | 4.4 | -35.0 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | -13.6 | -10.9 | 0.0 | 13.6 | 0.1 | -38.5 |
| 6 | -0.0 | -3.8 | -2.8 | 0.0 | 0.0 | 0.0 |
| 7 | -0.0 | -3.8 | -2.8 | 0.0 | -0.0 | 0.0 |
| 左地震 | 1 | -0.5 | 0.5 | -0.0 | 0.5 | -0.5 | 3.6 |
| 2 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 |
| 3 | -0.0 | 0.6 | -0.0 | 0.0 | -0.6 | 4.7 |
| 4 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 |
| 5 | 0.5 | 0.5 | -0.0 | -0.5 | -0.5 | 3.6 |
| 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 | -3.6 |
| 2 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 |
| 3 | 0.0 | -0.6 | -0.0 | -0.0 | 0.6 | -4.7 |
| 4 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 | -0.0 |
| 5 | -0.5 | -0.5 | -0.0 | 0.5 | 0.5 | -3.6 |
| 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 | 3.3 | 13.0 | 15.6 | -2.3 | -1.0 | 19.5 |
| 2 | 2.3 | 1.0 | -19.5 | -0.9 | 16.7 | -38.0 |
| 3 | 2.1 | 1.4 | -19.3 | -3.3 | 13.0 | -15.6 |
| 4 | 0.9 | 16.7 | 38.0 | -2.1 | -1.4 | 19.3 |
| 左风1 | 1 | -1.2 | -17.8 | -47.7 | 1.2 | 5.7 | -11.2 |
| 2 | -1.2 | -5.7 | 11.2 | 1.2 | -12.1 | 12.5 |
| 3 | -5.3 | -5.4 | 14.7 | 5.3 | -2.9 | -22.1 |
| 4 | -5.3 | -14.1 | -47.1 | 5.3 | 5.4 | -14.7 |
| 右风1 | 1 | -5.3 | -2.9 | 22.2 | 5.3 | -4.0 | -19.3 |
| 2 | -5.3 | 4.0 | 19.3 | 5.3 | -14.1 | 47.1 |
| 3 | -1.1 | 3.3 | 15.6 | 1.1 | -17.8 | 47.8 |
| 4 | -1.1 | -12.1 | -12.4 | 1.1 | -3.3 | -15.6 |
| 左风2 | 1 | 2.6 | -13.8 | -41.3 | -2.6 | 5.2 | -6.3 |
| 2 | 2.6 | -5.2 | 6.3 | -2.6 | -7.5 | 2.3 |
| 3 | -1.7 | -5.2 | 9.7 | 1.7 | 1.2 | -28.9 |
| 4 | -1.7 | -9.5 | -37.2 | 1.7 | 5.2 | -9.7 |
| 右风2 | 1 | -1.7 | 1.2 | 28.9 | 1.7 | -4.6 | -14.5 |
| 2 | -1.7 | 4.6 | 14.5 | 1.7 | -9.5 | 37.2 |
| 3 | 2.6 | 3.5 | 10.5 | -2.6 | -13.8 | 41.3 |
| 4 | 2.6 | -7.5 | -2.3 | -2.6 | -3.5 | -10.5 |
| 左地震 | 1 | -0.2 | -0.5 | -3.6 | 0.2 | 0.5 | 1.2 |
| 2 | 0.1 | -0.5 | -1.2 | -0.1 | 0.5 | -2.4 |
| 3 | 0.2 | -0.5 | 0.8 | -0.2 | 0.5 | -3.6 |
| 4 | -0.1 | -0.5 | -2.4 | 0.1 | 0.5 | -0.8 |
| 右地震 | 1 | 0.2 | 0.5 | 3.6 | -0.2 | -0.5 | -1.2 |
| 2 | -0.1 | 0.5 | 1.2 | 0.1 | -0.5 | 2.4 |
| 3 | -0.2 | 0.5 | -0.8 | 0.2 | -0.5 | 3.6 |
| 4 | 0.1 | 0.5 | 2.4 | -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 | 0.69 | 8.78 |
| 4 | -0.70 | 8.85 |
| 5 | -0.00 | 0.24 |
| 6 | 2.79 | 0.09 |
| 7 | -2.79 | 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 | 0.60 | 10.61 |
| 4 | -0.61 | 10.94 |
| 5 | -0.00 | 0.20 |
| 6 | 2.43 | 0.07 |
| 7 | -2.43 | 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 | 50.41 | 2 | 50.46 |
| 3 | 50.00 | 4 | 51.02 |
| 5 | 50.42 | 6 | 52.55 |
| 7 | 56.83 | 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 | -50.62 | 2 | -50.57 |
| 3 | -51.27 | 4 | -50.08 |
| 5 | -50.58 | 6 | -57.00 |
| 7 | -52.73 | 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 | 50.88 | 2 | 50.86 |
| 3 | 50.63 | 4 | 51.28 |
| 5 | 50.85 | 6 | 53.50 |
| 7 | 56.83 | 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 | -50.86 | 2 | -50.88 |
| 3 | -51.36 | 4 | -50.54 |
| 5 | -50.85 | 6 | -56.83 |
| 7 | -53.50 | 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 | 5.82 | 2 | 5.82 |
| 3 | 5.88 | 4 | 5.87 |
| 5 | 5.83 | 6 | 6.43 |
| 7 | 6.43 | 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 | -5.82 | 2 | -5.82 |
| 3 | -5.88 | 4 | -5.87 |
| 5 | -5.83 | 6 | -6.43 |
| 7 | -6.43 | 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 | 0.43 | 0.05 | 0.48 | 0.62 | 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 | 0.39 | 0.03 | 0.44 | 0.67 | 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 | 0.43 | 0.05 | 0.47 | 0.62 | 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 | 0.41 | 0.10 | 0.38 | 0.70 | 55.00 | 8.70 | 219.7 | 通过 |
| 2 | 0.51 | 0.13 | 0.47 | 0.59 | 55.00 | 8.70 | 320.8 | 通过 |
| 3 | 0.41 | 0.10 | 0.38 | 0.58 | 55.00 | 8.70 | 262.6 | 通过 |
| 4 | 0.51 | 0.13 | 0.47 | 0.74 | 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 | 21.89 | -2.62 | -18.33 | -17.02 | 2.62 |
| 2 | 0.00 | 41.09 | -6.06 | -42.39 | -36.22 | 6.06 |
| 3 | 0.00 | 41.21 | -5.78 | -40.46 | -36.34 | 5.78 |
| 4 | 0.00 | 21.77 | -2.89 | -20.25 | -16.90 | 2.89 |
| 5 | 0.00 | 16.62 | -1.95 | -13.67 | -12.87 | 1.95 |
| 6 | 0.00 | 35.82 | -5.39 | -37.72 | -32.08 | 5.39 |
| 7 | 0.00 | 35.94 | -5.11 | -35.80 | -32.19 | 5.11 |
| 8 | 0.00 | 16.50 | -2.23 | -15.59 | -12.76 | 2.23 |
| 9 | 0.00 | -3.97 | 11.08 | 47.08 | 8.84 | -2.37 |
| 10 | 0.00 | 17.90 | -13.15 | -49.23 | -13.03 | 0.92 |
| 11 | 0.00 | 2.49 | 13.41 | 37.53 | 2.38 | 2.69 |
| 12 | 0.00 | 24.39 | -11.02 | -59.30 | -19.52 | 5.93 |
| 13 | 0.00 | -9.25 | 11.75 | 51.74 | 12.99 | -3.03 |
| 14 | 0.00 | 12.62 | -12.48 | -44.57 | -8.88 | 0.25 |
| 15 | 0.00 | -2.78 | 14.08 | 42.19 | 6.53 | 2.02 |
| 16 | 0.00 | 19.12 | -10.35 | -54.64 | -15.38 | 5.26 |
| 17 | 0.00 | 5.80 | 5.76 | 22.04 | -0.93 | -0.53 |
| 18 | 0.00 | 18.92 | -8.77 | -35.75 | -14.05 | 1.44 |
| 19 | 0.00 | 9.67 | 7.16 | 16.31 | -4.81 | 2.50 |
| 20 | 0.00 | 22.82 | -7.50 | -41.79 | -17.95 | 4.44 |
| 21 | 0.00 | 25.00 | 2.33 | -2.01 | -20.13 | 2.90 |
| 22 | 0.00 | 38.12 | -12.21 | -59.80 | -33.25 | 4.88 |
| 23 | 0.00 | 28.88 | 3.72 | -7.74 | -24.01 | 5.94 |
| 24 | 0.00 | 42.02 | -10.93 | -65.84 | -37.15 | 7.88 |
| 25 | 0.00 | 25.12 | 2.60 | -0.09 | -20.25 | 2.63 |
| 26 | 0.00 | 38.24 | -11.94 | -57.88 | -33.37 | 4.60 |
| 27 | 0.00 | 28.99 | 4.00 | -5.82 | -24.12 | 5.66 |
| 28 | 0.00 | 42.14 | -10.66 | -63.92 | -37.27 | 7.60 |
| 29 | 0.00 | 5.68 | 5.49 | 20.12 | -0.81 | -0.26 |
| 30 | 0.00 | 18.80 | -9.05 | -37.67 | -13.93 | 1.71 |
| 31 | 0.00 | 9.56 | 6.88 | 14.39 | -4.69 | 2.77 |
| 32 | 0.00 | 22.70 | -7.77 | -43.71 | -17.83 | 4.72 |
| 33 | 0.00 | 0.53 | 6.43 | 26.71 | 3.22 | -1.20 |
| 34 | 0.00 | 13.65 | -8.11 | -31.08 | -9.90 | 0.77 |
| 35 | 0.00 | 4.40 | 7.82 | 20.97 | -0.66 | 1.83 |
| 36 | 0.00 | 17.55 | -6.83 | -37.13 | -13.80 | 3.78 |
| 37 | 0.00 | 19.73 | 2.99 | 2.65 | -15.98 | 2.24 |
| 38 | 0.00 | 32.85 | -11.54 | -55.14 | -29.11 | 4.21 |
| 39 | 0.00 | 23.61 | 4.39 | -3.08 | -19.86 | 5.27 |
| 40 | 0.00 | 36.75 | -10.27 | -61.18 | -33.00 | 7.21 |
| 41 | 0.00 | 19.85 | 3.27 | 4.57 | -16.10 | 1.96 |
| 42 | 0.00 | 32.97 | -11.27 | -53.21 | -29.22 | 3.93 |
| 43 | 0.00 | 23.72 | 4.66 | -1.16 | -19.98 | 4.99 |
| 44 | 0.00 | 36.87 | -9.99 | -59.26 | -33.12 | 6.94 |
| 45 | 0.00 | 0.41 | 6.15 | 24.78 | 3.33 | -0.93 |
| 46 | 0.00 | 13.53 | -8.38 | -33.01 | -9.79 | 1.05 |
| 47 | 0.00 | 4.29 | 7.55 | 19.05 | -0.54 | 2.11 |
| 48 | 0.00 | 17.43 | -7.11 | -39.05 | -13.69 | 4.05 |
| 49 | 0.00 | -4.64 | 11.27 | 48.39 | 9.51 | -2.56 |
| 50 | 0.00 | 17.23 | -12.96 | -47.92 | -12.36 | 0.73 |
| 51 | 0.00 | 1.82 | 13.60 | 38.84 | 3.05 | 2.50 |
| 52 | 0.00 | 23.72 | -10.83 | -57.99 | -18.86 | 5.74 |
| 53 | 0.00 | 8.80 | 8.87 | 31.56 | -3.93 | -0.15 |
| 54 | 0.00 | 30.67 | -15.36 | -64.76 | -25.80 | 3.14 |
| 55 | 0.00 | 15.26 | 11.19 | 22.00 | -10.39 | 4.90 |
| 56 | 0.00 | 37.17 | -13.24 | -74.83 | -32.30 | 8.14 |
| 57 | 0.00 | 8.88 | 9.06 | 32.90 | -4.01 | -0.34 |
| 58 | 0.00 | 30.75 | -15.17 | -63.41 | -25.88 | 2.95 |
| 59 | 0.00 | 15.34 | 11.38 | 23.35 | -10.47 | 4.71 |
| 60 | 0.00 | 37.25 | -13.04 | -73.48 | -32.38 | 7.95 |
| 61 | 0.00 | -4.72 | 11.08 | 47.05 | 9.59 | -2.36 |
| 62 | 0.00 | 17.15 | -13.15 | -49.27 | -12.28 | 0.93 |
| 63 | 0.00 | 1.74 | 13.40 | 37.49 | 3.13 | 2.69 |
| 64 | 0.00 | 23.64 | -11.02 | -59.34 | -18.77 | 5.93 |
| 65 | 0.00 | -9.91 | 11.94 | 53.06 | 13.66 | -3.22 |
| 66 | 0.00 | 11.95 | -12.29 | -43.26 | -8.21 | 0.07 |
| 67 | 0.00 | -3.45 | 14.26 | 43.51 | 7.20 | 1.83 |
| 68 | 0.00 | 18.45 | -10.16 | -53.33 | -14.71 | 5.07 |
| 69 | 0.00 | 3.53 | 9.53 | 36.22 | 0.22 | -0.82 |
| 70 | 0.00 | 25.40 | -14.70 | -60.10 | -21.65 | 2.47 |
| 71 | 0.00 | 9.99 | 11.86 | 26.67 | -6.24 | 4.24 |
| 72 | 0.00 | 31.90 | -12.57 | -70.17 | -28.15 | 7.48 |
| 73 | 0.00 | 3.61 | 9.72 | 37.57 | 0.14 | -1.01 |
| 74 | 0.00 | 25.48 | -14.50 | -58.75 | -21.73 | 2.28 |
| 75 | 0.00 | 10.07 | 12.05 | 28.01 | -6.32 | 4.05 |
| 76 | 0.00 | 31.98 | -12.38 | -68.82 | -28.23 | 7.28 |
| 77 | 0.00 | -10.00 | 11.74 | 51.71 | 13.74 | -3.03 |
| 78 | 0.00 | 11.87 | -12.48 | -44.60 | -8.13 | 0.26 |
| 79 | 0.00 | -3.53 | 14.07 | 42.16 | 7.28 | 2.03 |
| 80 | 0.00 | 18.37 | -10.36 | -54.67 | -14.63 | 5.26 |
| 81 | 0.00 | 21.75 | -2.05 | -14.37 | -16.88 | 2.05 |
| 82 | 0.00 | 23.11 | -3.49 | -24.42 | -18.24 | 3.49 |
| 83 | 0.00 | 30.07 | -3.54 | -24.79 | -25.20 | 3.54 |
| 84 | 0.00 | 31.43 | -4.98 | -34.84 | -26.56 | 4.98 |
| 85 | 0.00 | 30.12 | -3.42 | -23.96 | -25.25 | 3.42 |
| 86 | 0.00 | 31.48 | -4.86 | -34.01 | -26.61 | 4.86 |
| 87 | 0.00 | 21.70 | -2.17 | -15.20 | -16.83 | 2.17 |
| 88 | 0.00 | 23.06 | -3.61 | -25.25 | -18.19 | 3.61 |
| 89 | 0.00 | 16.58 | -1.41 | -9.89 | -12.83 | 1.41 |
| 90 | 0.00 | 17.93 | -2.85 | -19.94 | -14.19 | 2.85 |
| 91 | 0.00 | 22.98 | -2.56 | -17.91 | -19.23 | 2.56 |
| 92 | 0.00 | 24.33 | -3.99 | -27.96 | -20.59 | 3.99 |
| 93 | 0.00 | 23.02 | -2.47 | -17.27 | -19.27 | 2.47 |
| 94 | 0.00 | 24.37 | -3.90 | -27.32 | -20.63 | 3.90 |
| 95 | 0.00 | 16.54 | -1.51 | -10.54 | -12.79 | 1.51 |
| 96 | 0.00 | 17.89 | -2.94 | -20.58 | -14.15 | 2.94 |

强度计算控制组合号: 56, M=0.00, N=37.17, M=-74.83, N=-32.30

强度计算应力比 =0.429

抗剪强度计算控制组合号: 54, V=-15.36

抗剪强度计算应力比 =0.052

平面内稳定计算最大应力对应组合号: 56, M=0.00, N=37.17, M=-74.83, N=-32.30

平面内稳定计算最大应力 (N/mm\*mm) =144.97

平面内稳定计算最大应力比 =0.475

临界弯矩Mcr(kN\*m) =213.12

平面外稳定计算最大应力比 =0.623

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 =0.429 < 1.0

抗剪强度计算应力比 =0.052 < 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 | 17.25 | -2.13 | -14.92 | -13.51 | 2.13 |
| 2 | 0.00 | 23.66 | -3.28 | -22.94 | -19.91 | 3.28 |
| 3 | 0.00 | 23.69 | -3.18 | -22.29 | -19.95 | 3.18 |
| 4 | 0.00 | 17.22 | -2.22 | -15.56 | -13.47 | 2.22 |
| 5 | 0.00 | 15.50 | -1.91 | -13.36 | -12.13 | 1.91 |
| 6 | 0.00 | 21.90 | -3.05 | -21.38 | -18.53 | 3.05 |
| 7 | 0.00 | 21.94 | -2.96 | -20.74 | -18.57 | 2.96 |
| 8 | 0.00 | 15.46 | -2.00 | -14.00 | -12.09 | 2.00 |
| 9 | 0.00 | 10.42 | 1.50 | 2.40 | -6.68 | 0.82 |
| 10 | 0.00 | 16.25 | -4.96 | -23.28 | -12.51 | 1.70 |
| 11 | 0.00 | 12.14 | 2.13 | -0.15 | -8.40 | 2.17 |
| 12 | 0.00 | 17.99 | -4.39 | -25.97 | -14.24 | 3.03 |
| 13 | 0.00 | 8.66 | 1.73 | 3.96 | -5.29 | 0.60 |
| 14 | 0.00 | 14.50 | -4.73 | -21.73 | -11.13 | 1.47 |
| 15 | 0.00 | 10.39 | 2.35 | 1.41 | -7.02 | 1.94 |
| 16 | 0.00 | 16.23 | -4.17 | -24.41 | -12.86 | 2.81 |

防火设计控制的偶然组合号: 12, M=0.00, N=17.99, M=-25.97, N=-14.24

强度计算荷载比 =0.15

平面内稳定计算荷载比 =0.17

平面外稳定计算荷载比 =0.18

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: 20mm; 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 | 70.14 | 2.89 | 23.05 | -64.59 | -2.89 |
| 2 | 0.00 | 70.14 | -2.89 | -23.05 | -64.59 | 2.89 |
| 3 | 0.00 | 91.72 | -0.00 | -0.00 | -86.17 | 0.00 |
| 4 | 0.00 | 48.57 | -0.00 | -0.00 | -43.01 | 0.00 |
| 5 | 0.00 | 58.94 | 2.89 | 23.05 | -54.66 | -2.89 |
| 6 | 0.00 | 58.94 | -2.89 | -23.05 | -54.66 | 2.89 |
| 7 | 0.00 | 80.51 | -0.00 | -0.00 | -76.24 | 0.00 |
| 8 | 0.00 | 37.36 | -0.00 | -0.00 | -33.09 | 0.00 |
| 9 | 0.00 | 10.08 | 6.50 | 51.90 | -4.52 | -6.50 |
| 10 | 0.00 | 10.15 | -6.53 | -52.11 | -4.59 | 6.53 |
| 11 | 0.00 | 22.98 | 6.57 | 52.43 | -17.43 | -6.57 |
| 12 | 0.00 | 22.98 | -6.57 | -52.43 | -17.43 | 6.57 |
| 13 | 0.00 | -1.13 | 6.50 | 51.90 | 5.40 | -6.50 |
| 14 | 0.00 | -1.06 | -6.53 | -52.11 | 5.33 | 6.53 |
| 15 | 0.00 | 11.78 | 6.57 | 52.43 | -7.50 | -6.57 |
| 16 | 0.00 | 11.78 | -6.57 | -52.43 | -7.50 | 6.57 |
| 17 | 0.00 | 47.05 | 6.79 | 54.19 | -41.50 | -6.79 |
| 18 | 0.00 | 47.09 | -1.03 | -8.22 | -41.54 | 1.03 |
| 19 | 0.00 | 54.79 | 6.83 | 54.51 | -49.24 | -6.83 |
| 20 | 0.00 | 54.79 | -1.05 | -8.41 | -49.24 | 1.05 |
| 21 | 0.00 | 47.05 | 1.01 | 8.09 | -41.50 | -1.01 |
| 22 | 0.00 | 47.09 | -6.80 | -54.31 | -41.54 | 6.80 |
| 23 | 0.00 | 54.79 | 1.05 | 8.41 | -49.24 | -1.05 |
| 24 | 0.00 | 54.79 | -6.83 | -54.51 | -49.24 | 6.83 |
| 25 | 0.00 | 68.63 | 3.90 | 31.14 | -63.07 | -3.90 |
| 26 | 0.00 | 68.67 | -3.92 | -31.27 | -63.12 | 3.92 |
| 27 | 0.00 | 76.37 | 3.94 | 31.46 | -70.82 | -3.94 |
| 28 | 0.00 | 76.37 | -3.94 | -31.46 | -70.82 | 3.94 |
| 29 | 0.00 | 25.47 | 3.90 | 31.14 | -19.92 | -3.90 |
| 30 | 0.00 | 25.51 | -3.92 | -31.27 | -19.96 | 3.92 |
| 31 | 0.00 | 33.22 | 3.94 | 31.46 | -27.66 | -3.94 |
| 32 | 0.00 | 33.22 | -3.94 | -31.46 | -27.66 | 3.94 |
| 33 | 0.00 | 35.84 | 6.79 | 54.19 | -31.57 | -6.79 |
| 34 | 0.00 | 35.88 | -1.03 | -8.22 | -31.61 | 1.03 |
| 35 | 0.00 | 43.59 | 6.83 | 54.51 | -39.31 | -6.83 |
| 36 | 0.00 | 43.59 | -1.05 | -8.41 | -39.31 | 1.05 |
| 37 | 0.00 | 35.84 | 1.01 | 8.09 | -31.57 | -1.01 |
| 38 | 0.00 | 35.88 | -6.80 | -54.31 | -31.61 | 6.80 |
| 39 | 0.00 | 43.59 | 1.05 | 8.41 | -39.31 | -1.05 |
| 40 | 0.00 | 43.59 | -6.83 | -54.51 | -39.31 | 6.83 |
| 41 | 0.00 | 57.42 | 3.90 | 31.14 | -53.15 | -3.90 |
| 42 | 0.00 | 57.46 | -3.92 | -31.27 | -53.19 | 3.92 |
| 43 | 0.00 | 65.16 | 3.94 | 31.46 | -60.89 | -3.94 |
| 44 | 0.00 | 65.16 | -3.94 | -31.46 | -60.89 | 3.94 |
| 45 | 0.00 | 14.27 | 3.90 | 31.14 | -9.99 | -3.90 |
| 46 | 0.00 | 14.31 | -3.92 | -31.27 | -10.03 | 3.92 |
| 47 | 0.00 | 22.01 | 3.94 | 31.46 | -17.74 | -3.94 |
| 48 | 0.00 | 22.01 | -3.94 | -31.46 | -17.74 | 3.94 |
| 49 | 0.00 | 25.18 | 8.52 | 68.03 | -19.63 | -8.52 |
| 50 | 0.00 | 25.25 | -4.51 | -35.98 | -19.70 | 4.51 |
| 51 | 0.00 | 38.09 | 8.59 | 68.56 | -32.53 | -8.59 |
| 52 | 0.00 | 38.09 | -4.55 | -36.30 | -32.53 | 4.55 |
| 53 | 0.00 | 25.18 | 4.48 | 35.77 | -19.63 | -4.48 |
| 54 | 0.00 | 25.25 | -8.55 | -68.24 | -19.70 | 8.55 |
| 55 | 0.00 | 38.09 | 4.55 | 36.30 | -32.53 | -4.55 |
| 56 | 0.00 | 38.09 | -8.59 | -68.56 | -32.53 | 8.59 |
| 57 | 0.00 | 40.28 | 6.50 | 51.90 | -34.73 | -6.50 |
| 58 | 0.00 | 40.35 | -6.53 | -52.11 | -34.80 | 6.53 |
| 59 | 0.00 | 53.19 | 6.57 | 52.43 | -47.64 | -6.57 |
| 60 | 0.00 | 53.19 | -6.57 | -52.43 | -47.64 | 6.57 |
| 61 | 0.00 | 10.08 | 6.50 | 51.90 | -4.52 | -6.50 |
| 62 | 0.00 | 10.15 | -6.53 | -52.11 | -4.59 | 6.53 |
| 63 | 0.00 | 22.98 | 6.57 | 52.43 | -17.43 | -6.57 |
| 64 | 0.00 | 22.98 | -6.57 | -52.43 | -17.43 | 6.57 |
| 65 | 0.00 | 13.97 | 8.52 | 68.03 | -9.70 | -8.52 |
| 66 | 0.00 | 14.04 | -4.51 | -35.98 | -9.77 | 4.51 |
| 67 | 0.00 | 26.88 | 8.59 | 68.56 | -22.61 | -8.59 |
| 68 | 0.00 | 26.88 | -4.55 | -36.30 | -22.61 | 4.55 |
| 69 | 0.00 | 13.97 | 4.48 | 35.77 | -9.70 | -4.48 |
| 70 | 0.00 | 14.04 | -8.55 | -68.24 | -9.77 | 8.55 |
| 71 | 0.00 | 26.88 | 4.55 | 36.30 | -22.61 | -4.55 |
| 72 | 0.00 | 26.88 | -8.59 | -68.56 | -22.61 | 8.59 |
| 73 | 0.00 | 29.08 | 6.50 | 51.90 | -24.81 | -6.50 |
| 74 | 0.00 | 29.15 | -6.53 | -52.11 | -24.87 | 6.53 |
| 75 | 0.00 | 41.98 | 6.57 | 52.43 | -37.71 | -6.57 |
| 76 | 0.00 | 41.98 | -6.57 | -52.43 | -37.71 | 6.57 |
| 77 | 0.00 | -1.13 | 6.50 | 51.90 | 5.40 | -6.50 |
| 78 | 0.00 | -1.06 | -6.53 | -52.11 | 5.33 | 6.53 |
| 79 | 0.00 | 11.78 | 6.57 | 52.43 | -7.50 | -6.57 |
| 80 | 0.00 | 11.78 | -6.57 | -52.43 | -7.50 | 6.57 |
| 81 | 0.00 | 57.91 | 2.08 | 16.63 | -52.36 | -2.08 |
| 82 | 0.00 | 57.92 | 0.42 | 3.34 | -52.37 | -0.42 |
| 83 | 0.00 | 57.91 | -0.42 | -3.34 | -52.36 | 0.42 |
| 84 | 0.00 | 57.92 | -2.08 | -16.63 | -52.37 | 2.08 |
| 85 | 0.00 | 67.26 | 0.83 | 6.64 | -61.71 | -0.83 |
| 86 | 0.00 | 67.27 | -0.83 | -6.64 | -61.72 | 0.83 |
| 87 | 0.00 | 48.56 | 0.83 | 6.64 | -43.01 | -0.83 |
| 88 | 0.00 | 48.57 | -0.83 | -6.64 | -43.02 | 0.83 |
| 89 | 0.00 | 44.55 | 1.79 | 14.33 | -40.28 | -1.79 |
| 90 | 0.00 | 44.56 | 0.13 | 1.04 | -40.28 | -0.13 |
| 91 | 0.00 | 44.55 | -0.13 | -1.04 | -40.28 | 0.13 |
| 92 | 0.00 | 44.56 | -1.79 | -14.33 | -40.28 | 1.79 |
| 93 | 0.00 | 51.74 | 0.83 | 6.64 | -47.47 | -0.83 |
| 94 | 0.00 | 51.75 | -0.83 | -6.64 | -47.48 | 0.83 |
| 95 | 0.00 | 37.36 | 0.83 | 6.64 | -33.08 | -0.83 |
| 96 | 0.00 | 37.36 | -0.83 | -6.64 | -33.09 | 0.83 |

强度计算控制组合号: 56, M=0.00, N=38.09, M=-68.56, N=-32.53

强度计算应力比 =0.393

抗剪强度计算控制组合号: 56, V=-8.59

抗剪强度计算应力比 =0.029

平面内稳定计算最大应力对应组合号: 56, M=0.00, N=38.09, M=-68.56, N=-32.53

平面内稳定计算最大应力 (N/mm\*mm) =133.05

平面内稳定计算最大应力比 =0.436

临界弯矩Mcr(kN\*m) =175.96

平面外稳定计算最大应力比 =0.675

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 =0.393 < 1.0

抗剪强度计算应力比 =0.029 < 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 | 44.55 | 0.96 | 7.68 | -40.28 | -0.96 |
| 2 | 0.00 | 44.55 | -0.96 | -7.68 | -40.28 | 0.96 |
| 3 | 0.00 | 51.74 | -0.00 | -0.00 | -47.47 | 0.00 |
| 4 | 0.00 | 37.36 | -0.00 | -0.00 | -33.09 | 0.00 |
| 5 | 0.00 | 40.82 | 0.96 | 7.68 | -36.97 | -0.96 |
| 6 | 0.00 | 40.82 | -0.96 | -7.68 | -36.97 | 0.96 |
| 7 | 0.00 | 48.01 | -0.00 | -0.00 | -44.16 | 0.00 |
| 8 | 0.00 | 33.62 | -0.00 | -0.00 | -29.78 | 0.00 |
| 9 | 0.00 | 27.10 | 1.73 | 13.84 | -22.82 | -1.73 |
| 10 | 0.00 | 27.11 | -1.74 | -13.90 | -22.84 | 1.74 |
| 11 | 0.00 | 30.54 | 1.75 | 13.98 | -26.27 | -1.75 |
| 12 | 0.00 | 30.54 | -1.75 | -13.98 | -26.27 | 1.75 |
| 13 | 0.00 | 23.36 | 1.73 | 13.84 | -19.51 | -1.73 |
| 14 | 0.00 | 23.38 | -1.74 | -13.90 | -19.53 | 1.74 |
| 15 | 0.00 | 26.80 | 1.75 | 13.98 | -22.96 | -1.75 |
| 16 | 0.00 | 26.80 | -1.75 | -13.98 | -22.96 | 1.75 |

防火设计控制的偶然组合号: 12, M=0.00, N=30.54, M=-13.98, N=-26.27

强度计算荷载比 =0.08

平面内稳定计算荷载比 =0.13

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): 644.77℃

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: 20mm; 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 | 41.19 | 6.04 | 42.25 | -36.32 | -6.04 |
| 2 | 0.00 | 21.79 | 2.64 | 18.46 | -16.92 | -2.64 |
| 3 | 0.00 | 41.21 | 5.78 | 40.46 | -36.34 | -5.78 |
| 4 | 0.00 | 21.77 | 2.89 | 20.25 | -16.90 | -2.89 |
| 5 | 0.00 | 35.92 | 5.37 | 37.59 | -32.17 | -5.37 |
| 6 | 0.00 | 16.52 | 1.97 | 13.80 | -12.77 | -1.97 |
| 7 | 0.00 | 35.94 | 5.11 | 35.80 | -32.19 | -5.11 |
| 8 | 0.00 | 16.50 | 2.23 | 15.59 | -12.76 | -2.23 |
| 9 | 0.00 | 17.86 | 13.10 | 49.08 | -12.99 | -0.92 |
| 10 | 0.00 | -3.95 | -11.12 | -47.17 | 8.82 | 2.36 |
| 11 | 0.00 | 24.39 | 11.02 | 59.30 | -19.52 | -5.93 |
| 12 | 0.00 | 2.49 | -13.41 | -37.53 | 2.38 | -2.69 |
| 13 | 0.00 | 12.59 | 12.44 | 44.42 | -8.84 | -0.26 |
| 14 | 0.00 | -9.22 | -11.78 | -51.83 | 12.97 | 3.02 |
| 15 | 0.00 | 19.12 | 10.35 | 54.64 | -15.38 | -5.26 |
| 16 | 0.00 | -2.78 | -14.08 | -42.19 | 6.53 | -2.02 |
| 17 | 0.00 | 38.20 | 12.17 | 59.58 | -33.33 | -4.86 |
| 18 | 0.00 | 25.11 | -2.37 | 1.83 | -20.24 | -2.89 |
| 19 | 0.00 | 42.12 | 10.92 | 65.71 | -37.25 | -7.86 |
| 20 | 0.00 | 28.98 | -3.74 | 7.61 | -24.11 | -5.92 |
| 21 | 0.00 | 18.80 | 8.77 | 35.79 | -13.93 | -1.46 |
| 22 | 0.00 | 5.71 | -5.77 | -21.96 | -0.84 | 0.51 |
| 23 | 0.00 | 22.72 | 7.52 | 41.92 | -17.85 | -4.46 |
| 24 | 0.00 | 9.58 | -7.14 | -16.18 | -4.71 | -2.52 |
| 25 | 0.00 | 38.22 | 11.91 | 57.79 | -33.35 | -4.60 |
| 26 | 0.00 | 25.13 | -2.62 | 0.04 | -20.26 | -2.63 |
| 27 | 0.00 | 42.14 | 10.66 | 63.92 | -37.27 | -7.60 |
| 28 | 0.00 | 28.99 | -4.00 | 5.82 | -24.12 | -5.66 |
| 29 | 0.00 | 18.78 | 9.02 | 37.58 | -13.91 | -1.71 |
| 30 | 0.00 | 5.70 | -5.51 | -20.17 | -0.83 | 0.25 |
| 31 | 0.00 | 22.70 | 7.77 | 43.71 | -17.83 | -4.72 |
| 32 | 0.00 | 9.56 | -6.88 | -14.39 | -4.69 | -2.77 |
| 33 | 0.00 | 32.93 | 11.50 | 54.92 | -29.18 | -4.19 |
| 34 | 0.00 | 19.84 | -3.03 | -2.83 | -16.10 | -2.22 |
| 35 | 0.00 | 36.85 | 10.25 | 61.05 | -33.10 | -7.19 |
| 36 | 0.00 | 23.71 | -4.41 | 2.95 | -19.96 | -5.25 |
| 37 | 0.00 | 13.53 | 8.10 | 31.13 | -9.78 | -0.79 |
| 38 | 0.00 | 0.44 | -6.43 | -26.62 | 3.31 | 1.18 |
| 39 | 0.00 | 17.45 | 6.85 | 37.26 | -13.70 | -3.79 |
| 40 | 0.00 | 4.30 | -7.81 | -20.84 | -0.56 | -1.85 |
| 41 | 0.00 | 32.95 | 11.24 | 53.12 | -29.20 | -3.94 |
| 42 | 0.00 | 19.86 | -3.29 | -4.62 | -16.11 | -1.97 |
| 43 | 0.00 | 36.87 | 9.99 | 59.26 | -33.12 | -6.94 |
| 44 | 0.00 | 23.72 | -4.66 | 1.16 | -19.98 | -4.99 |
| 45 | 0.00 | 13.51 | 8.36 | 32.92 | -9.77 | -1.05 |
| 46 | 0.00 | 0.42 | -6.18 | -24.83 | 3.32 | 0.92 |
| 47 | 0.00 | 17.43 | 7.11 | 39.05 | -13.69 | -4.05 |
| 48 | 0.00 | 4.29 | -7.55 | -19.05 | -0.54 | -2.11 |
| 49 | 0.00 | 30.70 | 15.31 | 64.52 | -25.83 | -3.13 |
| 50 | 0.00 | 8.89 | -8.91 | -31.73 | -4.02 | 0.15 |
| 51 | 0.00 | 37.24 | 13.22 | 74.74 | -32.37 | -8.13 |
| 52 | 0.00 | 15.33 | -11.20 | -22.10 | -10.46 | -4.89 |
| 53 | 0.00 | 17.12 | 12.93 | 47.86 | -12.25 | -0.75 |
| 54 | 0.00 | -4.69 | -11.29 | -48.39 | 9.56 | 2.53 |
| 55 | 0.00 | 23.66 | 10.84 | 58.08 | -18.79 | -5.75 |
| 56 | 0.00 | 1.75 | -13.58 | -38.75 | 3.12 | -2.51 |
| 57 | 0.00 | 30.71 | 15.13 | 63.26 | -25.84 | -2.95 |
| 58 | 0.00 | 8.90 | -9.09 | -32.99 | -4.03 | 0.33 |
| 59 | 0.00 | 37.25 | 13.04 | 73.48 | -32.38 | -7.95 |
| 60 | 0.00 | 15.34 | -11.38 | -23.35 | -10.47 | -4.71 |
| 61 | 0.00 | 17.11 | 13.11 | 49.12 | -12.24 | -0.93 |
| 62 | 0.00 | -4.70 | -11.11 | -47.13 | 9.57 | 2.35 |
| 63 | 0.00 | 23.64 | 11.02 | 59.34 | -18.77 | -5.93 |
| 64 | 0.00 | 1.74 | -13.40 | -37.49 | 3.13 | -2.69 |
| 65 | 0.00 | 25.43 | 14.64 | 59.85 | -21.69 | -2.46 |
| 66 | 0.00 | 3.62 | -9.58 | -36.40 | 0.13 | 0.82 |
| 67 | 0.00 | 31.96 | 12.56 | 70.07 | -28.22 | -7.46 |
| 68 | 0.00 | 10.06 | -11.87 | -26.76 | -6.31 | -4.23 |
| 69 | 0.00 | 11.85 | 12.26 | 43.20 | -8.10 | -0.08 |
| 70 | 0.00 | -9.96 | -11.96 | -53.05 | 13.71 | 3.20 |
| 71 | 0.00 | 18.38 | 10.18 | 53.42 | -14.64 | -5.08 |
| 72 | 0.00 | -3.52 | -14.25 | -43.41 | 7.27 | -1.85 |
| 73 | 0.00 | 25.44 | 14.46 | 58.60 | -21.70 | -2.28 |
| 74 | 0.00 | 3.63 | -9.76 | -37.65 | 0.12 | 1.00 |
| 75 | 0.00 | 31.98 | 12.38 | 68.82 | -28.23 | -7.28 |
| 76 | 0.00 | 10.07 | -12.05 | -28.01 | -6.32 | -4.05 |
| 77 | 0.00 | 11.84 | 12.44 | 44.45 | -8.09 | -0.26 |
| 78 | 0.00 | -9.97 | -11.78 | -51.79 | 13.72 | 3.02 |
| 79 | 0.00 | 18.37 | 10.36 | 54.67 | -14.63 | -5.26 |
| 80 | 0.00 | -3.53 | -14.07 | -42.16 | 7.28 | -2.03 |
| 81 | 0.00 | 31.48 | 4.97 | 34.79 | -26.61 | -4.97 |
| 82 | 0.00 | 30.11 | 3.53 | 24.73 | -25.24 | -3.53 |
| 83 | 0.00 | 23.07 | 3.50 | 24.48 | -18.20 | -3.50 |
| 84 | 0.00 | 21.71 | 2.06 | 14.42 | -16.84 | -2.06 |
| 85 | 0.00 | 31.49 | 4.86 | 34.01 | -26.62 | -4.86 |
| 86 | 0.00 | 30.12 | 3.42 | 23.96 | -25.25 | -3.42 |
| 87 | 0.00 | 23.06 | 3.61 | 25.25 | -18.19 | -3.61 |
| 88 | 0.00 | 21.70 | 2.17 | 15.20 | -16.83 | -2.17 |
| 89 | 0.00 | 24.37 | 3.99 | 27.92 | -20.63 | -3.99 |
| 90 | 0.00 | 23.01 | 2.55 | 17.86 | -19.26 | -2.55 |
| 91 | 0.00 | 17.90 | 2.86 | 19.99 | -14.16 | -2.86 |
| 92 | 0.00 | 16.54 | 1.42 | 9.93 | -12.79 | -1.42 |
| 93 | 0.00 | 24.38 | 3.90 | 27.32 | -20.63 | -3.90 |
| 94 | 0.00 | 23.01 | 2.47 | 17.27 | -19.27 | -2.47 |
| 95 | 0.00 | 17.90 | 2.94 | 20.59 | -14.15 | -2.94 |
| 96 | 0.00 | 16.53 | 1.50 | 10.53 | -12.79 | -1.50 |

强度计算控制组合号: 51, M=0.00, N=37.24, M=74.74, N=-32.37

强度计算应力比 =0.428

抗剪强度计算控制组合号: 49, V=15.31

抗剪强度计算应力比 =0.052

平面内稳定计算最大应力对应组合号: 51, M=0.00, N=37.24, M=74.74, N=-32.37

平面内稳定计算最大应力 (N/mm\*mm) =144.87

平面内稳定计算最大应力比 =0.475

临界弯矩Mcr(kN\*m) =213.12

平面外稳定计算最大应力比 =0.623

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 =0.428 < 1.0

抗剪强度计算应力比 =0.052 < 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 | 23.69 | 3.27 | 22.89 | -19.94 | -3.27 |
| 2 | 0.00 | 17.22 | 2.14 | 14.96 | -13.48 | -2.14 |
| 3 | 0.00 | 23.69 | 3.18 | 22.29 | -19.95 | -3.18 |
| 4 | 0.00 | 17.22 | 2.22 | 15.56 | -13.47 | -2.22 |
| 5 | 0.00 | 21.93 | 3.05 | 21.34 | -18.56 | -3.05 |
| 6 | 0.00 | 15.46 | 1.92 | 13.41 | -12.09 | -1.92 |
| 7 | 0.00 | 21.94 | 2.96 | 20.74 | -18.57 | -2.96 |
| 8 | 0.00 | 15.46 | 2.00 | 14.00 | -12.09 | -2.00 |
| 9 | 0.00 | 16.24 | 4.94 | 23.24 | -12.50 | -1.70 |
| 10 | 0.00 | 10.43 | -1.51 | -2.42 | -6.68 | -0.82 |
| 11 | 0.00 | 17.99 | 4.39 | 25.97 | -14.24 | -3.03 |
| 12 | 0.00 | 12.14 | -2.13 | 0.15 | -8.40 | -2.17 |
| 13 | 0.00 | 14.49 | 4.72 | 21.69 | -11.12 | -1.47 |
| 14 | 0.00 | 8.67 | -1.74 | -3.98 | -5.30 | -0.60 |
| 15 | 0.00 | 16.23 | 4.17 | 24.41 | -12.86 | -2.81 |
| 16 | 0.00 | 10.39 | -2.35 | -1.41 | -7.02 | -1.94 |

防火设计控制的偶然组合号: 11, M=0.00, N=17.99, M=25.97, N=-14.24

强度计算荷载比 =0.15

平面内稳定计算荷载比 =0.17

平面外稳定计算荷载比 =0.18

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 | 4.25 | 0.73 | 5.67 | 0.00 | 0.00 | -0.00 |
| 10 | -4.26 | 0.73 | -5.68 | -0.00 | -0.00 | 0.00 |
| 11 | 4.26 | 0.73 | 5.68 | 0.00 | 0.00 | -0.00 |
| 12 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | 0.00 |
| 13 | 4.25 | 0.56 | 5.67 | 0.00 | 0.00 | -0.00 |
| 14 | -4.26 | 0.56 | -5.68 | -0.00 | -0.00 | 0.00 |
| 15 | 4.26 | 0.56 | 5.68 | 0.00 | 0.00 | -0.00 |
| 16 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | 0.00 |
| 17 | 2.55 | 0.73 | 3.40 | 0.00 | 0.00 | -0.00 |
| 18 | -2.55 | 0.73 | -3.41 | -0.00 | -0.00 | 0.00 |
| 19 | 2.55 | 0.73 | 3.41 | 0.00 | 0.00 | -0.00 |
| 20 | -2.55 | 0.73 | -3.41 | 0.00 | 0.00 | 0.00 |
| 21 | 2.55 | 0.73 | 3.40 | 0.00 | 0.00 | -0.00 |
| 22 | -2.55 | 0.73 | -3.41 | -0.00 | -0.00 | 0.00 |
| 23 | 2.55 | 0.73 | 3.41 | 0.00 | 0.00 | -0.00 |
| 24 | -2.55 | 0.73 | -3.41 | 0.00 | 0.00 | 0.00 |
| 25 | 2.55 | 0.73 | 3.40 | 0.00 | 0.00 | -0.00 |
| 26 | -2.55 | 0.73 | -3.41 | -0.00 | -0.00 | 0.00 |
| 27 | 2.55 | 0.73 | 3.41 | 0.00 | 0.00 | -0.00 |
| 28 | -2.55 | 0.73 | -3.41 | 0.00 | 0.00 | 0.00 |
| 29 | 2.55 | 0.73 | 3.40 | 0.00 | 0.00 | -0.00 |
| 30 | -2.55 | 0.73 | -3.41 | -0.00 | -0.00 | 0.00 |
| 31 | 2.55 | 0.73 | 3.41 | 0.00 | 0.00 | -0.00 |
| 32 | -2.55 | 0.73 | -3.41 | 0.00 | 0.00 | 0.00 |
| 33 | 2.55 | 0.56 | 3.40 | 0.00 | 0.00 | -0.00 |
| 34 | -2.55 | 0.56 | -3.41 | -0.00 | -0.00 | 0.00 |
| 35 | 2.55 | 0.56 | 3.41 | 0.00 | 0.00 | -0.00 |
| 36 | -2.55 | 0.56 | -3.41 | 0.00 | 0.00 | 0.00 |
| 37 | 2.55 | 0.56 | 3.40 | 0.00 | 0.00 | -0.00 |
| 38 | -2.55 | 0.56 | -3.41 | -0.00 | -0.00 | 0.00 |
| 39 | 2.55 | 0.56 | 3.41 | 0.00 | 0.00 | -0.00 |
| 40 | -2.55 | 0.56 | -3.41 | 0.00 | 0.00 | 0.00 |
| 41 | 2.55 | 0.56 | 3.40 | 0.00 | 0.00 | -0.00 |
| 42 | -2.55 | 0.56 | -3.41 | -0.00 | -0.00 | 0.00 |
| 43 | 2.55 | 0.56 | 3.41 | 0.00 | 0.00 | -0.00 |
| 44 | -2.55 | 0.56 | -3.41 | 0.00 | 0.00 | 0.00 |
| 45 | 2.55 | 0.56 | 3.40 | 0.00 | 0.00 | -0.00 |
| 46 | -2.55 | 0.56 | -3.41 | -0.00 | -0.00 | 0.00 |
| 47 | 2.55 | 0.56 | 3.41 | 0.00 | 0.00 | -0.00 |
| 48 | -2.55 | 0.56 | -3.41 | 0.00 | 0.00 | 0.00 |
| 49 | 4.25 | 0.73 | 5.67 | 0.00 | 0.00 | -0.00 |
| 50 | -4.26 | 0.73 | -5.68 | -0.00 | -0.00 | 0.00 |
| 51 | 4.26 | 0.73 | 5.68 | 0.00 | 0.00 | -0.00 |
| 52 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | 0.00 |
| 53 | 4.25 | 0.73 | 5.67 | 0.00 | 0.00 | -0.00 |
| 54 | -4.26 | 0.73 | -5.68 | -0.00 | -0.00 | 0.00 |
| 55 | 4.26 | 0.73 | 5.68 | 0.00 | 0.00 | -0.00 |
| 56 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | 0.00 |
| 57 | 4.25 | 0.73 | 5.67 | 0.00 | 0.00 | -0.00 |
| 58 | -4.26 | 0.73 | -5.68 | -0.00 | -0.00 | 0.00 |
| 59 | 4.26 | 0.73 | 5.68 | 0.00 | 0.00 | -0.00 |
| 60 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | 0.00 |
| 61 | 4.25 | 0.73 | 5.67 | 0.00 | 0.00 | -0.00 |
| 62 | -4.26 | 0.73 | -5.68 | -0.00 | -0.00 | 0.00 |
| 63 | 4.26 | 0.73 | 5.68 | 0.00 | 0.00 | -0.00 |
| 64 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | 0.00 |
| 65 | 4.25 | 0.56 | 5.67 | 0.00 | 0.00 | -0.00 |
| 66 | -4.26 | 0.56 | -5.68 | -0.00 | -0.00 | 0.00 |
| 67 | 4.26 | 0.56 | 5.68 | 0.00 | 0.00 | -0.00 |
| 68 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | 0.00 |
| 69 | 4.25 | 0.56 | 5.67 | 0.00 | 0.00 | -0.00 |
| 70 | -4.26 | 0.56 | -5.68 | -0.00 | -0.00 | 0.00 |
| 71 | 4.26 | 0.56 | 5.68 | 0.00 | 0.00 | -0.00 |
| 72 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | 0.00 |
| 73 | 4.25 | 0.56 | 5.67 | 0.00 | 0.00 | -0.00 |
| 74 | -4.26 | 0.56 | -5.68 | -0.00 | -0.00 | 0.00 |
| 75 | 4.26 | 0.56 | 5.68 | 0.00 | 0.00 | -0.00 |
| 76 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | 0.00 |
| 77 | 4.25 | 0.56 | 5.67 | 0.00 | 0.00 | -0.00 |
| 78 | -4.26 | 0.56 | -5.68 | -0.00 | -0.00 | 0.00 |
| 79 | 4.26 | 0.56 | 5.68 | 0.00 | 0.00 | -0.00 |
| 80 | -4.26 | 0.56 | -5.68 | 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: 54, M=-4.26, N=0.73, M=-0.00, N=-0.00

强度计算应力比 =0.051

抗剪强度计算控制组合号: 58, V=-5.68

抗剪强度计算应力比 =0.029

平面内稳定计算最大应力对应组合号: 54, M=-4.26, N=0.73, M=-0.00, N=-0.00

平面内稳定计算最大应力 (N/mm\*mm) =14.56

平面内稳定计算最大应力比 =0.048

临界弯矩Mcr(kN\*m) =1309.58

平面外稳定计算最大应力比 =0.018

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 =0.051 < 1.0

抗剪强度计算应力比 =0.029 < 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 | 1.13 | 0.56 | 1.51 | 0.00 | 0.00 | -0.00 |
| 10 | -1.14 | 0.56 | -1.51 | -0.00 | 0.00 | 0.00 |
| 11 | 1.14 | 0.56 | 1.51 | 0.00 | 0.00 | -0.00 |
| 12 | -1.14 | 0.56 | -1.51 | 0.00 | 0.00 | 0.00 |
| 13 | 1.13 | 0.51 | 1.51 | 0.00 | 0.00 | -0.00 |
| 14 | -1.14 | 0.51 | -1.51 | -0.00 | -0.00 | 0.00 |
| 15 | 1.14 | 0.51 | 1.51 | 0.00 | 0.00 | -0.00 |
| 16 | -1.14 | 0.51 | -1.51 | 0.00 | 0.00 | 0.00 |

防火设计控制的偶然组合号: 10, M=-1.14, 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 | 4.25 | 0.73 | 5.67 | -0.00 | -0.00 | -0.00 |
| 10 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | -0.00 |
| 11 | 4.26 | 0.73 | 5.68 | -0.00 | -0.00 | 0.00 |
| 12 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | -0.00 |
| 13 | 4.25 | 0.56 | 5.67 | -0.00 | -0.00 | -0.00 |
| 14 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | -0.00 |
| 15 | 4.26 | 0.56 | 5.68 | -0.00 | -0.00 | 0.00 |
| 16 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | -0.00 |
| 17 | 2.55 | 0.73 | 3.40 | -0.00 | -0.00 | -0.00 |
| 18 | -2.55 | 0.73 | -3.41 | 0.00 | 0.00 | -0.00 |
| 19 | 2.55 | 0.73 | 3.41 | -0.00 | -0.00 | 0.00 |
| 20 | -2.55 | 0.73 | -3.41 | 0.00 | 0.00 | -0.00 |
| 21 | 2.55 | 0.73 | 3.40 | -0.00 | -0.00 | 0.00 |
| 22 | -2.55 | 0.73 | -3.41 | 0.00 | 0.00 | 0.00 |
| 23 | 2.55 | 0.73 | 3.41 | -0.00 | -0.00 | 0.00 |
| 24 | -2.55 | 0.73 | -3.41 | 0.00 | -0.00 | 0.00 |
| 25 | 2.55 | 0.73 | 3.40 | -0.00 | -0.00 | 0.00 |
| 26 | -2.55 | 0.73 | -3.41 | 0.00 | -0.00 | 0.00 |
| 27 | 2.55 | 0.73 | 3.41 | -0.00 | -0.00 | 0.00 |
| 28 | -2.55 | 0.73 | -3.41 | 0.00 | -0.00 | -0.00 |
| 29 | 2.55 | 0.73 | 3.40 | -0.00 | -0.00 | -0.00 |
| 30 | -2.55 | 0.73 | -3.41 | 0.00 | 0.00 | 0.00 |
| 31 | 2.55 | 0.73 | 3.41 | -0.00 | -0.00 | 0.00 |
| 32 | -2.55 | 0.73 | -3.41 | 0.00 | 0.00 | -0.00 |
| 33 | 2.55 | 0.56 | 3.40 | -0.00 | -0.00 | -0.00 |
| 34 | -2.55 | 0.56 | -3.41 | 0.00 | 0.00 | -0.00 |
| 35 | 2.55 | 0.56 | 3.41 | -0.00 | -0.00 | 0.00 |
| 36 | -2.55 | 0.56 | -3.41 | 0.00 | 0.00 | -0.00 |
| 37 | 2.55 | 0.56 | 3.40 | -0.00 | -0.00 | 0.00 |
| 38 | -2.55 | 0.56 | -3.41 | 0.00 | 0.00 | 0.00 |
| 39 | 2.55 | 0.56 | 3.41 | -0.00 | -0.00 | 0.00 |
| 40 | -2.55 | 0.56 | -3.41 | 0.00 | -0.00 | 0.00 |
| 41 | 2.55 | 0.56 | 3.40 | -0.00 | -0.00 | 0.00 |
| 42 | -2.55 | 0.56 | -3.41 | 0.00 | -0.00 | 0.00 |
| 43 | 2.55 | 0.56 | 3.41 | -0.00 | -0.00 | 0.00 |
| 44 | -2.55 | 0.56 | -3.41 | 0.00 | -0.00 | -0.00 |
| 45 | 2.55 | 0.56 | 3.40 | -0.00 | -0.00 | -0.00 |
| 46 | -2.55 | 0.56 | -3.41 | 0.00 | 0.00 | 0.00 |
| 47 | 2.55 | 0.56 | 3.41 | -0.00 | -0.00 | 0.00 |
| 48 | -2.55 | 0.56 | -3.41 | 0.00 | 0.00 | -0.00 |
| 49 | 4.25 | 0.73 | 5.67 | -0.00 | -0.00 | -0.00 |
| 50 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | -0.00 |
| 51 | 4.26 | 0.73 | 5.68 | -0.00 | -0.00 | 0.00 |
| 52 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | -0.00 |
| 53 | 4.25 | 0.73 | 5.67 | -0.00 | -0.00 | -0.00 |
| 54 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | 0.00 |
| 55 | 4.26 | 0.73 | 5.68 | -0.00 | -0.00 | 0.00 |
| 56 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | -0.00 |
| 57 | 4.25 | 0.73 | 5.67 | -0.00 | -0.00 | -0.00 |
| 58 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | 0.00 |
| 59 | 4.26 | 0.73 | 5.68 | -0.00 | -0.00 | 0.00 |
| 60 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | -0.00 |
| 61 | 4.25 | 0.73 | 5.67 | -0.00 | -0.00 | -0.00 |
| 62 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | -0.00 |
| 63 | 4.26 | 0.73 | 5.68 | -0.00 | -0.00 | 0.00 |
| 64 | -4.26 | 0.73 | -5.68 | 0.00 | 0.00 | -0.00 |
| 65 | 4.25 | 0.56 | 5.67 | -0.00 | -0.00 | -0.00 |
| 66 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | -0.00 |
| 67 | 4.26 | 0.56 | 5.68 | -0.00 | -0.00 | 0.00 |
| 68 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | -0.00 |
| 69 | 4.25 | 0.56 | 5.67 | -0.00 | -0.00 | -0.00 |
| 70 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | 0.00 |
| 71 | 4.26 | 0.56 | 5.68 | -0.00 | -0.00 | 0.00 |
| 72 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | -0.00 |
| 73 | 4.25 | 0.56 | 5.67 | -0.00 | -0.00 | -0.00 |
| 74 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | 0.00 |
| 75 | 4.26 | 0.56 | 5.68 | -0.00 | -0.00 | 0.00 |
| 76 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | -0.00 |
| 77 | 4.25 | 0.56 | 5.67 | -0.00 | -0.00 | -0.00 |
| 78 | -4.26 | 0.56 | -5.68 | 0.00 | 0.00 | -0.00 |
| 79 | 4.26 | 0.56 | 5.68 | -0.00 | -0.00 | 0.00 |
| 80 | -4.26 | 0.56 | -5.68 | 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=4.26, N=0.73, M=-0.00, N=-0.00

强度计算应力比 =0.051

抗剪强度计算控制组合号: 54, V=-5.68

抗剪强度计算应力比 =0.029

平面内稳定计算最大应力对应组合号: 51, M=4.26, N=0.73, M=-0.00, N=-0.00

平面内稳定计算最大应力 (N/mm\*mm) =14.56

平面内稳定计算最大应力比 =0.048

临界弯矩Mcr(kN\*m) =1309.58

平面外稳定计算最大应力比 =0.018

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 =0.051 < 1.0

抗剪强度计算应力比 =0.029 < 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 | 1.13 | 0.56 | 1.51 | -0.00 | -0.00 | -0.00 |
| 10 | -1.14 | 0.56 | -1.51 | 0.00 | 0.00 | -0.00 |
| 11 | 1.14 | 0.56 | 1.51 | -0.00 | -0.00 | 0.00 |
| 12 | -1.14 | 0.56 | -1.51 | 0.00 | -0.00 | -0.00 |
| 13 | 1.13 | 0.51 | 1.51 | -0.00 | -0.00 | -0.00 |
| 14 | -1.14 | 0.51 | -1.51 | 0.00 | 0.00 | -0.00 |
| 15 | 1.14 | 0.51 | 1.51 | -0.00 | -0.00 | 0.00 |
| 16 | -1.14 | 0.51 | -1.51 | 0.00 | -0.00 | -0.00 |

防火设计控制的偶然组合号: 12, M=-1.14, 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 | 42.46 | 8.87 | 34.89 | 56.30 | -6.08 | -3.58 |
| 2 | 18.40 | 3.91 | 16.03 | 19.99 | -2.92 | -0.19 |
| 3 | 40.53 | 8.60 | 35.03 | 56.30 | -6.08 | -3.58 |
| 4 | 20.33 | 4.17 | 15.89 | 19.99 | -2.92 | -0.19 |
| 5 | 37.78 | 7.88 | 30.98 | 50.44 | -5.39 | -3.29 |
| 6 | 13.72 | 2.93 | 12.11 | 14.13 | -2.23 | 0.10 |
| 7 | 35.85 | 7.62 | 31.12 | 50.44 | -5.39 | -3.29 |
| 8 | 15.65 | 3.19 | 11.98 | 14.13 | -2.23 | 0.10 |
| 9 | -51.26 | 2.53 | -9.81 | 8.53 | -1.27 | 7.23 |
| 10 | 53.56 | -3.76 | 12.63 | -3.58 | 5.02 | -7.30 |
| 11 | -41.71 | 8.09 | -3.77 | 16.00 | -6.83 | 6.48 |
| 12 | 63.63 | 1.74 | 18.71 | 3.66 | -0.49 | -8.12 |
| 13 | -55.94 | 1.55 | -13.72 | 2.67 | -0.58 | 7.52 |
| 14 | 48.88 | -4.74 | 8.72 | -9.44 | 5.71 | -7.01 |
| 15 | -46.39 | 7.11 | -7.69 | 10.14 | -6.14 | 6.77 |
| 16 | 58.95 | 0.76 | 14.80 | -2.20 | 0.20 | -7.83 |
| 17 | -0.46 | 7.83 | 18.83 | 46.18 | -5.05 | 1.51 |
| 18 | 62.43 | 4.06 | 32.30 | 38.91 | -1.28 | -7.20 |
| 19 | 5.26 | 11.17 | 22.46 | 50.66 | -8.39 | 1.06 |
| 20 | 68.47 | 7.36 | 35.95 | 43.26 | -4.58 | -7.70 |
| 21 | -24.52 | 2.87 | -0.03 | 9.87 | -1.88 | 4.90 |
| 22 | 38.37 | -0.90 | 13.43 | 2.60 | 1.89 | -3.81 |
| 23 | -18.79 | 6.21 | 3.59 | 14.35 | -5.22 | 4.45 |
| 24 | 44.42 | 2.40 | 17.08 | 6.95 | -1.41 | -4.31 |
| 25 | -2.39 | 7.57 | 18.97 | 46.18 | -5.05 | 1.51 |
| 26 | 60.50 | 3.79 | 32.44 | 38.91 | -1.28 | -7.20 |
| 27 | 3.34 | 10.90 | 22.59 | 50.66 | -8.39 | 1.06 |
| 28 | 66.55 | 7.10 | 36.08 | 43.26 | -4.58 | -7.70 |
| 29 | -22.60 | 3.14 | -0.17 | 9.87 | -1.88 | 4.90 |
| 30 | 40.30 | -0.63 | 13.29 | 2.60 | 1.89 | -3.81 |
| 31 | -16.87 | 6.48 | 3.45 | 14.35 | -5.22 | 4.45 |
| 32 | 46.34 | 2.67 | 16.94 | 6.95 | -1.41 | -4.31 |
| 33 | -5.14 | 6.85 | 14.92 | 40.32 | -4.36 | 1.80 |
| 34 | 57.75 | 3.08 | 28.39 | 33.05 | -0.59 | -6.91 |
| 35 | 0.58 | 10.19 | 18.54 | 44.80 | -7.69 | 1.35 |
| 36 | 63.79 | 6.38 | 32.03 | 37.40 | -3.89 | -7.41 |
| 37 | -29.20 | 1.89 | -3.95 | 4.01 | -1.19 | 5.19 |
| 38 | 33.69 | -1.88 | 9.52 | -3.26 | 2.58 | -3.52 |
| 39 | -23.47 | 5.23 | -0.33 | 8.49 | -4.53 | 4.74 |
| 40 | 39.74 | 1.42 | 13.17 | 1.08 | -0.72 | -4.02 |
| 41 | -7.07 | 6.58 | 15.06 | 40.32 | -4.36 | 1.80 |
| 42 | 55.82 | 2.81 | 28.52 | 33.05 | -0.59 | -6.91 |
| 43 | -1.34 | 9.92 | 18.68 | 44.80 | -7.69 | 1.35 |
| 44 | 61.87 | 6.12 | 32.17 | 37.40 | -3.89 | -7.41 |
| 45 | -27.28 | 2.16 | -4.08 | 4.01 | -1.19 | 5.19 |
| 46 | 35.62 | -1.61 | 9.38 | -3.26 | 2.58 | -3.52 |
| 47 | -21.55 | 5.49 | -0.46 | 8.49 | -4.53 | 4.74 |
| 48 | 41.66 | 1.69 | 13.03 | 1.08 | -0.72 | -4.02 |
| 49 | -35.73 | 5.76 | 2.75 | 30.16 | -3.43 | 5.60 |
| 50 | 69.09 | -0.53 | 25.19 | 18.05 | 2.85 | -8.92 |
| 51 | -26.19 | 11.32 | 8.78 | 37.63 | -8.99 | 4.85 |
| 52 | 79.16 | 4.97 | 31.27 | 25.29 | -2.65 | -9.75 |
| 53 | -52.57 | 2.29 | -10.46 | 4.75 | -1.22 | 7.98 |
| 54 | 52.25 | -4.00 | 11.98 | -7.37 | 5.07 | -6.55 |
| 55 | -43.03 | 7.85 | -4.42 | 12.21 | -6.78 | 7.23 |
| 56 | 62.32 | 1.50 | 18.06 | -0.13 | -0.43 | -7.37 |
| 57 | -37.08 | 5.57 | 2.84 | 30.16 | -3.43 | 5.60 |
| 58 | 67.74 | -0.71 | 25.28 | 18.05 | 2.85 | -8.92 |
| 59 | -27.53 | 11.13 | 8.88 | 37.63 | -8.99 | 4.85 |
| 60 | 77.81 | 4.79 | 31.36 | 25.29 | -2.65 | -9.75 |
| 61 | -51.23 | 2.47 | -10.56 | 4.75 | -1.22 | 7.98 |
| 62 | 53.60 | -3.81 | 11.88 | -7.37 | 5.07 | -6.55 |
| 63 | -41.68 | 8.03 | -4.52 | 12.21 | -6.78 | 7.23 |
| 64 | 63.67 | 1.69 | 17.96 | -0.13 | -0.43 | -7.37 |
| 65 | -40.41 | 4.77 | -1.17 | 24.30 | -2.74 | 5.89 |
| 66 | 64.41 | -1.51 | 21.28 | 12.19 | 3.54 | -8.63 |
| 67 | -30.87 | 10.34 | 4.87 | 31.77 | -8.30 | 5.14 |
| 68 | 74.48 | 3.99 | 27.35 | 19.43 | -1.96 | -9.46 |
| 69 | -57.25 | 1.31 | -14.37 | -1.11 | -0.52 | 8.27 |
| 70 | 47.57 | -4.98 | 8.07 | -13.23 | 5.76 | -6.26 |
| 71 | -47.71 | 6.87 | -8.34 | 6.35 | -6.09 | 7.52 |
| 72 | 57.64 | 0.52 | 14.15 | -5.99 | 0.26 | -7.08 |
| 73 | -41.76 | 4.59 | -1.07 | 24.30 | -2.74 | 5.89 |
| 74 | 63.06 | -1.70 | 21.37 | 12.19 | 3.54 | -8.63 |
| 75 | -32.21 | 10.15 | 4.97 | 31.77 | -8.30 | 5.14 |
| 76 | 73.13 | 3.81 | 27.45 | 19.43 | -1.96 | -9.46 |
| 77 | -55.91 | 1.49 | -14.47 | -1.11 | -0.52 | 8.27 |
| 78 | 48.92 | -4.80 | 7.97 | -13.23 | 5.76 | -6.26 |
| 79 | -46.36 | 7.05 | -8.43 | 6.35 | -6.09 | 7.52 |
| 80 | 58.99 | 0.71 | 14.05 | -5.99 | 0.26 | -7.08 |
| 81 | 24.85 | 5.94 | 24.07 | 40.54 | -4.02 | -1.61 |
| 82 | 34.93 | 6.56 | 25.39 | 37.04 | -4.65 | -2.92 |
| 83 | 14.43 | 3.79 | 15.90 | 24.80 | -2.65 | -0.14 |
| 84 | 24.50 | 4.42 | 17.21 | 21.31 | -3.27 | -1.45 |
| 85 | 24.02 | 5.82 | 24.13 | 40.54 | -4.02 | -1.61 |
| 86 | 34.09 | 6.45 | 25.45 | 37.04 | -4.65 | -2.92 |
| 87 | 15.26 | 3.91 | 15.84 | 24.80 | -2.65 | -0.14 |
| 88 | 25.34 | 4.53 | 17.15 | 21.31 | -3.27 | -1.45 |
| 89 | 17.96 | 4.50 | 18.37 | 31.59 | -3.02 | -1.08 |
| 90 | 28.03 | 5.12 | 19.68 | 28.09 | -3.65 | -2.40 |
| 91 | 9.94 | 2.84 | 12.08 | 19.48 | -1.97 | 0.05 |
| 92 | 20.01 | 3.47 | 13.39 | 15.99 | -2.59 | -1.27 |
| 93 | 17.32 | 4.41 | 18.41 | 31.59 | -3.02 | -1.08 |
| 94 | 27.39 | 5.03 | 19.72 | 28.09 | -3.65 | -2.40 |
| 95 | 10.58 | 2.93 | 12.03 | 19.48 | -1.97 | 0.05 |
| 96 | 20.65 | 3.56 | 13.34 | 15.99 | -2.59 | -1.27 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -57.25 | -44.90 | -39.48 | -38.92 | -43.00 | -51.12 | -56.30 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 79.16 | 47.74 | 34.78 | 28.09 | 21.63 | 15.42 | 13.23 |

强度计算应力比 =0.407

抗剪强度计算应力比 =0.104

平面内稳定计算最大应力对应组合号: 1, M=42.46, N=8.87, M=56.30, N=-6.08

平面内稳定最大应力 (N/mm\*mm) =115.52

平面内稳定计算最大应力比 =0.379

临界弯矩Mcr(kN\*m) =289.60

平面外稳定计算最大应力比 =0.698

强度计算应力比 =0.407 < 1.0

抗剪强度计算应力比 =0.104 < 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 =0.698 < 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 | 3.82 | 7.92 | 11.85 | 15.24 | 17.82 | 19.39 |

最大挠度值 =19.39 最大挠度/梁跨度 =1/634.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/13.32

变形后斜梁坡度改变率 =0.062 < 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 | 22.99 | 4.81 | 19.02 | 29.84 | -3.33 | -1.74 |
| 2 | 14.97 | 3.16 | 12.73 | 17.74 | -2.28 | -0.61 |
| 3 | 22.35 | 4.72 | 19.07 | 29.84 | -3.33 | -1.74 |
| 4 | 15.62 | 3.24 | 12.69 | 17.74 | -2.28 | -0.61 |
| 5 | 21.43 | 4.48 | 17.72 | 27.89 | -3.10 | -1.64 |
| 6 | 13.41 | 2.83 | 11.43 | 15.78 | -2.05 | -0.51 |
| 7 | 20.79 | 4.39 | 17.76 | 27.89 | -3.10 | -1.64 |
| 8 | 14.06 | 2.92 | 11.38 | 15.78 | -2.05 | -0.51 |
| 9 | -3.48 | 2.81 | 5.91 | 15.04 | -1.84 | 1.30 |
| 10 | 24.47 | 1.13 | 11.89 | 11.81 | -0.17 | -2.58 |
| 11 | -0.93 | 4.29 | 7.52 | 17.03 | -3.33 | 1.10 |
| 12 | 27.16 | 2.60 | 13.51 | 13.74 | -1.64 | -2.80 |
| 13 | -5.04 | 2.48 | 4.60 | 13.09 | -1.61 | 1.39 |
| 14 | 22.91 | 0.81 | 10.59 | 9.86 | 0.06 | -2.48 |
| 15 | -2.49 | 3.97 | 6.21 | 15.08 | -3.10 | 1.19 |
| 16 | 25.60 | 2.28 | 12.21 | 11.79 | -1.41 | -2.70 |

--- 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 -5.04 -8.47 -11.35 -14.61 -22.10 -27.18 -29.84

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 27.16 15.18 7.47 1.45 0.00 0.00 0.00

强度计算荷载比 =0.16

平面内稳定计算荷载比 =0.15

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 | -19.99 | 2.92 | 0.19 | -49.34 | -1.16 | 21.67 |
| 2 | -56.30 | 6.08 | 3.58 | -98.86 | -2.33 | 43.41 |
| 3 | -56.30 | 6.08 | 3.58 | -85.63 | -2.41 | 42.34 |
| 4 | -19.99 | 2.92 | 0.19 | -62.58 | -1.08 | 22.74 |
| 5 | -14.13 | 2.23 | -0.10 | -37.96 | -0.89 | 16.67 |
| 6 | -50.44 | 5.39 | 3.29 | -87.47 | -2.06 | 38.41 |
| 7 | -50.44 | 5.39 | 3.29 | -74.24 | -2.14 | 37.34 |
| 8 | -14.13 | 2.23 | -0.10 | -51.19 | -0.82 | 17.74 |
| 9 | -8.53 | 1.27 | -7.23 | -30.59 | 0.56 | 3.46 |
| 10 | 3.58 | -5.02 | 7.30 | 21.33 | 6.85 | 0.49 |
| 11 | -16.00 | 6.83 | -6.48 | -45.93 | -5.00 | 10.43 |
| 12 | -3.66 | 0.49 | 8.12 | 6.50 | 1.34 | 7.34 |
| 13 | -2.67 | 0.58 | -7.52 | -19.21 | 0.83 | -1.54 |
| 14 | 9.44 | -5.71 | 7.01 | 32.72 | 7.12 | -4.51 |
| 15 | -10.14 | 6.14 | -6.77 | -34.55 | -4.73 | 5.43 |
| 16 | 2.20 | -0.20 | 7.83 | 17.88 | 1.61 | 2.34 |
| 17 | -9.87 | 1.88 | -4.90 | -38.09 | -0.13 | 10.74 |
| 18 | -2.60 | -1.89 | 3.81 | -6.94 | 3.64 | 8.96 |
| 19 | -14.35 | 5.22 | -4.45 | -47.30 | -3.46 | 14.93 |
| 20 | -6.95 | 1.42 | 4.31 | -15.84 | 0.34 | 13.07 |
| 21 | -46.18 | 5.05 | -1.51 | -87.61 | -1.30 | 32.48 |
| 22 | -38.91 | 1.28 | 7.20 | -56.45 | 2.47 | 30.70 |
| 23 | -50.66 | 8.39 | -1.06 | -96.81 | -4.63 | 36.67 |
| 24 | -43.26 | 4.58 | 7.70 | -65.35 | -0.83 | 34.81 |
| 25 | -46.18 | 5.05 | -1.51 | -74.38 | -1.38 | 31.41 |
| 26 | -38.91 | 1.28 | 7.20 | -43.22 | 2.40 | 29.63 |
| 27 | -50.66 | 8.39 | -1.06 | -83.58 | -4.71 | 35.60 |
| 28 | -43.26 | 4.58 | 7.70 | -52.12 | -0.91 | 33.75 |
| 29 | -9.87 | 1.88 | -4.90 | -51.33 | -0.05 | 11.81 |
| 30 | -2.60 | -1.89 | 3.81 | -20.17 | 3.72 | 10.03 |
| 31 | -14.35 | 5.22 | -4.45 | -60.53 | -3.39 | 16.00 |
| 32 | -6.95 | 1.42 | 4.31 | -29.07 | 0.42 | 14.14 |
| 33 | -4.01 | 1.19 | -5.19 | -26.71 | 0.14 | 5.74 |
| 34 | 3.26 | -2.58 | 3.52 | 4.45 | 3.91 | 3.96 |
| 35 | -8.49 | 4.53 | -4.74 | -35.91 | -3.20 | 9.93 |
| 36 | -1.08 | 0.72 | 4.02 | -4.45 | 0.61 | 8.07 |
| 37 | -40.32 | 4.36 | -1.80 | -76.22 | -1.03 | 27.48 |
| 38 | -33.05 | 0.59 | 6.91 | -45.07 | 2.74 | 25.70 |
| 39 | -44.80 | 7.69 | -1.35 | -85.42 | -4.37 | 31.67 |
| 40 | -37.40 | 3.89 | 7.41 | -53.97 | -0.56 | 29.81 |
| 41 | -40.32 | 4.36 | -1.80 | -62.99 | -1.11 | 26.41 |
| 42 | -33.05 | 0.59 | 6.91 | -31.83 | 2.66 | 24.63 |
| 43 | -44.80 | 7.69 | -1.35 | -72.19 | -4.44 | 30.60 |
| 44 | -37.40 | 3.89 | 7.41 | -40.73 | -0.64 | 28.74 |
| 45 | -4.01 | 1.19 | -5.19 | -39.94 | 0.22 | 6.81 |
| 46 | 3.26 | -2.58 | 3.52 | -8.79 | 3.99 | 5.03 |
| 47 | -8.49 | 4.53 | -4.74 | -49.14 | -3.12 | 11.00 |
| 48 | -1.08 | 0.72 | 4.02 | -17.69 | 0.69 | 9.14 |
| 49 | -4.75 | 1.21 | -7.98 | -30.59 | 0.56 | 3.46 |
| 50 | 7.37 | -5.07 | 6.55 | 21.33 | 6.85 | 0.49 |
| 51 | -12.21 | 6.78 | -7.23 | -45.93 | -5.00 | 10.43 |
| 52 | 0.13 | 0.44 | 7.37 | 6.50 | 1.34 | 7.34 |
| 53 | -30.16 | 3.43 | -5.60 | -65.25 | -0.25 | 18.68 |
| 54 | -18.05 | -2.85 | 8.92 | -13.33 | 6.03 | 15.71 |
| 55 | -37.63 | 8.99 | -4.85 | -80.59 | -5.82 | 25.65 |
| 56 | -25.29 | 2.65 | 9.75 | -28.16 | 0.52 | 22.56 |
| 57 | -30.16 | 3.43 | -5.60 | -55.99 | -0.31 | 17.93 |
| 58 | -18.05 | -2.85 | 8.92 | -4.06 | 5.97 | 14.96 |
| 59 | -37.63 | 8.99 | -4.85 | -71.33 | -5.87 | 24.90 |
| 60 | -25.29 | 2.65 | 9.75 | -18.90 | 0.47 | 21.81 |
| 61 | -4.75 | 1.21 | -7.98 | -39.86 | 0.62 | 4.21 |
| 62 | 7.37 | -5.07 | 6.55 | 12.07 | 6.90 | 1.24 |
| 63 | -12.21 | 6.78 | -7.23 | -55.20 | -4.94 | 11.18 |
| 64 | 0.13 | 0.44 | 7.37 | -2.77 | 1.40 | 8.09 |
| 65 | 1.11 | 0.52 | -8.27 | -19.21 | 0.83 | -1.54 |
| 66 | 13.23 | -5.76 | 6.26 | 32.72 | 7.12 | -4.51 |
| 67 | -6.35 | 6.09 | -7.52 | -34.55 | -4.73 | 5.43 |
| 68 | 5.99 | -0.25 | 7.08 | 17.88 | 1.61 | 2.34 |
| 69 | -24.30 | 2.74 | -5.89 | -53.87 | 0.01 | 13.68 |
| 70 | -12.19 | -3.54 | 8.63 | -1.94 | 6.30 | 10.71 |
| 71 | -31.77 | 8.30 | -5.14 | -69.21 | -5.55 | 20.65 |
| 72 | -19.43 | 1.96 | 9.46 | -16.78 | 0.79 | 17.56 |
| 73 | -24.30 | 2.74 | -5.89 | -44.60 | -0.04 | 12.93 |
| 74 | -12.19 | -3.54 | 8.63 | 7.32 | 6.24 | 9.96 |
| 75 | -31.77 | 8.30 | -5.14 | -59.94 | -5.60 | 19.90 |
| 76 | -19.43 | 1.96 | 9.46 | -7.51 | 0.74 | 16.81 |
| 77 | 1.11 | 0.52 | -8.27 | -28.47 | 0.89 | -0.79 |
| 78 | 13.23 | -5.76 | 6.26 | 23.46 | 7.17 | -3.76 |
| 79 | -6.35 | 6.09 | -7.52 | -43.81 | -4.67 | 6.18 |
| 80 | 5.99 | -0.25 | 7.08 | 8.62 | 1.67 | 3.09 |
| 81 | -24.80 | 3.10 | 0.10 | -52.66 | -1.30 | 22.36 |
| 82 | -21.31 | 2.83 | 1.48 | -46.03 | -1.03 | 20.98 |
| 83 | -40.54 | 4.47 | 1.57 | -74.12 | -1.81 | 31.78 |
| 84 | -37.04 | 4.20 | 2.95 | -67.48 | -1.53 | 30.40 |
| 85 | -40.54 | 4.47 | 1.57 | -68.38 | -1.84 | 31.32 |
| 86 | -37.04 | 4.20 | 2.95 | -61.75 | -1.57 | 29.93 |
| 87 | -24.80 | 3.10 | 0.10 | -58.40 | -1.26 | 22.82 |
| 88 | -21.31 | 2.83 | 1.48 | -51.76 | -0.99 | 21.44 |
| 89 | -19.48 | 2.41 | -0.08 | -41.28 | -1.03 | 17.36 |
| 90 | -15.99 | 2.14 | 1.30 | -34.64 | -0.76 | 15.98 |
| 91 | -31.59 | 3.47 | 1.05 | -57.78 | -1.42 | 24.61 |
| 92 | -28.09 | 3.20 | 2.43 | -51.14 | -1.15 | 23.22 |
| 93 | -31.59 | 3.47 | 1.05 | -53.37 | -1.45 | 24.25 |
| 94 | -28.09 | 3.20 | 2.43 | -46.73 | -1.17 | 22.87 |
| 95 | -19.48 | 2.41 | -0.08 | -45.69 | -1.00 | 17.72 |
| 96 | -15.99 | 2.14 | 1.30 | -39.05 | -0.73 | 16.33 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -56.30 | -56.00 | -46.36 | -31.57 | -24.08 | -26.96 | -32.72 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 13.23 | 5.58 | 11.99 | 16.56 | 20.62 | 39.07 | 98.86 |

强度计算应力比 =0.508

抗剪强度计算应力比 =0.125

平面内稳定计算最大应力对应组合号: 1, M=-19.99, N=2.92, M=-49.34, N=-1.16

平面内稳定最大应力 (N/mm\*mm) =144.32

平面内稳定计算最大应力比 =0.473

临界弯矩Mcr(kN\*m) =222.35

平面外稳定计算最大应力比 =0.592

强度计算应力比 =0.508 < 1.0

抗剪强度计算应力比 =0.125 < 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 =0.592 < 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 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 19.39 | 19.58 | 17.46 | 13.43 | 8.30 | 3.29 | 0.00 |

最大挠度值 =19.79 最大挠度/梁跨度 =1/622.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.86

变形后斜梁坡度改变率 =0.054 < 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 | -17.74 | 2.28 | 0.61 | -37.96 | -0.89 | 16.67 |
| 2 | -29.84 | 3.33 | 1.74 | -54.46 | -1.28 | 23.91 |
| 3 | -29.84 | 3.33 | 1.74 | -50.05 | -1.31 | 23.56 |
| 4 | -17.74 | 2.28 | 0.61 | -42.37 | -0.87 | 17.02 |
| 5 | -15.78 | 2.05 | 0.51 | -34.16 | -0.80 | 15.00 |
| 6 | -27.89 | 3.10 | 1.64 | -50.67 | -1.19 | 22.25 |
| 7 | -27.89 | 3.10 | 1.64 | -46.26 | -1.22 | 21.89 |
| 8 | -15.78 | 2.05 | 0.51 | -38.57 | -0.78 | 15.36 |
| 9 | -15.04 | 1.84 | -1.30 | -32.96 | -0.43 | 11.81 |
| 10 | -11.81 | 0.17 | 2.58 | -19.11 | 1.24 | 11.02 |
| 11 | -17.03 | 3.33 | -1.10 | -37.05 | -1.92 | 13.67 |
| 12 | -13.74 | 1.64 | 2.80 | -23.07 | -0.23 | 12.85 |
| 13 | -13.09 | 1.61 | -1.39 | -29.16 | -0.34 | 10.15 |
| 14 | -9.86 | -0.06 | 2.48 | -15.31 | 1.33 | 9.35 |
| 15 | -15.08 | 3.10 | -1.19 | -33.25 | -1.83 | 12.01 |
| 16 | -11.79 | 1.41 | 2.70 | -19.27 | -0.14 | 11.18 |

--- 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 -29.84 -29.39 -23.80 -13.05 -2.71 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 0.03 8.40 23.87 54.46

强度计算荷载比 =0.28

平面内稳定计算荷载比 =0.26

平面外稳定计算荷载比 =0.25

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 | -18.68 | 2.67 | 2.87 | -18.54 | -3.92 | 15.93 |
| 2 | -56.80 | 5.59 | 2.55 | -42.33 | -8.86 | 34.99 |
| 3 | -56.80 | 5.59 | 2.55 | -40.53 | -8.60 | 35.03 |
| 4 | -18.68 | 2.67 | 2.87 | -20.33 | -4.17 | 15.89 |
| 5 | -12.88 | 2.04 | 2.46 | -13.86 | -2.94 | 12.01 |
| 6 | -51.00 | 4.96 | 2.14 | -37.65 | -7.87 | 31.08 |
| 7 | -51.00 | 4.96 | 2.14 | -35.85 | -7.62 | 31.12 |
| 8 | -12.88 | 2.04 | 2.46 | -15.65 | -3.19 | 11.98 |
| 9 | -3.05 | -5.26 | -6.24 | -53.41 | 3.76 | 12.60 |
| 10 | -1.79 | 1.04 | 6.75 | 51.35 | -2.55 | -9.79 |
| 11 | -10.59 | 0.25 | -6.05 | -63.63 | -1.75 | 18.71 |
| 12 | -9.40 | 6.59 | 7.01 | 41.71 | -8.09 | -3.77 |
| 13 | 2.75 | -5.89 | -6.66 | -48.73 | 4.74 | 8.68 |
| 14 | 4.01 | 0.41 | 6.33 | 56.03 | -1.56 | -13.70 |
| 15 | -4.79 | -0.39 | -6.47 | -58.95 | -0.77 | 14.80 |
| 16 | -3.60 | 5.95 | 6.59 | 46.39 | -7.11 | -7.69 |
| 17 | -5.43 | -2.13 | -1.95 | -38.41 | 0.88 | 13.31 |
| 18 | -4.67 | 1.65 | 5.84 | 24.44 | -2.90 | -0.12 |
| 19 | -9.95 | 1.17 | -1.84 | -44.55 | -2.42 | 16.98 |
| 20 | -9.24 | 4.97 | 6.00 | 18.66 | -6.22 | 3.49 |
| 21 | -43.56 | 0.79 | -2.27 | -62.20 | -4.05 | 32.38 |
| 22 | -42.80 | 4.57 | 5.52 | 0.65 | -7.83 | 18.95 |
| 23 | -48.08 | 4.09 | -2.16 | -68.34 | -7.35 | 36.05 |
| 24 | -47.37 | 7.90 | 5.67 | -5.13 | -11.16 | 22.56 |
| 25 | -43.56 | 0.79 | -2.27 | -60.41 | -3.80 | 32.41 |
| 26 | -42.80 | 4.57 | 5.52 | 2.44 | -7.58 | 18.98 |
| 27 | -48.08 | 4.09 | -2.16 | -66.55 | -7.10 | 36.08 |
| 28 | -47.37 | 7.90 | 5.67 | -3.34 | -10.90 | 22.59 |
| 29 | -5.43 | -2.13 | -1.95 | -40.21 | 0.63 | 13.27 |
| 30 | -4.67 | 1.65 | 5.84 | 22.65 | -3.15 | -0.16 |
| 31 | -9.95 | 1.17 | -1.84 | -46.34 | -2.67 | 16.94 |
| 32 | -9.24 | 4.97 | 6.00 | 16.87 | -6.47 | 3.45 |
| 33 | 0.37 | -2.77 | -2.37 | -33.73 | 1.87 | 9.40 |
| 34 | 1.12 | 1.01 | 5.42 | 29.12 | -1.91 | -4.04 |
| 35 | -4.15 | 0.53 | -2.26 | -39.87 | -1.44 | 13.06 |
| 36 | -3.44 | 4.34 | 5.58 | 23.34 | -5.24 | -0.43 |
| 37 | -37.76 | 0.15 | -2.69 | -57.52 | -3.07 | 28.46 |
| 38 | -37.00 | 3.94 | 5.10 | 5.33 | -6.85 | 15.03 |
| 39 | -42.28 | 3.46 | -2.58 | -63.66 | -6.37 | 32.13 |
| 40 | -41.57 | 7.26 | 5.26 | -0.45 | -10.17 | 18.64 |
| 41 | -37.76 | 0.15 | -2.69 | -55.73 | -2.82 | 28.50 |
| 42 | -37.00 | 3.94 | 5.10 | 7.12 | -6.60 | 15.07 |
| 43 | -42.28 | 3.46 | -2.58 | -61.87 | -6.12 | 32.17 |
| 44 | -41.57 | 7.26 | 5.26 | 1.34 | -9.92 | 18.68 |
| 45 | 0.37 | -2.77 | -2.37 | -35.53 | 1.61 | 9.36 |
| 46 | 1.12 | 1.01 | 5.42 | 27.33 | -2.17 | -4.07 |
| 47 | -4.15 | 0.53 | -2.26 | -41.66 | -1.69 | 13.03 |
| 48 | -3.44 | 4.34 | 5.58 | 21.55 | -5.49 | -0.46 |
| 49 | 1.47 | -5.31 | -5.49 | -52.19 | 3.99 | 11.87 |
| 50 | 2.72 | 0.99 | 7.49 | 52.57 | -2.31 | -10.51 |
| 51 | -6.07 | 0.19 | -5.31 | -62.41 | -1.51 | 17.99 |
| 52 | -4.89 | 6.53 | 7.76 | 42.93 | -7.85 | -4.49 |
| 53 | -25.22 | -3.27 | -5.72 | -68.84 | 0.53 | 25.22 |
| 54 | -23.96 | 3.03 | 7.27 | 35.92 | -5.77 | 2.84 |
| 55 | -32.76 | 2.24 | -5.53 | -79.07 | -4.97 | 31.34 |
| 56 | -31.57 | 8.58 | 7.53 | 26.28 | -11.31 | 8.85 |
| 57 | -25.22 | -3.27 | -5.72 | -67.59 | 0.71 | 25.25 |
| 58 | -23.96 | 3.03 | 7.27 | 37.17 | -5.59 | 2.86 |
| 59 | -32.76 | 2.24 | -5.53 | -77.81 | -4.79 | 31.36 |
| 60 | -31.57 | 8.58 | 7.53 | 27.53 | -11.13 | 8.88 |
| 61 | 1.47 | -5.31 | -5.49 | -53.44 | 3.81 | 11.85 |
| 62 | 2.72 | 0.99 | 7.49 | 51.31 | -2.49 | -10.54 |
| 63 | -6.07 | 0.19 | -5.31 | -63.67 | -1.69 | 17.96 |
| 64 | -4.89 | 6.53 | 7.76 | 41.68 | -8.03 | -4.52 |
| 65 | 7.27 | -5.95 | -5.91 | -47.51 | 4.97 | 7.96 |
| 66 | 8.52 | 0.35 | 7.08 | 57.25 | -1.33 | -14.43 |
| 67 | -0.27 | -0.44 | -5.72 | -57.73 | -0.53 | 14.08 |
| 68 | 0.91 | 5.90 | 7.34 | 47.61 | -6.87 | -8.41 |
| 69 | -19.42 | -3.90 | -6.13 | -64.16 | 1.52 | 21.31 |
| 70 | -18.17 | 2.40 | 6.85 | 40.60 | -4.79 | -1.08 |
| 71 | -26.96 | 1.60 | -5.95 | -74.39 | -3.99 | 27.42 |
| 72 | -25.78 | 7.94 | 7.11 | 30.96 | -10.33 | 4.94 |
| 73 | -19.42 | -3.90 | -6.13 | -62.91 | 1.69 | 21.34 |
| 74 | -18.17 | 2.40 | 6.85 | 41.85 | -4.61 | -1.05 |
| 75 | -26.96 | 1.60 | -5.95 | -73.13 | -3.81 | 27.45 |
| 76 | -25.78 | 7.94 | 7.11 | 32.21 | -10.15 | 4.97 |
| 77 | 7.27 | -5.95 | -5.91 | -48.76 | 4.79 | 7.94 |
| 78 | 8.52 | 0.35 | 7.08 | 55.99 | -1.51 | -14.45 |
| 79 | -0.27 | -0.44 | -5.72 | -58.99 | -0.71 | 14.05 |
| 80 | 0.91 | 5.90 | 7.34 | 46.36 | -7.05 | -8.43 |
| 81 | -21.25 | 3.03 | 1.61 | -24.56 | -4.42 | 17.17 |
| 82 | -23.42 | 2.40 | 2.93 | -14.49 | -3.79 | 15.85 |
| 83 | -37.77 | 4.30 | 1.47 | -34.87 | -6.56 | 25.43 |
| 84 | -39.94 | 3.67 | 2.79 | -24.79 | -5.93 | 24.11 |
| 85 | -37.77 | 4.30 | 1.47 | -34.09 | -6.45 | 25.45 |
| 86 | -39.94 | 3.67 | 2.79 | -24.02 | -5.82 | 24.13 |
| 87 | -21.25 | 3.03 | 1.61 | -25.34 | -4.53 | 17.15 |
| 88 | -23.42 | 2.40 | 2.93 | -15.26 | -3.90 | 15.84 |
| 89 | -16.09 | 2.40 | 1.09 | -20.06 | -3.47 | 13.36 |
| 90 | -18.27 | 1.78 | 2.40 | -9.98 | -2.85 | 12.04 |
| 91 | -28.80 | 3.38 | 0.98 | -27.99 | -5.12 | 19.72 |
| 92 | -30.97 | 2.75 | 2.30 | -17.91 | -4.49 | 18.40 |
| 93 | -28.80 | 3.38 | 0.98 | -27.39 | -5.03 | 19.73 |
| 94 | -30.97 | 2.75 | 2.30 | -17.31 | -4.41 | 18.41 |
| 95 | -16.09 | 2.40 | 1.09 | -20.65 | -3.56 | 13.35 |
| 96 | -18.27 | 1.78 | 2.40 | -10.58 | -2.93 | 12.03 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -56.80 | -56.23 | -49.39 | -40.98 | -39.52 | -42.95 | -57.25 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 8.52 | 9.57 | 16.73 | 24.22 | 32.05 | 43.99 | 79.07 |

强度计算应力比 =0.407

抗剪强度计算应力比 =0.104

平面内稳定计算最大应力对应组合号: 1, M=-18.68, N=2.67, M=-18.54, N=-3.92

平面内稳定最大应力 (N/mm\*mm) =115.38

平面内稳定计算最大应力比 =0.378

临界弯矩Mcr(kN\*m) =336.52

平面外稳定计算最大应力比 =0.579

强度计算应力比 =0.407 < 1.0

抗剪强度计算应力比 =0.104 < 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 =0.579 < 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 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 19.79 | 19.34 | 17.31 | 13.90 | 9.48 | 4.61 | 0.00 |

最大挠度值 =19.79 最大挠度/梁跨度 =1/622.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/13.32

变形后斜梁坡度改变率 =0.062 < 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 | -17.18 | 2.09 | 1.75 | -15.02 | -3.16 | 12.70 |
| 2 | -29.89 | 3.06 | 1.64 | -22.95 | -4.81 | 19.06 |
| 3 | -29.89 | 3.06 | 1.64 | -22.35 | -4.72 | 19.07 |
| 4 | -17.18 | 2.09 | 1.75 | -15.62 | -3.24 | 12.69 |
| 5 | -15.25 | 1.88 | 1.61 | -13.46 | -2.83 | 11.40 |
| 6 | -27.96 | 2.85 | 1.50 | -21.39 | -4.48 | 17.75 |
| 7 | -27.96 | 2.85 | 1.50 | -20.79 | -4.39 | 17.76 |
| 8 | -15.25 | 1.88 | 1.61 | -14.06 | -2.92 | 11.38 |
| 9 | -13.44 | -0.02 | -0.76 | -24.43 | -1.14 | 11.88 |
| 10 | -13.11 | 1.66 | 2.71 | 3.50 | -2.82 | 5.91 |
| 11 | -15.45 | 1.45 | -0.71 | -27.16 | -2.60 | 13.51 |
| 12 | -15.14 | 3.14 | 2.78 | 0.93 | -4.29 | 7.52 |
| 13 | -11.51 | -0.23 | -0.90 | -22.87 | -0.81 | 10.58 |
| 14 | -11.18 | 1.45 | 2.57 | 5.06 | -2.49 | 4.61 |
| 15 | -13.52 | 1.24 | -0.85 | -25.60 | -2.28 | 12.21 |
| 16 | -13.20 | 2.93 | 2.64 | 2.49 | -3.97 | 6.21 |

--- 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 -29.89 -29.80 -26.27 -19.28 -12.44 -9.07 -5.06

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 0.00 0.00 0.00 4.96 13.49 27.16

强度计算荷载比 =0.16

平面内稳定计算荷载比 =0.15

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 | 98.86 | 2.33 | 43.41 | 56.80 | -5.59 | -2.55 |
| 2 | 49.34 | 1.16 | 21.67 | 18.68 | -2.67 | -2.87 |
| 3 | 85.63 | 2.41 | 42.34 | 56.80 | -5.59 | -2.55 |
| 4 | 62.58 | 1.08 | 22.74 | 18.68 | -2.67 | -2.87 |
| 5 | 87.47 | 2.06 | 38.41 | 51.00 | -4.96 | -2.14 |
| 6 | 37.96 | 0.89 | 16.67 | 12.88 | -2.04 | -2.46 |
| 7 | 74.24 | 2.14 | 37.34 | 51.00 | -4.96 | -2.14 |
| 8 | 51.19 | 0.82 | 17.74 | 12.88 | -2.04 | -2.46 |
| 9 | -21.31 | -6.85 | 0.49 | 3.05 | 5.26 | 6.24 |
| 10 | 30.78 | -0.54 | 3.52 | 1.79 | -1.05 | -6.75 |
| 11 | -6.50 | -1.34 | 7.34 | 10.59 | -0.25 | 6.05 |
| 12 | 45.93 | 5.00 | 10.43 | 9.40 | -6.59 | -7.01 |
| 13 | -32.69 | -7.11 | -4.51 | -2.75 | 5.89 | 6.66 |
| 14 | 19.39 | -0.81 | -1.48 | -4.01 | -0.41 | -6.33 |
| 15 | -17.88 | -1.61 | 2.34 | 4.79 | 0.39 | 6.47 |
| 16 | 34.55 | 4.73 | 5.43 | 3.60 | -5.95 | -6.59 |
| 17 | 56.47 | -2.47 | 30.70 | 43.56 | -0.79 | 2.27 |
| 18 | 87.72 | 1.31 | 32.52 | 42.80 | -4.57 | -5.52 |
| 19 | 65.35 | 0.83 | 34.81 | 48.08 | -4.09 | 2.16 |
| 20 | 96.81 | 4.63 | 36.67 | 47.37 | -7.90 | -5.67 |
| 21 | 6.95 | -3.64 | 8.96 | 5.43 | 2.13 | 1.95 |
| 22 | 38.21 | 0.14 | 10.78 | 4.67 | -1.65 | -5.84 |
| 23 | 15.84 | -0.34 | 13.07 | 9.95 | -1.17 | 1.84 |
| 24 | 47.30 | 3.46 | 14.93 | 9.24 | -4.97 | -6.00 |
| 25 | 43.23 | -2.39 | 29.63 | 43.56 | -0.79 | 2.27 |
| 26 | 74.49 | 1.39 | 31.45 | 42.80 | -4.57 | -5.52 |
| 27 | 52.12 | 0.91 | 33.75 | 48.08 | -4.09 | 2.16 |
| 28 | 83.58 | 4.71 | 35.60 | 47.37 | -7.90 | -5.67 |
| 29 | 20.19 | -3.72 | 10.03 | 5.43 | 2.13 | 1.95 |
| 30 | 51.44 | 0.06 | 11.85 | 4.67 | -1.65 | -5.84 |
| 31 | 29.07 | -0.42 | 14.14 | 9.95 | -1.17 | 1.84 |
| 32 | 60.53 | 3.39 | 16.00 | 9.24 | -4.97 | -6.00 |
| 33 | 45.08 | -2.74 | 25.70 | 37.76 | -0.15 | 2.69 |
| 34 | 76.33 | 1.04 | 27.52 | 37.00 | -3.94 | -5.10 |
| 35 | 53.97 | 0.56 | 29.81 | 42.28 | -3.46 | 2.58 |
| 36 | 85.43 | 4.37 | 31.67 | 41.57 | -7.26 | -5.26 |
| 37 | -4.43 | -3.91 | 3.96 | -0.37 | 2.77 | 2.37 |
| 38 | 26.82 | -0.13 | 5.78 | -1.12 | -1.01 | -5.42 |
| 39 | 4.45 | -0.61 | 8.07 | 4.15 | -0.54 | 2.26 |
| 40 | 35.91 | 3.20 | 9.93 | 3.44 | -4.34 | -5.58 |
| 41 | 31.85 | -2.66 | 24.63 | 37.76 | -0.15 | 2.69 |
| 42 | 63.10 | 1.12 | 26.45 | 37.00 | -3.94 | -5.10 |
| 43 | 40.73 | 0.64 | 28.74 | 42.28 | -3.46 | 2.58 |
| 44 | 72.19 | 4.44 | 30.60 | 41.57 | -7.26 | -5.26 |
| 45 | 8.80 | -3.99 | 5.03 | -0.37 | 2.77 | 2.37 |
| 46 | 40.05 | -0.21 | 6.85 | -1.12 | -1.01 | -5.42 |
| 47 | 17.69 | -0.69 | 9.14 | 4.15 | -0.54 | 2.26 |
| 48 | 49.14 | 3.12 | 11.00 | 3.44 | -4.34 | -5.58 |
| 49 | 13.35 | -6.03 | 15.70 | 25.22 | 3.27 | 5.72 |
| 50 | 65.44 | 0.28 | 18.74 | 23.96 | -3.04 | -7.27 |
| 51 | 28.16 | -0.52 | 22.56 | 32.76 | -2.24 | 5.53 |
| 52 | 80.59 | 5.82 | 25.65 | 31.57 | -8.58 | -7.53 |
| 53 | -21.31 | -6.85 | 0.49 | -1.47 | 5.31 | 5.49 |
| 54 | 30.78 | -0.54 | 3.52 | -2.72 | -0.99 | -7.49 |
| 55 | -6.50 | -1.34 | 7.34 | 6.07 | -0.19 | 5.31 |
| 56 | 45.93 | 5.00 | 10.43 | 4.89 | -6.53 | -7.76 |
| 57 | 4.09 | -5.97 | 14.96 | 25.22 | 3.27 | 5.72 |
| 58 | 56.18 | 0.33 | 17.99 | 23.96 | -3.04 | -7.27 |
| 59 | 18.90 | -0.47 | 21.81 | 32.76 | -2.24 | 5.53 |
| 60 | 71.33 | 5.87 | 24.90 | 31.57 | -8.58 | -7.53 |
| 61 | -12.04 | -6.90 | 1.23 | -1.47 | 5.31 | 5.49 |
| 62 | 40.04 | -0.60 | 4.27 | -2.72 | -0.99 | -7.49 |
| 63 | 2.77 | -1.40 | 8.09 | 6.07 | -0.19 | 5.31 |
| 64 | 55.20 | 4.94 | 11.18 | 4.89 | -6.53 | -7.76 |
| 65 | 1.97 | -6.29 | 10.70 | 19.42 | 3.90 | 6.13 |
| 66 | 54.05 | 0.01 | 13.74 | 18.17 | -2.40 | -6.85 |
| 67 | 16.78 | -0.79 | 17.56 | 26.96 | -1.60 | 5.95 |
| 68 | 69.21 | 5.55 | 20.65 | 25.78 | -7.94 | -7.11 |
| 69 | -32.69 | -7.11 | -4.51 | -7.27 | 5.95 | 5.91 |
| 70 | 19.39 | -0.81 | -1.48 | -8.52 | -0.36 | -7.08 |
| 71 | -17.88 | -1.61 | 2.34 | 0.27 | 0.44 | 5.72 |
| 72 | 34.55 | 4.73 | 5.43 | -0.91 | -5.90 | -7.34 |
| 73 | -7.30 | -6.24 | 9.96 | 19.42 | 3.90 | 6.13 |
| 74 | 44.79 | 0.06 | 12.99 | 18.17 | -2.40 | -6.85 |
| 75 | 7.51 | -0.74 | 16.81 | 26.96 | -1.60 | 5.95 |
| 76 | 59.94 | 5.60 | 19.90 | 25.78 | -7.94 | -7.11 |
| 77 | -23.43 | -7.17 | -3.77 | -7.27 | 5.95 | 5.91 |
| 78 | 28.66 | -0.87 | -0.73 | -8.52 | -0.36 | -7.08 |
| 79 | -8.62 | -1.67 | 3.09 | 0.27 | 0.44 | 5.72 |
| 80 | 43.81 | 4.68 | 6.18 | -0.91 | -5.90 | -7.34 |
| 81 | 67.47 | 1.53 | 30.39 | 37.77 | -3.85 | -1.43 |
| 82 | 74.13 | 1.81 | 31.78 | 39.94 | -4.12 | -2.83 |
| 83 | 46.02 | 1.03 | 20.97 | 21.25 | -2.58 | -1.57 |
| 84 | 52.67 | 1.30 | 22.36 | 23.42 | -2.85 | -2.96 |
| 85 | 61.74 | 1.57 | 29.93 | 37.77 | -3.85 | -1.43 |
| 86 | 68.39 | 1.84 | 31.32 | 39.94 | -4.12 | -2.83 |
| 87 | 51.75 | 0.99 | 21.44 | 21.25 | -2.58 | -1.57 |
| 88 | 58.41 | 1.26 | 22.83 | 23.42 | -2.85 | -2.96 |
| 89 | 51.14 | 1.15 | 23.22 | 28.80 | -2.93 | -0.94 |
| 90 | 57.79 | 1.42 | 24.61 | 30.97 | -3.20 | -2.33 |
| 91 | 34.63 | 0.76 | 15.97 | 16.09 | -1.95 | -1.05 |
| 92 | 41.28 | 1.03 | 17.36 | 18.27 | -2.23 | -2.44 |
| 93 | 46.72 | 1.17 | 22.86 | 28.80 | -2.93 | -0.94 |
| 94 | 53.38 | 1.45 | 24.25 | 30.97 | -3.20 | -2.33 |
| 95 | 39.04 | 0.73 | 16.33 | 16.09 | -1.95 | -1.05 |
| 96 | 45.70 | 1.00 | 17.72 | 18.27 | -2.23 | -2.44 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -32.69 | -27.73 | -22.68 | -26.96 | -37.38 | -50.60 | -56.80 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 98.86 | 44.36 | 22.19 | 17.89 | 14.64 | 10.01 | 8.52 |

强度计算应力比 =0.508

抗剪强度计算应力比 =0.125

平面内稳定计算最大应力对应组合号: 1, M=98.86, N=2.33, M=56.80, N=-5.59

平面内稳定最大应力 (N/mm\*mm) =144.11

平面内稳定计算最大应力比 =0.472

临界弯矩Mcr(kN\*m) =307.77

平面外稳定计算最大应力比 =0.740

强度计算应力比 =0.508 < 1.0

抗剪强度计算应力比 =0.125 < 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 =0.740 < 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 | 2.73 | 6.92 | 11.48 | 15.54 | 18.45 | 19.79 |

最大挠度值 =19.79 最大挠度/梁跨度 =1/622.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.85

变形后斜梁坡度改变率 =0.054 < 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 | 54.46 | 1.28 | 23.91 | 29.89 | -3.06 | -1.64 |
| 2 | 37.96 | 0.89 | 16.67 | 17.18 | -2.09 | -1.75 |
| 3 | 50.05 | 1.31 | 23.56 | 29.89 | -3.06 | -1.64 |
| 4 | 42.37 | 0.87 | 17.02 | 17.18 | -2.09 | -1.75 |
| 5 | 50.67 | 1.19 | 22.25 | 27.96 | -2.85 | -1.50 |
| 6 | 34.16 | 0.80 | 15.00 | 15.25 | -1.88 | -1.61 |
| 7 | 46.26 | 1.22 | 21.89 | 27.96 | -2.85 | -1.50 |
| 8 | 38.57 | 0.78 | 15.36 | 15.25 | -1.88 | -1.61 |
| 9 | 19.12 | -1.24 | 11.02 | 13.44 | 0.02 | 0.76 |
| 10 | 33.01 | 0.44 | 11.83 | 13.11 | -1.66 | -2.71 |
| 11 | 23.07 | 0.23 | 12.85 | 15.45 | -1.45 | 0.71 |
| 12 | 37.05 | 1.92 | 13.67 | 15.14 | -3.14 | -2.78 |
| 13 | 15.32 | -1.33 | 9.35 | 11.51 | 0.23 | 0.90 |
| 14 | 29.21 | 0.35 | 10.16 | 11.18 | -1.45 | -2.57 |
| 15 | 19.27 | 0.14 | 11.18 | 13.52 | -1.24 | 0.85 |
| 16 | 33.25 | 1.83 | 12.01 | 13.20 | -2.93 | -2.64 |

--- 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 -0.85 -7.31 -18.70 -26.22 -29.89

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 54.46 27.07 11.20 2.99 0.00 0.00 0.00

强度计算荷载比 =0.28

平面内稳定计算荷载比 =0.26

平面外稳定计算荷载比 =0.20

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=50.884(mm) =H /138.

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=5.825(mm) =H /1202.

梁的(恒+活)最大挠度:

梁( 3), 挠跨比 =1 /622.

风载作用下柱顶最大水平位移: H/138< 柱顶位移容许值: H/60

地震作用下柱顶最大水平位移: H/1202< 柱顶位移容许值: H/60

梁的(恒+活)最大挠跨比: 1/622< 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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%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2-%2520边跨\\CalcTemp\\平面外计算长度系数.T)