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21分47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: 5

梁数: 6

支座约束数: 3

标准截面总数: 9

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 | 3.08 | 7.25 | 4 | 21.52 | 7.25 |
| 5 | 9.23 | 7.74 | 6 | 15.38 | 7.74 |
| 7 | 12.30 | 7.98 | 8 | -0.25 | 8.50 |
| 9 | 24.85 | 8.50 | 10 | 0.00 | 0.00 |
| 11 | 12.30 | 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 | 10 | 1 | 2 | 11 | 7 |
| 3 | 12 | 2 | 4 | 1 | 8 |
| 5 | 2 | 9 |  |  |  |

**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 | 7 |
| 5 | 6 | 4 | 6 | 7 | 6 |

**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 | -0.250 | 2 | 0.250 | 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\*240\*240\*6\*10\*10 |
| 5 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(450~350)\*180\*180\*6\*10\*10 |
| 6 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=350\*180\*180\*6\*10\*10 |
| 7 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(350~450)\*180\*180\*6\*10\*10 |
| 8 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(400~350)\*180\*180\*6\*10\*10 |
| 9 | 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 | 4 | I端铰接 | 0 |
| 3 | 4 | I端铰接 | 0 |
| 4 | 3 | 两端刚接 | 0 |
| 5 | 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 | 8 | 两端刚接 |
| 2 | 6 | 两端刚接 |
| 3 | 9 | 两端刚接 |
| 4 | 7 | 两端刚接 |
| 5 | 6 | 两端刚接 |
| 6 | 5 | 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 | 120.0 | 150.0 | 11193.6 | 2304.5 | 64.8 |
| 5 | 90.0 | 200.0 | 16435.6 | 972.7 | 58.8 |
| 6 | 90.0 | 175.0 | 12203.9 | 972.6 | 55.8 |
| 7 | 90.0 | 200.0 | 16435.6 | 972.7 | 58.8 |
| 8 | 90.0 | 187.5 | 14230.2 | 972.6 | 57.3 |
| 9 | 90.0 | 187.5 | 14230.2 | 972.6 | 57.3 |

| 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 | 13.1 | 6.0 | 746.2 | 746.2 | 192.0 | 192.0 |
| 5 | 16.7 | 4.1 | 821.8 | 821.8 | 108.1 | 108.1 |
| 6 | 14.8 | 4.2 | 697.4 | 697.4 | 108.1 | 108.1 |
| 7 | 16.7 | 4.1 | 821.8 | 821.8 | 108.1 | 108.1 |
| 8 | 15.8 | 4.1 | 758.9 | 758.9 | 108.1 | 108.1 |
| 9 | 15.8 | 4.1 | 758.9 | 758.9 | 108.1 | 108.1 |

**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 | 0.88 | 0.00 | 0.00 |
| 3 | 1 | 1.88 | 0.00 | 0.00 |
| 4 | 1 | 5.21 | 0.00 | 0.00 |
| 5 | 1 | 5.21 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | -1.88 | 0.00 | 0.00 |
| 3 | 1 | -0.88 | 0.00 | 0.00 |
| 4 | 1 | -5.21 | 0.00 | 0.00 |
| 5 | 1 | -5.21 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 2.32 | 0.00 | 0.00 |
| 3 | 1 | 0.44 | 0.00 | 0.00 |
| 4 | 1 | 5.21 | 0.00 | 0.00 |
| 5 | 1 | 5.21 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | -0.44 | 0.00 | 0.00 |
| 3 | 1 | -2.32 | 0.00 | 0.00 |
| 4 | 1 | -5.21 | 0.00 | 0.00 |
| 5 | 1 | -5.21 | 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 | 3.91 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.91 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.91 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.91 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.91 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.91 | 0.00 | 0.00 | 0.00 |
| 活荷载 | 1 | 1 | 1 | 4.34 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.34 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.34 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.34 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.34 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.34 | 0.00 | 0.00 | 0.00 |
| 左风1 | 1 | 1 | 1 | -3.49 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.49 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.20 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.49 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.20 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.20 | 0.00 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | 1 | -2.20 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.20 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.49 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.20 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.49 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.49 | 0.00 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 1 | -2.04 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.04 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.76 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.04 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.76 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.76 | 0.00 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | 1 | -0.76 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.76 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.04 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.76 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.04 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.04 | 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 |

**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 | 170.562 |
| 8 | 0.285 |
| 9 | 0.285 |

水平地震标准值作用底层剪力： 2.334

底层最小地震剪力(抗震规范5.2.5条): 1.369

各质点地震力调整系数: 1.000

地震力调整后剪重比： 0.014

**周期(已乘折减系数)**

| 振型号 | 周期(s) |
| --- | --- |
| 1 | 1.157 |
| 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 | 170.562 |
| 8 | 0.285 |
| 9 | 0.285 |

水平地震标准值作用底层剪力： 2.334

底层最小地震剪力(抗震规范5.2.5条): 1.369

各质点地震力调整系数: 1.000

地震力调整后剪重比： 0.014

**周期(已乘折减系数)**

| 振型号 | 周期(s) |
| --- | --- |
| 1 | 1.157 |
| 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 | 28.6 | -4.1 | 0.0 | -24.4 | 4.1 | -28.9 |
| 2 | 67.0 | 0.0 | 0.0 | -62.2 | -0.0 | 0.0 |
| 3 | 28.6 | 4.1 | 0.0 | -24.4 | -4.1 | 28.9 |
| 4 | 0.6 | 0.0 | 0.0 | 0.0 | -0.0 | -0.0 |
| 5 | 0.6 | -0.0 | -0.0 | 0.0 | 0.0 | 0.0 |
| 左风1 | 1 | -26.9 | 13.8 | 0.0 | 26.9 | -7.6 | 74.8 |
| 2 | -38.8 | 8.4 | 0.0 | 38.8 | -8.4 | 67.0 |
| 3 | -4.4 | 11.5 | 0.0 | 4.4 | 1.6 | 34.7 |
| 4 | -0.0 | 7.8 | 5.9 | 0.0 | -0.0 | 0.0 |
| 5 | 0.0 | 7.8 | 5.9 | -0.0 | -0.0 | 0.0 |
| 右风1 | 1 | -4.4 | -11.5 | 0.0 | 4.4 | -1.6 | -34.7 |
| 2 | -38.8 | -8.4 | 0.0 | 38.8 | 8.4 | -67.1 |
| 3 | -26.9 | -13.8 | 0.0 | 26.9 | 7.6 | -74.9 |
| 4 | 0.0 | -7.8 | -5.9 | -0.0 | 0.0 | 0.0 |
| 5 | -0.0 | -7.8 | -5.9 | 0.0 | -0.0 | 0.0 |
| 左风2 | 1 | -18.1 | 16.9 | 0.0 | 18.1 | -0.6 | 61.1 |
| 2 | -20.8 | 8.4 | 0.0 | 20.8 | -8.4 | 67.1 |
| 3 | 4.4 | 8.5 | 0.0 | -4.4 | -5.4 | 48.4 |
| 4 | 0.0 | 7.8 | 5.9 | -0.0 | -0.0 | 0.0 |
| 5 | -0.0 | 7.8 | 5.9 | 0.0 | -0.0 | 0.0 |
| 右风2 | 1 | 4.4 | -8.5 | 0.0 | -4.4 | 5.4 | -48.4 |
| 2 | -20.8 | -8.4 | 0.0 | 20.8 | 8.4 | -67.1 |
| 3 | -18.1 | -16.9 | 0.0 | 18.1 | 0.6 | -61.1 |
| 4 | 0.0 | -7.8 | -5.9 | -0.0 | 0.0 | -0.0 |
| 5 | -0.0 | -7.8 | -5.9 | 0.0 | -0.0 | 0.0 |
| 左地震 | 1 | -0.7 | 0.8 | -0.0 | 0.7 | -0.8 | 5.3 |
| 2 | 0.0 | 0.9 | -0.0 | -0.0 | -0.9 | 7.4 |
| 3 | 0.7 | 0.8 | -0.0 | -0.7 | -0.8 | 5.3 |
| 4 | 0.0 | 0.0 | 0.0 | -0.0 | -0.0 | 0.0 |
| 5 | -0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 0.0 |
| 右地震 | 1 | 0.7 | -0.8 | -0.0 | -0.7 | 0.8 | -5.3 |
| 2 | -0.0 | -0.9 | -0.0 | 0.0 | 0.9 | -7.4 |
| 3 | -0.7 | -0.8 | -0.0 | 0.7 | 0.8 | -5.3 |
| 4 | 0.0 | -0.0 | -0.0 | -0.0 | 0.0 | -0.0 |
| 5 | 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 | 6.0 | 23.4 | 29.0 | -4.9 | -9.7 | 22.0 |
| 2 | 4.9 | 9.7 | -22.0 | -2.7 | 17.6 | -2.3 |
| 3 | 4.9 | -9.7 | -22.0 | -6.0 | 23.4 | -29.0 |
| 4 | 2.7 | -17.6 | 2.3 | -1.6 | 31.3 | -77.7 |
| 5 | 2.7 | 17.6 | 2.3 | -4.9 | 9.7 | 22.0 |
| 6 | 1.6 | 31.3 | 77.7 | -2.7 | -17.6 | -2.3 |
| 左风1 | 1 | -1.9 | -26.8 | -80.7 | 1.9 | 16.0 | 14.6 |
| 2 | -1.9 | -16.0 | -14.6 | 1.9 | -5.5 | -17.9 |
| 3 | -9.8 | -3.2 | 41.1 | 9.8 | -3.6 | -40.5 |
| 4 | -1.9 | 5.5 | 17.9 | 1.9 | -16.3 | 15.7 |
| 5 | -9.8 | -16.8 | -20.4 | 9.8 | 3.2 | -41.1 |
| 6 | -9.8 | -23.6 | -82.6 | 9.8 | 16.8 | 20.4 |
| 右风1 | 1 | -9.8 | -3.6 | 40.5 | 9.8 | -3.2 | -41.2 |
| 2 | -9.8 | 3.2 | 41.2 | 9.8 | -16.8 | 20.4 |
| 3 | -1.9 | 16.0 | -14.7 | 1.9 | -26.8 | 80.7 |
| 4 | -9.8 | 16.8 | -20.4 | 9.8 | -23.6 | 82.7 |
| 5 | -1.9 | -5.5 | 17.9 | 1.9 | -16.0 | 14.7 |
| 6 | -1.9 | -16.2 | -15.6 | 1.9 | 5.5 | -17.9 |
| 左风2 | 1 | 5.7 | -18.6 | -67.0 | -5.7 | 12.3 | 19.2 |
| 2 | 5.7 | -12.3 | -19.2 | -5.7 | -0.3 | -17.9 |
| 3 | -2.1 | -6.9 | 36.6 | 2.1 | 4.5 | -54.3 |
| 4 | 5.8 | 0.3 | 17.9 | -5.8 | -6.6 | -7.3 |
| 5 | -2.1 | -11.6 | -20.4 | 2.1 | 6.9 | -36.6 |
| 6 | -2.1 | -13.9 | -59.8 | 2.1 | 11.6 | 20.4 |
| 右风2 | 1 | -2.1 | 4.5 | 54.3 | 2.1 | -6.9 | -36.6 |
| 2 | -2.1 | 6.9 | 36.6 | 2.1 | -11.6 | 20.4 |
| 3 | 5.8 | 12.3 | -19.2 | -5.8 | -18.6 | 67.0 |
| 4 | -2.1 | 11.6 | -20.4 | 2.1 | -13.9 | 59.8 |
| 5 | 5.8 | -0.3 | 17.9 | -5.8 | -12.3 | 19.2 |
| 6 | 5.7 | -6.6 | 7.3 | -5.7 | 0.3 | -17.9 |
| 左地震 | 1 | -0.5 | -0.7 | -5.3 | 0.5 | 0.7 | 3.2 |
| 2 | -0.1 | -0.7 | -3.2 | 0.1 | 0.7 | -1.4 |
| 3 | 0.5 | -0.7 | 3.2 | -0.5 | 0.7 | -5.3 |
| 4 | 0.2 | -0.8 | 1.4 | -0.2 | 0.8 | -3.7 |
| 5 | 0.1 | -0.7 | -1.4 | -0.1 | 0.7 | -3.2 |
| 6 | -0.2 | -0.8 | -3.7 | 0.2 | 0.8 | 1.4 |
| 右地震 | 1 | 0.5 | 0.7 | 5.3 | -0.5 | -0.7 | -3.2 |
| 2 | 0.1 | 0.7 | 3.2 | -0.1 | -0.7 | 1.4 |
| 3 | -0.5 | 0.7 | -3.2 | 0.5 | -0.7 | 5.3 |
| 4 | -0.2 | 0.8 | -1.4 | 0.2 | -0.8 | 3.7 |
| 5 | -0.1 | 0.7 | 1.4 | 0.1 | -0.7 | 3.2 |
| 6 | 0.2 | 0.8 | 3.7 | -0.2 | -0.8 | -1.4 |

**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 | 0.02 | 0.14 |
| 2 | -0.02 | 0.14 |
| 3 | 0.82 | 10.31 |
| 4 | -0.82 | 10.31 |
| 5 | 0.49 | 6.41 |
| 6 | -0.49 | 6.41 |
| 7 | 0.00 | 0.39 |
| 8 | 4.41 | 0.14 |
| 9 | -4.41 | 0.14 |

**活荷载工况下节点位移（mm）**

| 节点号 | X向位移 | Y向位移 |
| --- | --- | --- |
| 1 | 0.02 | 0.13 |
| 2 | -0.02 | 0.13 |
| 3 | 0.80 | 14.42 |
| 4 | -0.80 | 14.42 |
| 5 | 0.48 | 12.27 |
| 6 | -0.48 | 12.27 |
| 7 | 0.00 | 0.36 |
| 8 | 4.32 | 0.13 |
| 9 | -4.32 | 0.13 |

**节点侧向（水平向）位移(mm)**

| 工况 | 节点 | δx | 节点 | δx |
| --- | --- | --- | --- | --- |
| 左风1 | 1 | 76.08 | 2 | 76.18 |
| 3 | 76.08 | 4 | 77.15 |
| 5 | 75.64 | 6 | 76.27 |
| 7 | 76.09 | 8 | 80.74 |
| 9 | 86.03 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 右风1 | 1 | -76.28 | 2 | -76.18 |
| 3 | -77.26 | 4 | -76.19 |
| 5 | -76.38 | 6 | -75.74 |
| 7 | -76.19 | 8 | -86.15 |
| 9 | -80.86 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 左风2 | 1 | 76.26 | 2 | 76.21 |
| 3 | 76.45 | 4 | 77.00 |
| 5 | 75.90 | 6 | 76.22 |
| 7 | 76.19 | 8 | 81.70 |
| 9 | 85.32 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 右风2 | 1 | -76.21 | 2 | -76.26 |
| 3 | -77.00 | 4 | -76.45 |
| 5 | -76.22 | 6 | -75.90 |
| 7 | -76.19 | 8 | -85.32 |
| 9 | -81.70 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 左地震 | 1 | 7.44 | 2 | 7.44 |
| 3 | 7.52 | 4 | 7.52 |
| 5 | 7.46 | 6 | 7.46 |
| 7 | 7.45 | 8 | 8.23 |
| 9 | 8.23 | 10 | 0.00 |
| 11 | 0.00 | 12 | 0.00 |
| 右地震 | 1 | -7.44 | 2 | -7.44 |
| 3 | -7.52 | 4 | -7.52 |
| 5 | -7.46 | 6 | -7.46 |
| 7 | -7.45 | 8 | -8.23 |
| 9 | -8.23 | 10 | 0.00 |
| 11 | 0.00 | 12 | 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 | 0.70 | 0.09 | 0.80 | 0.89 | 46.67 | 11.70 | 131.82 | 117.38 | 356.3 | 通过 |
| 2 | 0.68 | 0.06 | 0.80 | 0.99 | 46.67 | 11.70 | 124.61 | 129.96 | 406.1 | 通过 |
| 3 | 0.70 | 0.09 | 0.80 | 0.89 | 46.67 | 11.70 | 131.82 | 117.38 | 356.3 | 通过 |
| 4 | 0.11 | 0.06 | 0.10 | 0.05 | 30.67 | 10.88 | 35.24 | 33.95 | 47.6 | 通过 |
| 5 | 0.11 | 0.06 | 0.10 | 0.05 | 30.67 | 10.88 | 35.24 | 33.95 | 47.6 | 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 | 0.67 | 0.21 | 0.62 | 0.62 | 59.17 | 8.70 | 138.8 | 通过 |
| 2 | 0.53 | 0.13 | 0.51 | 0.55 | 55.00 | 8.70 | 270.2 | 通过 |
| 3 | 0.67 | 0.21 | 0.62 | 0.62 | 59.17 | 8.70 | 138.8 | 通过 |
| 4 | 0.84 | 0.25 | 0.78 | 0.92 | 63.33 | 8.70 | 142.4 | 通过 |
| 5 | 0.53 | 0.13 | 0.51 | 0.55 | 55.00 | 8.70 | 270.2 | 通过 |
| 6 | 0.84 | 0.25 | 0.78 | 0.92 | 63.33 | 8.70 | 142.4 | 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=17.33, Ly=7.00; 长细比：λx=131.8,λy=117.4

构件长度=7.00; 计算长度系数: Ux=2.48 Uy=1.00

抗震等级: 四级

截面参数: B1=240, B2=240, 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: 238.888885(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 34.47 | -4.84 | -33.89 | -28.91 | 4.84 |
| 2 | 0.00 | 74.81 | -11.95 | -83.64 | -69.25 | 11.95 |
| 3 | 0.00 | 74.81 | -11.95 | -83.64 | -69.25 | 11.95 |
| 4 | 0.00 | 34.47 | -4.84 | -33.89 | -28.91 | 4.84 |
| 5 | 0.00 | 25.88 | -3.60 | -25.23 | -21.60 | 3.60 |
| 6 | 0.00 | 66.22 | -10.71 | -74.97 | -61.95 | 10.71 |
| 7 | 0.00 | 66.22 | -10.71 | -74.97 | -61.95 | 10.71 |
| 8 | 0.00 | 25.88 | -3.60 | -25.23 | -21.60 | 3.60 |
| 9 | 0.00 | -3.08 | 15.29 | 74.68 | 8.64 | -6.05 |
| 10 | 0.00 | 30.65 | -22.69 | -89.57 | -25.09 | 2.91 |
| 11 | 0.00 | 10.04 | 19.94 | 54.17 | -4.49 | 4.47 |
| 12 | 0.00 | 43.76 | -18.05 | -110.14 | -38.20 | 13.42 |
| 13 | 0.00 | -11.67 | 16.53 | 83.35 | 15.95 | -7.29 |
| 14 | 0.00 | 22.06 | -21.45 | -80.91 | -17.79 | 1.67 |
| 15 | 0.00 | 1.45 | 21.18 | 62.84 | 2.82 | 3.23 |
| 16 | 0.00 | 35.17 | -16.81 | -101.48 | -30.90 | 12.18 |
| 17 | 0.00 | 10.28 | 7.55 | 33.44 | -4.73 | -2.01 |
| 18 | 0.00 | 30.52 | -15.24 | -65.11 | -24.97 | 3.37 |
| 19 | 0.00 | 18.16 | 10.34 | 21.13 | -12.60 | 4.30 |
| 20 | 0.00 | 38.39 | -12.45 | -77.45 | -32.83 | 9.68 |
| 21 | 0.00 | 50.63 | 0.44 | -16.30 | -45.07 | 5.10 |
| 22 | 0.00 | 70.87 | -22.34 | -114.85 | -65.31 | 10.47 |
| 23 | 0.00 | 58.50 | 3.24 | -28.61 | -52.95 | 11.41 |
| 24 | 0.00 | 78.74 | -19.56 | -127.20 | -73.18 | 16.78 |
| 25 | 0.00 | 50.63 | 0.44 | -16.30 | -45.07 | 5.10 |
| 26 | 0.00 | 70.87 | -22.34 | -114.85 | -65.31 | 10.47 |
| 27 | 0.00 | 58.50 | 3.24 | -28.61 | -52.95 | 11.41 |
| 28 | 0.00 | 78.74 | -19.56 | -127.20 | -73.18 | 16.78 |
| 29 | 0.00 | 10.28 | 7.55 | 33.44 | -4.73 | -2.01 |
| 30 | 0.00 | 30.52 | -15.24 | -65.11 | -24.97 | 3.37 |
| 31 | 0.00 | 18.16 | 10.34 | 21.13 | -12.60 | 4.30 |
| 32 | 0.00 | 38.39 | -12.45 | -77.45 | -32.83 | 9.68 |
| 33 | 0.00 | 1.69 | 8.79 | 42.11 | 2.58 | -3.24 |
| 34 | 0.00 | 21.94 | -14.00 | -56.45 | -17.66 | 2.13 |
| 35 | 0.00 | 9.57 | 11.58 | 29.80 | -5.30 | 3.07 |
| 36 | 0.00 | 29.80 | -11.22 | -68.79 | -25.53 | 8.44 |
| 37 | 0.00 | 42.04 | 1.68 | -7.64 | -37.76 | 3.86 |
| 38 | 0.00 | 62.28 | -21.10 | -106.19 | -58.00 | 9.24 |
| 39 | 0.00 | 49.92 | 4.47 | -19.94 | -45.64 | 10.17 |
| 40 | 0.00 | 70.15 | -18.32 | -118.53 | -65.87 | 15.54 |
| 41 | 0.00 | 42.04 | 1.68 | -7.64 | -37.76 | 3.86 |
| 42 | 0.00 | 62.28 | -21.10 | -106.19 | -58.00 | 9.24 |
| 43 | 0.00 | 49.92 | 4.47 | -19.94 | -45.64 | 10.17 |
| 44 | 0.00 | 70.15 | -18.32 | -118.53 | -65.87 | 15.54 |
| 45 | 0.00 | 1.69 | 8.79 | 42.11 | 2.58 | -3.24 |
| 46 | 0.00 | 21.94 | -14.00 | -56.45 | -17.66 | 2.13 |
| 47 | 0.00 | 9.57 | 11.58 | 29.80 | -5.30 | 3.07 |
| 48 | 0.00 | 29.80 | -11.22 | -68.79 | -25.53 | 8.44 |
| 49 | 0.00 | -5.01 | 15.65 | 77.24 | 10.57 | -6.41 |
| 50 | 0.00 | 28.72 | -22.32 | -87.02 | -23.16 | 2.54 |
| 51 | 0.00 | 8.12 | 20.31 | 56.73 | -2.56 | 4.10 |
| 52 | 0.00 | 41.83 | -17.68 | -107.59 | -36.28 | 13.05 |
| 53 | 0.00 | 23.23 | 10.68 | 42.42 | -17.67 | -1.44 |
| 54 | 0.00 | 56.96 | -27.29 | -121.84 | -51.41 | 7.52 |
| 55 | 0.00 | 36.36 | 15.33 | 21.91 | -30.80 | 9.07 |
| 56 | 0.00 | 70.08 | -22.66 | -142.41 | -64.52 | 18.03 |
| 57 | 0.00 | 23.23 | 10.68 | 42.42 | -17.67 | -1.44 |
| 58 | 0.00 | 56.96 | -27.29 | -121.84 | -51.41 | 7.52 |
| 59 | 0.00 | 36.36 | 15.33 | 21.91 | -30.80 | 9.07 |
| 60 | 0.00 | 70.08 | -22.66 | -142.41 | -64.52 | 18.03 |
| 61 | 0.00 | -5.01 | 15.65 | 77.24 | 10.57 | -6.41 |
| 62 | 0.00 | 28.72 | -22.32 | -87.02 | -23.16 | 2.54 |
| 63 | 0.00 | 8.12 | 20.31 | 56.73 | -2.56 | 4.10 |
| 64 | 0.00 | 41.83 | -17.68 | -107.59 | -36.28 | 13.05 |
| 65 | 0.00 | -13.60 | 16.89 | 85.90 | 17.88 | -7.65 |
| 66 | 0.00 | 20.13 | -21.08 | -78.35 | -15.86 | 1.30 |
| 67 | 0.00 | -0.47 | 21.55 | 65.39 | 4.75 | 2.86 |
| 68 | 0.00 | 33.25 | -16.45 | -98.92 | -28.97 | 11.82 |
| 69 | 0.00 | 14.64 | 11.92 | 51.08 | -10.36 | -2.68 |
| 70 | 0.00 | 48.37 | -26.06 | -113.17 | -44.10 | 6.28 |
| 71 | 0.00 | 27.77 | 16.57 | 30.57 | -23.49 | 7.84 |
| 72 | 0.00 | 61.49 | -21.42 | -133.74 | -57.21 | 16.79 |
| 73 | 0.00 | 14.64 | 11.92 | 51.08 | -10.36 | -2.68 |
| 74 | 0.00 | 48.37 | -26.06 | -113.17 | -44.10 | 6.28 |
| 75 | 0.00 | 27.77 | 16.57 | 30.57 | -23.49 | 7.84 |
| 76 | 0.00 | 61.49 | -21.42 | -133.74 | -57.21 | 16.79 |
| 77 | 0.00 | -13.60 | 16.89 | 85.90 | 17.88 | -7.65 |
| 78 | 0.00 | 20.13 | -21.08 | -78.35 | -15.86 | 1.30 |
| 79 | 0.00 | -0.47 | 21.55 | 65.39 | 4.75 | 2.86 |
| 80 | 0.00 | 33.25 | -16.45 | -98.92 | -28.97 | 11.82 |
| 81 | 0.00 | 34.99 | -4.07 | -28.49 | -29.43 | 4.07 |
| 82 | 0.00 | 37.06 | -6.21 | -43.44 | -31.51 | 6.21 |
| 83 | 0.00 | 52.47 | -7.15 | -50.04 | -46.92 | 7.15 |
| 84 | 0.00 | 54.55 | -9.28 | -64.99 | -48.99 | 9.28 |
| 85 | 0.00 | 52.47 | -7.15 | -50.04 | -46.92 | 7.15 |
| 86 | 0.00 | 54.55 | -9.28 | -64.99 | -48.99 | 9.28 |
| 87 | 0.00 | 34.99 | -4.07 | -28.49 | -29.43 | 4.07 |
| 88 | 0.00 | 37.06 | -6.21 | -43.44 | -31.51 | 6.21 |
| 89 | 0.00 | 26.68 | -2.88 | -20.19 | -22.40 | 2.88 |
| 90 | 0.00 | 28.75 | -5.02 | -35.14 | -24.47 | 5.02 |
| 91 | 0.00 | 40.13 | -5.25 | -36.77 | -35.85 | 5.25 |
| 92 | 0.00 | 42.20 | -7.39 | -51.72 | -37.92 | 7.39 |
| 93 | 0.00 | 40.13 | -5.25 | -36.77 | -35.85 | 5.25 |
| 94 | 0.00 | 42.20 | -7.39 | -51.72 | -37.92 | 7.39 |
| 95 | 0.00 | 26.68 | -2.88 | -20.19 | -22.40 | 2.88 |
| 96 | 0.00 | 28.75 | -5.02 | -35.14 | -24.47 | 5.02 |

强度计算控制组合号: 56, M=0.00, N=70.08, M=-142.41, N=-64.52

强度计算应力比 =0.703

抗剪强度计算控制组合号: 54, V=-27.29

抗剪强度计算应力比 =0.093

平面内稳定计算最大应力对应组合号: 56, M=0.00, N=70.08, M=-142.41, N=-64.52

平面内稳定计算最大应力 (N/mm\*mm) =245.44

平面内稳定计算最大应力比 =0.805

临界弯矩Mcr(kN\*m) =336.74

平面外稳定计算最大应力比 =0.893

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 =0.703 < 1.0

抗剪强度计算应力比 =0.093 < 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 =11.70 < [B/T]=12.20

压杆,平面内长细比 λ=132. ≤ [λ]=180

压杆,平面外长细比 λ=117. ≤ [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 | 27.71 | -3.95 | -27.66 | -23.44 | 3.95 |
| 2 | 0.00 | 41.16 | -6.32 | -44.24 | -36.89 | 6.32 |
| 3 | 0.00 | 41.16 | -6.32 | -44.24 | -36.89 | 6.32 |
| 4 | 0.00 | 27.71 | -3.95 | -27.66 | -23.44 | 3.95 |
| 5 | 0.00 | 24.85 | -3.54 | -24.78 | -21.00 | 3.54 |
| 6 | 0.00 | 38.30 | -5.91 | -41.36 | -34.45 | 5.91 |
| 7 | 0.00 | 38.30 | -5.91 | -41.36 | -34.45 | 5.91 |
| 8 | 0.00 | 24.85 | -3.54 | -24.78 | -21.00 | 3.54 |
| 9 | 0.00 | 17.88 | 1.38 | 1.05 | -13.61 | 1.08 |
| 10 | 0.00 | 26.88 | -8.74 | -42.75 | -22.60 | 3.47 |
| 11 | 0.00 | 21.38 | 2.62 | -4.42 | -17.11 | 3.89 |
| 12 | 0.00 | 30.38 | -7.51 | -48.24 | -26.10 | 6.27 |
| 13 | 0.00 | 15.02 | 1.79 | 3.94 | -11.17 | 0.67 |
| 14 | 0.00 | 24.02 | -8.33 | -39.87 | -20.17 | 3.06 |
| 15 | 0.00 | 18.52 | 3.04 | -1.53 | -14.67 | 3.47 |
| 16 | 0.00 | 27.51 | -7.10 | -45.35 | -23.66 | 5.86 |

防火设计控制的偶然组合号: 12, M=0.00, N=30.38, M=-48.24, N=-26.10

强度计算荷载比 =0.23

平面内稳定计算荷载比 =0.27

平面外稳定计算荷载比 =0.24

无防护下钢构件最大升温(Ts): 1081.76℃ ,按临界温度法求得临界温度(Td): 644.52℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4281(m^2\*℃/w)

构件重量 (Kg)=356.30

**2. 钢 柱 2
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=16.38, Ly=7.75; 长细比：λx=124.6,λy=130.0

构件长度=7.98; 计算长度系数: Ux=2.05 Uy=0.97

抗震等级: 四级

截面参数: B1=240, B2=240, 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: 238.888885(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 132.63 | 6.49 | 51.84 | -126.30 | -6.49 |
| 2 | 0.00 | 132.63 | -6.49 | -51.84 | -126.30 | 6.49 |
| 3 | 0.00 | 178.13 | 0.00 | 0.00 | -171.79 | -0.00 |
| 4 | 0.00 | 87.14 | 0.00 | 0.00 | -80.80 | -0.00 |
| 5 | 0.00 | 112.52 | 6.49 | 51.84 | -107.65 | -6.49 |
| 6 | 0.00 | 112.52 | -6.49 | -51.84 | -107.65 | 6.49 |
| 7 | 0.00 | 158.02 | 0.00 | 0.00 | -153.14 | -0.00 |
| 8 | 0.00 | 67.03 | 0.00 | 0.00 | -62.16 | -0.00 |
| 9 | 0.00 | 29.01 | 12.58 | 100.43 | -22.67 | -12.58 |
| 10 | 0.00 | 29.00 | -12.61 | -100.65 | -22.66 | 12.61 |
| 11 | 0.00 | 56.01 | 12.61 | 100.65 | -49.68 | -12.61 |
| 12 | 0.00 | 56.01 | -12.61 | -100.65 | -49.68 | 12.61 |
| 13 | 0.00 | 8.90 | 12.58 | 100.43 | -4.02 | -12.58 |
| 14 | 0.00 | 8.89 | -12.61 | -100.65 | -4.01 | 12.61 |
| 15 | 0.00 | 35.90 | 12.61 | 100.65 | -31.03 | -12.61 |
| 16 | 0.00 | 35.90 | -12.61 | -100.65 | -31.03 | 12.61 |
| 17 | 0.00 | 97.75 | 14.04 | 112.10 | -91.42 | -14.04 |
| 18 | 0.00 | 97.75 | -1.07 | -8.55 | -91.41 | 1.07 |
| 19 | 0.00 | 113.96 | 14.06 | 112.23 | -107.62 | -14.06 |
| 20 | 0.00 | 113.96 | -1.07 | -8.55 | -107.62 | 1.07 |
| 21 | 0.00 | 97.75 | 1.05 | 8.42 | -91.42 | -1.05 |
| 22 | 0.00 | 97.75 | -14.06 | -112.23 | -91.41 | 14.06 |
| 23 | 0.00 | 113.96 | 1.07 | 8.55 | -107.62 | -1.07 |
| 24 | 0.00 | 113.96 | -14.06 | -112.23 | -107.62 | 14.06 |
| 25 | 0.00 | 143.25 | 7.55 | 60.26 | -136.91 | -7.55 |
| 26 | 0.00 | 143.24 | -7.56 | -60.39 | -136.90 | 7.56 |
| 27 | 0.00 | 159.45 | 7.56 | 60.39 | -153.11 | -7.56 |
| 28 | 0.00 | 159.45 | -7.56 | -60.39 | -153.11 | 7.56 |
| 29 | 0.00 | 52.26 | 7.55 | 60.26 | -45.92 | -7.55 |
| 30 | 0.00 | 52.25 | -7.56 | -60.39 | -45.92 | 7.56 |
| 31 | 0.00 | 68.46 | 7.56 | 60.39 | -62.13 | -7.56 |
| 32 | 0.00 | 68.46 | -7.56 | -60.39 | -62.13 | 7.56 |
| 33 | 0.00 | 77.64 | 14.04 | 112.10 | -72.77 | -14.04 |
| 34 | 0.00 | 77.64 | -1.07 | -8.55 | -72.76 | 1.07 |
| 35 | 0.00 | 93.85 | 14.06 | 112.23 | -88.97 | -14.06 |
| 36 | 0.00 | 93.85 | -1.07 | -8.55 | -88.97 | 1.07 |
| 37 | 0.00 | 77.64 | 1.05 | 8.42 | -72.77 | -1.05 |
| 38 | 0.00 | 77.64 | -14.06 | -112.23 | -72.76 | 14.06 |
| 39 | 0.00 | 93.85 | 1.07 | 8.55 | -88.97 | -1.07 |
| 40 | 0.00 | 93.85 | -14.06 | -112.23 | -88.97 | 14.06 |
| 41 | 0.00 | 123.14 | 7.55 | 60.26 | -118.26 | -7.55 |
| 42 | 0.00 | 123.13 | -7.56 | -60.39 | -118.26 | 7.56 |
| 43 | 0.00 | 139.34 | 7.56 | 60.39 | -134.47 | -7.56 |
| 44 | 0.00 | 139.34 | -7.56 | -60.39 | -134.47 | 7.56 |
| 45 | 0.00 | 32.15 | 7.55 | 60.26 | -27.28 | -7.55 |
| 46 | 0.00 | 32.14 | -7.56 | -60.39 | -27.27 | 7.56 |
| 47 | 0.00 | 48.35 | 7.56 | 60.39 | -43.48 | -7.56 |
| 48 | 0.00 | 48.35 | -7.56 | -60.39 | -43.48 | 7.56 |
| 49 | 0.00 | 60.85 | 17.12 | 136.72 | -54.52 | -17.12 |
| 50 | 0.00 | 60.84 | -8.06 | -64.36 | -54.51 | 8.06 |
| 51 | 0.00 | 87.86 | 17.15 | 136.94 | -81.52 | -17.15 |
| 52 | 0.00 | 87.86 | -8.06 | -64.36 | -81.52 | 8.06 |
| 53 | 0.00 | 60.85 | 8.03 | 64.14 | -54.52 | -8.03 |
| 54 | 0.00 | 60.84 | -17.15 | -136.94 | -54.51 | 17.15 |
| 55 | 0.00 | 87.86 | 8.06 | 64.36 | -81.52 | -8.06 |
| 56 | 0.00 | 87.86 | -17.15 | -136.94 | -81.52 | 17.15 |
| 57 | 0.00 | 92.70 | 12.58 | 100.43 | -86.36 | -12.58 |
| 58 | 0.00 | 92.69 | -12.61 | -100.65 | -86.35 | 12.61 |
| 59 | 0.00 | 119.70 | 12.61 | 100.65 | -113.37 | -12.61 |
| 60 | 0.00 | 119.70 | -12.61 | -100.65 | -113.37 | 12.61 |
| 61 | 0.00 | 29.01 | 12.58 | 100.43 | -22.67 | -12.58 |
| 62 | 0.00 | 29.00 | -12.61 | -100.65 | -22.66 | 12.61 |
| 63 | 0.00 | 56.01 | 12.61 | 100.65 | -49.68 | -12.61 |
| 64 | 0.00 | 56.01 | -12.61 | -100.65 | -49.68 | 12.61 |
| 65 | 0.00 | 40.74 | 17.12 | 136.72 | -35.87 | -17.12 |
| 66 | 0.00 | 40.73 | -8.06 | -64.36 | -35.86 | 8.06 |
| 67 | 0.00 | 67.75 | 17.15 | 136.94 | -62.88 | -17.15 |
| 68 | 0.00 | 67.75 | -8.06 | -64.36 | -62.88 | 8.06 |
| 69 | 0.00 | 40.74 | 8.03 | 64.14 | -35.87 | -8.03 |
| 70 | 0.00 | 40.73 | -17.15 | -136.94 | -35.86 | 17.15 |
| 71 | 0.00 | 67.75 | 8.06 | 64.36 | -62.88 | -8.06 |
| 72 | 0.00 | 67.75 | -17.15 | -136.94 | -62.88 | 17.15 |
| 73 | 0.00 | 72.59 | 12.58 | 100.43 | -67.71 | -12.58 |
| 74 | 0.00 | 72.58 | -12.61 | -100.65 | -67.70 | 12.61 |
| 75 | 0.00 | 99.60 | 12.61 | 100.65 | -94.72 | -12.61 |
| 76 | 0.00 | 99.59 | -12.61 | -100.65 | -94.72 | 12.61 |
| 77 | 0.00 | 8.90 | 12.58 | 100.43 | -4.02 | -12.58 |
| 78 | 0.00 | 8.89 | -12.61 | -100.65 | -4.01 | 12.61 |
| 79 | 0.00 | 35.90 | 12.61 | 100.65 | -31.03 | -12.61 |
| 80 | 0.00 | 35.90 | -12.61 | -100.65 | -31.03 | 12.61 |
| 81 | 0.00 | 106.85 | 4.11 | 32.82 | -100.52 | -4.11 |
| 82 | 0.00 | 106.85 | 1.52 | 12.11 | -100.52 | -1.52 |
| 83 | 0.00 | 106.85 | -1.52 | -12.11 | -100.52 | 1.52 |
| 84 | 0.00 | 106.85 | -4.11 | -32.82 | -100.52 | 4.11 |
| 85 | 0.00 | 126.57 | 1.30 | 10.35 | -120.23 | -1.30 |
| 86 | 0.00 | 126.57 | -1.30 | -10.35 | -120.23 | 1.30 |
| 87 | 0.00 | 87.14 | 1.30 | 10.35 | -80.80 | -1.30 |
| 88 | 0.00 | 87.14 | -1.30 | -10.35 | -80.80 | 1.30 |
| 89 | 0.00 | 82.19 | 3.46 | 27.63 | -77.32 | -3.46 |
| 90 | 0.00 | 82.19 | 0.87 | 6.93 | -77.32 | -0.87 |
| 91 | 0.00 | 82.19 | -0.87 | -6.93 | -77.32 | 0.87 |
| 92 | 0.00 | 82.19 | -3.46 | -27.63 | -77.32 | 3.46 |
| 93 | 0.00 | 97.36 | 1.30 | 10.35 | -92.49 | -1.30 |
| 94 | 0.00 | 97.36 | -1.30 | -10.35 | -92.49 | 1.30 |
| 95 | 0.00 | 67.03 | 1.30 | 10.35 | -62.16 | -1.30 |
| 96 | 0.00 | 67.03 | -1.30 | -10.35 | -62.16 | 1.30 |

强度计算控制组合号: 51, M=0.00, N=87.86, M=136.94, N=-81.52

强度计算应力比 =0.682

抗剪强度计算控制组合号: 51, V=17.15

抗剪强度计算应力比 =0.058

平面内稳定计算最大应力对应组合号: 51, M=0.00, N=87.86, M=136.94, N=-81.52

平面内稳定计算最大应力 (N/mm\*mm) =245.34

平面内稳定计算最大应力比 =0.804

临界弯矩Mcr(kN\*m) =287.29

平面外稳定计算最大应力比 =0.994

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 =0.682 < 1.0

抗剪强度计算应力比 =0.058 < 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 =11.70 < [B/T]=12.20

压杆,平面内长细比 λ=125. ≤ [λ]=180

压杆,平面外长细比 λ=130. ≤ [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 | 82.19 | 2.16 | 17.28 | -77.32 | -2.16 |
| 2 | 0.00 | 82.19 | -2.16 | -17.28 | -77.32 | 2.16 |
| 3 | 0.00 | 97.36 | 0.00 | 0.00 | -92.49 | -0.00 |
| 4 | 0.00 | 67.03 | 0.00 | 0.00 | -62.16 | -0.00 |
| 5 | 0.00 | 75.49 | 2.16 | 17.28 | -71.11 | -2.16 |
| 6 | 0.00 | 75.49 | -2.16 | -17.28 | -71.11 | 2.16 |
| 7 | 0.00 | 90.66 | 0.00 | 0.00 | -86.27 | -0.00 |
| 8 | 0.00 | 60.33 | 0.00 | 0.00 | -55.94 | -0.00 |
| 9 | 0.00 | 51.53 | 3.35 | 26.78 | -46.65 | -3.35 |
| 10 | 0.00 | 51.53 | -3.36 | -26.84 | -46.65 | 3.36 |
| 11 | 0.00 | 58.73 | 3.36 | 26.84 | -53.86 | -3.36 |
| 12 | 0.00 | 58.73 | -3.36 | -26.84 | -53.86 | 3.36 |
| 13 | 0.00 | 44.82 | 3.35 | 26.78 | -40.44 | -3.35 |
| 14 | 0.00 | 44.82 | -3.36 | -26.84 | -40.44 | 3.36 |
| 15 | 0.00 | 52.03 | 3.36 | 26.84 | -47.64 | -3.36 |
| 16 | 0.00 | 52.03 | -3.36 | -26.84 | -47.64 | 3.36 |

防火设计控制的偶然组合号: 11, M=0.00, N=58.73, M=26.84, N=-53.86

强度计算荷载比 =0.13

平面内稳定计算荷载比 =0.22

平面外稳定计算荷载比 =0.22

无防护下钢构件最大升温(Ts): 1081.76℃ ,按临界温度法求得临界温度(Td): 644.87℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4277(m^2\*℃/w)

构件重量 (Kg)=406.13

**3. 钢 柱 3
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=17.33, Ly=7.00; 长细比：λx=131.8,λy=117.4

构件长度=7.00; 计算长度系数: Ux=2.48 Uy=1.00

抗震等级: 四级

截面参数: B1=240, B2=240, 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: 238.888885(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 74.81 | 11.95 | 83.64 | -69.25 | -11.95 |
| 2 | 0.00 | 34.47 | 4.84 | 33.89 | -28.91 | -4.84 |
| 3 | 0.00 | 74.81 | 11.95 | 83.64 | -69.25 | -11.95 |
| 4 | 0.00 | 34.47 | 4.84 | 33.89 | -28.91 | -4.84 |
| 5 | 0.00 | 66.22 | 10.71 | 74.97 | -61.95 | -10.71 |
| 6 | 0.00 | 25.88 | 3.60 | 25.23 | -21.60 | -3.60 |
| 7 | 0.00 | 66.22 | 10.71 | 74.97 | -61.95 | -10.71 |
| 8 | 0.00 | 25.88 | 3.60 | 25.23 | -21.60 | -3.60 |
| 9 | 0.00 | 30.68 | 22.66 | 89.53 | -25.12 | -2.92 |
| 10 | 0.00 | -3.07 | -15.31 | -74.74 | 8.63 | 6.05 |
| 11 | 0.00 | 43.76 | 18.05 | 110.14 | -38.20 | -13.42 |
| 12 | 0.00 | 10.04 | -19.94 | -54.17 | -4.49 | -4.47 |
| 13 | 0.00 | 22.09 | 21.42 | 80.87 | -17.81 | -1.68 |
| 14 | 0.00 | -11.66 | -16.54 | -83.40 | 15.93 | 7.29 |
| 15 | 0.00 | 35.17 | 16.81 | 101.48 | -30.90 | -12.18 |
| 16 | 0.00 | 1.45 | -21.18 | -62.84 | 2.82 | -3.23 |
| 17 | 0.00 | 70.89 | 22.33 | 114.83 | -65.33 | -10.48 |
| 18 | 0.00 | 50.64 | -0.45 | 16.27 | -45.08 | -5.10 |
| 19 | 0.00 | 78.74 | 19.56 | 127.20 | -73.18 | -16.78 |
| 20 | 0.00 | 58.50 | -3.24 | 28.61 | -52.95 | -11.41 |
| 21 | 0.00 | 30.54 | 15.22 | 65.09 | -24.98 | -3.38 |
| 22 | 0.00 | 10.29 | -7.56 | -33.48 | -4.74 | 2.00 |
| 23 | 0.00 | 38.39 | 12.45 | 77.45 | -32.83 | -9.68 |
| 24 | 0.00 | 18.16 | -10.34 | -21.13 | -12.60 | -4.30 |
| 25 | 0.00 | 70.89 | 22.33 | 114.83 | -65.33 | -10.48 |
| 26 | 0.00 | 50.64 | -0.45 | 16.27 | -45.08 | -5.10 |
| 27 | 0.00 | 78.74 | 19.56 | 127.20 | -73.18 | -16.78 |
| 28 | 0.00 | 58.50 | -3.24 | 28.61 | -52.95 | -11.41 |
| 29 | 0.00 | 30.54 | 15.22 | 65.09 | -24.98 | -3.38 |
| 30 | 0.00 | 10.29 | -7.56 | -33.48 | -4.74 | 2.00 |
| 31 | 0.00 | 38.39 | 12.45 | 77.45 | -32.83 | -9.68 |
| 32 | 0.00 | 18.16 | -10.34 | -21.13 | -12.60 | -4.30 |
| 33 | 0.00 | 62.30 | 21.09 | 106.17 | -58.02 | -9.24 |
| 34 | 0.00 | 42.05 | -1.69 | 7.60 | -37.77 | -3.86 |
| 35 | 0.00 | 70.15 | 18.32 | 118.53 | -65.87 | -15.54 |
| 36 | 0.00 | 49.92 | -4.47 | 19.94 | -45.64 | -10.17 |
| 37 | 0.00 | 21.95 | 13.98 | 56.42 | -17.68 | -2.14 |
| 38 | 0.00 | 1.70 | -8.80 | -42.14 | 2.57 | 3.24 |
| 39 | 0.00 | 29.80 | 11.22 | 68.79 | -25.53 | -8.44 |
| 40 | 0.00 | 9.57 | -11.58 | -29.80 | -5.30 | -3.07 |
| 41 | 0.00 | 62.30 | 21.09 | 106.17 | -58.02 | -9.24 |
| 42 | 0.00 | 42.05 | -1.69 | 7.60 | -37.77 | -3.86 |
| 43 | 0.00 | 70.15 | 18.32 | 118.53 | -65.87 | -15.54 |
| 44 | 0.00 | 49.92 | -4.47 | 19.94 | -45.64 | -10.17 |
| 45 | 0.00 | 21.95 | 13.98 | 56.42 | -17.68 | -2.14 |
| 46 | 0.00 | 1.70 | -8.80 | -42.14 | 2.57 | 3.24 |
| 47 | 0.00 | 29.80 | 11.22 | 68.79 | -25.53 | -8.44 |
| 48 | 0.00 | 9.57 | -11.58 | -29.80 | -5.30 | -3.07 |
| 49 | 0.00 | 56.99 | 27.27 | 121.80 | -51.43 | -7.53 |
| 50 | 0.00 | 23.25 | -10.70 | -42.48 | -17.69 | 1.44 |
| 51 | 0.00 | 70.08 | 22.66 | 142.41 | -64.52 | -18.03 |
| 52 | 0.00 | 36.36 | -15.33 | -21.91 | -30.80 | -9.07 |
| 53 | 0.00 | 28.75 | 22.30 | 86.98 | -23.19 | -2.56 |
| 54 | 0.00 | -5.00 | -15.67 | -77.30 | 10.55 | 6.41 |
| 55 | 0.00 | 41.83 | 17.68 | 107.59 | -36.28 | -13.05 |
| 56 | 0.00 | 8.12 | -20.31 | -56.73 | -2.56 | -4.10 |
| 57 | 0.00 | 56.99 | 27.27 | 121.80 | -51.43 | -7.53 |
| 58 | 0.00 | 23.25 | -10.70 | -42.48 | -17.69 | 1.44 |
| 59 | 0.00 | 70.08 | 22.66 | 142.41 | -64.52 | -18.03 |
| 60 | 0.00 | 36.36 | -15.33 | -21.91 | -30.80 | -9.07 |
| 61 | 0.00 | 28.75 | 22.30 | 86.98 | -23.19 | -2.56 |
| 62 | 0.00 | -5.00 | -15.67 | -77.30 | 10.55 | 6.41 |
| 63 | 0.00 | 41.83 | 17.68 | 107.59 | -36.28 | -13.05 |
| 64 | 0.00 | 8.12 | -20.31 | -56.73 | -2.56 | -4.10 |
| 65 | 0.00 | 48.40 | 26.03 | 113.14 | -44.13 | -6.29 |
| 66 | 0.00 | 14.66 | -11.93 | -51.14 | -10.38 | 2.68 |
| 67 | 0.00 | 61.49 | 21.42 | 133.74 | -57.21 | -16.79 |
| 68 | 0.00 | 27.77 | -16.57 | -30.57 | -23.49 | -7.84 |
| 69 | 0.00 | 20.16 | 21.06 | 78.32 | -15.89 | -1.32 |
| 70 | 0.00 | -13.58 | -16.91 | -85.96 | 17.86 | 7.65 |
| 71 | 0.00 | 33.25 | 16.45 | 98.92 | -28.97 | -11.82 |
| 72 | 0.00 | -0.47 | -21.55 | -65.39 | 4.75 | -2.86 |
| 73 | 0.00 | 48.40 | 26.03 | 113.14 | -44.13 | -6.29 |
| 74 | 0.00 | 14.66 | -11.93 | -51.14 | -10.38 | 2.68 |
| 75 | 0.00 | 61.49 | 21.42 | 133.74 | -57.21 | -16.79 |
| 76 | 0.00 | 27.77 | -16.57 | -30.57 | -23.49 | -7.84 |
| 77 | 0.00 | 20.16 | 21.06 | 78.32 | -15.89 | -1.32 |
| 78 | 0.00 | -13.58 | -16.91 | -85.96 | 17.86 | 7.65 |
| 79 | 0.00 | 33.25 | 16.45 | 98.92 | -28.97 | -11.82 |
| 80 | 0.00 | -0.47 | -21.55 | -65.39 | 4.75 | -2.86 |
| 81 | 0.00 | 54.55 | 9.28 | 64.99 | -48.99 | -9.28 |
| 82 | 0.00 | 52.47 | 7.15 | 50.04 | -46.92 | -7.15 |
| 83 | 0.00 | 37.06 | 6.21 | 43.44 | -31.51 | -6.21 |
| 84 | 0.00 | 34.99 | 4.07 | 28.49 | -29.43 | -4.07 |
| 85 | 0.00 | 54.55 | 9.28 | 64.99 | -48.99 | -9.28 |
| 86 | 0.00 | 52.47 | 7.15 | 50.04 | -46.92 | -7.15 |
| 87 | 0.00 | 37.06 | 6.21 | 43.44 | -31.51 | -6.21 |
| 88 | 0.00 | 34.99 | 4.07 | 28.49 | -29.43 | -4.07 |
| 89 | 0.00 | 42.20 | 7.39 | 51.72 | -37.92 | -7.39 |
| 90 | 0.00 | 40.13 | 5.25 | 36.77 | -35.85 | -5.25 |
| 91 | 0.00 | 28.75 | 5.02 | 35.14 | -24.47 | -5.02 |
| 92 | 0.00 | 26.68 | 2.88 | 20.19 | -22.40 | -2.88 |
| 93 | 0.00 | 42.20 | 7.39 | 51.72 | -37.92 | -7.39 |
| 94 | 0.00 | 40.13 | 5.25 | 36.77 | -35.85 | -5.25 |
| 95 | 0.00 | 28.75 | 5.02 | 35.14 | -24.47 | -5.02 |
| 96 | 0.00 | 26.68 | 2.88 | 20.19 | -22.40 | -2.88 |

强度计算控制组合号: 51, M=0.00, N=70.08, M=142.41, N=-64.52

强度计算应力比 =0.703

抗剪强度计算控制组合号: 49, V=27.27

抗剪强度计算应力比 =0.093

平面内稳定计算最大应力对应组合号: 51, M=0.00, N=70.08, M=142.41, N=-64.52

平面内稳定计算最大应力 (N/mm\*mm) =245.44

平面内稳定计算最大应力比 =0.805

临界弯矩Mcr(kN\*m) =336.74

平面外稳定计算最大应力比 =0.893

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 =0.703 < 1.0

抗剪强度计算应力比 =0.093 < 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 =11.70 < [B/T]=12.20

压杆,平面内长细比 λ=132. ≤ [λ]=180

压杆,平面外长细比 λ=117. ≤ [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 | 41.16 | 6.32 | 44.24 | -36.89 | -6.32 |
| 2 | 0.00 | 27.71 | 3.95 | 27.66 | -23.44 | -3.95 |
| 3 | 0.00 | 41.16 | 6.32 | 44.24 | -36.89 | -6.32 |
| 4 | 0.00 | 27.71 | 3.95 | 27.66 | -23.44 | -3.95 |
| 5 | 0.00 | 38.30 | 5.91 | 41.36 | -34.45 | -5.91 |
| 6 | 0.00 | 24.85 | 3.54 | 24.78 | -21.00 | -3.54 |
| 7 | 0.00 | 38.30 | 5.91 | 41.36 | -34.45 | -5.91 |
| 8 | 0.00 | 24.85 | 3.54 | 24.78 | -21.00 | -3.54 |
| 9 | 0.00 | 26.89 | 8.74 | 42.74 | -22.61 | -3.47 |
| 10 | 0.00 | 17.89 | -1.39 | -1.06 | -13.61 | -1.08 |
| 11 | 0.00 | 30.38 | 7.51 | 48.24 | -26.10 | -6.27 |
| 12 | 0.00 | 21.38 | -2.62 | 4.42 | -17.11 | -3.89 |
| 13 | 0.00 | 24.02 | 8.33 | 39.86 | -20.18 | -3.06 |
| 14 | 0.00 | 15.02 | -1.80 | -3.95 | -11.18 | -0.67 |
| 15 | 0.00 | 27.51 | 7.10 | 45.35 | -23.66 | -5.86 |
| 16 | 0.00 | 18.52 | -3.04 | 1.53 | -14.67 | -3.47 |

防火设计控制的偶然组合号: 11, M=0.00, N=30.38, M=48.24, N=-26.10

强度计算荷载比 =0.23

平面内稳定计算荷载比 =0.27

平面外稳定计算荷载比 =0.24

无防护下钢构件最大升温(Ts): 1081.76℃ ,按临界温度法求得临界温度(Td): 644.52℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4281(m^2\*℃/w)

构件重量 (Kg)=356.30

**4. 钢 柱 4
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=35.2,λy=33.9

构件长度=1.52; 计算长度系数: Ux=1.97 Uy=0.99

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 | 0.74 | 0.00 | -0.00 | 0.00 | -0.00 |
| 2 | -0.00 | 0.74 | -0.00 | -0.00 | 0.00 | 0.00 |
| 3 | -0.00 | 0.74 | -0.00 | -0.00 | 0.00 | 0.00 |
| 4 | 0.00 | 0.74 | 0.00 | -0.00 | 0.00 | -0.00 |
| 5 | 0.00 | 0.57 | 0.00 | -0.00 | 0.00 | -0.00 |
| 6 | -0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 7 | -0.00 | 0.57 | -0.00 | -0.00 | -0.00 | 0.00 |
| 8 | 0.00 | 0.57 | 0.00 | -0.00 | 0.00 | -0.00 |
| 9 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 10 | -8.79 | 0.74 | -11.72 | 0.00 | -0.00 | 0.00 |
| 11 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 12 | -8.79 | 0.74 | -11.72 | -0.00 | -0.00 | 0.00 |
| 13 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 14 | -8.79 | 0.57 | -11.72 | 0.00 | -0.00 | 0.00 |
| 15 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 16 | -8.79 | 0.57 | -11.72 | -0.00 | -0.00 | 0.00 |
| 17 | 5.28 | 0.74 | 7.03 | 0.00 | 0.00 | -0.00 |
| 18 | -5.28 | 0.74 | -7.03 | 0.00 | -0.00 | 0.00 |
| 19 | 5.28 | 0.74 | 7.03 | 0.00 | -0.00 | -0.00 |
| 20 | -5.28 | 0.74 | -7.03 | -0.00 | -0.00 | 0.00 |
| 21 | 5.28 | 0.74 | 7.03 | 0.00 | 0.00 | -0.00 |
| 22 | -5.28 | 0.74 | -7.03 | -0.00 | -0.00 | 0.00 |
| 23 | 5.28 | 0.74 | 7.03 | 0.00 | -0.00 | -0.00 |
| 24 | -5.28 | 0.74 | -7.03 | -0.00 | -0.00 | 0.00 |
| 25 | 5.28 | 0.74 | 7.03 | 0.00 | 0.00 | -0.00 |
| 26 | -5.28 | 0.74 | -7.03 | -0.00 | -0.00 | 0.00 |
| 27 | 5.28 | 0.74 | 7.03 | 0.00 | -0.00 | -0.00 |
| 28 | -5.28 | 0.74 | -7.03 | -0.00 | -0.00 | 0.00 |
| 29 | 5.28 | 0.74 | 7.03 | 0.00 | 0.00 | -0.00 |
| 30 | -5.28 | 0.74 | -7.03 | 0.00 | 0.00 | 0.00 |
| 31 | 5.28 | 0.74 | 7.03 | 0.00 | -0.00 | -0.00 |
| 32 | -5.28 | 0.74 | -7.03 | -0.00 | -0.00 | 0.00 |
| 33 | 5.28 | 0.57 | 7.03 | 0.00 | 0.00 | -0.00 |
| 34 | -5.28 | 0.57 | -7.03 | 0.00 | -0.00 | 0.00 |
| 35 | 5.28 | 0.57 | 7.03 | 0.00 | -0.00 | -0.00 |
| 36 | -5.28 | 0.57 | -7.03 | -0.00 | -0.00 | 0.00 |
| 37 | 5.28 | 0.57 | 7.03 | 0.00 | 0.00 | -0.00 |
| 38 | -5.28 | 0.57 | -7.03 | -0.00 | -0.00 | 0.00 |
| 39 | 5.28 | 0.57 | 7.03 | 0.00 | -0.00 | -0.00 |
| 40 | -5.28 | 0.57 | -7.03 | -0.00 | -0.00 | 0.00 |
| 41 | 5.28 | 0.57 | 7.03 | 0.00 | 0.00 | -0.00 |
| 42 | -5.28 | 0.57 | -7.03 | -0.00 | -0.00 | 0.00 |
| 43 | 5.28 | 0.57 | 7.03 | 0.00 | -0.00 | -0.00 |
| 44 | -5.28 | 0.57 | -7.03 | -0.00 | -0.00 | 0.00 |
| 45 | 5.28 | 0.57 | 7.03 | 0.00 | 0.00 | -0.00 |
| 46 | -5.28 | 0.57 | -7.03 | 0.00 | 0.00 | 0.00 |
| 47 | 5.28 | 0.57 | 7.03 | 0.00 | -0.00 | -0.00 |
| 48 | -5.28 | 0.57 | -7.03 | -0.00 | -0.00 | 0.00 |
| 49 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 50 | -8.79 | 0.74 | -11.72 | 0.00 | -0.00 | 0.00 |
| 51 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 52 | -8.79 | 0.74 | -11.72 | -0.00 | -0.00 | 0.00 |
| 53 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 54 | -8.79 | 0.74 | -11.72 | 0.00 | -0.00 | 0.00 |
| 55 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 56 | -8.79 | 0.74 | -11.72 | -0.00 | -0.00 | 0.00 |
| 57 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 58 | -8.79 | 0.74 | -11.72 | 0.00 | -0.00 | 0.00 |
| 59 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 60 | -8.79 | 0.74 | -11.72 | -0.00 | -0.00 | 0.00 |
| 61 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 62 | -8.79 | 0.74 | -11.72 | 0.00 | -0.00 | 0.00 |
| 63 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 64 | -8.79 | 0.74 | -11.72 | -0.00 | -0.00 | 0.00 |
| 65 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 66 | -8.79 | 0.57 | -11.72 | 0.00 | -0.00 | 0.00 |
| 67 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 68 | -8.79 | 0.57 | -11.72 | -0.00 | -0.00 | 0.00 |
| 69 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 70 | -8.79 | 0.57 | -11.72 | 0.00 | -0.00 | 0.00 |
| 71 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 72 | -8.79 | 0.57 | -11.72 | -0.00 | -0.00 | 0.00 |
| 73 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 74 | -8.79 | 0.57 | -11.72 | 0.00 | -0.00 | 0.00 |
| 75 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 76 | -8.79 | 0.57 | -11.72 | -0.00 | -0.00 | 0.00 |
| 77 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 78 | -8.79 | 0.57 | -11.72 | 0.00 | -0.00 | 0.00 |
| 79 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 80 | -8.79 | 0.57 | -11.72 | -0.00 | -0.00 | 0.00 |
| 81 | 0.01 | 0.74 | 0.01 | 0.00 | -0.00 | -0.01 |
| 82 | -0.01 | 0.74 | -0.01 | -0.00 | 0.00 | 0.01 |
| 83 | 0.01 | 0.74 | 0.01 | 0.00 | -0.00 | -0.01 |
| 84 | -0.01 | 0.74 | -0.01 | -0.00 | 0.00 | 0.01 |
| 85 | 0.01 | 0.74 | 0.01 | 0.00 | -0.00 | -0.01 |
| 86 | -0.01 | 0.74 | -0.01 | -0.00 | 0.00 | 0.01 |
| 87 | 0.01 | 0.74 | 0.01 | 0.00 | 0.00 | -0.01 |
| 88 | -0.01 | 0.74 | -0.01 | -0.00 | 0.00 | 0.01 |
| 89 | 0.01 | 0.57 | 0.01 | 0.00 | -0.00 | -0.01 |
| 90 | -0.01 | 0.57 | -0.01 | -0.00 | 0.00 | 0.01 |
| 91 | 0.01 | 0.57 | 0.01 | 0.00 | -0.00 | -0.01 |
| 92 | -0.01 | 0.57 | -0.01 | -0.00 | 0.00 | 0.01 |
| 93 | 0.01 | 0.57 | 0.01 | 0.00 | -0.00 | -0.01 |
| 94 | -0.01 | 0.57 | -0.01 | -0.00 | 0.00 | 0.01 |
| 95 | 0.01 | 0.57 | 0.01 | 0.00 | -0.00 | -0.01 |
| 96 | -0.01 | 0.57 | -0.01 | -0.00 | 0.00 | 0.01 |

强度计算控制组合号: 51, M=8.79, N=0.74, M=0.00, N=-0.00

强度计算应力比 =0.106

抗剪强度计算控制组合号: 72, V=-11.72

抗剪强度计算应力比 =0.061

平面内稳定计算最大应力对应组合号: 51, M=8.79, N=0.74, M=0.00, N=-0.00

平面内稳定计算最大应力 (N/mm\*mm) =29.85

平面内稳定计算最大应力比 =0.098

临界弯矩Mcr(kN\*m) =1309.58

平面外稳定计算最大应力比 =0.046

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 =0.106 < 1.0

抗剪强度计算应力比 =0.061 < 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 | 0.57 | 0.00 | -0.00 | 0.00 | -0.00 |
| 2 | -0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 3 | -0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 4 | 0.00 | 0.57 | 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 | 2.34 | 0.57 | 3.13 | 0.00 | 0.00 | -0.00 |
| 10 | -2.34 | 0.57 | -3.13 | 0.00 | 0.00 | 0.00 |
| 11 | 2.34 | 0.57 | 3.13 | 0.00 | -0.00 | -0.00 |
| 12 | -2.34 | 0.57 | -3.13 | -0.00 | -0.00 | 0.00 |
| 13 | 2.34 | 0.51 | 3.13 | 0.00 | 0.00 | -0.00 |
| 14 | -2.34 | 0.51 | -3.13 | 0.00 | -0.00 | 0.00 |
| 15 | 2.34 | 0.51 | 3.13 | 0.00 | -0.00 | -0.00 |
| 16 | -2.34 | 0.51 | -3.13 | -0.00 | -0.00 | 0.00 |

防火设计控制的偶然组合号: 11, M=2.34, N=0.57, M=0.00, N=-0.00

强度计算荷载比 =0.03

平面内稳定计算荷载比 =0.03

平面外稳定计算荷载比 =0.01

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)=47.56

**5. 钢 柱 5
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=35.2,λy=33.9

构件长度=1.52; 计算长度系数: Ux=1.97 Uy=0.99

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 | 0.74 | 0.00 | 0.00 | -0.00 | -0.00 |
| 2 | -0.00 | 0.74 | -0.00 | -0.00 | 0.00 | 0.00 |
| 3 | -0.00 | 0.74 | 0.00 | 0.00 | -0.00 | -0.00 |
| 4 | -0.00 | 0.74 | -0.00 | -0.00 | 0.00 | 0.00 |
| 5 | -0.00 | 0.57 | 0.00 | 0.00 | -0.00 | -0.00 |
| 6 | -0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 7 | -0.00 | 0.57 | 0.00 | 0.00 | -0.00 | -0.00 |
| 8 | -0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 9 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 10 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 11 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 12 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 13 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 14 | -8.79 | 0.57 | -11.72 | 0.00 | 0.00 | -0.00 |
| 15 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 16 | -8.79 | 0.57 | -11.72 | 0.00 | 0.00 | -0.00 |
| 17 | 5.28 | 0.74 | 7.03 | 0.00 | -0.00 | -0.00 |
| 18 | -5.28 | 0.74 | -7.03 | 0.00 | 0.00 | -0.00 |
| 19 | 5.28 | 0.74 | 7.03 | 0.00 | 0.00 | -0.00 |
| 20 | -5.28 | 0.74 | -7.03 | 0.00 | -0.00 | -0.00 |
| 21 | 5.28 | 0.74 | 7.03 | 0.00 | -0.00 | -0.00 |
| 22 | -5.28 | 0.74 | -7.03 | 0.00 | 0.00 | -0.00 |
| 23 | 5.28 | 0.74 | 7.03 | 0.00 | 0.00 | -0.00 |
| 24 | -5.28 | 0.74 | -7.03 | 0.00 | 0.00 | -0.00 |
| 25 | 5.28 | 0.74 | 7.03 | 0.00 | -0.00 | -0.00 |
| 26 | -5.28 | 0.74 | -7.03 | 0.00 | 0.00 | -0.00 |
| 27 | 5.28 | 0.74 | 7.03 | 0.00 | 0.00 | -0.00 |
| 28 | -5.28 | 0.74 | -7.03 | 0.00 | -0.00 | -0.00 |
| 29 | 5.28 | 0.74 | 7.03 | 0.00 | -0.00 | -0.00 |
| 30 | -5.28 | 0.74 | -7.03 | 0.00 | 0.00 | -0.00 |
| 31 | 5.28 | 0.74 | 7.03 | 0.00 | 0.00 | -0.00 |
| 32 | -5.28 | 0.74 | -7.03 | 0.00 | 0.00 | -0.00 |
| 33 | 5.28 | 0.57 | 7.03 | 0.00 | -0.00 | -0.00 |
| 34 | -5.28 | 0.57 | -7.03 | 0.00 | 0.00 | -0.00 |
| 35 | 5.28 | 0.57 | 7.03 | 0.00 | 0.00 | -0.00 |
| 36 | -5.28 | 0.57 | -7.03 | 0.00 | -0.00 | -0.00 |
| 37 | 5.28 | 0.57 | 7.03 | 0.00 | -0.00 | -0.00 |
| 38 | -5.28 | 0.57 | -7.03 | 0.00 | 0.00 | -0.00 |
| 39 | 5.28 | 0.57 | 7.03 | 0.00 | 0.00 | -0.00 |
| 40 | -5.28 | 0.57 | -7.03 | 0.00 | 0.00 | -0.00 |
| 41 | 5.28 | 0.57 | 7.03 | 0.00 | -0.00 | -0.00 |
| 42 | -5.28 | 0.57 | -7.03 | 0.00 | 0.00 | -0.00 |
| 43 | 5.28 | 0.57 | 7.03 | 0.00 | 0.00 | -0.00 |
| 44 | -5.28 | 0.57 | -7.03 | 0.00 | -0.00 | -0.00 |
| 45 | 5.28 | 0.57 | 7.03 | 0.00 | -0.00 | -0.00 |
| 46 | -5.28 | 0.57 | -7.03 | 0.00 | 0.00 | -0.00 |
| 47 | 5.28 | 0.57 | 7.03 | 0.00 | 0.00 | -0.00 |
| 48 | -5.28 | 0.57 | -7.03 | 0.00 | 0.00 | -0.00 |
| 49 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 50 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 51 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 52 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 53 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 54 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 55 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 56 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 57 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 58 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 59 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 60 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 61 | 8.79 | 0.74 | 11.72 | 0.00 | -0.00 | -0.00 |
| 62 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 63 | 8.79 | 0.74 | 11.72 | 0.00 | 0.00 | -0.00 |
| 64 | -8.79 | 0.74 | -11.72 | 0.00 | 0.00 | -0.00 |
| 65 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 66 | -8.79 | 0.57 | -11.72 | 0.00 | 0.00 | -0.00 |
| 67 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 68 | -8.79 | 0.57 | -11.72 | 0.00 | 0.00 | -0.00 |
| 69 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 70 | -8.79 | 0.57 | -11.72 | 0.00 | 0.00 | -0.00 |
| 71 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 72 | -8.79 | 0.57 | -11.72 | 0.00 | 0.00 | -0.00 |
| 73 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 74 | -8.79 | 0.57 | -11.72 | 0.00 | 0.00 | -0.00 |
| 75 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 76 | -8.79 | 0.57 | -11.72 | 0.00 | -0.00 | -0.00 |
| 77 | 8.79 | 0.57 | 11.72 | 0.00 | -0.00 | -0.00 |
| 78 | -8.79 | 0.57 | -11.72 | 0.00 | 0.00 | -0.00 |
| 79 | 8.79 | 0.57 | 11.72 | 0.00 | 0.00 | -0.00 |
| 80 | -8.79 | 0.57 | -11.72 | 0.00 | 0.00 | -0.00 |
| 81 | 0.01 | 0.74 | 0.01 | 0.00 | 0.00 | -0.01 |
| 82 | -0.01 | 0.74 | -0.01 | -0.00 | -0.00 | 0.01 |
| 83 | 0.01 | 0.74 | 0.01 | 0.00 | 0.00 | -0.01 |
| 84 | -0.01 | 0.74 | -0.01 | -0.00 | -0.00 | 0.01 |
| 85 | 0.01 | 0.74 | 0.01 | 0.00 | 0.00 | -0.01 |
| 86 | -0.01 | 0.74 | -0.01 | -0.00 | -0.00 | 0.01 |
| 87 | 0.01 | 0.74 | 0.01 | 0.00 | 0.00 | -0.01 |
| 88 | -0.01 | 0.74 | -0.01 | -0.00 | -0.00 | 0.01 |
| 89 | 0.01 | 0.57 | 0.01 | 0.00 | 0.00 | -0.01 |
| 90 | -0.01 | 0.57 | -0.01 | -0.00 | -0.00 | 0.01 |
| 91 | 0.01 | 0.57 | 0.01 | 0.00 | 0.00 | -0.01 |
| 92 | -0.01 | 0.57 | -0.01 | -0.00 | -0.00 | 0.01 |
| 93 | 0.01 | 0.57 | 0.01 | 0.00 | 0.00 | -0.01 |
| 94 | -0.01 | 0.57 | -0.01 | -0.00 | -0.00 | 0.01 |
| 95 | 0.01 | 0.57 | 0.01 | 0.00 | 0.00 | -0.01 |
| 96 | -0.01 | 0.57 | -0.01 | -0.00 | -0.00 | 0.01 |

强度计算控制组合号: 54, M=-8.79, N=0.74, M=0.00, N=0.00

强度计算应力比 =0.106

抗剪强度计算控制组合号: 67, V=11.72

抗剪强度计算应力比 =0.061

平面内稳定计算最大应力对应组合号: 54, M=-8.79, N=0.74, M=0.00, N=0.00

平面内稳定计算最大应力 (N/mm\*mm) =29.85

平面内稳定计算最大应力比 =0.098

临界弯矩Mcr(kN\*m) =1309.58

平面外稳定计算最大应力比 =0.046

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 =0.106 < 1.0

抗剪强度计算应力比 =0.061 < 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 | 0.57 | 0.00 | 0.00 | 0.00 | -0.00 |
| 2 | -0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 3 | -0.00 | 0.57 | -0.00 | 0.00 | 0.00 | 0.00 |
| 4 | -0.00 | 0.57 | -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 | 2.34 | 0.57 | 3.13 | 0.00 | -0.00 | -0.00 |
| 10 | -2.34 | 0.57 | -3.13 | 0.00 | 0.00 | -0.00 |
| 11 | 2.34 | 0.57 | 3.13 | 0.00 | 0.00 | -0.00 |
| 12 | -2.34 | 0.57 | -3.13 | 0.00 | 0.00 | -0.00 |
| 13 | 2.34 | 0.51 | 3.13 | 0.00 | -0.00 | -0.00 |
| 14 | -2.34 | 0.51 | -3.13 | 0.00 | 0.00 | -0.00 |
| 15 | 2.34 | 0.51 | 3.13 | 0.00 | 0.00 | -0.00 |
| 16 | -2.34 | 0.51 | -3.13 | 0.00 | 0.00 | -0.00 |

防火设计控制的偶然组合号: 10, M=-2.34, N=0.57, M=0.00, N=0.00

强度计算荷载比 =0.03

平面内稳定计算荷载比 =0.03

平面外稳定计算荷载比 =0.01

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)=47.56

**6、 钢 梁 1
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=12.34

构件长度=3.08; 计算长度系数: Ux=4.00

支撑长度=12.30

隅撑作为梁面外弹性支撑点，以下为隅撑支撑信息：

隅撑截面:L50X5 ; 布置间距: 2.44

隅撑与檩条夹角(度): 45.00; 隅撑孔距檩条下边缘距离: 0.10

檩条截面:XZ200X70X20X2.0 ; 檩条跨度: 9.00; 檩条到梁上皮距离: 0.02

抗震等级: 四级

变截面 H 形截面 H: B1=180, B2=180, H1=400, H2=350 T1=6 T2=10 T3=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: 256.068390(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 83.82 | 17.37 | 67.34 | 67.54 | -14.04 | -29.47 |
| 2 | 34.08 | 7.07 | 27.69 | 21.96 | -5.96 | -9.97 |
| 3 | 44.34 | 10.09 | 47.04 | 42.46 | -7.07 | -9.24 |
| 4 | 73.56 | 14.35 | 47.99 | 47.04 | -12.93 | -30.20 |
| 5 | 75.12 | 15.57 | 60.33 | 60.94 | -12.56 | -26.56 |
| 6 | 25.37 | 5.27 | 20.68 | 15.36 | -4.49 | -7.06 |
| 7 | 35.64 | 8.29 | 40.03 | 35.86 | -5.59 | -6.33 |
| 8 | 64.85 | 12.55 | 40.97 | 40.44 | -11.46 | -27.29 |
| 9 | -83.29 | 4.91 | -9.81 | 50.51 | -3.48 | 11.45 |
| 10 | 98.55 | -6.85 | 24.98 | -33.21 | 8.27 | -17.39 |
| 11 | -62.78 | 16.44 | 2.44 | 57.46 | -15.01 | 5.89 |
| 12 | 119.12 | 4.67 | 37.21 | -26.34 | -3.25 | -22.94 |
| 13 | -92.00 | 3.10 | -16.82 | 43.91 | -2.01 | 14.36 |
| 14 | 89.84 | -8.65 | 17.96 | -39.80 | 9.74 | -14.48 |
| 15 | -71.48 | 14.63 | -4.57 | 50.86 | -13.54 | 8.80 |
| 16 | 110.41 | 2.87 | 30.19 | -32.94 | -1.78 | -20.03 |
| 17 | 11.21 | 15.63 | 43.22 | 80.69 | -12.29 | -15.04 |
| 18 | 120.31 | 8.58 | 64.09 | 30.46 | -5.24 | -32.34 |
| 19 | 23.52 | 22.55 | 50.57 | 84.86 | -19.21 | -18.37 |
| 20 | 132.66 | 15.49 | 71.43 | 34.58 | -12.15 | -35.67 |
| 21 | -38.53 | 5.33 | 3.57 | 35.11 | -4.22 | 4.46 |
| 22 | 70.57 | -1.72 | 24.44 | -15.12 | 2.83 | -12.84 |
| 23 | -26.22 | 12.25 | 10.92 | 39.28 | -11.14 | 1.13 |
| 24 | 82.91 | 5.19 | 31.78 | -11.00 | -4.08 | -16.17 |
| 25 | -28.27 | 8.35 | 22.92 | 55.60 | -5.32 | 5.20 |
| 26 | 80.84 | 1.30 | 43.79 | 5.38 | 1.73 | -12.10 |
| 27 | -15.96 | 15.27 | 30.27 | 59.78 | -12.24 | 1.86 |
| 28 | 93.18 | 8.21 | 51.13 | 9.49 | -5.19 | -15.44 |
| 29 | 0.95 | 12.61 | 23.87 | 60.19 | -11.19 | -15.77 |
| 30 | 110.05 | 5.56 | 44.74 | 9.96 | -4.14 | -33.07 |
| 31 | 13.25 | 19.53 | 31.22 | 64.36 | -18.11 | -19.10 |
| 32 | 122.39 | 12.47 | 52.08 | 14.08 | -11.05 | -36.40 |
| 33 | 2.50 | 13.83 | 36.20 | 74.09 | -10.82 | -12.13 |
| 34 | 111.61 | 6.78 | 57.07 | 23.86 | -3.77 | -29.43 |
| 35 | 14.81 | 20.74 | 43.55 | 78.26 | -17.74 | -15.46 |
| 36 | 123.95 | 13.69 | 64.41 | 27.98 | -10.68 | -32.76 |
| 37 | -47.24 | 3.53 | -3.44 | 28.51 | -2.74 | 7.37 |
| 38 | 61.86 | -3.53 | 17.43 | -21.72 | 4.31 | -9.93 |
| 39 | -34.93 | 10.44 | 3.90 | 32.68 | -9.66 | 4.04 |
| 40 | 74.21 | 3.39 | 24.76 | -17.60 | -2.61 | -13.26 |
| 41 | -36.97 | 6.55 | 15.91 | 49.01 | -3.85 | 8.11 |
| 42 | 72.13 | -0.51 | 36.78 | -1.22 | 3.20 | -9.19 |
| 43 | -24.67 | 13.46 | 23.26 | 53.18 | -10.77 | 4.77 |
| 44 | 84.47 | 6.41 | 44.11 | 2.90 | -3.71 | -12.53 |
| 45 | -7.76 | 10.81 | 16.85 | 53.59 | -9.71 | -12.86 |
| 46 | 101.34 | 3.76 | 37.72 | 3.36 | -2.66 | -30.16 |
| 47 | 4.55 | 17.73 | 24.20 | 57.76 | -16.63 | -16.19 |
| 48 | 113.68 | 10.67 | 45.06 | 7.48 | -9.57 | -33.49 |
| 49 | -51.03 | 11.60 | 16.05 | 77.77 | -8.84 | -0.36 |
| 50 | 130.81 | -0.15 | 50.84 | -5.94 | 2.92 | -29.19 |
| 51 | -30.51 | 23.13 | 28.30 | 84.72 | -20.37 | -5.91 |
| 52 | 151.38 | 11.37 | 63.07 | 0.92 | -8.60 | -34.75 |
| 53 | -85.85 | 4.39 | -11.70 | 45.86 | -3.18 | 13.29 |
| 54 | 95.99 | -7.36 | 23.08 | -37.85 | 8.57 | -15.54 |
| 55 | -65.33 | 15.92 | 0.55 | 52.81 | -14.71 | 7.74 |
| 56 | 116.56 | 4.16 | 35.31 | -30.99 | -2.95 | -21.10 |
| 57 | -78.66 | 6.50 | 1.85 | 60.21 | -3.96 | 13.81 |
| 58 | 103.18 | -5.25 | 36.63 | -23.50 | 7.79 | -15.03 |
| 59 | -58.15 | 18.03 | 14.09 | 67.16 | -15.49 | 8.25 |
| 60 | 123.75 | 6.27 | 48.86 | -16.64 | -3.73 | -20.58 |
| 61 | -58.21 | 9.49 | 2.51 | 63.42 | -8.06 | -0.87 |
| 62 | 123.63 | -2.27 | 37.29 | -20.29 | 3.69 | -29.70 |
| 63 | -37.70 | 21.02 | 14.76 | 70.37 | -19.59 | -6.43 |
| 64 | 144.20 | 9.25 | 49.52 | -13.43 | -7.83 | -35.26 |
| 65 | -59.73 | 9.80 | 9.04 | 71.17 | -7.36 | 2.55 |
| 66 | 122.11 | -1.96 | 43.82 | -12.54 | 4.39 | -26.28 |
| 67 | -39.22 | 21.33 | 21.29 | 78.12 | -18.89 | -3.00 |
| 68 | 142.68 | 9.56 | 56.05 | -5.68 | -7.13 | -31.84 |
| 69 | -94.55 | 2.59 | -18.71 | 39.26 | -1.71 | 16.20 |
| 70 | 87.29 | -9.17 | 16.07 | -44.45 | 10.04 | -12.63 |
| 71 | -74.04 | 14.12 | -6.47 | 46.21 | -13.24 | 10.65 |
| 72 | 107.86 | 2.35 | 28.30 | -37.59 | -1.48 | -18.19 |
| 73 | -87.37 | 4.70 | -5.17 | 53.61 | -2.48 | 16.72 |
| 74 | 94.47 | -7.05 | 29.61 | -30.10 | 9.27 | -12.12 |
| 75 | -66.85 | 16.23 | 7.08 | 60.56 | -14.01 | 11.16 |
| 76 | 115.04 | 4.47 | 41.85 | -23.24 | -2.25 | -17.67 |
| 77 | -66.92 | 7.68 | -4.51 | 56.82 | -6.59 | 2.04 |
| 78 | 114.92 | -4.07 | 30.28 | -26.89 | 5.16 | -26.79 |
| 79 | -46.40 | 19.21 | 7.74 | 63.77 | -18.12 | -3.52 |
| 80 | 135.49 | 7.45 | 42.51 | -20.03 | -6.36 | -32.35 |
| 81 | 50.22 | 11.30 | 45.42 | 49.91 | -9.05 | -18.93 |
| 82 | 65.19 | 12.61 | 47.39 | 41.03 | -10.36 | -20.90 |
| 83 | 28.66 | 6.84 | 28.24 | 30.16 | -5.55 | -10.48 |
| 84 | 43.63 | 8.15 | 30.21 | 21.28 | -6.86 | -12.45 |
| 85 | 33.11 | 8.15 | 36.62 | 39.04 | -6.03 | -10.16 |
| 86 | 48.08 | 9.45 | 38.60 | 30.16 | -7.34 | -12.13 |
| 87 | 45.77 | 9.99 | 37.03 | 41.03 | -8.57 | -19.24 |
| 88 | 60.74 | 11.30 | 39.01 | 32.15 | -9.88 | -21.22 |
| 89 | 36.90 | 8.54 | 34.71 | 39.42 | -6.81 | -14.33 |
| 90 | 51.87 | 9.85 | 36.68 | 30.54 | -8.12 | -16.30 |
| 91 | 20.32 | 5.11 | 21.49 | 24.22 | -4.12 | -7.83 |
| 92 | 35.29 | 6.42 | 23.47 | 15.35 | -5.43 | -9.81 |
| 93 | 23.74 | 6.12 | 27.94 | 31.06 | -4.49 | -7.59 |
| 94 | 38.71 | 7.42 | 29.92 | 22.18 | -5.79 | -9.56 |
| 95 | 33.48 | 7.54 | 28.26 | 32.59 | -6.44 | -14.58 |
| 96 | 48.45 | 8.84 | 30.23 | 23.71 | -7.75 | -16.55 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -94.55 | -84.22 | -80.07 | -75.47 | -71.73 | -66.64 | -84.86 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 151.38 | 86.03 | 74.17 | 63.48 | 55.29 | 47.40 | 44.45 |

强度计算应力比 =0.665

抗剪强度计算应力比 =0.206

平面内稳定计算最大应力对应组合号: 1, M=83.82, N=17.37, M=67.54, N=-14.04

平面内稳定最大应力 (N/mm\*mm) =188.37

平面内稳定计算最大应力比 =0.618

临界弯矩Mcr(kN\*m) =602.70

平面外稳定计算最大应力比 =0.625

梁面外稳定计算方式：梁面外稳定按隅撑间距计算。

强度计算应力比 =0.665 < 1.0

抗剪强度计算应力比 =0.206 < 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 =0.625 < 1.0

腹板高厚比 H0/TW=59.17 < [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 | 4.13 | 8.40 | 12.70 | 16.91 | 20.95 | 24.72 |

最大挠度值 =24.72 最大挠度/梁跨度 =1/498.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/13.97

变形后斜梁坡度改变率 =0.105 < 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 | 44.39 | 9.20 | 35.70 | 34.98 | -7.46 | -15.32 |
| 2 | 27.81 | 5.76 | 22.48 | 19.78 | -4.77 | -8.82 |
| 3 | 31.23 | 6.77 | 28.93 | 26.62 | -5.14 | -8.57 |
| 4 | 40.97 | 8.19 | 29.25 | 28.15 | -7.10 | -15.56 |
| 5 | 41.49 | 8.60 | 33.36 | 32.78 | -6.97 | -14.35 |
| 6 | 24.90 | 5.16 | 20.14 | 17.58 | -4.28 | -7.85 |
| 7 | 28.33 | 6.17 | 26.59 | 24.42 | -4.65 | -7.60 |
| 8 | 38.06 | 7.59 | 26.91 | 25.95 | -6.60 | -14.59 |
| 9 | -3.25 | 5.23 | 12.66 | 27.84 | -4.14 | -3.28 |
| 10 | 45.24 | 2.10 | 21.94 | 5.52 | -1.01 | -10.97 |
| 11 | 2.22 | 8.31 | 15.93 | 29.69 | -7.21 | -4.77 |
| 12 | 50.73 | 5.17 | 25.20 | 7.35 | -4.08 | -12.45 |
| 13 | -6.15 | 4.63 | 10.32 | 25.64 | -3.65 | -2.31 |
| 14 | 42.34 | 1.50 | 19.60 | 3.32 | -0.51 | -10.00 |
| 15 | -0.68 | 7.71 | 13.59 | 27.49 | -6.72 | -3.80 |
| 16 | 47.82 | 4.57 | 22.86 | 5.15 | -3.59 | -11.48 |

--- 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 -6.15 -11.12 -15.39 -19.16 -22.86 -25.75 -34.98

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 50.73 34.43 24.56 15.81 8.61 2.24 0.00

强度计算荷载比 =0.23

平面内稳定计算荷载比 =0.21

平面外稳定计算荷载比 =0.14

无防护下钢构件最大升温(Ts): 1004.71℃ ,按临界温度法求得临界温度(Td): 649.67℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2377(m^2\*℃/w)

构件重量 (Kg)=138.76

**7、 钢 梁 2
设计结果**

截面类型=16; 布置角度=0; 计算长度： Lx=12.34

构件长度=6.17; 计算长度系数: Ux=2.00

支撑长度=12.30

隅撑作为梁面外弹性支撑点，以下为隅撑支撑信息：

隅撑截面:L50X5 ; 布置间距: 2.44

隅撑与檩条夹角(度): 45.00; 隅撑孔距檩条下边缘距离: 0.10

檩条截面:XZ200X70X20X2.0 ; 檩条跨度: 9.00; 檩条到梁上皮距离: 0.02

抗震等级: 三级

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 | -21.96 | 5.96 | 9.97 | 17.98 | -6.89 | 43.51 |
| 2 | -67.54 | 14.04 | 29.47 | -27.47 | -4.23 | 28.01 |
| 3 | -67.54 | 14.04 | 29.47 | 16.45 | -8.00 | 46.03 |
| 4 | -21.96 | 5.96 | 9.97 | -25.94 | -3.13 | 25.49 |
| 5 | -15.36 | 4.49 | 7.06 | 18.68 | -6.07 | 38.24 |
| 6 | -60.94 | 12.56 | 26.56 | -26.77 | -3.41 | 22.74 |
| 7 | -60.94 | 12.56 | 26.56 | 17.14 | -7.18 | 40.76 |
| 8 | -15.36 | 4.49 | 7.06 | -25.24 | -2.31 | 20.22 |
| 9 | -50.51 | 3.49 | -11.45 | -29.88 | -0.65 | 14.61 |
| 10 | 33.21 | -8.27 | 17.39 | 27.61 | 11.11 | -2.33 |
| 11 | -57.46 | 15.01 | -5.89 | -29.92 | -12.18 | 22.44 |
| 12 | 26.34 | 3.25 | 22.94 | 27.56 | -0.41 | 5.47 |
| 13 | -43.91 | 2.01 | -14.36 | -29.18 | 0.17 | 9.34 |
| 14 | 39.80 | -9.74 | 14.48 | 28.30 | 11.93 | -7.60 |
| 15 | -50.86 | 13.54 | -8.80 | -29.22 | -11.36 | 17.16 |
| 16 | 32.94 | 1.78 | 20.03 | 28.25 | 0.41 | 0.20 |
| 17 | -35.11 | 4.22 | -4.46 | 1.87 | -5.15 | 38.57 |
| 18 | 15.12 | -2.83 | 12.84 | 36.36 | 1.90 | 28.41 |
| 19 | -39.28 | 11.14 | -1.13 | 1.84 | -12.07 | 43.26 |
| 20 | 11.00 | 4.08 | 16.17 | 36.32 | -5.01 | 33.08 |
| 21 | -80.69 | 12.30 | 15.04 | -43.58 | -2.49 | 23.06 |
| 22 | -30.46 | 5.24 | 32.34 | -9.09 | 4.56 | 12.90 |
| 23 | -84.86 | 19.21 | 18.37 | -43.61 | -9.41 | 27.76 |
| 24 | -34.58 | 12.15 | 35.67 | -9.12 | -2.35 | 17.58 |
| 25 | -80.69 | 12.30 | 15.04 | 0.33 | -6.26 | 41.08 |
| 26 | -30.46 | 5.24 | 32.34 | 34.82 | 0.80 | 30.92 |
| 27 | -84.86 | 19.21 | 18.37 | 0.31 | -13.17 | 45.78 |
| 28 | -34.58 | 12.15 | 35.67 | 34.79 | -6.11 | 35.60 |
| 29 | -35.11 | 4.22 | -4.46 | -42.05 | -1.38 | 20.55 |
| 30 | 15.12 | -2.83 | 12.84 | -7.56 | 5.67 | 10.39 |
| 31 | -39.28 | 11.14 | -1.13 | -42.08 | -8.30 | 25.24 |
| 32 | 11.00 | 4.08 | 16.17 | -7.59 | -1.24 | 15.06 |
| 33 | -28.51 | 2.75 | -7.37 | 2.56 | -4.33 | 33.29 |
| 34 | 21.72 | -4.31 | 9.93 | 37.05 | 2.72 | 23.13 |
| 35 | -32.68 | 9.66 | -4.04 | 2.54 | -11.25 | 37.99 |
| 36 | 17.60 | 2.61 | 13.26 | 37.02 | -4.19 | 27.81 |
| 37 | -74.09 | 10.82 | 12.13 | -42.89 | -1.67 | 17.79 |
| 38 | -23.86 | 3.77 | 29.43 | -8.39 | 5.38 | 7.63 |
| 39 | -78.26 | 17.74 | 15.46 | -42.91 | -8.59 | 22.48 |
| 40 | -27.98 | 10.68 | 32.76 | -8.43 | -1.53 | 12.31 |
| 41 | -74.09 | 10.82 | 12.13 | 1.03 | -5.44 | 35.81 |
| 42 | -23.86 | 3.77 | 29.43 | 35.52 | 1.62 | 25.65 |
| 43 | -78.26 | 17.74 | 15.46 | 1.01 | -12.35 | 40.50 |
| 44 | -27.98 | 10.68 | 32.76 | 35.49 | -5.29 | 30.33 |
| 45 | -28.51 | 2.75 | -7.37 | -41.35 | -0.57 | 15.27 |
| 46 | 21.72 | -4.31 | 9.93 | -6.86 | 6.49 | 5.11 |
| 47 | -32.68 | 9.66 | -4.04 | -41.38 | -7.48 | 19.97 |
| 48 | 17.60 | 2.61 | 13.26 | -6.89 | -0.42 | 9.79 |
| 49 | -45.86 | 3.19 | -13.29 | -15.18 | -2.99 | 29.07 |
| 50 | 37.85 | -8.57 | 15.54 | 42.31 | 8.77 | 12.14 |
| 51 | -52.81 | 14.71 | -7.74 | -15.22 | -14.51 | 36.90 |
| 52 | 30.99 | 2.95 | 21.10 | 42.25 | -2.75 | 19.93 |
| 53 | -77.77 | 8.84 | 0.36 | -46.99 | -1.13 | 18.22 |
| 54 | 5.94 | -2.92 | 29.19 | 10.49 | 10.63 | 1.28 |
| 55 | -84.72 | 20.37 | 5.91 | -47.03 | -12.65 | 26.04 |
| 56 | -0.92 | 8.60 | 34.75 | 10.44 | -0.89 | 9.08 |
| 57 | -77.77 | 8.84 | 0.36 | -16.25 | -3.76 | 30.83 |
| 58 | 5.94 | -2.92 | 29.19 | 41.23 | 8.00 | 13.90 |
| 59 | -84.72 | 20.37 | 5.91 | -16.29 | -15.29 | 38.66 |
| 60 | -0.92 | 8.60 | 34.75 | 41.18 | -3.52 | 21.69 |
| 61 | -45.86 | 3.19 | -13.29 | -45.92 | -0.35 | 16.46 |
| 62 | 37.85 | -8.57 | 15.54 | 11.57 | 11.41 | -0.48 |
| 63 | -52.81 | 14.71 | -7.74 | -45.96 | -11.88 | 24.28 |
| 64 | 30.99 | 2.95 | 21.10 | 11.51 | -0.12 | 7.32 |
| 65 | -39.26 | 1.72 | -16.20 | -14.48 | -2.17 | 23.80 |
| 66 | 44.45 | -10.04 | 12.63 | 43.00 | 9.59 | 6.86 |
| 67 | -46.21 | 13.24 | -10.65 | -14.52 | -13.69 | 31.62 |
| 68 | 37.59 | 1.48 | 18.19 | 42.95 | -1.93 | 14.66 |
| 69 | -71.17 | 7.37 | -2.55 | -46.29 | -0.31 | 12.95 |
| 70 | 12.54 | -4.39 | 26.28 | 11.19 | 11.45 | -3.99 |
| 71 | -78.12 | 18.89 | 3.00 | -46.34 | -11.83 | 20.77 |
| 72 | 5.68 | 7.13 | 31.84 | 11.14 | -0.07 | 3.81 |
| 73 | -71.17 | 7.37 | -2.55 | -15.55 | -2.94 | 25.56 |
| 74 | 12.54 | -4.39 | 26.28 | 41.93 | 8.82 | 8.62 |
| 75 | -78.12 | 18.89 | 3.00 | -15.59 | -14.47 | 33.38 |
| 76 | 5.68 | 7.13 | 31.84 | 41.88 | -2.71 | 16.42 |
| 77 | -39.26 | 1.72 | -16.20 | -45.22 | 0.47 | 11.18 |
| 78 | 44.45 | -10.04 | 12.63 | 12.26 | 12.23 | -5.75 |
| 79 | -46.21 | 13.24 | -10.65 | -45.26 | -11.06 | 19.01 |
| 80 | 37.59 | 1.48 | 18.19 | 12.21 | 0.70 | 2.04 |
| 81 | -30.16 | 6.04 | 10.44 | 4.19 | -4.83 | 32.83 |
| 82 | -21.28 | 6.37 | 12.49 | 7.97 | -5.17 | 30.78 |
| 83 | -49.91 | 9.54 | 18.89 | -15.51 | -3.68 | 26.12 |
| 84 | -41.03 | 9.87 | 20.94 | -11.72 | -4.01 | 24.06 |
| 85 | -49.91 | 9.54 | 18.89 | 3.52 | -5.31 | 33.92 |
| 86 | -41.03 | 9.87 | 20.94 | 7.31 | -5.64 | 31.87 |
| 87 | -30.16 | 6.04 | 10.44 | -14.84 | -3.20 | 25.03 |
| 88 | -21.28 | 6.37 | 12.49 | -11.06 | -3.53 | 22.97 |
| 89 | -24.22 | 4.61 | 7.79 | 2.79 | -3.68 | 25.49 |
| 90 | -15.35 | 4.94 | 9.84 | 6.57 | -4.01 | 23.44 |
| 91 | -39.42 | 7.30 | 14.29 | -12.36 | -2.79 | 20.33 |
| 92 | -30.54 | 7.63 | 16.34 | -8.58 | -3.13 | 18.27 |
| 93 | -39.42 | 7.30 | 14.29 | 2.27 | -4.05 | 26.33 |
| 94 | -30.54 | 7.63 | 16.34 | 6.06 | -4.38 | 24.28 |
| 95 | -24.22 | 4.61 | 7.79 | -11.85 | -2.42 | 19.49 |
| 96 | -15.35 | 4.94 | 9.84 | -8.07 | -2.76 | 17.44 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -84.86 | -91.37 | -102.27 | -100.22 | -85.23 | -61.20 | -43.00 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 44.45 | 25.51 | 12.39 | 0.44 | 8.26 | 19.15 | 47.03 |

强度计算应力比 =0.532

抗剪强度计算应力比 =0.133

平面内稳定计算最大应力对应组合号: 1, M=-21.96, N=5.96, M=17.98, N=-6.89

平面内稳定最大应力 (N/mm\*mm) =155.65

平面内稳定计算最大应力比 =0.510

临界弯矩Mcr(kN\*m) =598.99

平面外稳定计算最大应力比 =0.555

梁面外稳定计算方式：梁面外稳定按隅撑间距计算。

强度计算应力比 =0.532 < 1.0

抗剪强度计算应力比 =0.133 < 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 =0.555 < 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 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 24.72 | 30.53 | 33.66 | 33.78 | 30.95 | 25.64 | 18.68 |

最大挠度值 =34.10 最大挠度/梁跨度 =1/361.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.49

变形后斜梁坡度改变率 =0.088 < 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 | -19.78 | 4.77 | 8.82 | 4.68 | -3.85 | 24.47 |
| 2 | -34.98 | 7.46 | 15.32 | -10.47 | -2.96 | 19.30 |
| 3 | -34.98 | 7.46 | 15.32 | 4.17 | -4.21 | 25.31 |
| 4 | -19.78 | 4.77 | 8.82 | -9.96 | -2.59 | 18.46 |
| 5 | -17.58 | 4.28 | 7.85 | 4.91 | -3.57 | 22.71 |
| 6 | -32.78 | 6.97 | 14.35 | -10.24 | -2.69 | 17.54 |
| 7 | -32.78 | 6.97 | 14.35 | 4.40 | -3.94 | 23.55 |
| 8 | -17.58 | 4.28 | 7.85 | -9.73 | -2.32 | 16.70 |
| 9 | -27.84 | 4.14 | 3.28 | -9.49 | -1.96 | 15.38 |
| 10 | -5.52 | 1.01 | 10.97 | 5.84 | 1.18 | 10.87 |
| 11 | -29.69 | 7.21 | 4.77 | -9.50 | -5.03 | 17.47 |
| 12 | -7.35 | 4.08 | 12.45 | 5.83 | -1.90 | 12.95 |
| 13 | -25.64 | 3.65 | 2.31 | -9.25 | -1.69 | 13.62 |
| 14 | -3.32 | 0.51 | 10.00 | 6.08 | 1.45 | 9.11 |
| 15 | -27.49 | 6.72 | 3.80 | -9.26 | -4.76 | 15.71 |
| 16 | -5.15 | 3.59 | 11.48 | 6.06 | -1.62 | 11.19 |

--- 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 -34.98 -47.25 -52.56 -50.90 -42.29 -26.71 -6.08

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 0.00 0.00 0.00 0.00 0.00 10.47

强度计算荷载比 =0.27

平面内稳定计算荷载比 =0.17

平面外稳定计算荷载比 =0.13

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)=270.25

**8、 钢 梁 3
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=12.34

构件长度=3.08; 计算长度系数: Ux=4.00

支撑长度=12.30

隅撑作为梁面外弹性支撑点，以下为隅撑支撑信息：

隅撑截面:L50X5 ; 布置间距: 2.44

隅撑与檩条夹角(度): 45.00; 隅撑孔距檩条下边缘距离: 0.10

檩条截面:XZ200X70X20X2.0 ; 檩条跨度: 9.00; 檩条到梁上皮距离: 0.02

抗震等级: 四级

变截面 H 形截面 H: B1=180, B2=180, H1=350, H2=400 T1=6 T2=10 T3=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: 256.068390(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -21.96 | 5.96 | -9.97 | -34.08 | -7.07 | 27.69 |
| 2 | -67.54 | 14.04 | -29.47 | -83.82 | -17.37 | 67.34 |
| 3 | -42.46 | 7.07 | -9.24 | -44.34 | -10.09 | 47.04 |
| 4 | -47.04 | 12.93 | -30.20 | -73.56 | -14.35 | 47.99 |
| 5 | -15.36 | 4.49 | -7.06 | -25.37 | -5.27 | 20.68 |
| 6 | -60.94 | 12.56 | -26.56 | -75.12 | -15.57 | 60.33 |
| 7 | -35.86 | 5.59 | -6.33 | -35.64 | -8.29 | 40.03 |
| 8 | -40.44 | 11.46 | -27.29 | -64.85 | -12.55 | 40.97 |
| 9 | 33.12 | -8.25 | -17.40 | -98.51 | 6.83 | 25.00 |
| 10 | -50.60 | 3.49 | 11.44 | 83.35 | -4.91 | -9.79 |
| 11 | 26.34 | 3.25 | -22.94 | -119.12 | -4.68 | 37.21 |
| 12 | -57.46 | 15.02 | 5.89 | 62.78 | -16.44 | 2.44 |
| 13 | 39.72 | -9.73 | -14.49 | -89.80 | 8.63 | 17.99 |
| 14 | -44.00 | 2.02 | 14.35 | 92.05 | -3.11 | -16.80 |
| 15 | 32.94 | 1.78 | -20.03 | -110.41 | -2.88 | 30.19 |
| 16 | -50.86 | 13.54 | 8.80 | 71.48 | -14.64 | -4.57 |
| 17 | 15.07 | -2.82 | -12.84 | -70.55 | 1.71 | 24.46 |
| 18 | -35.16 | 4.22 | 4.46 | 38.57 | -5.33 | 3.58 |
| 19 | 11.00 | 4.08 | -16.17 | -82.91 | -5.19 | 31.78 |
| 20 | -39.28 | 11.14 | 1.13 | 26.22 | -12.25 | 10.92 |
| 21 | -30.51 | 5.25 | -32.34 | -120.29 | -8.59 | 64.10 |
| 22 | -80.74 | 12.30 | -15.04 | -11.18 | -15.63 | 43.23 |
| 23 | -34.58 | 12.16 | -35.67 | -132.66 | -15.49 | 71.43 |
| 24 | -84.86 | 19.21 | -18.37 | -23.52 | -22.55 | 50.57 |
| 25 | -5.43 | -1.72 | -12.11 | -80.81 | -1.31 | 43.81 |
| 26 | -55.66 | 5.33 | 5.20 | 28.30 | -8.35 | 22.93 |
| 27 | -9.49 | 5.19 | -15.44 | -93.18 | -8.21 | 51.13 |
| 28 | -59.78 | 12.24 | 1.86 | 15.96 | -15.27 | 30.27 |
| 29 | -10.02 | 4.14 | -33.07 | -110.03 | -5.57 | 44.75 |
| 30 | -60.24 | 11.19 | -15.77 | -0.91 | -12.61 | 23.88 |
| 31 | -14.08 | 11.05 | -36.40 | -122.39 | -12.47 | 52.08 |
| 32 | -64.36 | 18.11 | -19.10 | -13.25 | -19.53 | 31.22 |
| 33 | 21.67 | -4.30 | -9.93 | -61.84 | 3.52 | 17.44 |
| 34 | -28.56 | 2.75 | 7.37 | 47.27 | -3.53 | -3.43 |
| 35 | 17.60 | 2.61 | -13.26 | -74.21 | -3.39 | 24.76 |
| 36 | -32.68 | 9.66 | 4.04 | 34.93 | -10.45 | 3.90 |
| 37 | -23.91 | 3.78 | -29.43 | -111.59 | -6.78 | 57.09 |
| 38 | -74.14 | 10.82 | -12.13 | -2.47 | -13.83 | 36.21 |
| 39 | -27.98 | 10.68 | -32.76 | -123.95 | -13.69 | 64.41 |
| 40 | -78.26 | 17.74 | -15.46 | -14.81 | -20.75 | 43.55 |
| 41 | 1.17 | -3.19 | -9.20 | -72.11 | 0.50 | 36.79 |
| 42 | -49.06 | 3.85 | 8.10 | 37.01 | -6.55 | 15.92 |
| 43 | -2.90 | 3.71 | -12.53 | -84.47 | -6.41 | 44.11 |
| 44 | -53.18 | 10.77 | 4.77 | 24.67 | -13.47 | 23.26 |
| 45 | -3.42 | 2.67 | -30.16 | -101.32 | -3.77 | 37.74 |
| 46 | -53.64 | 9.72 | -12.86 | 7.79 | -10.81 | 16.86 |
| 47 | -7.48 | 9.58 | -33.49 | -113.68 | -10.67 | 45.06 |
| 48 | -57.76 | 16.63 | -16.19 | -4.55 | -17.73 | 24.20 |
| 49 | 37.76 | -8.55 | -15.55 | -95.96 | 7.35 | 23.11 |
| 50 | -45.95 | 3.19 | 13.29 | 85.90 | -4.40 | -11.68 |
| 51 | 30.99 | 2.96 | -21.10 | -116.56 | -4.16 | 35.31 |
| 52 | -52.81 | 14.72 | 7.74 | 65.33 | -15.92 | 0.55 |
| 53 | 5.85 | -2.90 | -29.20 | -130.78 | 0.14 | 50.86 |
| 54 | -77.86 | 8.84 | -0.36 | 51.08 | -11.61 | 16.07 |
| 55 | -0.92 | 8.61 | -34.75 | -151.38 | -11.37 | 63.07 |
| 56 | -84.72 | 20.37 | -5.91 | 30.51 | -23.13 | 28.30 |
| 57 | 23.41 | -7.78 | -15.04 | -103.14 | 5.23 | 36.66 |
| 58 | -60.30 | 3.97 | 13.80 | 78.72 | -6.51 | 1.86 |
| 59 | 16.64 | 3.73 | -20.58 | -123.75 | -6.27 | 48.86 |
| 60 | -67.16 | 15.49 | 8.25 | 58.15 | -18.04 | 14.09 |
| 61 | 20.20 | -3.67 | -29.71 | -123.59 | 2.25 | 37.32 |
| 62 | -63.51 | 8.07 | -0.87 | 58.27 | -9.49 | 2.53 |
| 63 | 13.43 | 7.83 | -35.26 | -144.20 | -9.26 | 49.52 |
| 64 | -70.37 | 19.60 | -6.43 | 37.70 | -21.02 | 14.76 |
| 65 | 44.36 | -10.03 | -12.64 | -87.25 | 9.15 | 16.10 |
| 66 | -39.35 | 1.72 | 16.20 | 94.61 | -2.59 | -18.70 |
| 67 | 37.59 | 1.48 | -18.19 | -107.86 | -2.36 | 28.30 |
| 68 | -46.21 | 13.24 | 10.65 | 74.04 | -14.12 | -6.47 |
| 69 | 12.45 | -4.38 | -26.29 | -122.07 | 1.94 | 43.85 |
| 70 | -71.26 | 7.37 | 2.55 | 59.79 | -9.80 | 9.06 |
| 71 | 5.68 | 7.13 | -31.84 | -142.68 | -9.57 | 56.05 |
| 72 | -78.12 | 18.89 | -3.00 | 39.22 | -21.33 | 21.29 |
| 73 | 30.01 | -9.25 | -12.13 | -94.44 | 7.04 | 29.64 |
| 74 | -53.70 | 2.49 | 16.71 | 87.42 | -4.71 | -5.15 |
| 75 | 23.24 | 2.26 | -17.67 | -115.04 | -4.47 | 41.85 |
| 76 | -60.56 | 14.02 | 11.16 | 66.85 | -16.23 | 7.08 |
| 77 | 26.80 | -5.15 | -26.80 | -114.89 | 4.05 | 30.31 |
| 78 | -56.91 | 6.60 | 2.04 | 66.97 | -7.69 | -4.49 |
| 79 | 20.03 | 6.36 | -32.35 | -135.49 | -7.45 | 42.51 |
| 80 | -63.77 | 18.12 | -3.52 | 46.40 | -19.22 | 7.74 |
| 81 | -21.28 | 6.86 | -12.45 | -43.63 | -8.15 | 30.21 |
| 82 | -30.16 | 5.55 | -10.48 | -28.66 | -6.84 | 28.24 |
| 83 | -41.03 | 10.36 | -20.90 | -65.19 | -12.61 | 47.39 |
| 84 | -49.91 | 9.05 | -18.93 | -50.22 | -11.30 | 45.42 |
| 85 | -30.16 | 7.34 | -12.13 | -48.08 | -9.45 | 38.60 |
| 86 | -39.04 | 6.03 | -10.16 | -33.11 | -8.15 | 36.62 |
| 87 | -32.15 | 9.88 | -21.22 | -60.74 | -11.30 | 39.01 |
| 88 | -41.03 | 8.57 | -19.24 | -45.77 | -9.99 | 37.03 |
| 89 | -15.35 | 5.43 | -9.80 | -35.29 | -6.42 | 23.47 |
| 90 | -24.22 | 4.12 | -7.83 | -20.32 | -5.11 | 21.49 |
| 91 | -30.54 | 8.12 | -16.30 | -51.87 | -9.85 | 36.68 |
| 92 | -39.42 | 6.81 | -14.33 | -36.90 | -8.54 | 34.71 |
| 93 | -22.18 | 5.80 | -9.56 | -38.71 | -7.42 | 29.92 |
| 94 | -31.06 | 4.49 | -7.59 | -23.74 | -6.12 | 27.94 |
| 95 | -23.71 | 7.75 | -16.55 | -48.45 | -8.84 | 30.23 |
| 96 | -32.59 | 6.44 | -14.58 | -33.48 | -7.54 | 28.26 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -84.86 | -66.72 | -71.81 | -75.55 | -80.15 | -84.28 | -94.61 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 44.36 | 47.31 | 55.21 | 63.41 | 74.11 | 85.98 | 151.38 |

强度计算应力比 =0.665

抗剪强度计算应力比 =0.206

平面内稳定计算最大应力对应组合号: 1, M=-21.96, N=5.96, M=-34.08, N=-7.07

平面内稳定最大应力 (N/mm\*mm) =188.37

平面内稳定计算最大应力比 =0.618

临界弯矩Mcr(kN\*m) =602.70

平面外稳定计算最大应力比 =0.625

梁面外稳定计算方式：梁面外稳定按隅撑间距计算。

强度计算应力比 =0.665 < 1.0

抗剪强度计算应力比 =0.206 < 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 =0.625 < 1.0

腹板高厚比 H0/TW=59.17 < [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 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 24.72 | 20.95 | 16.91 | 12.70 | 8.40 | 4.13 | 0.00 |

最大挠度值 =24.72 最大挠度/梁跨度 =1/498.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/13.97

变形后斜梁坡度改变率 =0.105 < 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 | -19.78 | 4.77 | -8.82 | -27.81 | -5.76 | 22.48 |
| 2 | -34.98 | 7.46 | -15.32 | -44.39 | -9.20 | 35.70 |
| 3 | -26.62 | 5.14 | -8.57 | -31.23 | -6.77 | 28.93 |
| 4 | -28.15 | 7.10 | -15.56 | -40.97 | -8.19 | 29.25 |
| 5 | -17.58 | 4.28 | -7.85 | -24.90 | -5.16 | 20.14 |
| 6 | -32.78 | 6.97 | -14.35 | -41.49 | -8.60 | 33.36 |
| 7 | -24.42 | 4.65 | -7.60 | -28.33 | -6.17 | 26.59 |
| 8 | -25.95 | 6.60 | -14.59 | -38.06 | -7.59 | 26.91 |
| 9 | -5.54 | 1.01 | -10.97 | -45.23 | -2.10 | 21.94 |
| 10 | -27.86 | 4.14 | -3.28 | 3.26 | -5.24 | 12.66 |
| 11 | -7.35 | 4.08 | -12.45 | -50.73 | -5.17 | 25.20 |
| 12 | -29.69 | 7.22 | -4.77 | -2.22 | -8.31 | 15.93 |
| 13 | -3.34 | 0.52 | -10.00 | -42.33 | -1.50 | 19.60 |
| 14 | -25.66 | 3.65 | -2.31 | 6.17 | -4.64 | 10.33 |
| 15 | -5.15 | 3.59 | -11.48 | -47.82 | -4.57 | 22.86 |
| 16 | -27.49 | 6.72 | -3.80 | 0.68 | -7.71 | 13.59 |

--- 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 -34.98 -25.77 -22.88 -19.18 -15.41 -11.13 -6.17

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 2.21 8.59 15.79 24.55 34.42 50.73

强度计算荷载比 =0.23

平面内稳定计算荷载比 =0.21

平面外稳定计算荷载比 =0.14

无防护下钢构件最大升温(Ts): 1004.71℃ ,按临界温度法求得临界温度(Td): 649.67℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2377(m^2\*℃/w)

构件重量 (Kg)=138.76

**9、 钢 梁 4
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=12.34

构件长度=3.08; 计算长度系数: Ux=4.00

支撑长度=12.30

隅撑作为梁面外弹性支撑点，以下为隅撑支撑信息：

隅撑截面:L50X5 ; 布置间距: 2.44

隅撑与檩条夹角(度): 45.00; 隅撑孔距檩条下边缘距离: 0.10

檩条截面:XZ200X70X20X2.0 ; 檩条跨度: 9.00; 檩条到梁上皮距离: 0.02

抗震等级: 三级

变截面 H 形截面 H: B1=180, B2=180, H1=350, H2=450 T1=6 T2=10 T3=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: 258.000000(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 27.47 | 4.23 | -28.01 | -101.05 | -2.12 | 40.70 |
| 2 | -17.98 | 6.89 | -43.51 | -215.01 | -4.54 | 86.53 |
| 3 | -7.00 | 4.32 | -21.29 | -117.07 | -1.29 | 59.15 |
| 4 | 16.49 | 6.80 | -50.24 | -198.99 | -5.37 | 68.08 |
| 5 | 26.77 | 3.41 | -22.74 | -77.73 | -1.63 | 31.31 |
| 6 | -18.68 | 6.07 | -38.24 | -191.69 | -4.05 | 77.14 |
| 7 | -7.69 | 3.50 | -16.01 | -93.75 | -0.80 | 49.76 |
| 8 | 15.79 | 5.98 | -44.96 | -175.67 | -4.88 | 58.69 |
| 9 | 29.88 | 0.64 | -14.61 | -77.56 | 0.78 | 16.31 |
| 10 | -27.61 | -11.11 | 2.33 | 22.99 | 12.54 | 5.32 |
| 11 | 29.92 | 12.18 | -22.44 | -112.06 | -10.75 | 30.82 |
| 12 | -27.56 | 0.43 | -5.47 | -11.41 | 1.00 | 19.79 |
| 13 | 29.18 | -0.18 | -9.34 | -54.25 | 1.27 | 6.91 |
| 14 | -28.30 | -11.93 | 7.60 | 46.31 | 13.03 | -4.07 |
| 15 | 29.22 | 11.36 | -17.16 | -88.74 | -10.26 | 21.43 |
| 16 | -28.25 | -0.39 | -0.20 | 11.91 | 1.49 | 10.40 |
| 17 | 43.58 | 2.49 | -23.06 | -86.96 | -0.38 | 26.06 |
| 18 | 9.09 | -4.57 | -12.90 | -26.63 | 6.67 | 19.47 |
| 19 | 43.61 | 9.41 | -27.76 | -107.66 | -7.30 | 34.77 |
| 20 | 9.12 | 2.36 | -17.58 | -47.27 | -0.25 | 28.16 |
| 21 | -1.87 | 5.15 | -38.57 | -200.92 | -2.80 | 71.90 |
| 22 | -36.36 | -1.91 | -28.41 | -140.58 | 4.26 | 65.30 |
| 23 | -1.84 | 12.07 | -43.26 | -221.62 | -9.72 | 80.61 |
| 24 | -36.32 | 5.02 | -33.08 | -161.23 | -2.67 | 73.99 |
| 25 | 9.12 | 2.58 | -16.34 | -102.98 | 0.45 | 44.51 |
| 26 | -25.37 | -4.48 | -6.18 | -42.65 | 7.50 | 37.92 |
| 27 | 9.14 | 9.50 | -21.04 | -123.68 | -6.47 | 53.22 |
| 28 | -25.34 | 2.45 | -10.86 | -63.29 | 0.58 | 46.61 |
| 29 | 32.60 | 5.06 | -45.29 | -184.89 | -3.63 | 53.45 |
| 30 | -1.89 | -1.99 | -35.13 | -124.56 | 3.42 | 46.85 |
| 31 | 32.63 | 11.98 | -49.99 | -205.59 | -10.55 | 62.15 |
| 32 | -1.86 | 4.93 | -39.81 | -145.20 | -3.50 | 55.54 |
| 33 | 42.89 | 1.67 | -17.79 | -63.64 | 0.11 | 16.67 |
| 34 | 8.39 | -5.38 | -7.63 | -3.31 | 7.16 | 10.08 |
| 35 | 42.91 | 8.59 | -22.48 | -84.34 | -6.81 | 25.38 |
| 36 | 8.43 | 1.54 | -12.31 | -23.95 | 0.24 | 18.76 |
| 37 | -2.56 | 4.33 | -33.29 | -177.60 | -2.31 | 62.50 |
| 38 | -37.05 | -2.72 | -23.13 | -117.26 | 4.75 | 55.91 |
| 39 | -2.54 | 11.25 | -37.99 | -198.30 | -9.23 | 71.21 |
| 40 | -37.02 | 4.20 | -27.81 | -137.91 | -2.18 | 64.60 |
| 41 | 8.42 | 1.76 | -11.07 | -79.66 | 0.94 | 35.12 |
| 42 | -26.07 | -5.29 | -0.91 | -19.33 | 7.99 | 28.53 |
| 43 | 8.44 | 8.68 | -15.76 | -100.36 | -5.98 | 43.83 |
| 44 | -26.04 | 1.63 | -5.58 | -39.97 | 1.07 | 37.21 |
| 45 | 31.90 | 4.24 | -40.02 | -161.57 | -3.14 | 44.05 |
| 46 | -2.59 | -2.81 | -29.85 | -101.24 | 3.91 | 37.46 |
| 47 | 31.93 | 11.16 | -44.71 | -182.27 | -10.06 | 52.76 |
| 48 | -2.56 | 4.11 | -34.53 | -121.88 | -3.01 | 46.15 |
| 49 | 46.99 | 1.12 | -18.22 | -77.56 | 0.78 | 16.31 |
| 50 | -10.49 | -10.63 | -1.28 | 22.99 | 12.54 | 5.32 |
| 51 | 47.03 | 12.66 | -26.04 | -112.06 | -10.75 | 30.82 |
| 52 | -10.44 | 0.90 | -9.08 | -11.41 | 1.00 | 19.79 |
| 53 | 15.18 | 2.98 | -29.07 | -157.33 | -0.91 | 48.39 |
| 54 | -42.31 | -8.77 | -12.14 | -56.78 | 10.84 | 37.40 |
| 55 | 15.22 | 14.52 | -36.90 | -191.83 | -12.45 | 62.90 |
| 56 | -42.25 | 2.76 | -19.93 | -91.18 | -0.69 | 51.88 |
| 57 | 22.86 | 1.18 | -13.51 | -88.78 | 1.37 | 29.22 |
| 58 | -34.62 | -10.57 | 3.42 | 11.77 | 13.12 | 18.23 |
| 59 | 22.91 | 12.72 | -21.34 | -123.28 | -10.17 | 43.74 |
| 60 | -34.57 | 0.96 | -4.37 | -22.63 | 1.58 | 32.71 |
| 61 | 39.30 | 2.92 | -33.78 | -146.12 | -1.49 | 35.47 |
| 62 | -18.18 | -8.83 | -16.84 | -45.56 | 10.26 | 24.49 |
| 63 | 39.35 | 14.46 | -41.60 | -180.62 | -13.03 | 49.99 |
| 64 | -18.13 | 2.70 | -24.64 | -79.97 | -1.27 | 38.96 |
| 65 | 46.29 | 0.30 | -12.95 | -54.25 | 1.27 | 6.91 |
| 66 | -11.19 | -11.45 | 3.99 | 46.31 | 13.03 | -4.07 |
| 67 | 46.34 | 11.84 | -20.77 | -88.74 | -10.26 | 21.43 |
| 68 | -11.14 | 0.08 | -3.81 | 11.91 | 1.49 | 10.40 |
| 69 | 14.48 | 2.16 | -23.80 | -134.01 | -0.42 | 39.00 |
| 70 | -43.00 | -9.59 | -6.86 | -33.46 | 11.33 | 28.01 |
| 71 | 14.52 | 13.70 | -31.62 | -168.51 | -11.96 | 53.51 |
| 72 | -42.95 | 1.94 | -14.66 | -67.86 | -0.20 | 42.48 |
| 73 | 22.17 | 0.36 | -8.24 | -65.46 | 1.86 | 19.83 |
| 74 | -35.32 | -11.39 | 8.70 | 35.09 | 13.61 | 8.84 |
| 75 | 22.21 | 11.90 | -16.06 | -99.96 | -9.68 | 34.35 |
| 76 | -35.26 | 0.14 | 0.90 | 0.69 | 2.07 | 23.32 |
| 77 | 38.61 | 2.10 | -28.50 | -122.80 | -1.00 | 26.08 |
| 78 | -18.88 | -9.65 | -11.57 | -22.24 | 10.75 | 15.09 |
| 79 | 38.65 | 13.64 | -36.33 | -157.30 | -12.54 | 40.60 |
| 80 | -18.83 | 1.88 | -19.36 | -56.65 | -0.78 | 29.57 |
| 81 | 15.51 | 4.17 | -26.15 | -106.23 | -2.44 | 41.77 |
| 82 | 11.72 | 3.53 | -24.03 | -95.88 | -1.80 | 39.64 |
| 83 | -4.19 | 5.32 | -32.87 | -155.61 | -3.49 | 61.63 |
| 84 | -7.97 | 4.68 | -30.74 | -145.26 | -2.85 | 59.50 |
| 85 | 0.57 | 4.21 | -23.24 | -113.17 | -2.08 | 49.76 |
| 86 | -3.21 | 3.57 | -21.11 | -102.82 | -1.44 | 47.63 |
| 87 | 10.75 | 5.28 | -35.79 | -148.67 | -3.85 | 53.63 |
| 88 | 6.97 | 4.64 | -33.66 | -138.31 | -3.21 | 51.50 |
| 89 | 12.36 | 3.28 | -20.36 | -82.91 | -1.95 | 32.37 |
| 90 | 8.58 | 2.64 | -18.24 | -72.56 | -1.31 | 30.24 |
| 91 | -2.79 | 4.17 | -25.53 | -120.89 | -2.76 | 47.65 |
| 92 | -6.57 | 3.53 | -23.40 | -110.54 | -2.12 | 45.52 |
| 93 | 0.88 | 3.31 | -18.12 | -88.25 | -1.68 | 38.52 |
| 94 | -2.91 | 2.67 | -15.99 | -77.90 | -1.04 | 36.39 |
| 95 | 8.70 | 4.14 | -27.77 | -115.55 | -3.04 | 41.50 |
| 96 | 4.92 | 3.50 | -25.64 | -105.20 | -2.40 | 39.37 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -43.00 | -39.04 | -41.25 | -41.97 | -41.52 | -44.06 | -46.31 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 47.03 | 37.46 | 45.19 | 53.07 | 66.55 | 88.72 | 221.62 |

强度计算应力比 =0.837

抗剪强度计算应力比 =0.250

平面内稳定计算最大应力对应组合号: 1, M=27.47, N=4.23, M=-101.05, N=-2.12

平面内稳定最大应力 (N/mm\*mm) =236.99

平面内稳定计算最大应力比 =0.777

临界弯矩Mcr(kN\*m) =606.53

平面外稳定计算最大应力比 =0.922

梁面外稳定计算方式：梁面外稳定按隅撑间距计算。

强度计算应力比 =0.837 < 1.0

抗剪强度计算应力比 =0.250 < 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 =0.922 < 1.0

腹板高厚比 H0/TW=63.33 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =8.70 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 18.68 | 15.12 | 11.60 | 8.23 | 5.11 | 2.34 | 0.00 |

最大挠度值 =18.68 最大挠度/梁跨度 =1/658.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.50

变形后斜梁坡度改变率 =0.087 < 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 | 10.47 | 2.96 | -19.30 | -77.73 | -1.63 | 31.31 |
| 2 | -4.68 | 3.85 | -24.47 | -115.72 | -2.44 | 46.59 |
| 3 | -1.02 | 2.99 | -17.06 | -83.07 | -1.36 | 37.46 |
| 4 | 6.81 | 3.82 | -26.71 | -110.38 | -2.72 | 40.44 |
| 5 | 10.24 | 2.69 | -17.54 | -69.96 | -1.47 | 28.18 |
| 6 | -4.91 | 3.57 | -22.71 | -107.94 | -2.28 | 43.45 |
| 7 | -1.25 | 2.72 | -15.30 | -75.30 | -1.19 | 34.33 |
| 8 | 6.58 | 3.54 | -24.95 | -102.60 | -2.55 | 37.30 |
| 9 | 9.49 | 1.96 | -15.38 | -71.47 | -0.86 | 24.80 |
| 10 | -5.84 | -1.18 | -10.87 | -44.65 | 2.28 | 21.87 |
| 11 | 9.50 | 5.03 | -17.47 | -80.67 | -3.94 | 28.67 |
| 12 | -5.83 | 1.90 | -12.95 | -53.83 | -0.80 | 25.73 |
| 13 | 9.25 | 1.68 | -13.62 | -63.70 | -0.70 | 21.67 |
| 14 | -6.08 | -1.45 | -9.11 | -36.88 | 2.44 | 18.74 |
| 15 | 9.26 | 4.76 | -15.71 | -72.90 | -3.77 | 25.54 |
| 16 | -6.06 | 1.63 | -11.19 | -46.06 | -0.64 | 22.60 |

--- 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 -6.08 -0.98 0.00 0.00 0.00 0.00 0.00

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 10.47 17.80 26.92 36.84 48.05 64.69 115.72

强度计算荷载比 =0.44

平面内稳定计算荷载比 =0.40

平面外稳定计算荷载比 =0.39

无防护下钢构件最大升温(Ts): 1004.72℃ ,按临界温度法求得临界温度(Td): 606.42℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2718(m^2\*℃/w)

构件重量 (Kg)=142.39

**10、 钢 梁 5
设计结果**

截面类型=16; 布置角度=0; 计算长度： Lx=12.34

构件长度=6.17; 计算长度系数: Ux=2.00

支撑长度=12.30

隅撑作为梁面外弹性支撑点，以下为隅撑支撑信息：

隅撑截面:L50X5 ; 布置间距: 2.44

隅撑与檩条夹角(度): 45.00; 隅撑孔距檩条下边缘距离: 0.10

檩条截面:XZ200X70X20X2.0 ; 檩条跨度: 9.00; 檩条到梁上皮距离: 0.02

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 | 27.47 | 4.23 | 28.01 | 67.54 | -14.04 | 29.47 |
| 2 | -17.98 | 6.89 | 43.51 | 21.96 | -5.96 | 9.97 |
| 3 | -16.45 | 8.00 | 46.03 | 67.54 | -14.04 | 29.47 |
| 4 | 25.94 | 3.13 | 25.49 | 21.96 | -5.96 | 9.97 |
| 5 | 26.77 | 3.41 | 22.74 | 60.94 | -12.56 | 26.56 |
| 6 | -18.68 | 6.07 | 38.24 | 15.36 | -4.49 | 7.06 |
| 7 | -17.14 | 7.18 | 40.76 | 60.94 | -12.56 | 26.56 |
| 8 | 25.24 | 2.31 | 20.22 | 15.36 | -4.49 | 7.06 |
| 9 | -27.62 | -11.09 | -2.29 | -33.12 | 8.26 | 17.40 |
| 10 | 29.87 | 0.65 | 14.64 | 50.60 | -3.49 | -11.44 |
| 11 | -27.56 | 0.41 | 5.47 | -26.34 | -3.25 | 22.94 |
| 12 | 29.92 | 12.18 | 22.44 | 57.46 | -15.02 | -5.89 |
| 13 | -28.32 | -11.91 | -7.57 | -39.72 | 9.73 | 14.49 |
| 14 | 29.17 | -0.17 | 9.36 | 44.00 | -2.02 | -14.35 |
| 15 | -28.25 | -0.40 | 0.20 | -32.94 | -1.78 | 20.03 |
| 16 | 29.22 | 11.36 | 17.16 | 50.86 | -13.54 | -8.80 |
| 17 | 9.09 | -4.56 | 12.92 | 30.51 | -5.25 | 32.34 |
| 18 | 43.58 | 2.49 | 23.08 | 80.74 | -12.30 | 15.04 |
| 19 | 9.12 | 2.35 | 17.58 | 34.58 | -12.15 | 35.67 |
| 20 | 43.61 | 9.41 | 27.76 | 84.86 | -19.21 | 18.37 |
| 21 | -36.36 | -1.90 | 28.43 | -15.07 | 2.83 | 12.84 |
| 22 | -1.87 | 5.15 | 38.58 | 35.16 | -4.22 | -4.46 |
| 23 | -36.32 | 5.01 | 33.08 | -11.00 | -4.08 | 16.17 |
| 24 | -1.84 | 12.07 | 43.26 | 39.28 | -11.14 | -1.13 |
| 25 | -34.83 | -0.79 | 30.94 | 30.51 | -5.25 | 32.34 |
| 26 | -0.34 | 6.26 | 41.10 | 80.74 | -12.30 | 15.04 |
| 27 | -34.79 | 6.11 | 35.60 | 34.58 | -12.15 | 35.67 |
| 28 | -0.31 | 13.17 | 45.78 | 84.86 | -19.21 | 18.37 |
| 29 | 7.55 | -5.66 | 10.41 | -15.07 | 2.83 | 12.84 |
| 30 | 42.04 | 1.39 | 20.56 | 35.16 | -4.22 | -4.46 |
| 31 | 7.59 | 1.24 | 15.06 | -11.00 | -4.08 | 16.17 |
| 32 | 42.08 | 8.30 | 25.24 | 39.28 | -11.14 | -1.13 |
| 33 | 8.39 | -5.38 | 7.65 | 23.91 | -3.77 | 29.43 |
| 34 | 42.88 | 1.67 | 17.81 | 74.14 | -10.82 | 12.13 |
| 35 | 8.43 | 1.53 | 12.31 | 27.98 | -10.68 | 32.76 |
| 36 | 42.91 | 8.59 | 22.48 | 78.26 | -17.74 | 15.46 |
| 37 | -37.06 | -2.72 | 23.15 | -21.67 | 4.30 | 9.93 |
| 38 | -2.57 | 4.33 | 33.31 | 28.56 | -2.75 | -7.37 |
| 39 | -37.02 | 4.19 | 27.81 | -17.60 | -2.61 | 13.26 |
| 40 | -2.54 | 11.25 | 37.99 | 32.68 | -9.66 | -4.04 |
| 41 | -35.53 | -1.61 | 25.67 | 23.91 | -3.77 | 29.43 |
| 42 | -1.04 | 5.44 | 35.83 | 74.14 | -10.82 | 12.13 |
| 43 | -35.49 | 5.29 | 30.33 | 27.98 | -10.68 | 32.76 |
| 44 | -1.01 | 12.35 | 40.50 | 78.26 | -17.74 | 15.46 |
| 45 | 6.86 | -6.48 | 5.13 | -21.67 | 4.30 | 9.93 |
| 46 | 41.35 | 0.57 | 15.29 | 28.56 | -2.75 | -7.37 |
| 47 | 6.89 | 0.42 | 9.79 | -17.60 | -2.61 | 13.26 |
| 48 | 41.38 | 7.48 | 19.97 | 32.68 | -9.66 | -4.04 |
| 49 | -10.50 | -10.62 | 1.32 | -5.85 | 2.90 | 29.20 |
| 50 | 46.98 | 1.13 | 18.25 | 77.86 | -8.84 | 0.36 |
| 51 | -10.44 | 0.89 | 9.08 | 0.92 | -8.61 | 34.75 |
| 52 | 47.03 | 12.65 | 26.04 | 84.72 | -20.37 | 5.91 |
| 53 | -42.32 | -8.76 | 12.17 | -37.76 | 8.56 | 15.55 |
| 54 | 15.17 | 2.99 | 29.10 | 45.95 | -3.19 | -13.29 |
| 55 | -42.25 | 2.75 | 19.93 | -30.99 | -2.95 | 21.10 |
| 56 | 15.22 | 14.52 | 36.90 | 52.81 | -14.72 | -7.74 |
| 57 | -41.25 | -7.98 | 13.93 | -5.85 | 2.90 | 29.20 |
| 58 | 16.24 | 3.77 | 30.86 | 77.86 | -8.84 | 0.36 |
| 59 | -41.18 | 3.53 | 21.69 | 0.92 | -8.61 | 34.75 |
| 60 | 16.29 | 15.29 | 38.66 | 84.72 | -20.37 | 5.91 |
| 61 | -11.58 | -11.39 | -0.45 | -37.76 | 8.56 | 15.55 |
| 62 | 45.91 | 0.36 | 16.49 | 45.95 | -3.19 | -13.29 |
| 63 | -11.51 | 0.12 | 7.32 | -30.99 | -2.95 | 21.10 |
| 64 | 45.96 | 11.88 | 24.28 | 52.81 | -14.72 | -7.74 |
| 65 | -11.20 | -11.44 | -3.96 | -12.45 | 4.38 | 26.29 |
| 66 | 46.28 | 0.31 | 12.97 | 71.26 | -7.37 | -2.55 |
| 67 | -11.14 | 0.07 | 3.81 | -5.68 | -7.13 | 31.84 |
| 68 | 46.34 | 11.83 | 20.77 | 78.12 | -18.89 | 3.00 |
| 69 | -43.02 | -9.58 | 6.89 | -44.36 | 10.03 | 12.64 |
| 70 | 14.47 | 2.17 | 23.83 | 39.35 | -1.72 | -16.20 |
| 71 | -42.95 | 1.93 | 14.66 | -37.59 | -1.48 | 18.19 |
| 72 | 14.52 | 13.70 | 31.62 | 46.21 | -13.24 | -10.65 |
| 73 | -41.94 | -8.80 | 8.66 | -12.45 | 4.38 | 26.29 |
| 74 | 15.54 | 2.95 | 25.59 | 71.26 | -7.37 | -2.55 |
| 75 | -41.88 | 2.71 | 16.42 | -5.68 | -7.13 | 31.84 |
| 76 | 15.59 | 14.47 | 33.38 | 78.12 | -18.89 | 3.00 |
| 77 | -12.27 | -12.21 | -5.72 | -44.36 | 10.03 | 12.64 |
| 78 | 45.21 | -0.46 | 11.21 | 39.35 | -1.72 | -16.20 |
| 79 | -12.21 | -0.70 | 2.04 | -37.59 | -1.48 | 18.19 |
| 80 | 45.26 | 11.06 | 19.01 | 46.21 | -13.24 | -10.65 |
| 81 | 11.72 | 4.01 | 24.06 | 41.03 | -9.87 | 20.94 |
| 82 | 15.51 | 3.68 | 26.12 | 49.91 | -9.54 | 18.89 |
| 83 | -7.97 | 5.17 | 30.78 | 21.28 | -6.37 | 12.49 |
| 84 | -4.19 | 4.83 | 32.83 | 30.16 | -6.04 | 10.44 |
| 85 | -7.31 | 5.65 | 31.87 | 41.03 | -9.87 | 20.94 |
| 86 | -3.52 | 5.31 | 33.92 | 49.91 | -9.54 | 18.89 |
| 87 | 11.06 | 3.53 | 22.97 | 21.28 | -6.37 | 12.49 |
| 88 | 14.84 | 3.20 | 25.03 | 30.16 | -6.04 | 10.44 |
| 89 | 8.58 | 3.13 | 18.27 | 30.54 | -7.63 | 16.34 |
| 90 | 12.36 | 2.79 | 20.33 | 39.42 | -7.30 | 14.29 |
| 91 | -6.57 | 4.01 | 23.44 | 15.35 | -4.94 | 9.84 |
| 92 | -2.79 | 3.68 | 25.49 | 24.22 | -4.61 | 7.79 |
| 93 | -6.06 | 4.38 | 24.28 | 30.54 | -7.63 | 16.34 |
| 94 | -2.27 | 4.05 | 26.33 | 39.42 | -7.30 | 14.29 |
| 95 | 8.07 | 2.76 | 17.44 | 15.35 | -4.94 | 9.84 |
| 96 | 11.85 | 2.42 | 19.49 | 24.22 | -4.61 | 7.79 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -43.02 | -61.22 | -85.23 | -100.22 | -102.27 | -91.39 | -84.86 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 47.03 | 19.11 | 8.20 | 0.36 | 12.29 | 25.41 | 44.36 |

强度计算应力比 =0.532

抗剪强度计算应力比 =0.133

平面内稳定计算最大应力对应组合号: 1, M=27.47, N=4.23, M=67.54, N=-14.04

平面内稳定最大应力 (N/mm\*mm) =155.65

平面内稳定计算最大应力比 =0.510

临界弯矩Mcr(kN\*m) =598.99

平面外稳定计算最大应力比 =0.555

梁面外稳定计算方式：梁面外稳定按隅撑间距计算。

强度计算应力比 =0.532 < 1.0

抗剪强度计算应力比 =0.133 < 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 =0.555 < 1.0

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

翼缘宽厚比 B/T =8.70 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 18.68 | 25.64 | 30.95 | 33.78 | 33.66 | 30.53 | 24.72 |

最大挠度值 =34.10 最大挠度/梁跨度 =1/361.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.49

变形后斜梁坡度改变率 =0.088 < 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 | 10.47 | 2.96 | 19.30 | 34.98 | -7.46 | 15.32 |
| 2 | -4.68 | 3.85 | 24.47 | 19.78 | -4.77 | 8.82 |
| 3 | -4.17 | 4.21 | 25.31 | 34.98 | -7.46 | 15.32 |
| 4 | 9.96 | 2.59 | 18.46 | 19.78 | -4.77 | 8.82 |
| 5 | 10.24 | 2.69 | 17.54 | 32.78 | -6.97 | 14.35 |
| 6 | -4.91 | 3.57 | 22.71 | 17.58 | -4.28 | 7.85 |
| 7 | -4.40 | 3.94 | 23.55 | 32.78 | -6.97 | 14.35 |
| 8 | 9.73 | 2.32 | 16.70 | 17.58 | -4.28 | 7.85 |
| 9 | -5.85 | -1.17 | 10.88 | 5.54 | -1.01 | 10.97 |
| 10 | 9.48 | 1.96 | 15.39 | 27.86 | -4.14 | 3.28 |
| 11 | -5.83 | 1.90 | 12.95 | 7.35 | -4.08 | 12.45 |
| 12 | 9.50 | 5.03 | 17.47 | 29.69 | -7.22 | 4.77 |
| 13 | -6.08 | -1.45 | 9.12 | 3.34 | -0.52 | 10.00 |
| 14 | 9.25 | 1.69 | 13.63 | 25.66 | -3.65 | 2.31 |
| 15 | -6.06 | 1.62 | 11.19 | 5.15 | -3.59 | 11.48 |
| 16 | 9.26 | 4.76 | 15.71 | 27.49 | -6.72 | 3.80 |

--- 梁的弯矩包络(偶然组合) ---

梁下部受拉:

截面 1 2 3 4 5 6 7

弯矩 -6.08 -26.71 -42.29 -50.90 -52.56 -47.25 -34.98

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 10.47 0.00 0.00 0.00 0.00 0.00 0.00

强度计算荷载比 =0.27

平面内稳定计算荷载比 =0.17

平面外稳定计算荷载比 =0.13

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)=270.25

**11、 钢 梁 6
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=12.34

构件长度=3.08; 计算长度系数: Ux=4.00

支撑长度=12.30

隅撑作为梁面外弹性支撑点，以下为隅撑支撑信息：

隅撑截面:L50X5 ; 布置间距: 2.44

隅撑与檩条夹角(度): 45.00; 隅撑孔距檩条下边缘距离: 0.10

檩条截面:XZ200X70X20X2.0 ; 檩条跨度: 9.00; 檩条到梁上皮距离: 0.02

抗震等级: 四级

变截面 H 形截面 H: B1=180, B2=180, H1=450, H2=350 T1=6 T2=10 T3=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: 258.000000(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 215.01 | 4.54 | 86.53 | 17.98 | -6.89 | -43.51 |
| 2 | 101.05 | 2.12 | 40.70 | -27.47 | -4.23 | -28.01 |
| 3 | 117.07 | 1.29 | 59.15 | 7.00 | -4.32 | -21.29 |
| 4 | 198.99 | 5.37 | 68.08 | -16.49 | -6.80 | -50.24 |
| 5 | 191.69 | 4.05 | 77.14 | 18.68 | -6.07 | -38.24 |
| 6 | 77.73 | 1.63 | 31.31 | -26.77 | -3.41 | -22.74 |
| 7 | 93.75 | 0.80 | 49.76 | 7.69 | -3.50 | -16.01 |
| 8 | 175.67 | 4.88 | 58.69 | -15.79 | -5.98 | -44.96 |
| 9 | -22.87 | -12.51 | 5.37 | 27.62 | 11.09 | 2.29 |
| 10 | 77.66 | -0.78 | 16.35 | -29.87 | -0.65 | -14.64 |
| 11 | 11.41 | -1.00 | 19.79 | 27.56 | -0.43 | -5.47 |
| 12 | 112.06 | 10.75 | 30.82 | -29.92 | -12.18 | -22.44 |
| 13 | -46.19 | -13.01 | -4.02 | 28.32 | 11.91 | 7.57 |
| 14 | 54.34 | -1.27 | 6.96 | -29.17 | 0.17 | -9.36 |
| 15 | -11.91 | -1.49 | 10.40 | 28.25 | 0.39 | -0.20 |
| 16 | 88.74 | 10.26 | 21.43 | -29.22 | -11.36 | -17.16 |
| 17 | 140.66 | -4.24 | 65.34 | 36.36 | 1.89 | -28.43 |
| 18 | 200.97 | 2.80 | 71.92 | 1.87 | -5.15 | -38.58 |
| 19 | 161.23 | 2.67 | 73.99 | 36.32 | -5.02 | -33.08 |
| 20 | 221.62 | 9.72 | 80.61 | 1.84 | -12.07 | -43.26 |
| 21 | 26.70 | -6.66 | 19.50 | -9.09 | 4.55 | -12.92 |
| 22 | 87.02 | 0.38 | 26.09 | -43.58 | -2.49 | -23.08 |
| 23 | 47.27 | 0.25 | 28.16 | -9.12 | -2.36 | -17.58 |
| 24 | 107.66 | 7.30 | 34.77 | -43.61 | -9.41 | -27.76 |
| 25 | 42.72 | -7.49 | 37.95 | 25.38 | 4.46 | -6.20 |
| 26 | 103.04 | -0.45 | 44.54 | -9.11 | -2.58 | -16.36 |
| 27 | 63.29 | -0.58 | 46.61 | 25.34 | -2.45 | -10.86 |
| 28 | 123.68 | 6.47 | 53.22 | -9.14 | -9.50 | -21.04 |
| 29 | 124.63 | -3.41 | 46.88 | 1.90 | 1.98 | -35.15 |
| 30 | 184.95 | 3.63 | 53.47 | -32.59 | -5.06 | -45.31 |
| 31 | 145.20 | 3.50 | 55.54 | 1.86 | -4.93 | -39.81 |
| 32 | 205.59 | 10.55 | 62.15 | -32.63 | -11.98 | -49.99 |
| 33 | 117.34 | -4.73 | 55.94 | 37.06 | 2.71 | -23.15 |
| 34 | 177.65 | 2.31 | 62.53 | 2.57 | -4.33 | -33.31 |
| 35 | 137.91 | 2.18 | 64.60 | 37.02 | -4.20 | -27.81 |
| 36 | 198.30 | 9.23 | 71.21 | 2.54 | -11.25 | -37.99 |
| 37 | 3.38 | -7.15 | 10.11 | -8.39 | 5.37 | -7.65 |
| 38 | 63.70 | -0.11 | 16.70 | -42.88 | -1.67 | -17.81 |
| 39 | 23.95 | -0.24 | 18.76 | -8.43 | -1.54 | -12.31 |
| 40 | 84.34 | 6.81 | 25.38 | -42.91 | -8.59 | -22.48 |
| 41 | 19.40 | -7.98 | 28.56 | 26.08 | 5.28 | -0.92 |
| 42 | 79.72 | -0.94 | 35.15 | -8.41 | -1.76 | -11.08 |
| 43 | 39.97 | -1.07 | 37.21 | 26.04 | -1.63 | -5.58 |
| 44 | 100.36 | 5.98 | 43.83 | -8.44 | -8.68 | -15.76 |
| 45 | 101.31 | -3.90 | 37.49 | 2.59 | 2.80 | -29.87 |
| 46 | 161.63 | 3.14 | 44.08 | -31.90 | -4.24 | -40.03 |
| 47 | 121.88 | 3.01 | 46.15 | 2.56 | -4.11 | -34.53 |
| 48 | 182.27 | 10.06 | 52.76 | -31.93 | -11.16 | -44.71 |
| 49 | 56.90 | -10.82 | 37.45 | 42.32 | 8.75 | -12.17 |
| 50 | 157.43 | 0.91 | 48.43 | -15.17 | -2.99 | -29.10 |
| 51 | 91.18 | 0.69 | 51.88 | 42.25 | -2.76 | -19.93 |
| 52 | 191.83 | 12.44 | 62.90 | -15.22 | -14.51 | -36.90 |
| 53 | -22.87 | -12.51 | 5.37 | 10.50 | 10.61 | -1.32 |
| 54 | 77.66 | -0.78 | 16.35 | -46.98 | -1.12 | -18.25 |
| 55 | 11.41 | -1.00 | 19.79 | 10.44 | -0.90 | -9.08 |
| 56 | 112.06 | 10.75 | 30.82 | -47.03 | -12.65 | -26.04 |
| 57 | -11.65 | -13.10 | 18.29 | 34.63 | 10.55 | 3.39 |
| 58 | 88.88 | -1.36 | 29.26 | -22.85 | -1.19 | -13.54 |
| 59 | 22.63 | -1.58 | 32.71 | 34.57 | -0.97 | -4.37 |
| 60 | 123.28 | 10.17 | 43.74 | -22.91 | -12.71 | -21.34 |
| 61 | 45.69 | -10.24 | 24.54 | 18.19 | 8.81 | -16.87 |
| 62 | 146.21 | 1.50 | 35.52 | -39.29 | -2.92 | -33.81 |
| 63 | 79.97 | 1.27 | 38.96 | 18.13 | -2.70 | -24.64 |
| 64 | 180.62 | 13.02 | 49.99 | -39.35 | -14.45 | -41.60 |
| 65 | 33.58 | -11.31 | 28.06 | 43.02 | 9.57 | -6.89 |
| 66 | 134.11 | 0.42 | 39.04 | -14.47 | -2.17 | -23.82 |
| 67 | 67.86 | 0.20 | 42.48 | 42.95 | -1.94 | -14.66 |
| 68 | 168.51 | 11.95 | 53.51 | -14.52 | -13.69 | -31.62 |
| 69 | -46.19 | -13.01 | -4.02 | 11.20 | 11.43 | 3.96 |
| 70 | 54.34 | -1.27 | 6.96 | -46.28 | -0.31 | -12.97 |
| 71 | -11.91 | -1.49 | 10.40 | 11.14 | -0.08 | -3.81 |
| 72 | 88.74 | 10.26 | 21.43 | -46.34 | -11.83 | -20.77 |
| 73 | -34.97 | -13.59 | 8.90 | 35.33 | 11.37 | 8.66 |
| 74 | 65.56 | -1.85 | 19.87 | -22.16 | -0.37 | -8.27 |
| 75 | -0.69 | -2.07 | 23.32 | 35.26 | -0.15 | 0.90 |
| 76 | 99.96 | 9.68 | 34.35 | -22.21 | -11.90 | -16.06 |
| 77 | 22.37 | -10.73 | 15.15 | 18.89 | 9.63 | -11.60 |
| 78 | 122.89 | 1.01 | 26.12 | -38.60 | -2.10 | -28.53 |
| 79 | 56.65 | 0.78 | 29.57 | 18.83 | -1.88 | -19.36 |
| 80 | 157.30 | 12.53 | 40.60 | -38.65 | -13.63 | -36.33 |
| 81 | 145.26 | 2.85 | 59.50 | 7.97 | -4.68 | -30.74 |
| 82 | 155.61 | 3.49 | 61.63 | 4.19 | -5.32 | -32.87 |
| 83 | 95.88 | 1.80 | 39.64 | -11.72 | -3.53 | -24.03 |
| 84 | 106.23 | 2.44 | 41.77 | -15.51 | -4.17 | -26.15 |
| 85 | 102.82 | 1.44 | 47.63 | 3.21 | -3.57 | -21.11 |
| 86 | 113.17 | 2.08 | 49.76 | -0.57 | -4.21 | -23.24 |
| 87 | 138.31 | 3.21 | 51.50 | -6.97 | -4.64 | -33.66 |
| 88 | 148.67 | 3.85 | 53.63 | -10.75 | -5.28 | -35.79 |
| 89 | 110.54 | 2.12 | 45.52 | 6.57 | -3.53 | -23.40 |
| 90 | 120.89 | 2.76 | 47.65 | 2.79 | -4.17 | -25.53 |
| 91 | 72.56 | 1.31 | 30.24 | -8.58 | -2.64 | -18.24 |
| 92 | 82.91 | 1.95 | 32.37 | -12.36 | -3.28 | -20.36 |
| 93 | 77.90 | 1.04 | 36.39 | 2.91 | -2.67 | -15.99 |
| 94 | 88.25 | 1.68 | 38.52 | -0.88 | -3.31 | -18.12 |
| 95 | 105.20 | 2.40 | 39.37 | -4.92 | -3.50 | -25.64 |
| 96 | 115.55 | 3.04 | 41.50 | -8.70 | -4.14 | -27.77 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -46.19 | -43.97 | -41.45 | -41.92 | -41.23 | -39.03 | -43.02 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 221.62 | 88.72 | 66.55 | 53.10 | 45.21 | 37.47 | 47.03 |

强度计算应力比 =0.837

抗剪强度计算应力比 =0.250

平面内稳定计算最大应力对应组合号: 1, M=215.01, N=4.54, M=17.98, N=-6.89

平面内稳定最大应力 (N/mm\*mm) =236.99

平面内稳定计算最大应力比 =0.777

临界弯矩Mcr(kN\*m) =606.53

平面外稳定计算最大应力比 =0.922

梁面外稳定计算方式：梁面外稳定按隅撑间距计算。

强度计算应力比 =0.837 < 1.0

抗剪强度计算应力比 =0.250 < 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 =0.922 < 1.0

腹板高厚比 H0/TW=63.33 < [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 | 2.34 | 5.11 | 8.23 | 11.60 | 15.12 | 18.68 |

最大挠度值 =18.68 最大挠度/梁跨度 =1/658.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.50

变形后斜梁坡度改变率 =0.087 < 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 | 115.72 | 2.44 | 46.59 | 4.68 | -3.85 | -24.47 |
| 2 | 77.73 | 1.63 | 31.31 | -10.47 | -2.96 | -19.30 |
| 3 | 83.07 | 1.36 | 37.46 | 1.02 | -2.99 | -17.06 |
| 4 | 110.38 | 2.72 | 40.44 | -6.81 | -3.82 | -26.71 |
| 5 | 107.94 | 2.28 | 43.45 | 4.91 | -3.57 | -22.71 |
| 6 | 69.96 | 1.47 | 28.18 | -10.24 | -2.69 | -17.54 |
| 7 | 75.30 | 1.19 | 34.33 | 1.25 | -2.72 | -15.30 |
| 8 | 102.60 | 2.55 | 37.30 | -6.58 | -3.54 | -24.95 |
| 9 | 44.69 | -2.27 | 21.89 | 5.85 | 1.17 | -10.88 |
| 10 | 71.49 | 0.86 | 24.81 | -9.48 | -1.96 | -15.39 |
| 11 | 53.83 | 0.80 | 25.73 | 5.83 | -1.90 | -12.95 |
| 12 | 80.67 | 3.93 | 28.67 | -9.50 | -5.03 | -17.47 |
| 13 | 36.91 | -2.43 | 18.76 | 6.08 | 1.44 | -9.12 |
| 14 | 63.72 | 0.70 | 21.68 | -9.25 | -1.69 | -13.63 |
| 15 | 46.06 | 0.64 | 22.60 | 6.06 | -1.63 | -11.19 |
| 16 | 72.90 | 3.77 | 25.54 | -9.26 | -4.76 | -15.71 |

--- 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 0.00 0.00 0.00 -0.98 -6.08

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 115.72 64.69 48.05 36.85 26.92 17.80 10.47

强度计算荷载比 =0.44

平面内稳定计算荷载比 =0.40

平面外稳定计算荷载比 =0.39

无防护下钢构件最大升温(Ts): 1004.72℃ ,按临界温度法求得临界温度(Td): 606.42℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2718(m^2\*℃/w)

构件重量 (Kg)=142.39

风荷载作用下柱顶最大水平（X 向）位移:

节点( 1), 水平位移 dx=76.281(mm) =H /92.

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=7.445(mm) =H /940.

梁的(恒+活)最大挠度:

梁( 2), 挠跨比 =1 /361.

风载作用下柱顶最大水平位移: H/92< 柱顶位移容许值: H/60

地震作用下柱顶最大水平位移: H/940< 柱顶位移容许值: H/60

梁的(恒+活)最大挠跨比: 1/361< 梁的容许挠跨比: 1/180

所有钢柱的总重量 (Kg)=1214.

所有钢梁的总重量 (Kg)=1103.

钢梁与钢柱重量之和 (Kg)=2317.

**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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\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1\\CalcTemp\\平面外计算长度系数.T)