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 9时 8分16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: 13

柱数: 5

梁数: 7

支座约束数: 3

标准截面总数: 12

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: 0.95

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 | -0.20 | 7.80 | 2 | 50.25 | 7.80 |
| 3 | 5.65 | 8.25 | 4 | 43.15 | 8.25 |
| 5 | 36.30 | 8.70 | 6 | 16.95 | 9.16 |
| 7 | 29.45 | 9.16 | 8 | -0.55 | 9.40 |
| 9 | 50.60 | 9.40 | 10 | 22.60 | 9.61 |
| 11 | -0.20 | 0.00 | 12 | 22.60 | 0.00 |
| 13 | 50.25 | 0.00 |  |  |  |

**柱关联号**

| 柱号 | 节点Ⅰ | 节点Ⅱ | 柱号 | 节点Ⅰ | 节点Ⅱ |
| --- | --- | --- | --- | --- | --- |
| 1 | 11 | 1 | 2 | 12 | 10 |
| 3 | 13 | 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 | 6 |
| 3 | 4 | 2 | 4 | 5 | 4 |
| 5 | 6 | 10 | 6 | 7 | 5 |
| 7 | 10 | 7 |  |  |  |

**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 | -0.350 | 2 | 0.350 | 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 |
| 13 | 0.000 |  |  |  |  |

**标准截面信息**

| 截面号 | 截面信息 |
| --- | --- |
| 1 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=400\*320\*320\*6\*14\*14 |
| 2 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=200\*180\*180\*6\*8\*8 |
| 3 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=500\*320\*320\*6\*14\*14 |
| 4 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=400\*300\*300\*6\*14\*14 |
| 5 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(750~500)\*250\*250\*6\*12\*12 |
| 6 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=500\*220\*220\*6\*10\*10 |
| 7 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(500~800)\*320\*320\*8\*14\*14 |
| 8 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(800~500)\*320\*320\*8\*14\*14 |
| 9 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=500\*180\*180\*6\*8\*8 |
| 10 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(500~750)\*280\*280\*6\*14\*14 |
| 11 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(500~700)\*250\*250\*6\*12\*12 |
| 12 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(700~500)\*260\*260\*6\*12\*12 |

**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 | 两端刚接 | 0 |
| 2 | 1 | 两端刚接 | 0 |
| 3 | 3 | 两端刚接 | 0 |
| 4 | 2 | 两端刚接 | 0 |
| 5 | 2 | 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 | 5 | 两端刚接 |
| 2 | 6 | 两端刚接 |
| 3 | 10 | 两端刚接 |
| 4 | 12 | 两端刚接 |
| 5 | 7 | 两端刚接 |
| 6 | 11 | 两端刚接 |
| 7 | 8 | 两端刚接 |

**截面特性**

| 截面号 | Xc (mm) | Yc (mm) | Ix (cm4) | Iy (cm4) | A (cm2) |
| --- | --- | --- | --- | --- | --- |
| 1 | 160.0 | 200.0 | 35963.7 | 7646.5 | 111.9 |
| 2 | 90.0 | 100.0 | 2967.2 | 777.9 | 39.8 |
| 3 | 160.0 | 250.0 | 58180.2 | 7646.7 | 117.9 |
| 4 | 150.0 | 200.0 | 33876.8 | 6300.7 | 106.3 |
| 5 | 125.0 | 312.5 | 67226.6 | 3126.1 | 96.1 |
| 6 | 110.0 | 250.0 | 31944.3 | 1775.5 | 72.8 |
| 7 | 160.0 | 325.0 | 106664.5 | 7648.5 | 139.4 |
| 8 | 160.0 | 325.0 | 106664.5 | 7648.5 | 139.4 |
| 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 140.0 | 312.5 | 83822.5 | 5123.2 | 114.2 |
| 11 | 125.0 | 300.0 | 61423.9 | 3126.0 | 94.6 |
| 12 | 130.0 | 300.0 | 63498.7 | 3516.2 | 97.0 |

| 截面号 | ix (cm) | iy (cm) | W1x (cm3) | W2x (cm3) | W1y (cm3) | W2y (cm3) |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 17.9 | 8.3 | 1798.2 | 1798.2 | 477.9 | 477.9 |
| 2 | 8.6 | 4.4 | 296.7 | 296.7 | 86.4 | 86.4 |
| 3 | 22.2 | 8.1 | 2327.2 | 2327.2 | 477.9 | 477.9 |
| 4 | 17.9 | 7.7 | 1693.8 | 1693.8 | 420.0 | 420.0 |
| 5 | 26.5 | 5.7 | 2151.3 | 2151.3 | 250.1 | 250.1 |
| 6 | 20.9 | 4.9 | 1277.8 | 1277.8 | 161.4 | 161.4 |
| 7 | 27.7 | 7.4 | 3282.0 | 3282.0 | 478.0 | 478.0 |
| 8 | 27.7 | 7.4 | 3282.0 | 3282.0 | 478.0 | 478.0 |
| 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 27.1 | 6.7 | 2682.3 | 2682.3 | 365.9 | 365.9 |
| 11 | 25.5 | 5.7 | 2047.5 | 2047.5 | 250.1 | 250.1 |
| 12 | 25.6 | 6.0 | 2116.6 | 2116.6 | 270.5 | 270.5 |

**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 | 0.84 | 0.00 | 0.00 |
| 3 | 1 | 1.79 | 0.00 | 0.00 |
| 4 | 1 | 4.95 | 0.00 | 0.00 |
| 5 | 1 | 4.95 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | -1.79 | 0.00 | 0.00 |
| 3 | 1 | -0.84 | 0.00 | 0.00 |
| 4 | 1 | -4.95 | 0.00 | 0.00 |
| 5 | 1 | -4.95 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 2.21 | 0.00 | 0.00 |
| 3 | 1 | 0.42 | 0.00 | 0.00 |
| 4 | 1 | 4.95 | 0.00 | 0.00 |
| 5 | 1 | 4.95 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | -0.42 | 0.00 | 0.00 |
| 3 | 1 | -2.21 | 0.00 | 0.00 |
| 4 | 1 | -4.95 | 0.00 | 0.00 |
| 5 | 1 | -4.95 | 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 | 3.71 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.71 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.71 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.71 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.71 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.71 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 3.71 | 0.00 | 0.00 | 0.00 |
| 活荷载 | 1 | 1 | 1 | 4.13 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.13 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.13 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.13 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.13 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.13 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.13 | 0.00 | 0.00 | 0.00 |
| 左风1 | 1 | 1 | 1 | -3.32 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.32 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.10 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.10 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.32 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.10 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.10 | 0.00 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | 1 | -2.10 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.10 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.32 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.32 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.10 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.32 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.32 | 0.00 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 1 | -1.94 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.94 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.72 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.72 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.94 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.72 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.72 | 0.00 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | 1 | -0.72 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.72 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.94 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.94 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.72 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.94 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -1.94 | 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 | 355.605 |
| 8 | 0.307 |
| 9 | 0.307 |

水平地震标准值作用底层剪力： 9.768

底层最小地震剪力(抗震规范5.2.5条): 2.850

各质点地震力调整系数: 1.000

地震力调整后剪重比： 0.027

**周期(已乘折减系数)**

| 振型号 | 周期(s) |
| --- | --- |
| 1 | 0.532 |
| 2 | 0.015 |
| 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 | 355.605 |
| 8 | 0.307 |
| 9 | 0.307 |

水平地震标准值作用底层剪力： 9.768

底层最小地震剪力(抗震规范5.2.5条): 2.850

各质点地震力调整系数: 1.000

地震力调整后剪重比： 0.027

**周期(已乘折减系数)**

| 振型号 | 周期(s) |
| --- | --- |
| 1 | 0.530 |
| 2 | 0.016 |
| 3 | 0.014 |

**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 | 53.8 | -27.2 | -81.2 | -46.0 | 27.2 | -130.9 |
| 2 | 140.5 | -10.2 | -40.4 | -130.3 | 10.2 | -57.1 |
| 3 | 71.0 | 37.3 | 75.5 | -62.3 | -37.3 | 215.8 |
| 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 | -35.9 | 29.8 | 89.8 | 35.9 | -23.2 | 116.8 |
| 2 | -72.4 | 3.8 | 24.2 | 72.4 | -3.8 | 12.2 |
| 3 | -25.2 | 0.6 | 23.4 | 25.2 | 13.4 | -73.1 |
| 4 | -0.0 | 7.9 | 6.3 | 0.0 | -0.0 | -0.0 |
| 5 | 0.0 | 7.9 | 6.3 | -0.0 | 0.0 | 0.0 |
| 右风1 | 1 | -19.1 | -1.3 | 0.2 | 19.1 | -12.7 | 44.3 |
| 2 | -74.7 | 6.7 | 18.0 | 74.7 | -6.7 | 46.3 |
| 3 | -45.9 | -39.6 | -105.5 | 45.9 | 33.0 | -177.5 |
| 4 | 0.0 | -7.9 | -6.3 | -0.0 | 0.0 | 0.0 |
| 5 | -0.0 | -7.9 | -6.3 | 0.0 | -0.0 | 0.0 |
| 左风2 | 1 | -21.5 | 27.7 | 74.9 | 21.5 | -10.5 | 74.1 |
| 2 | -35.9 | 1.1 | 13.6 | 35.9 | -1.1 | -2.6 |
| 3 | -6.9 | 5.3 | 36.4 | 6.9 | -2.0 | -7.9 |
| 4 | -0.0 | 7.9 | 6.3 | 0.0 | -0.0 | -0.0 |
| 5 | 0.0 | 7.9 | 6.3 | -0.0 | 0.0 | -0.0 |
| 右风2 | 1 | -4.7 | -3.3 | -14.8 | 4.7 | 0.1 | 1.5 |
| 2 | -38.0 | 4.0 | 7.3 | 38.0 | -4.0 | 31.4 |
| 3 | -27.5 | -34.9 | -92.4 | 27.5 | 17.6 | -112.2 |
| 4 | -0.0 | -7.9 | -6.3 | 0.0 | 0.0 | -0.0 |
| 5 | 0.0 | -7.9 | -6.3 | -0.0 | 0.0 | -0.0 |
| 左地震 | 1 | -0.7 | 2.9 | 14.8 | 0.7 | -2.9 | 8.1 |
| 2 | -0.0 | 3.0 | 14.8 | 0.0 | -3.0 | 14.5 |
| 3 | 0.7 | 4.3 | 23.4 | -0.7 | -4.3 | 10.0 |
| 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 | -2.9 | -14.9 | -0.7 | 2.9 | -8.1 |
| 2 | 0.0 | -3.1 | -14.8 | -0.0 | 3.1 | -14.5 |
| 3 | -0.7 | -4.3 | -23.5 | 0.7 | 4.3 | -10.1 |
| 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 | 30.6 | 43.1 | 131.1 | -28.5 | -16.1 | 42.7 |
| 2 | 28.6 | 16.0 | -42.7 | -24.6 | 33.7 | -57.3 |
| 3 | 39.0 | -25.2 | -84.1 | -41.2 | 59.2 | -216.0 |
| 4 | 37.0 | 6.6 | -147.6 | -39.1 | 25.1 | 84.1 |
| 5 | 24.6 | -33.7 | 57.3 | -22.3 | 62.1 | -328.7 |
| 6 | 34.9 | 38.1 | 5.9 | -37.0 | -6.6 | 147.6 |
| 7 | 32.6 | 72.5 | 385.7 | -34.9 | -38.1 | -5.9 |
| 左风1 | 1 | -18.0 | -34.6 | -123.1 | 18.0 | 15.2 | -22.8 |
| 2 | -18.0 | -15.1 | 22.8 | 18.0 | -22.5 | 19.1 |
| 3 | -22.8 | 8.9 | 49.8 | 22.8 | -23.8 | 66.8 |
| 4 | -22.9 | -5.5 | 61.3 | 22.9 | -8.9 | -49.8 |
| 5 | -18.0 | 22.5 | -19.1 | 18.0 | -41.3 | 199.8 |
| 6 | -22.9 | -19.9 | -26.0 | 22.9 | 5.5 | -61.3 |
| 7 | -22.9 | -34.3 | -212.0 | 22.9 | 19.9 | 26.0 |
| 右风1 | 1 | -22.0 | -17.5 | -38.0 | 22.0 | 5.2 | -28.4 |
| 2 | -22.0 | -5.1 | 28.4 | 22.0 | -18.7 | 48.7 |
| 3 | -28.0 | 20.6 | 46.6 | 28.0 | -44.2 | 183.9 |
| 4 | -28.0 | -2.3 | 109.3 | 28.0 | -20.5 | -46.6 |
| 5 | -22.0 | 18.7 | -48.7 | 22.0 | -30.6 | 188.5 |
| 6 | -28.0 | -25.1 | 15.5 | 28.0 | 2.3 | -109.3 |
| 7 | -28.0 | -47.9 | -234.8 | 28.0 | 25.1 | -15.5 |
| 左风2 | 1 | -4.2 | -21.3 | -80.4 | 4.2 | 9.9 | -10.9 |
| 2 | -4.2 | -9.9 | 10.9 | 4.2 | -12.2 | 2.3 |
| 3 | -6.3 | 1.3 | 26.3 | 6.3 | -6.5 | 1.6 |
| 4 | -6.3 | -3.6 | 18.3 | 6.3 | -1.3 | -26.3 |
| 5 | -4.2 | 12.2 | -2.3 | 4.2 | -23.2 | 102.6 |
| 6 | -6.3 | -8.6 | -23.8 | 6.3 | 3.6 | -18.3 |
| 7 | -6.3 | -13.6 | -100.0 | 6.3 | 8.6 | 23.8 |
| 右风2 | 1 | -8.2 | -4.1 | 4.8 | 8.2 | -0.1 | -16.5 |
| 2 | -8.2 | 0.2 | 16.5 | 8.2 | -8.4 | 31.9 |
| 3 | -11.4 | 13.0 | 23.1 | 11.4 | -26.8 | 118.5 |
| 4 | -11.4 | -0.4 | 66.2 | 11.4 | -13.0 | -23.1 |
| 5 | -8.2 | 8.4 | -31.9 | 8.2 | -12.5 | 91.0 |
| 6 | -11.4 | -13.7 | 17.7 | 11.4 | 0.4 | -66.2 |
| 7 | -11.4 | -27.1 | -122.4 | 11.4 | 13.7 | -17.7 |
| 左地震 | 1 | -1.7 | -0.6 | -8.1 | 1.7 | 0.6 | 4.8 |
| 2 | -0.4 | -0.7 | -4.8 | 0.4 | 0.7 | -2.5 |
| 3 | 3.0 | -0.5 | 6.3 | -3.0 | 0.5 | -10.0 |
| 4 | 1.8 | -0.6 | 2.3 | -1.8 | 0.6 | -6.3 |
| 5 | 0.9 | -0.8 | 2.5 | -0.9 | 0.8 | -6.8 |
| 6 | 0.5 | -0.7 | -2.4 | -0.5 | 0.7 | -2.3 |
| 7 | -0.8 | -0.8 | -7.6 | 0.8 | 0.8 | 2.4 |
| 右地震 | 1 | 1.7 | 0.6 | 8.1 | -1.7 | -0.6 | -4.9 |
| 2 | 0.4 | 0.7 | 4.9 | -0.4 | -0.7 | 2.6 |
| 3 | -3.0 | 0.5 | -6.4 | 3.0 | -0.5 | 10.1 |
| 4 | -1.8 | 0.6 | -2.3 | 1.8 | -0.6 | 6.4 |
| 5 | -0.9 | 0.8 | -2.6 | 0.9 | -0.8 | 6.9 |
| 6 | -0.5 | 0.7 | 2.4 | 0.5 | -0.7 | 2.3 |
| 7 | 0.8 | 0.8 | 7.7 | -0.8 | -0.8 | -2.4 |

**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 | -4.58 | 0.18 |
| 2 | -5.48 | 0.21 |
| 3 | -2.98 | 22.01 |
| 4 | -8.09 | 43.06 |
| 5 | -8.84 | 56.50 |
| 6 | -4.31 | 7.86 |
| 7 | -6.86 | 28.36 |
| 8 | -0.14 | 0.18 |
| 9 | -12.79 | 0.21 |
| 10 | -4.94 | 0.56 |

**活荷载工况下节点位移（mm）**

| 节点号 | X向位移 | Y向位移 |
| --- | --- | --- |
| 1 | -3.77 | 0.16 |
| 2 | -4.59 | 0.18 |
| 3 | -2.25 | 35.61 |
| 4 | -6.86 | 48.80 |
| 5 | -7.50 | 68.96 |
| 6 | -3.46 | 28.87 |
| 7 | -5.75 | 42.97 |
| 8 | 0.49 | 0.16 |
| 9 | -10.93 | 0.18 |
| 10 | -4.11 | 0.47 |

**节点侧向（水平向）位移(mm)**

| 工况 | 节点 | δx | 节点 | δx |
| --- | --- | --- | --- | --- |
| 左风1 | 1 | 7.26 | 2 | 7.84 |
| 3 | 5.93 | 4 | 9.03 |
| 5 | 9.10 | 6 | 6.52 |
| 7 | 8.04 | 8 | 4.75 |
| 9 | 12.58 | 10 | 7.52 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 右风1 | 1 | -2.44 | 2 | -1.75 |
| 3 | -3.08 | 4 | 0.02 |
| 5 | 0.79 | 6 | -2.03 |
| 7 | -0.49 | 8 | -5.43 |
| 9 | 1.78 | 10 | -2.16 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 左风2 | 1 | 6.13 | 2 | 6.30 |
| 3 | 5.26 | 4 | 6.76 |
| 5 | 6.63 | 6 | 5.42 |
| 7 | 6.16 | 8 | 4.87 |
| 9 | 9.05 | 10 | 6.21 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 右风2 | 1 | -3.58 | 2 | -3.31 |
| 3 | -3.76 | 4 | -2.26 |
| 5 | -1.70 | 6 | -3.13 |
| 7 | -2.38 | 8 | -5.32 |
| 9 | -1.78 | 10 | -3.48 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 左地震 | 1 | 3.12 | 2 | 3.11 |
| 3 | 3.24 | 4 | 3.25 |
| 5 | 3.23 | 6 | 3.14 |
| 7 | 3.15 | 8 | 3.72 |
| 9 | 3.81 | 10 | 3.12 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 右地震 | 1 | -3.14 | 2 | -3.13 |
| 3 | -3.25 | 4 | -3.26 |
| 5 | -3.24 | 6 | -3.16 |
| 7 | -3.17 | 8 | -3.74 |
| 9 | -3.83 | 10 | -3.14 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 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 | 0.82 | 0.22 | 0.82 | 0.73 | 62.00 | 10.50 | 64.18 | 101.32 | 651.7 | 通过 |
| 2 | 0.73 | 0.17 | 0.79 | 0.78 | 62.00 | 11.21 | 66.42 | 116.24 | 844.1 | 通过 |
| 3 | 0.93 | 0.30 | 0.92 | 0.97 | 78.67 | 11.21 | 54.16 | 96.86 | 722.8 | 通过 |
| 4 | 0.11 | 0.06 | 0.11 | 0.05 | 30.67 | 10.88 | 37.96 | 36.21 | 51.2 | 通过 |
| 5 | 0.11 | 0.06 | 0.11 | 0.05 | 30.67 | 10.88 | 37.96 | 36.21 | 51.2 | 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 | 0.52 | 0.48 | 0.53 | 0.47 | 100.17 | 10.17 | 442.4 | 通过 |
| 2 | 0.64 | 0.27 | 0.70 | 0.51 | 80.00 | 10.70 | 647.8 | 通过 |
| 3 | 0.64 | 0.64 | 0.67 | 0.58 | 99.50 | 9.79 | 637.9 | 通过 |
| 4 | 0.68 | 0.27 | 0.70 | 0.81 | 96.00 | 10.58 | 522.5 | 通过 |
| 5 | 0.72 | 0.30 | 0.70 | 0.85 | 77.75 | 11.14 | 620.1 | 通过 |
| 6 | 0.63 | 0.36 | 0.67 | 0.79 | 96.00 | 10.17 | 509.6 | 通过 |
| 7 | 0.84 | 0.35 | 0.84 | 0.98 | 77.75 | 11.14 | 751.0 | 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=11.46, Ly=7.80; 长细比：λx=64.2,λy=101.3

构件长度=7.80; 计算长度系数: Ux=1.47 Uy=1.00

抗震等级: 四级

截面参数: B1=300, B2=300, H=400, Tw=6, T1=14, T2=14

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: 186.982697(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -98.82 | 67.62 | -32.63 | -136.55 | -54.03 | 30.29 |
| 2 | -222.71 | 134.48 | -75.54 | -385.61 | -127.73 | 77.87 |
| 3 | -198.29 | 138.83 | -74.83 | -385.42 | -128.66 | 74.83 |
| 4 | -123.24 | 63.27 | -33.33 | -136.74 | -53.10 | 33.33 |
| 5 | -74.46 | 51.49 | -24.47 | -97.28 | -40.25 | 22.13 |
| 6 | -198.35 | 118.34 | -67.38 | -346.34 | -113.94 | 69.72 |
| 7 | -173.93 | 122.69 | -66.68 | -346.15 | -114.87 | 66.68 |
| 8 | -98.88 | 47.14 | -25.17 | -97.47 | -39.32 | 25.17 |
| 9 | 29.10 | 16.08 | 9.28 | 5.06 | -5.92 | 0.53 |
| 10 | -105.32 | 41.23 | -37.26 | -103.64 | -31.06 | 16.32 |
| 11 | 6.85 | 37.62 | 6.24 | -59.02 | -27.46 | 19.62 |
| 12 | -127.72 | 62.83 | -40.35 | -167.90 | -52.66 | 35.45 |
| 13 | 53.46 | -0.05 | 17.44 | 44.32 | 7.87 | -7.63 |
| 14 | -80.96 | 25.09 | -29.10 | -64.38 | -17.27 | 8.16 |
| 15 | 31.21 | 21.49 | 14.40 | -19.76 | -13.67 | 11.46 |
| 16 | -103.35 | 46.69 | -32.19 | -128.63 | -38.87 | 27.29 |
| 17 | -18.02 | 35.32 | -5.85 | -31.42 | -21.73 | 9.40 |
| 18 | -98.67 | 50.41 | -33.77 | -96.64 | -36.82 | 18.87 |
| 19 | -31.37 | 48.25 | -7.67 | -69.87 | -34.66 | 20.86 |
| 20 | -112.11 | 63.37 | -35.63 | -135.20 | -49.78 | 30.35 |
| 21 | -141.91 | 102.17 | -48.76 | -280.48 | -95.43 | 56.98 |
| 22 | -222.56 | 117.26 | -76.69 | -345.70 | -110.52 | 66.46 |
| 23 | -155.26 | 115.10 | -50.58 | -318.93 | -108.36 | 68.44 |
| 24 | -236.00 | 130.22 | -78.54 | -384.26 | -123.48 | 77.93 |
| 25 | -117.49 | 106.53 | -48.06 | -280.30 | -96.36 | 53.94 |
| 26 | -198.14 | 121.62 | -75.98 | -345.52 | -111.45 | 63.42 |
| 27 | -130.84 | 119.45 | -49.88 | -318.75 | -109.29 | 65.40 |
| 28 | -211.58 | 134.57 | -77.84 | -384.07 | -124.41 | 74.89 |
| 29 | -42.44 | 30.97 | -6.55 | -31.61 | -20.80 | 12.44 |
| 30 | -123.09 | 46.06 | -34.48 | -96.83 | -35.89 | 21.91 |
| 31 | -55.79 | 43.89 | -8.38 | -70.06 | -33.73 | 23.89 |
| 32 | -136.53 | 59.02 | -36.33 | -135.38 | -48.85 | 33.39 |
| 33 | 6.34 | 19.19 | 2.31 | 7.84 | -7.94 | 1.24 |
| 34 | -74.31 | 34.28 | -25.62 | -57.38 | -23.03 | 10.72 |
| 35 | -7.01 | 32.11 | 0.49 | -30.61 | -20.87 | 12.70 |
| 36 | -87.75 | 47.23 | -27.47 | -95.93 | -35.99 | 22.19 |
| 37 | -117.55 | 86.04 | -40.60 | -241.22 | -81.64 | 48.82 |
| 38 | -198.20 | 101.13 | -68.53 | -306.44 | -96.73 | 58.30 |
| 39 | -130.90 | 98.96 | -42.43 | -279.67 | -94.57 | 60.28 |
| 40 | -211.64 | 114.09 | -70.38 | -344.99 | -109.69 | 69.77 |
| 41 | -93.13 | 90.39 | -39.90 | -241.03 | -82.57 | 45.78 |
| 42 | -173.78 | 105.48 | -67.83 | -306.25 | -97.66 | 55.26 |
| 43 | -106.48 | 103.32 | -41.72 | -279.48 | -95.50 | 57.24 |
| 44 | -187.22 | 118.44 | -69.68 | -344.80 | -110.62 | 66.74 |
| 45 | -18.08 | 14.83 | 1.61 | 7.65 | -7.01 | 4.28 |
| 46 | -98.73 | 29.92 | -26.32 | -57.57 | -22.10 | 13.76 |
| 47 | -31.43 | 27.76 | -0.22 | -30.80 | -19.94 | 15.74 |
| 48 | -112.17 | 42.88 | -28.18 | -96.12 | -35.06 | 25.23 |
| 49 | 33.82 | 14.48 | 11.19 | 28.58 | -1.91 | -3.01 |
| 50 | -100.60 | 39.62 | -35.36 | -80.12 | -27.06 | 12.78 |
| 51 | 11.57 | 36.02 | 8.15 | -35.50 | -23.46 | 16.08 |
| 52 | -122.99 | 61.22 | -38.45 | -144.38 | -48.66 | 31.91 |
| 53 | -52.90 | 61.27 | -18.85 | -145.76 | -53.50 | 30.29 |
| 54 | -187.32 | 86.42 | -65.40 | -254.46 | -78.65 | 46.09 |
| 55 | -75.15 | 82.81 | -21.89 | -209.84 | -75.04 | 49.39 |
| 56 | -209.72 | 108.02 | -68.49 | -318.72 | -100.25 | 65.21 |
| 57 | -35.81 | 64.32 | -18.36 | -145.63 | -54.15 | 28.17 |
| 58 | -170.23 | 89.47 | -64.90 | -254.33 | -79.30 | 43.96 |
| 59 | -58.05 | 85.86 | -21.40 | -209.71 | -75.69 | 47.26 |
| 60 | -192.62 | 111.06 | -67.99 | -318.59 | -100.90 | 63.09 |
| 61 | 16.72 | 11.43 | 10.70 | 28.45 | -1.26 | -0.89 |
| 62 | -117.69 | 36.58 | -35.85 | -80.25 | -26.41 | 14.91 |
| 63 | -5.52 | 32.97 | 7.66 | -35.64 | -22.80 | 18.21 |
| 64 | -140.09 | 58.17 | -38.94 | -144.51 | -48.01 | 34.03 |
| 65 | 58.18 | -1.66 | 19.35 | 67.84 | 11.88 | -11.17 |
| 66 | -76.24 | 23.49 | -27.20 | -40.86 | -13.27 | 4.62 |
| 67 | 35.94 | 19.88 | 16.31 | 3.76 | -9.67 | 7.92 |
| 68 | -98.63 | 45.09 | -30.29 | -105.11 | -34.87 | 23.75 |
| 69 | -28.54 | 45.14 | -10.69 | -106.50 | -39.71 | 22.14 |
| 70 | -162.96 | 70.28 | -57.24 | -215.20 | -64.86 | 37.93 |
| 71 | -50.79 | 66.68 | -13.73 | -170.58 | -61.26 | 41.23 |
| 72 | -185.36 | 91.88 | -60.33 | -279.45 | -86.46 | 57.06 |
| 73 | -11.45 | 48.18 | -10.20 | -106.37 | -40.36 | 20.01 |
| 74 | -145.87 | 73.33 | -56.75 | -215.07 | -65.51 | 35.80 |
| 75 | -33.69 | 69.73 | -13.24 | -170.45 | -61.91 | 39.10 |
| 76 | -168.26 | 94.93 | -59.84 | -279.32 | -87.11 | 54.93 |
| 77 | 41.09 | -4.71 | 18.85 | 67.71 | 12.53 | -9.04 |
| 78 | -93.33 | 20.44 | -27.69 | -40.99 | -12.62 | 6.75 |
| 79 | 18.84 | 16.84 | 15.81 | 3.63 | -9.02 | 10.05 |
| 80 | -115.73 | 42.04 | -30.78 | -105.24 | -34.22 | 25.88 |
| 81 | -81.95 | 67.97 | -30.07 | -144.28 | -56.32 | 29.05 |
| 82 | -123.43 | 69.88 | -38.29 | -166.95 | -58.23 | 37.28 |
| 83 | -135.63 | 96.94 | -48.66 | -252.21 | -88.25 | 49.67 |
| 84 | -177.12 | 98.85 | -56.89 | -274.88 | -90.17 | 57.90 |
| 85 | -125.05 | 98.82 | -48.36 | -252.13 | -88.66 | 48.36 |
| 86 | -166.54 | 100.74 | -56.58 | -274.79 | -90.57 | 56.58 |
| 87 | -92.53 | 66.08 | -30.37 | -144.36 | -55.92 | 30.37 |
| 88 | -134.02 | 68.00 | -38.60 | -167.03 | -57.83 | 38.60 |
| 89 | -58.26 | 52.06 | -22.18 | -108.38 | -43.10 | 21.40 |
| 90 | -99.75 | 53.98 | -30.41 | -131.05 | -45.02 | 29.63 |
| 91 | -99.56 | 74.35 | -36.48 | -191.40 | -67.67 | 37.26 |
| 92 | -141.04 | 76.26 | -44.71 | -214.06 | -69.58 | 45.49 |
| 93 | -91.42 | 75.80 | -36.25 | -191.33 | -67.98 | 36.25 |
| 94 | -132.90 | 77.71 | -44.48 | -214.00 | -69.89 | 44.48 |
| 95 | -66.40 | 50.61 | -22.42 | -108.44 | -42.79 | 22.42 |
| 96 | -107.89 | 52.53 | -30.64 | -131.11 | -44.71 | 30.64 |

强度计算控制组合号: 2, M=-222.71, N=134.48, M=-385.61, N=-127.73

强度计算应力比 =0.818

抗剪强度计算控制组合号: 24, V=-78.54

抗剪强度计算应力比 =0.216

平面内稳定计算最大应力对应组合号: 3, M=-198.29, N=138.83, M=-385.42, N=-128.66

平面内稳定计算最大应力 (N/mm\*mm) =250.67

平面内稳定计算最大应力比 =0.822

临界弯矩Mcr(kN\*m) =1393.74

平面外稳定计算最大应力比 =0.729

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 =0.818 < 1.0

抗剪强度计算应力比 =0.216 < 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=62.00 < [H0/TW]=250.00

翼缘宽厚比 B/T =10.50 < [B/T]=12.20

压杆,平面内长细比 λ=64. ≤ [λ]=180

压杆,平面外长细比 λ=101. ≤ [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 | -78.95 | 53.02 | -26.28 | -119.68 | -44.06 | 25.51 |
| 2 | -120.25 | 75.30 | -40.59 | -202.70 | -68.62 | 41.37 |
| 3 | -112.11 | 76.75 | -40.35 | -202.64 | -68.93 | 40.35 |
| 4 | -87.09 | 51.57 | -26.52 | -119.75 | -43.75 | 26.52 |
| 5 | -70.83 | 47.64 | -23.56 | -106.60 | -39.46 | 22.79 |
| 6 | -112.13 | 69.92 | -37.87 | -189.61 | -64.03 | 38.65 |
| 7 | -103.99 | 71.37 | -37.63 | -189.55 | -64.34 | 37.63 |
| 8 | -78.97 | 46.19 | -23.80 | -106.66 | -39.15 | 23.80 |
| 9 | -45.29 | 39.43 | -15.29 | -84.16 | -31.61 | 17.90 |
| 10 | -81.14 | 46.13 | -27.70 | -113.15 | -38.31 | 22.12 |
| 11 | -51.22 | 45.17 | -16.10 | -101.25 | -37.35 | 23.00 |
| 12 | -87.11 | 51.89 | -28.52 | -130.28 | -44.07 | 27.22 |
| 13 | -37.17 | 34.05 | -12.57 | -71.07 | -27.01 | 15.19 |
| 14 | -73.02 | 40.75 | -24.98 | -100.06 | -33.72 | 19.40 |
| 15 | -43.10 | 39.79 | -13.38 | -88.16 | -32.75 | 20.28 |
| 16 | -78.99 | 46.51 | -25.81 | -117.19 | -39.48 | 24.50 |

防火设计控制的偶然组合号: 3, M=-112.11, N=76.75, M=-202.64, N=-68.93

强度计算荷载比 =0.42

平面内稳定计算荷载比 =0.43

平面外稳定计算荷载比 =0.30

无防护下钢构件最大升温(Ts): 1081.54℃ ,按临界温度法求得临界温度(Td): 602.20℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.3788(m^2\*℃/w)

构件重量 (Kg)=651.65

**2. 钢 柱 2
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=11.91, Ly=9.61; 长细比：λx=66.4,λy=116.2

构件长度=9.61; 计算长度系数: Ux=1.24 Uy=1.00

抗震等级: 四级

截面参数: B1=320, B2=320, H=400, Tw=6, T1=14, T2=14

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: 184.774841(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 73.53 | 260.93 | 21.97 | 137.58 | -247.76 | -21.97 |
| 2 | -227.00 | 274.18 | -60.36 | -352.91 | -261.01 | 60.36 |
| 3 | -100.89 | 352.51 | -25.19 | -141.12 | -339.34 | 25.19 |
| 4 | -52.58 | 182.60 | -13.20 | -74.21 | -169.43 | 13.20 |
| 5 | 85.67 | 218.79 | 25.02 | 154.70 | -208.66 | -25.02 |
| 6 | -214.87 | 232.04 | -57.31 | -335.78 | -221.91 | 57.31 |
| 7 | -88.75 | 310.37 | -22.14 | -123.99 | -300.24 | 22.14 |
| 8 | -40.45 | 140.46 | -10.15 | -57.08 | -130.33 | 10.15 |
| 9 | -16.23 | 73.95 | -7.50 | -55.85 | -60.78 | 7.50 |
| 10 | -25.64 | 70.61 | -3.16 | -4.74 | -57.44 | 3.16 |
| 11 | -32.14 | 128.70 | -11.48 | -78.16 | -115.53 | 11.48 |
| 12 | -41.64 | 125.52 | -7.16 | -27.17 | -112.35 | 7.16 |
| 13 | -4.09 | 31.81 | -4.46 | -38.72 | -21.68 | 4.46 |
| 14 | -13.50 | 28.47 | -0.12 | 12.38 | -18.34 | 0.12 |
| 15 | -20.00 | 86.56 | -8.43 | -61.03 | -76.43 | 8.43 |
| 16 | -29.51 | 83.38 | -4.12 | -10.04 | -73.25 | 4.12 |
| 17 | 95.35 | 195.74 | 25.39 | 148.59 | -182.57 | -25.39 |
| 18 | 89.70 | 193.73 | 27.99 | 179.26 | -180.57 | -27.99 |
| 19 | 85.80 | 228.59 | 23.00 | 135.21 | -215.42 | -23.00 |
| 20 | 80.09 | 226.68 | 25.59 | 165.80 | -213.51 | -25.59 |
| 21 | -205.19 | 208.99 | -56.94 | -341.89 | -195.82 | 56.94 |
| 22 | -210.84 | 206.99 | -54.34 | -311.23 | -193.82 | 54.34 |
| 23 | -214.74 | 241.84 | -59.33 | -355.27 | -228.67 | 59.33 |
| 24 | -220.44 | 239.94 | -56.74 | -324.68 | -226.77 | 56.74 |
| 25 | -79.08 | 287.32 | -21.77 | -130.10 | -274.15 | 21.77 |
| 26 | -84.72 | 285.32 | -19.17 | -99.44 | -272.15 | 19.17 |
| 27 | -88.62 | 320.17 | -24.16 | -143.49 | -307.00 | 24.16 |
| 28 | -94.33 | 318.27 | -21.57 | -112.89 | -305.10 | 21.57 |
| 29 | -30.77 | 117.41 | -9.78 | -63.19 | -104.24 | 9.78 |
| 30 | -36.42 | 115.40 | -7.18 | -32.53 | -102.24 | 7.18 |
| 31 | -40.31 | 150.26 | -12.17 | -76.58 | -137.09 | 12.17 |
| 32 | -46.02 | 148.35 | -9.58 | -45.98 | -135.18 | 9.58 |
| 33 | 107.48 | 153.60 | 28.43 | 165.72 | -143.47 | -28.43 |
| 34 | 101.83 | 151.60 | 31.04 | 196.38 | -141.47 | -31.04 |
| 35 | 97.93 | 186.45 | 26.05 | 152.34 | -176.32 | -26.05 |
| 36 | 92.23 | 184.54 | 28.64 | 182.93 | -174.41 | -28.64 |
| 37 | -193.06 | 166.85 | -53.89 | -324.77 | -156.72 | 53.89 |
| 38 | -198.70 | 164.85 | -51.29 | -294.10 | -154.72 | 51.29 |
| 39 | -202.60 | 199.70 | -56.28 | -338.15 | -189.57 | 56.28 |
| 40 | -208.31 | 197.80 | -53.69 | -307.56 | -187.67 | 53.69 |
| 41 | -66.94 | 245.18 | -18.73 | -112.98 | -235.05 | 18.73 |
| 42 | -72.59 | 243.18 | -16.12 | -82.31 | -233.05 | 16.12 |
| 43 | -76.49 | 278.03 | -21.11 | -126.36 | -267.90 | 21.11 |
| 44 | -82.19 | 276.13 | -18.52 | -95.77 | -266.00 | 18.52 |
| 45 | -18.63 | 75.27 | -6.73 | -46.07 | -65.14 | 6.73 |
| 46 | -24.28 | 73.27 | -4.13 | -15.40 | -63.14 | 4.13 |
| 47 | -28.18 | 108.12 | -9.12 | -59.45 | -97.99 | 9.12 |
| 48 | -33.88 | 106.21 | -6.53 | -28.86 | -96.08 | 6.53 |
| 49 | 72.05 | 128.78 | 17.12 | 92.40 | -115.61 | -17.12 |
| 50 | 62.64 | 125.44 | 21.46 | 143.51 | -112.27 | -21.46 |
| 51 | 56.14 | 183.53 | 13.14 | 70.10 | -170.36 | -13.14 |
| 52 | 46.64 | 180.35 | 17.46 | 121.09 | -167.18 | -17.46 |
| 53 | -138.32 | 138.05 | -40.51 | -250.94 | -124.89 | 40.51 |
| 54 | -147.73 | 134.72 | -36.17 | -199.83 | -121.55 | 36.17 |
| 55 | -154.23 | 192.81 | -44.49 | -273.24 | -179.64 | 44.49 |
| 56 | -163.74 | 189.63 | -40.17 | -222.25 | -176.46 | 40.17 |
| 57 | -50.04 | 192.89 | -15.90 | -102.69 | -179.72 | 15.90 |
| 58 | -59.45 | 189.55 | -11.56 | -51.58 | -176.38 | 11.56 |
| 59 | -65.95 | 247.64 | -19.87 | -124.99 | -234.47 | 19.87 |
| 60 | -75.46 | 244.46 | -15.56 | -74.00 | -231.29 | 15.56 |
| 61 | -16.23 | 73.95 | -7.50 | -55.85 | -60.78 | 7.50 |
| 62 | -25.64 | 70.61 | -3.16 | -4.74 | -57.44 | 3.16 |
| 63 | -32.14 | 128.70 | -11.48 | -78.16 | -115.53 | 11.48 |
| 64 | -41.64 | 125.52 | -7.16 | -27.17 | -112.35 | 7.16 |
| 65 | 84.19 | 86.64 | 20.16 | 109.53 | -76.51 | -20.16 |
| 66 | 74.78 | 83.30 | 24.50 | 160.64 | -73.17 | -24.50 |
| 67 | 68.28 | 141.39 | 16.18 | 87.22 | -131.26 | -16.18 |
| 68 | 58.77 | 138.21 | 20.50 | 138.21 | -128.09 | -20.50 |
| 69 | -126.19 | 95.92 | -37.47 | -233.81 | -85.79 | 37.47 |
| 70 | -135.60 | 92.58 | -33.13 | -182.70 | -82.45 | 33.13 |
| 71 | -142.10 | 150.67 | -41.45 | -256.12 | -140.54 | 41.45 |
| 72 | -151.60 | 147.49 | -37.13 | -205.13 | -137.36 | 37.13 |
| 73 | -37.91 | 150.75 | -12.85 | -85.56 | -140.62 | 12.85 |
| 74 | -47.32 | 147.41 | -8.51 | -34.45 | -137.28 | 8.51 |
| 75 | -53.82 | 205.50 | -16.83 | -107.87 | -195.37 | 16.83 |
| 76 | -63.32 | 202.32 | -12.51 | -56.88 | -192.19 | 12.51 |
| 77 | -4.09 | 31.81 | -4.46 | -38.72 | -21.68 | 4.46 |
| 78 | -13.50 | 28.47 | -0.12 | 12.38 | -18.34 | 0.12 |
| 79 | -20.00 | 86.56 | -8.43 | -61.03 | -76.43 | 8.43 |
| 80 | -29.51 | 83.38 | -4.12 | -10.04 | -73.25 | 4.12 |
| 81 | 22.72 | 216.50 | 6.30 | 37.81 | -203.33 | -6.30 |
| 82 | -18.68 | 216.58 | -2.23 | -2.77 | -203.41 | 2.23 |
| 83 | -107.51 | 222.24 | -29.38 | -174.73 | -209.08 | 29.38 |
| 84 | -148.92 | 222.32 | -37.91 | -215.32 | -209.15 | 37.91 |
| 85 | -52.86 | 256.19 | -14.14 | -82.96 | -243.02 | 14.14 |
| 86 | -94.27 | 256.26 | -22.67 | -123.54 | -243.09 | 22.67 |
| 87 | -31.93 | 182.56 | -8.94 | -53.97 | -169.39 | 8.94 |
| 88 | -73.33 | 182.63 | -17.47 | -94.55 | -169.47 | 17.47 |
| 89 | 22.24 | 166.53 | 5.83 | 33.76 | -156.40 | -5.83 |
| 90 | -19.16 | 166.61 | -2.71 | -6.83 | -156.48 | 2.71 |
| 91 | -77.93 | 170.95 | -21.61 | -129.74 | -160.82 | 21.61 |
| 92 | -119.34 | 171.02 | -30.15 | -170.32 | -160.89 | 30.15 |
| 93 | -35.90 | 197.06 | -9.89 | -59.14 | -186.93 | 9.89 |
| 94 | -77.30 | 197.13 | -18.43 | -99.73 | -187.00 | 18.43 |
| 95 | -19.79 | 140.42 | -5.89 | -36.84 | -130.29 | 5.89 |
| 96 | -61.20 | 140.50 | -14.43 | -77.42 | -130.37 | 14.43 |

强度计算控制组合号: 2, M=-227.00, N=274.18, M=-352.91, N=-261.01

强度计算应力比 =0.733

抗剪强度计算控制组合号: 2, V=-60.36

抗剪强度计算应力比 =0.166

平面内稳定计算最大应力对应组合号: 2, M=-227.00, N=274.18, M=-352.91, N=-261.01

平面内稳定计算最大应力 (N/mm\*mm) =241.17

平面内稳定计算最大应力比 =0.791

临界弯矩Mcr(kN\*m) =1188.51

平面外稳定计算最大应力比 =0.781

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 =0.733 < 1.0

抗剪强度计算应力比 =0.166 < 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=62.00 < [H0/TW]=250.00

翼缘宽厚比 B/T =11.21 < [B/T]=12.20

压杆,平面内长细比 λ=66. ≤ [λ]=180

压杆,平面外长细比 λ=116. ≤ [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 | 1.59 | 166.57 | 1.57 | 13.51 | -156.44 | -1.57 |
| 2 | -98.59 | 170.99 | -25.87 | -149.98 | -160.86 | 25.87 |
| 3 | -56.55 | 197.10 | -14.15 | -79.39 | -186.97 | 14.15 |
| 4 | -40.45 | 140.46 | -10.15 | -57.08 | -130.33 | 10.15 |
| 5 | 5.64 | 152.52 | 2.59 | 19.22 | -143.41 | -2.59 |
| 6 | -94.54 | 156.94 | -24.86 | -144.27 | -147.82 | 24.86 |
| 7 | -52.51 | 183.05 | -13.13 | -73.68 | -173.93 | 13.13 |
| 8 | -36.40 | 126.41 | -9.14 | -51.38 | -117.30 | 9.14 |
| 9 | -30.75 | 111.49 | -8.63 | -52.19 | -101.36 | 8.63 |
| 10 | -33.26 | 110.60 | -7.48 | -38.56 | -100.47 | 7.48 |
| 11 | -35.00 | 126.09 | -9.69 | -58.14 | -115.96 | 9.69 |
| 12 | -37.53 | 125.24 | -8.54 | -44.54 | -115.11 | 8.54 |
| 13 | -26.71 | 97.44 | -7.62 | -46.48 | -88.32 | 7.62 |
| 14 | -29.22 | 96.55 | -6.46 | -32.85 | -87.43 | 6.46 |
| 15 | -30.95 | 112.04 | -8.68 | -52.43 | -102.92 | 8.68 |
| 16 | -33.49 | 111.19 | -7.53 | -38.83 | -102.08 | 7.53 |

防火设计控制的偶然组合号: 2, M=-98.59, N=170.99, M=-149.98, N=-160.86

强度计算荷载比 =0.30

平面内稳定计算荷载比 =0.35

平面外稳定计算荷载比 =0.31

无防护下钢构件最大升温(Ts): 1081.52℃ ,按临界温度法求得临界温度(Td): 630.24℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.3433(m^2\*℃/w)

构件重量 (Kg)=844.13

**3. 钢 柱 3
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=12.03, Ly=7.80; 长细比：λx=54.2,λy=96.9

构件长度=7.80; 计算长度系数: Ux=1.54 Uy=1.00

抗震等级: 四级

截面参数: B1=320, B2=320, H=500, Tw=6, T1=14, T2=14

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: 192.333786(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 205.51 | 174.59 | 100.26 | 598.35 | -167.09 | -100.12 |
| 2 | 92.25 | 90.71 | 46.29 | 246.97 | -75.66 | -46.43 |
| 3 | 182.57 | 178.37 | 100.12 | 598.35 | -167.09 | -100.12 |
| 4 | 115.18 | 86.94 | 46.43 | 246.97 | -75.66 | -46.43 |
| 5 | 182.86 | 153.30 | 89.05 | 533.62 | -148.41 | -88.92 |
| 6 | 69.60 | 69.42 | 35.09 | 182.24 | -56.97 | -35.23 |
| 7 | 159.93 | 157.08 | 88.92 | 533.62 | -148.41 | -88.92 |
| 8 | 92.54 | 65.65 | 35.23 | 182.24 | -56.97 | -35.23 |
| 9 | 133.24 | 54.39 | 49.46 | 170.84 | -43.12 | -28.50 |
| 10 | -60.13 | 23.42 | -10.80 | 14.22 | -12.14 | 0.97 |
| 11 | 152.79 | 81.93 | 56.48 | 268.64 | -70.66 | -51.58 |
| 12 | -40.52 | 51.03 | -3.73 | 112.28 | -39.76 | -22.13 |
| 13 | 110.59 | 33.10 | 38.26 | 106.10 | -24.43 | -17.30 |
| 14 | -82.77 | 2.13 | -22.00 | -50.51 | 6.55 | 12.17 |
| 15 | 130.14 | 60.64 | 45.28 | 203.90 | -51.97 | -40.37 |
| 16 | -63.17 | 29.74 | -14.94 | 47.54 | -21.07 | -10.93 |
| 17 | 226.57 | 151.87 | 100.81 | 532.55 | -144.37 | -88.09 |
| 18 | 110.55 | 133.29 | 64.65 | 438.58 | -125.79 | -70.41 |
| 19 | 238.30 | 168.40 | 105.02 | 591.23 | -160.90 | -101.94 |
| 20 | 122.31 | 149.86 | 68.89 | 497.41 | -142.36 | -84.27 |
| 21 | 113.31 | 67.99 | 46.84 | 181.17 | -52.94 | -34.41 |
| 22 | -2.71 | 49.41 | 10.69 | 87.20 | -34.36 | -16.72 |
| 23 | 125.04 | 84.52 | 51.05 | 239.84 | -69.47 | -48.25 |
| 24 | 9.06 | 65.98 | 14.93 | 146.03 | -50.93 | -30.58 |
| 25 | 203.63 | 155.65 | 100.67 | 532.55 | -144.37 | -88.09 |
| 26 | 87.62 | 137.06 | 64.51 | 438.58 | -125.79 | -70.41 |
| 27 | 215.37 | 172.17 | 104.88 | 591.23 | -160.90 | -101.94 |
| 28 | 99.38 | 153.63 | 68.75 | 497.41 | -142.36 | -84.27 |
| 29 | 136.24 | 64.22 | 46.98 | 181.17 | -52.94 | -34.41 |
| 30 | 20.23 | 45.63 | 10.82 | 87.20 | -34.36 | -16.72 |
| 31 | 147.98 | 80.74 | 51.19 | 239.84 | -69.47 | -48.25 |
| 32 | 31.99 | 62.20 | 15.06 | 146.03 | -50.93 | -30.58 |
| 33 | 203.92 | 130.58 | 89.61 | 467.81 | -125.69 | -76.89 |
| 34 | 87.90 | 112.00 | 53.45 | 373.85 | -107.10 | -59.21 |
| 35 | 215.65 | 147.11 | 93.82 | 526.49 | -142.21 | -90.74 |
| 36 | 99.67 | 128.57 | 57.69 | 432.68 | -123.67 | -73.07 |
| 37 | 90.67 | 46.70 | 35.64 | 116.43 | -34.25 | -23.20 |
| 38 | -25.35 | 28.12 | -0.52 | 22.46 | -15.67 | -5.52 |
| 39 | 102.40 | 63.23 | 39.85 | 175.11 | -50.78 | -37.05 |
| 40 | -13.59 | 44.69 | 3.72 | 81.30 | -32.24 | -19.38 |
| 41 | 180.99 | 134.36 | 89.47 | 467.81 | -125.69 | -76.89 |
| 42 | 64.97 | 115.77 | 53.31 | 373.85 | -107.10 | -59.21 |
| 43 | 192.72 | 150.88 | 93.68 | 526.49 | -142.21 | -90.74 |
| 44 | 76.73 | 132.34 | 57.55 | 432.68 | -123.67 | -73.07 |
| 45 | 113.60 | 42.93 | 35.78 | 116.43 | -34.25 | -23.20 |
| 46 | -2.42 | 24.34 | -0.38 | 22.46 | -15.67 | -5.52 |
| 47 | 125.33 | 59.45 | 39.99 | 175.11 | -50.78 | -37.05 |
| 48 | 9.34 | 40.91 | 3.86 | 81.30 | -32.24 | -19.38 |
| 49 | 208.40 | 112.03 | 85.66 | 393.33 | -103.39 | -64.61 |
| 50 | 15.03 | 81.05 | 25.40 | 236.71 | -72.42 | -35.13 |
| 51 | 227.95 | 139.57 | 92.68 | 491.13 | -130.94 | -87.68 |
| 52 | 34.64 | 108.67 | 32.47 | 334.77 | -100.04 | -58.23 |
| 53 | 129.12 | 53.31 | 47.89 | 147.36 | -39.39 | -27.02 |
| 54 | -64.25 | 22.33 | -12.38 | -9.25 | -8.42 | 2.45 |
| 55 | 148.67 | 80.85 | 54.90 | 245.16 | -66.93 | -50.10 |
| 56 | -44.64 | 49.95 | -5.31 | 88.80 | -36.03 | -20.65 |
| 57 | 192.34 | 114.67 | 85.57 | 393.33 | -103.39 | -64.61 |
| 58 | -1.02 | 83.69 | 25.30 | 236.71 | -72.42 | -35.13 |
| 59 | 211.90 | 142.21 | 92.58 | 491.13 | -130.94 | -87.68 |
| 60 | 18.59 | 111.31 | 32.37 | 334.77 | -100.04 | -58.23 |
| 61 | 145.17 | 50.67 | 47.98 | 147.36 | -39.39 | -27.02 |
| 62 | -48.19 | 19.69 | -12.28 | -9.25 | -8.42 | 2.45 |
| 63 | 164.72 | 78.21 | 55.00 | 245.16 | -66.93 | -50.10 |
| 64 | -28.59 | 47.31 | -5.21 | 88.80 | -36.03 | -20.65 |
| 65 | 185.75 | 90.74 | 74.46 | 328.59 | -84.71 | -53.40 |
| 66 | -7.61 | 59.76 | 14.20 | 171.98 | -53.73 | -23.93 |
| 67 | 205.30 | 118.28 | 81.48 | 426.39 | -112.25 | -76.48 |
| 68 | 11.99 | 87.38 | 21.26 | 270.03 | -81.35 | -47.03 |
| 69 | 106.47 | 32.02 | 36.68 | 82.63 | -20.70 | -15.82 |
| 70 | -86.89 | 1.04 | -23.58 | -73.99 | 10.27 | 13.65 |
| 71 | 126.02 | 59.56 | 43.70 | 180.43 | -48.25 | -38.89 |
| 72 | -67.29 | 28.66 | -16.51 | 24.07 | -17.35 | -9.45 |
| 73 | 169.70 | 93.38 | 74.36 | 328.59 | -84.71 | -53.40 |
| 74 | -23.67 | 62.40 | 14.10 | 171.98 | -53.73 | -23.93 |
| 75 | 189.25 | 120.92 | 81.38 | 426.39 | -112.25 | -76.48 |
| 76 | -4.06 | 90.02 | 21.17 | 270.03 | -81.35 | -47.03 |
| 77 | 122.52 | 29.38 | 36.78 | 82.63 | -20.70 | -15.82 |
| 78 | -70.84 | -1.60 | -23.48 | -73.99 | 10.27 | 13.65 |
| 79 | 142.08 | 56.92 | 43.80 | 180.43 | -48.25 | -38.89 |
| 80 | -51.23 | 26.02 | -16.42 | 24.07 | -17.35 | -9.45 |
| 81 | 177.44 | 128.93 | 76.95 | 432.26 | -119.29 | -76.89 |
| 82 | 111.73 | 126.94 | 64.92 | 404.15 | -117.30 | -64.86 |
| 83 | 128.36 | 92.58 | 53.57 | 279.99 | -79.67 | -53.63 |
| 84 | 62.65 | 90.59 | 41.54 | 251.88 | -77.68 | -41.60 |
| 85 | 167.50 | 130.57 | 76.89 | 432.26 | -119.29 | -76.89 |
| 86 | 101.79 | 128.57 | 64.86 | 404.15 | -117.30 | -64.86 |
| 87 | 138.30 | 90.95 | 53.63 | 279.99 | -79.67 | -53.63 |
| 88 | 72.59 | 88.95 | 41.60 | 251.88 | -77.68 | -41.60 |
| 89 | 144.05 | 99.41 | 60.58 | 335.74 | -91.99 | -60.53 |
| 90 | 78.35 | 97.41 | 48.55 | 307.63 | -90.00 | -48.50 |
| 91 | 106.30 | 71.45 | 42.59 | 218.62 | -61.51 | -42.64 |
| 92 | 40.59 | 69.45 | 30.56 | 190.51 | -59.52 | -30.61 |
| 93 | 136.41 | 100.66 | 60.53 | 335.74 | -91.99 | -60.53 |
| 94 | 70.70 | 98.67 | 48.50 | 307.63 | -90.00 | -48.50 |
| 95 | 113.94 | 70.19 | 42.64 | 218.62 | -61.51 | -42.64 |
| 96 | 48.24 | 68.20 | 30.61 | 190.51 | -59.52 | -30.61 |

强度计算控制组合号: 1, M=205.51, N=174.59, M=598.35, N=-167.09

强度计算应力比 =0.931

抗剪强度计算控制组合号: 19, V=105.02

抗剪强度计算应力比 =0.300

平面内稳定计算最大应力对应组合号: 1, M=205.51, N=174.59, M=598.35, N=-167.09

平面内稳定计算最大应力 (N/mm\*mm) =280.85

平面内稳定计算最大应力比 =0.921

平面外稳定计算最大应力对应组合号: 3, M=182.57, N=178.37, M=598.35, N=-167.09

临界弯矩Mcr(kN\*m) =1665.50

平面外稳定计算最大应力比 =0.971

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 =0.931 < 1.0

抗剪强度计算应力比 =0.300 < 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=78.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =11.21 < [B/T]=12.20

压杆,平面内长细比 λ=54. ≤ [λ]=180

压杆,平面外长细比 λ=97. ≤ [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 | 111.28 | 98.41 | 54.58 | 321.72 | -91.00 | -54.53 |
| 2 | 73.53 | 70.45 | 36.59 | 204.59 | -60.52 | -36.64 |
| 3 | 103.63 | 99.67 | 54.53 | 321.72 | -91.00 | -54.53 |
| 4 | 81.17 | 69.19 | 36.64 | 204.59 | -60.52 | -36.64 |
| 5 | 103.73 | 91.32 | 50.84 | 300.14 | -84.77 | -50.80 |
| 6 | 65.98 | 63.36 | 32.86 | 183.02 | -54.29 | -32.90 |
| 7 | 96.08 | 92.57 | 50.80 | 300.14 | -84.77 | -50.80 |
| 8 | 73.62 | 62.10 | 32.90 | 183.02 | -54.29 | -32.90 |
| 9 | 84.85 | 60.87 | 37.59 | 186.53 | -52.20 | -32.00 |
| 10 | 33.28 | 52.61 | 21.52 | 144.76 | -43.94 | -24.14 |
| 11 | 90.06 | 68.21 | 39.46 | 212.61 | -59.54 | -38.15 |
| 12 | 38.51 | 59.97 | 23.40 | 170.91 | -51.30 | -30.30 |
| 13 | 77.30 | 53.77 | 33.85 | 164.95 | -45.97 | -28.26 |
| 14 | 25.74 | 45.51 | 17.78 | 123.19 | -37.71 | -20.40 |
| 15 | 82.51 | 61.12 | 35.72 | 191.03 | -53.31 | -34.42 |
| 16 | 30.96 | 52.88 | 19.67 | 149.34 | -45.07 | -26.56 |

防火设计控制的偶然组合号: 1, M=111.28, N=98.41, M=321.72, N=-91.00

强度计算荷载比 =0.49

平面内稳定计算荷载比 =0.49

平面外稳定计算荷载比 =0.41

无防护下钢构件最大升温(Ts): 1081.56℃ ,按临界温度法求得临界温度(Td): 579.15℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4192(m^2\*℃/w)

构件重量 (Kg)=722.75

**4. 钢 柱 4
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=3.20, Ly=1.60; 长细比：λx=38.0,λy=36.2

构件长度=1.64; 计算长度系数: Ux=1.95 Uy=0.98

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 | 0.80 | -0.00 | 0.00 | -0.00 | 0.00 |
| 2 | -0.00 | 0.80 | -0.00 | -0.00 | -0.00 | 0.00 |
| 3 | -0.00 | 0.80 | -0.00 | -0.00 | -0.00 | 0.00 |
| 4 | -0.00 | 0.80 | -0.00 | 0.00 | -0.00 | 0.00 |
| 5 | -0.00 | 0.61 | -0.00 | 0.00 | -0.00 | 0.00 |
| 6 | -0.00 | 0.61 | -0.00 | -0.00 | -0.00 | 0.00 |
| 7 | -0.00 | 0.61 | -0.00 | -0.00 | -0.00 | 0.00 |
| 8 | -0.00 | 0.61 | -0.00 | 0.00 | -0.00 | 0.00 |
| 9 | 9.51 | 0.80 | 11.89 | -0.00 | 0.00 | -0.00 |
| 10 | -9.50 | 0.80 | -11.88 | 0.00 | -0.00 | 0.00 |
| 11 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 12 | -9.51 | 0.80 | -11.89 | -0.00 | -0.00 | 0.00 |
| 13 | 9.51 | 0.61 | 11.89 | -0.00 | 0.00 | -0.00 |
| 14 | -9.50 | 0.61 | -11.88 | 0.00 | -0.00 | 0.00 |
| 15 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | -0.00 |
| 16 | -9.51 | 0.61 | -11.89 | -0.00 | -0.00 | 0.00 |
| 17 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 18 | -5.70 | 0.80 | -7.13 | 0.00 | -0.00 | 0.00 |
| 19 | 5.71 | 0.80 | 7.14 | 0.00 | -0.00 | 0.00 |
| 20 | -5.71 | 0.80 | -7.14 | 0.00 | -0.00 | 0.00 |
| 21 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 22 | -5.70 | 0.80 | -7.13 | -0.00 | -0.00 | 0.00 |
| 23 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 24 | -5.71 | 0.80 | -7.14 | -0.00 | -0.00 | 0.00 |
| 25 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 26 | -5.70 | 0.80 | -7.13 | -0.00 | -0.00 | 0.00 |
| 27 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 28 | -5.71 | 0.80 | -7.14 | -0.00 | -0.00 | 0.00 |
| 29 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 30 | -5.70 | 0.80 | -7.13 | 0.00 | -0.00 | 0.00 |
| 31 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 32 | -5.71 | 0.80 | -7.14 | -0.00 | -0.00 | 0.00 |
| 33 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 34 | -5.70 | 0.61 | -7.13 | 0.00 | -0.00 | 0.00 |
| 35 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 36 | -5.71 | 0.61 | -7.14 | 0.00 | -0.00 | 0.00 |
| 37 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 38 | -5.70 | 0.61 | -7.13 | -0.00 | -0.00 | 0.00 |
| 39 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 40 | -5.71 | 0.61 | -7.14 | -0.00 | -0.00 | 0.00 |
| 41 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 42 | -5.70 | 0.61 | -7.13 | -0.00 | -0.00 | 0.00 |
| 43 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 44 | -5.71 | 0.61 | -7.14 | -0.00 | -0.00 | 0.00 |
| 45 | 5.71 | 0.61 | 7.14 | -0.00 | 0.00 | 0.00 |
| 46 | -5.70 | 0.61 | -7.13 | 0.00 | -0.00 | 0.00 |
| 47 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 48 | -5.71 | 0.61 | -7.14 | -0.00 | -0.00 | 0.00 |
| 49 | 9.51 | 0.80 | 11.89 | -0.00 | 0.00 | 0.00 |
| 50 | -9.50 | 0.80 | -11.88 | 0.00 | -0.00 | 0.00 |
| 51 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 52 | -9.51 | 0.80 | -11.89 | 0.00 | -0.00 | 0.00 |
| 53 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 54 | -9.50 | 0.80 | -11.88 | -0.00 | -0.00 | 0.00 |
| 55 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 56 | -9.51 | 0.80 | -11.89 | -0.00 | -0.00 | 0.00 |
| 57 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 58 | -9.50 | 0.80 | -11.88 | -0.00 | -0.00 | 0.00 |
| 59 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 60 | -9.51 | 0.80 | -11.89 | -0.00 | -0.00 | 0.00 |
| 61 | 9.51 | 0.80 | 11.89 | -0.00 | 0.00 | 0.00 |
| 62 | -9.50 | 0.80 | -11.88 | 0.00 | -0.00 | 0.00 |
| 63 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 64 | -9.51 | 0.80 | -11.89 | -0.00 | -0.00 | 0.00 |
| 65 | 9.51 | 0.61 | 11.89 | -0.00 | 0.00 | 0.00 |
| 66 | -9.50 | 0.61 | -11.88 | 0.00 | -0.00 | 0.00 |
| 67 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 68 | -9.51 | 0.61 | -11.89 | 0.00 | -0.00 | 0.00 |
| 69 | 9.51 | 0.61 | 11.89 | -0.00 | 0.00 | 0.00 |
| 70 | -9.50 | 0.61 | -11.88 | -0.00 | -0.00 | 0.00 |
| 71 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 72 | -9.51 | 0.61 | -11.89 | -0.00 | -0.00 | 0.00 |
| 73 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 74 | -9.50 | 0.61 | -11.88 | -0.00 | -0.00 | 0.00 |
| 75 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 76 | -9.51 | 0.61 | -11.89 | -0.00 | -0.00 | 0.00 |
| 77 | 9.51 | 0.61 | 11.89 | -0.00 | 0.00 | 0.00 |
| 78 | -9.50 | 0.61 | -11.88 | 0.00 | -0.00 | 0.00 |
| 79 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 80 | -9.51 | 0.61 | -11.89 | -0.00 | -0.00 | 0.00 |
| 81 | 0.02 | 0.80 | 0.01 | 0.00 | -0.00 | -0.01 |
| 82 | -0.02 | 0.80 | -0.01 | 0.00 | -0.00 | 0.01 |
| 83 | 0.02 | 0.80 | 0.01 | -0.00 | -0.00 | -0.01 |
| 84 | -0.02 | 0.80 | -0.01 | -0.00 | -0.00 | 0.01 |
| 85 | 0.02 | 0.80 | 0.01 | -0.00 | -0.00 | -0.01 |
| 86 | -0.02 | 0.80 | -0.01 | 0.00 | -0.00 | 0.01 |
| 87 | 0.02 | 0.80 | 0.01 | 0.00 | -0.00 | -0.01 |
| 88 | -0.02 | 0.80 | -0.01 | 0.00 | -0.00 | 0.01 |
| 89 | 0.02 | 0.61 | 0.01 | 0.00 | -0.00 | -0.01 |
| 90 | -0.02 | 0.61 | -0.01 | 0.00 | -0.00 | 0.01 |
| 91 | 0.02 | 0.61 | 0.01 | -0.00 | -0.00 | -0.01 |
| 92 | -0.02 | 0.61 | -0.01 | -0.00 | -0.00 | 0.01 |
| 93 | 0.02 | 0.61 | 0.01 | -0.00 | -0.00 | -0.01 |
| 94 | -0.02 | 0.61 | -0.01 | 0.00 | -0.00 | 0.01 |
| 95 | 0.02 | 0.61 | 0.01 | 0.00 | -0.00 | -0.01 |
| 96 | -0.02 | 0.61 | -0.01 | 0.00 | -0.00 | 0.01 |

强度计算控制组合号: 56, M=-9.51, N=0.80, M=-0.00, N=-0.00

强度计算应力比 =0.111

抗剪强度计算控制组合号: 56, V=-11.89

抗剪强度计算应力比 =0.062

平面内稳定计算最大应力对应组合号: 56, M=-9.51, N=0.80, M=-0.00, N=-0.00

平面内稳定计算最大应力 (N/mm\*mm) =32.30

平面内稳定计算最大应力比 =0.106

临界弯矩Mcr(kN\*m) =1157.60

平面外稳定计算最大应力比 =0.051

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 =0.111 < 1.0

抗剪强度计算应力比 =0.062 < 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=38. ≤ [λ]=180

压杆,平面外长细比 λ=36. ≤ [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 | 0.61 | -0.00 | 0.00 | -0.00 | 0.00 |
| 2 | -0.00 | 0.61 | -0.00 | -0.00 | -0.00 | 0.00 |
| 3 | -0.00 | 0.61 | -0.00 | -0.00 | -0.00 | 0.00 |
| 4 | -0.00 | 0.61 | -0.00 | 0.00 | -0.00 | 0.00 |
| 5 | -0.00 | 0.55 | -0.00 | 0.00 | -0.00 | 0.00 |
| 6 | -0.00 | 0.55 | -0.00 | -0.00 | -0.00 | 0.00 |
| 7 | -0.00 | 0.55 | -0.00 | -0.00 | -0.00 | 0.00 |
| 8 | -0.00 | 0.55 | -0.00 | 0.00 | -0.00 | 0.00 |
| 9 | 2.54 | 0.61 | 3.17 | -0.00 | -0.00 | 0.00 |
| 10 | -2.53 | 0.61 | -3.17 | 0.00 | -0.00 | 0.00 |
| 11 | 2.54 | 0.61 | 3.17 | -0.00 | -0.00 | 0.00 |
| 12 | -2.54 | 0.61 | -3.17 | 0.00 | -0.00 | 0.00 |
| 13 | 2.54 | 0.55 | 3.17 | -0.00 | -0.00 | 0.00 |
| 14 | -2.53 | 0.55 | -3.17 | 0.00 | -0.00 | 0.00 |
| 15 | 2.54 | 0.55 | 3.17 | -0.00 | -0.00 | 0.00 |
| 16 | -2.54 | 0.55 | -3.17 | 0.00 | -0.00 | 0.00 |

防火设计控制的偶然组合号: 12, M=-2.54, N=0.61, 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)=51.22

**5. 钢 柱 5
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=3.20, Ly=1.60; 长细比：λx=38.0,λy=36.2

构件长度=1.64; 计算长度系数: Ux=1.95 Uy=0.98

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 | 0.80 | 0.00 | -0.00 | -0.00 | -0.00 |
| 2 | 0.00 | 0.80 | 0.00 | -0.00 | -0.00 | -0.00 |
| 3 | 0.00 | 0.80 | 0.00 | -0.00 | -0.00 | -0.00 |
| 4 | 0.00 | 0.80 | 0.00 | -0.00 | -0.00 | -0.00 |
| 5 | 0.00 | 0.61 | 0.00 | 0.00 | -0.00 | -0.00 |
| 6 | 0.00 | 0.61 | 0.00 | -0.00 | -0.00 | 0.00 |
| 7 | 0.00 | 0.61 | 0.00 | -0.00 | -0.00 | -0.00 |
| 8 | 0.00 | 0.61 | 0.00 | -0.00 | -0.00 | -0.00 |
| 9 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 10 | -9.50 | 0.80 | -11.88 | -0.00 | -0.00 | -0.00 |
| 11 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 12 | -9.51 | 0.80 | -11.89 | -0.00 | -0.00 | -0.00 |
| 13 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 14 | -9.50 | 0.61 | -11.88 | -0.00 | -0.00 | -0.00 |
| 15 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 16 | -9.51 | 0.61 | -11.89 | -0.00 | -0.00 | -0.00 |
| 17 | 5.71 | 0.80 | 7.14 | 0.00 | -0.00 | -0.00 |
| 18 | -5.70 | 0.80 | -7.13 | 0.00 | -0.00 | -0.00 |
| 19 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | -0.00 |
| 20 | -5.71 | 0.80 | -7.14 | -0.00 | -0.00 | -0.00 |
| 21 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 22 | -5.70 | 0.80 | -7.13 | -0.00 | -0.00 | -0.00 |
| 23 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 24 | -5.71 | 0.80 | -7.14 | -0.00 | -0.00 | -0.00 |
| 25 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 26 | -5.70 | 0.80 | -7.13 | -0.00 | -0.00 | -0.00 |
| 27 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 28 | -5.71 | 0.80 | -7.14 | -0.00 | -0.00 | -0.00 |
| 29 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | -0.00 |
| 30 | -5.70 | 0.80 | -7.13 | -0.00 | -0.00 | -0.00 |
| 31 | 5.71 | 0.80 | 7.14 | -0.00 | -0.00 | 0.00 |
| 32 | -5.71 | 0.80 | -7.14 | -0.00 | -0.00 | -0.00 |
| 33 | 5.71 | 0.61 | 7.14 | 0.00 | -0.00 | -0.00 |
| 34 | -5.70 | 0.61 | -7.13 | 0.00 | -0.00 | -0.00 |
| 35 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | -0.00 |
| 36 | -5.71 | 0.61 | -7.14 | -0.00 | -0.00 | -0.00 |
| 37 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 38 | -5.70 | 0.61 | -7.13 | -0.00 | -0.00 | -0.00 |
| 39 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 40 | -5.71 | 0.61 | -7.14 | -0.00 | -0.00 | 0.00 |
| 41 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 42 | -5.70 | 0.61 | -7.13 | -0.00 | -0.00 | -0.00 |
| 43 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 44 | -5.71 | 0.61 | -7.14 | -0.00 | -0.00 | -0.00 |
| 45 | 5.71 | 0.61 | 7.14 | 0.00 | -0.00 | -0.00 |
| 46 | -5.70 | 0.61 | -7.13 | -0.00 | -0.00 | -0.00 |
| 47 | 5.71 | 0.61 | 7.14 | -0.00 | -0.00 | 0.00 |
| 48 | -5.71 | 0.61 | -7.14 | -0.00 | -0.00 | -0.00 |
| 49 | 9.51 | 0.80 | 11.89 | 0.00 | -0.00 | -0.00 |
| 50 | -9.50 | 0.80 | -11.88 | 0.00 | -0.00 | -0.00 |
| 51 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 52 | -9.51 | 0.80 | -11.89 | -0.00 | -0.00 | -0.00 |
| 53 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 54 | -9.50 | 0.80 | -11.88 | -0.00 | -0.00 | -0.00 |
| 55 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 56 | -9.51 | 0.80 | -11.89 | -0.00 | -0.00 | -0.00 |
| 57 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 58 | -9.50 | 0.80 | -11.88 | -0.00 | -0.00 | -0.00 |
| 59 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 60 | -9.51 | 0.80 | -11.89 | -0.00 | -0.00 | -0.00 |
| 61 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 62 | -9.50 | 0.80 | -11.88 | -0.00 | -0.00 | -0.00 |
| 63 | 9.51 | 0.80 | 11.89 | -0.00 | -0.00 | 0.00 |
| 64 | -9.51 | 0.80 | -11.89 | -0.00 | -0.00 | -0.00 |
| 65 | 9.51 | 0.61 | 11.89 | 0.00 | -0.00 | 0.00 |
| 66 | -9.50 | 0.61 | -11.88 | 0.00 | -0.00 | -0.00 |
| 67 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 68 | -9.51 | 0.61 | -11.89 | -0.00 | -0.00 | -0.00 |
| 69 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 70 | -9.50 | 0.61 | -11.88 | -0.00 | -0.00 | -0.00 |
| 71 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 72 | -9.51 | 0.61 | -11.89 | -0.00 | -0.00 | -0.00 |
| 73 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 74 | -9.50 | 0.61 | -11.88 | -0.00 | -0.00 | -0.00 |
| 75 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 76 | -9.51 | 0.61 | -11.89 | -0.00 | -0.00 | -0.00 |
| 77 | 9.51 | 0.61 | 11.89 | 0.00 | -0.00 | 0.00 |
| 78 | -9.50 | 0.61 | -11.88 | 0.00 | -0.00 | -0.00 |
| 79 | 9.51 | 0.61 | 11.89 | -0.00 | -0.00 | 0.00 |
| 80 | -9.51 | 0.61 | -11.89 | -0.00 | -0.00 | -0.00 |
| 81 | 0.02 | 0.80 | 0.01 | -0.00 | -0.00 | -0.01 |
| 82 | -0.02 | 0.80 | -0.02 | -0.00 | -0.00 | 0.02 |
| 83 | 0.02 | 0.80 | 0.01 | -0.00 | -0.00 | -0.01 |
| 84 | -0.02 | 0.80 | -0.02 | -0.00 | -0.00 | 0.02 |
| 85 | 0.02 | 0.80 | 0.01 | -0.00 | -0.00 | -0.01 |
| 86 | -0.02 | 0.80 | -0.02 | -0.00 | -0.00 | 0.02 |
| 87 | 0.02 | 0.80 | 0.01 | -0.00 | -0.00 | -0.01 |
| 88 | -0.02 | 0.80 | -0.02 | -0.00 | -0.00 | 0.02 |
| 89 | 0.02 | 0.61 | 0.01 | -0.00 | -0.00 | -0.01 |
| 90 | -0.02 | 0.61 | -0.02 | -0.00 | -0.00 | 0.02 |
| 91 | 0.02 | 0.61 | 0.01 | -0.00 | -0.00 | -0.01 |
| 92 | -0.02 | 0.61 | -0.02 | -0.00 | -0.00 | 0.02 |
| 93 | 0.02 | 0.61 | 0.01 | -0.00 | -0.00 | -0.01 |
| 94 | -0.02 | 0.61 | -0.02 | -0.00 | -0.00 | 0.02 |
| 95 | 0.02 | 0.61 | 0.01 | -0.00 | -0.00 | -0.01 |
| 96 | -0.02 | 0.61 | -0.02 | -0.00 | -0.00 | 0.02 |

强度计算控制组合号: 51, M=9.51, N=0.80, M=-0.00, N=-0.00

强度计算应力比 =0.111

抗剪强度计算控制组合号: 49, V=11.89

抗剪强度计算应力比 =0.062

平面内稳定计算最大应力对应组合号: 51, M=9.51, N=0.80, M=-0.00, N=-0.00

平面内稳定计算最大应力 (N/mm\*mm) =32.30

平面内稳定计算最大应力比 =0.106

临界弯矩Mcr(kN\*m) =1157.60

平面外稳定计算最大应力比 =0.051

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 =0.111 < 1.0

抗剪强度计算应力比 =0.062 < 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=38. ≤ [λ]=180

压杆,平面外长细比 λ=36. ≤ [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 | 0.61 | 0.00 | -0.00 | -0.00 | -0.00 |
| 2 | 0.00 | 0.61 | 0.00 | -0.00 | -0.00 | -0.00 |
| 3 | 0.00 | 0.61 | 0.00 | -0.00 | -0.00 | -0.00 |
| 4 | 0.00 | 0.61 | 0.00 | -0.00 | -0.00 | -0.00 |
| 5 | 0.00 | 0.55 | 0.00 | -0.00 | -0.00 | -0.00 |
| 6 | 0.00 | 0.55 | 0.00 | -0.00 | -0.00 | -0.00 |
| 7 | 0.00 | 0.55 | 0.00 | -0.00 | -0.00 | -0.00 |
| 8 | 0.00 | 0.55 | 0.00 | -0.00 | -0.00 | -0.00 |
| 9 | 2.54 | 0.61 | 3.17 | -0.00 | -0.00 | -0.00 |
| 10 | -2.53 | 0.61 | -3.17 | -0.00 | -0.00 | -0.00 |
| 11 | 2.54 | 0.61 | 3.17 | -0.00 | -0.00 | -0.00 |
| 12 | -2.54 | 0.61 | -3.17 | -0.00 | -0.00 | -0.00 |
| 13 | 2.54 | 0.55 | 3.17 | -0.00 | -0.00 | -0.00 |
| 14 | -2.53 | 0.55 | -3.17 | -0.00 | -0.00 | -0.00 |
| 15 | 2.54 | 0.55 | 3.17 | -0.00 | -0.00 | -0.00 |
| 16 | -2.54 | 0.55 | -3.17 | -0.00 | -0.00 | -0.00 |

防火设计控制的偶然组合号: 11, M=2.54, N=0.61, 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)=51.22

**6、 钢 梁 1
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=22.87

构件长度=5.87; 计算长度系数: Ux=3.90

支撑长度=8.00

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:L50X4 ; 布置间距: 1.20

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=250, B2=250, H1=750, H2=500 T1=6 T2=12 T3=12

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: 234.461533(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 385.89 | 87.42 | 120.56 | 130.39 | -66.55 | -42.46 |
| 2 | 136.83 | 34.30 | 50.74 | 39.77 | -46.95 | -22.41 |
| 3 | 184.51 | 44.71 | 82.95 | 92.99 | -39.20 | -11.64 |
| 4 | 338.20 | 77.02 | 88.35 | 77.17 | -74.30 | -53.24 |
| 5 | 346.56 | 78.24 | 107.62 | 117.59 | -58.00 | -37.63 |
| 6 | 97.50 | 25.12 | 37.81 | 26.97 | -38.39 | -17.58 |
| 7 | 145.18 | 35.53 | 70.02 | 80.19 | -30.64 | -6.81 |
| 8 | 298.87 | 67.84 | 75.41 | 64.37 | -65.75 | -48.40 |
| 9 | -14.29 | 12.78 | 4.14 | 21.21 | -10.06 | 1.79 |
| 10 | 113.42 | 6.76 | 29.83 | 12.82 | -4.04 | -13.20 |
| 11 | 49.79 | 33.47 | 24.15 | 39.09 | -30.76 | -6.14 |
| 12 | 177.69 | 27.48 | 49.89 | 30.73 | -24.77 | -21.15 |
| 13 | -53.62 | 3.59 | -8.79 | 8.42 | -1.51 | 6.62 |
| 14 | 74.10 | -2.42 | 16.90 | 0.02 | 4.51 | -8.37 |
| 15 | 10.46 | 24.29 | 11.22 | 26.29 | -22.20 | -1.31 |
| 16 | 138.36 | 18.30 | 36.96 | 17.94 | -16.21 | -16.32 |
| 17 | 275.05 | 71.21 | 89.41 | 109.85 | -50.35 | -28.83 |
| 18 | 351.68 | 67.60 | 104.82 | 104.81 | -46.73 | -37.82 |
| 19 | 313.50 | 83.63 | 101.42 | 120.57 | -62.76 | -33.59 |
| 20 | 390.24 | 80.04 | 116.86 | 115.56 | -59.17 | -42.59 |
| 21 | 26.00 | 18.10 | 19.60 | 19.22 | -30.74 | -8.77 |
| 22 | 102.63 | 14.49 | 35.01 | 14.19 | -27.13 | -17.76 |
| 23 | 64.45 | 30.52 | 31.60 | 29.95 | -43.16 | -13.53 |
| 24 | 141.19 | 26.92 | 47.05 | 24.94 | -39.57 | -22.54 |
| 25 | 73.68 | 28.50 | 51.80 | 72.44 | -22.99 | 2.00 |
| 26 | 150.31 | 24.89 | 67.22 | 67.41 | -19.38 | -6.99 |
| 27 | 112.13 | 40.92 | 63.81 | 83.17 | -35.41 | -2.76 |
| 28 | 188.87 | 37.32 | 79.25 | 78.16 | -31.81 | -11.77 |
| 29 | 227.37 | 60.81 | 57.20 | 56.63 | -58.10 | -39.60 |
| 30 | 304.00 | 57.20 | 72.62 | 51.59 | -54.49 | -48.59 |
| 31 | 265.82 | 73.23 | 69.21 | 67.35 | -70.52 | -44.36 |
| 32 | 342.56 | 69.63 | 84.65 | 62.34 | -66.92 | -53.36 |
| 33 | 235.72 | 62.03 | 76.48 | 97.05 | -41.79 | -24.00 |
| 34 | 312.35 | 58.42 | 91.89 | 92.02 | -38.18 | -32.99 |
| 35 | 274.17 | 74.45 | 88.48 | 107.78 | -54.21 | -28.76 |
| 36 | 350.91 | 70.86 | 103.92 | 102.77 | -50.61 | -37.76 |
| 37 | -13.33 | 8.92 | 6.66 | 6.43 | -22.19 | -3.94 |
| 38 | 63.30 | 5.31 | 22.07 | 1.39 | -18.58 | -12.93 |
| 39 | 25.12 | 21.34 | 18.67 | 17.15 | -34.61 | -8.70 |
| 40 | 101.86 | 17.74 | 34.11 | 12.14 | -31.01 | -17.70 |
| 41 | 34.35 | 19.32 | 38.87 | 59.65 | -14.44 | 6.83 |
| 42 | 110.98 | 15.71 | 54.28 | 54.61 | -10.83 | -2.16 |
| 43 | 72.80 | 31.74 | 50.87 | 70.37 | -26.86 | 2.07 |
| 44 | 149.54 | 28.14 | 66.32 | 65.36 | -23.26 | -6.93 |
| 45 | 188.04 | 51.63 | 44.27 | 43.83 | -49.54 | -34.77 |
| 46 | 264.67 | 48.02 | 59.68 | 38.79 | -45.93 | -43.76 |
| 47 | 226.49 | 64.05 | 56.27 | 54.56 | -61.96 | -39.53 |
| 48 | 303.23 | 60.45 | 71.72 | 49.54 | -58.37 | -48.53 |
| 49 | 136.53 | 46.12 | 49.30 | 73.67 | -30.70 | -13.28 |
| 50 | 264.25 | 40.10 | 74.98 | 65.28 | -24.68 | -28.27 |
| 51 | 200.61 | 66.82 | 69.30 | 91.55 | -51.40 | -21.21 |
| 52 | 328.51 | 60.82 | 95.04 | 83.19 | -45.40 | -36.22 |
| 53 | -37.81 | 8.94 | 0.43 | 10.23 | -16.98 | 0.76 |
| 54 | 89.91 | 2.92 | 26.11 | 1.84 | -10.96 | -14.23 |
| 55 | 26.27 | 29.64 | 20.43 | 28.11 | -37.67 | -7.17 |
| 56 | 154.17 | 23.64 | 46.18 | 19.75 | -31.68 | -22.18 |
| 57 | -4.43 | 16.22 | 22.97 | 47.49 | -11.55 | 8.30 |
| 58 | 123.28 | 10.20 | 48.66 | 39.09 | -5.53 | -6.69 |
| 59 | 59.65 | 36.92 | 42.98 | 65.36 | -32.25 | 0.37 |
| 60 | 187.55 | 30.93 | 68.72 | 57.01 | -26.25 | -14.64 |
| 61 | 103.15 | 38.84 | 26.75 | 36.42 | -36.12 | -20.82 |
| 62 | 230.87 | 32.82 | 52.44 | 28.02 | -30.11 | -35.81 |
| 63 | 167.23 | 59.54 | 46.76 | 54.29 | -56.82 | -28.75 |
| 64 | 295.13 | 53.54 | 72.50 | 45.94 | -50.83 | -43.76 |
| 65 | 97.20 | 36.94 | 36.36 | 60.88 | -22.14 | -8.45 |
| 66 | 224.92 | 30.92 | 62.05 | 52.48 | -16.12 | -23.44 |
| 67 | 161.28 | 57.64 | 56.37 | 78.75 | -42.84 | -16.38 |
| 68 | 289.18 | 51.64 | 82.11 | 70.40 | -36.85 | -31.39 |
| 69 | -77.14 | -0.24 | -12.51 | -2.56 | -8.42 | 5.59 |
| 70 | 50.58 | -6.26 | 13.18 | -10.96 | -2.40 | -9.40 |
| 71 | -13.06 | 20.46 | 7.50 | 15.31 | -29.12 | -2.34 |
| 72 | 114.84 | 14.46 | 33.24 | 6.96 | -23.13 | -17.35 |
| 73 | -43.76 | 7.04 | 10.04 | 34.69 | -3.00 | 13.13 |
| 74 | 83.95 | 1.02 | 35.72 | 26.30 | 3.02 | -1.86 |
| 75 | 20.32 | 27.74 | 30.04 | 52.57 | -23.69 | 5.20 |
| 76 | 148.22 | 21.74 | 55.78 | 44.21 | -17.70 | -9.81 |
| 77 | 63.82 | 29.66 | 13.82 | 23.62 | -27.57 | -15.99 |
| 78 | 191.54 | 23.64 | 39.50 | 15.22 | -21.55 | -30.97 |
| 79 | 127.90 | 50.35 | 33.82 | 41.50 | -48.27 | -23.92 |
| 80 | 255.80 | 44.36 | 59.56 | 33.14 | -42.27 | -38.93 |
| 81 | 252.46 | 58.06 | 83.23 | 94.70 | -47.48 | -29.49 |
| 82 | 275.18 | 62.80 | 84.79 | 81.11 | -52.22 | -31.05 |
| 83 | 144.54 | 35.05 | 52.98 | 55.43 | -38.99 | -20.80 |
| 84 | 167.25 | 39.78 | 54.53 | 41.84 | -43.73 | -22.36 |
| 85 | 165.20 | 39.55 | 66.93 | 78.49 | -35.63 | -16.13 |
| 86 | 187.92 | 44.29 | 68.49 | 64.90 | -40.37 | -17.69 |
| 87 | 231.80 | 53.55 | 69.27 | 71.64 | -50.84 | -34.16 |
| 88 | 254.51 | 58.29 | 70.83 | 58.05 | -55.58 | -35.71 |
| 89 | 191.59 | 44.12 | 63.84 | 74.41 | -35.98 | -22.51 |
| 90 | 214.30 | 48.86 | 65.40 | 60.82 | -40.72 | -24.06 |
| 91 | 108.57 | 26.41 | 40.57 | 44.20 | -29.45 | -15.82 |
| 92 | 131.28 | 31.15 | 42.13 | 30.61 | -34.18 | -17.38 |
| 93 | 124.46 | 29.88 | 51.31 | 61.94 | -26.86 | -12.23 |
| 94 | 147.18 | 34.62 | 52.86 | 48.35 | -31.60 | -13.79 |
| 95 | 175.69 | 40.65 | 53.11 | 56.67 | -38.56 | -26.10 |
| 96 | 198.41 | 45.39 | 54.66 | 43.08 | -43.30 | -27.65 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -77.14 | -51.69 | -55.84 | -56.22 | -58.81 | -75.79 | -130.39 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 390.24 | 129.10 | 82.10 | 40.83 | 19.12 | 8.86 | 10.96 |

强度计算应力比 =0.515

抗剪强度计算应力比 =0.483

平面内稳定计算最大应力对应组合号: 1, M=385.89, N=87.42, M=130.39, N=-66.55

平面内稳定最大应力 (N/mm\*mm) =161.27

平面内稳定计算最大应力比 =0.529

临界弯矩Mcr(kN\*m) =1601.17

平面外稳定计算最大应力比 =0.468

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 =0.515 < 1.0

抗剪强度计算应力比 =0.483 < 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 =0.468 < 1.0

腹板高厚比 H0/TW=100.17 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =10.17 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0.00 | 9.26 | 18.96 | 28.88 | 38.80 | 48.47 | 57.63 |

最大挠度值 =57.63 最大挠度/梁跨度 =1/396.

斜梁坡度初始值: 1/12.94

变形后斜梁坡度最小值: 1/14.91

变形后斜梁坡度改变率 =0.132 < 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 | 202.92 | 46.48 | 64.62 | 67.63 | -38.34 | -23.28 |
| 2 | 119.90 | 28.78 | 41.35 | 37.42 | -31.81 | -16.60 |
| 3 | 135.79 | 32.24 | 52.08 | 55.17 | -29.22 | -13.01 |
| 4 | 187.02 | 43.01 | 53.88 | 49.89 | -40.93 | -26.87 |
| 5 | 189.81 | 43.42 | 60.31 | 63.37 | -35.49 | -21.67 |
| 6 | 106.79 | 25.72 | 37.04 | 33.16 | -28.96 | -14.99 |
| 7 | 122.68 | 29.18 | 47.77 | 50.90 | -26.37 | -11.40 |
| 8 | 173.91 | 39.95 | 49.57 | 45.63 | -38.08 | -25.26 |
| 9 | 81.84 | 23.40 | 29.28 | 33.52 | -21.31 | -10.05 |
| 10 | 115.90 | 21.80 | 36.13 | 31.28 | -19.71 | -14.04 |
| 11 | 98.93 | 28.92 | 34.61 | 38.29 | -26.83 | -12.16 |
| 12 | 133.03 | 27.32 | 41.48 | 36.06 | -25.23 | -16.16 |
| 13 | 68.73 | 20.34 | 24.96 | 29.26 | -18.46 | -8.44 |
| 14 | 102.79 | 18.74 | 31.81 | 27.02 | -16.86 | -12.43 |
| 15 | 85.82 | 25.86 | 30.30 | 34.02 | -23.98 | -10.55 |
| 16 | 119.93 | 24.26 | 37.16 | 31.80 | -22.38 | -14.55 |

--- 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 -16.99 -39.26 -67.63

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 202.92 91.13 55.57 26.11 3.61 0.00 0.00

强度计算荷载比 =0.28

平面内稳定计算荷载比 =0.28

平面外稳定计算荷载比 =0.18

无防护下钢构件最大升温(Ts): 1004.57℃ ,按临界温度法求得临界温度(Td): 649.78℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2184(m^2\*℃/w)

构件重量 (Kg)=442.45

**7、 钢 梁 2
设计结果**

截面类型=16; 布置角度=0; 计算长度： Lx=22.87

构件长度=11.34; 计算长度系数: Ux=2.02

支撑长度=8.00

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:L50X4 ; 布置间距: 1.20

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=220, B2=220, H=500, 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: 256.593414(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -39.77 | 47.01 | 22.28 | -50.52 | -35.32 | 41.42 |
| 2 | -130.39 | 66.67 | 42.28 | -176.14 | -62.42 | 93.15 |
| 3 | -125.34 | 75.53 | 49.93 | -71.18 | -64.76 | 84.60 |
| 4 | -44.81 | 38.15 | 14.64 | -155.48 | -32.98 | 49.97 |
| 5 | -26.97 | 38.44 | 17.47 | -33.32 | -27.95 | 31.32 |
| 6 | -117.59 | 58.10 | 37.48 | -158.94 | -55.05 | 83.05 |
| 7 | -112.55 | 66.96 | 45.12 | -53.98 | -57.39 | 74.50 |
| 8 | -32.02 | 29.58 | 9.83 | -138.28 | -25.61 | 39.87 |
| 9 | -21.21 | 10.06 | -1.81 | -45.96 | -4.89 | 10.04 |
| 10 | -12.82 | 4.08 | 13.19 | -1.50 | 1.09 | 15.71 |
| 11 | -39.09 | 30.78 | 6.06 | -71.08 | -25.61 | 25.50 |
| 12 | -30.73 | 24.82 | 21.08 | -26.68 | -19.66 | 31.21 |
| 13 | -8.42 | 1.49 | -6.62 | -28.76 | 2.49 | -0.06 |
| 14 | -0.02 | -4.49 | 8.38 | 15.70 | 8.46 | 5.61 |
| 15 | -26.29 | 22.21 | 1.25 | -53.87 | -18.23 | 15.39 |
| 16 | -17.94 | 16.26 | 16.27 | -9.48 | -12.28 | 21.11 |
| 17 | -19.22 | 30.77 | 8.69 | -33.37 | -19.08 | 21.18 |
| 18 | -14.19 | 27.18 | 17.69 | -6.70 | -15.49 | 24.59 |
| 19 | -29.95 | 43.20 | 13.41 | -48.44 | -31.51 | 30.46 |
| 20 | -24.94 | 39.63 | 22.43 | -21.80 | -27.94 | 33.89 |
| 21 | -109.85 | 50.42 | 28.69 | -158.99 | -46.18 | 72.91 |
| 22 | -104.81 | 46.84 | 37.69 | -132.32 | -42.59 | 76.32 |
| 23 | -120.57 | 62.85 | 33.42 | -174.06 | -58.61 | 82.19 |
| 24 | -115.56 | 59.28 | 42.43 | -147.42 | -55.04 | 85.62 |
| 25 | -104.80 | 59.28 | 36.34 | -54.03 | -48.52 | 64.36 |
| 26 | -99.76 | 55.70 | 45.34 | -27.36 | -44.93 | 67.77 |
| 27 | -115.53 | 71.71 | 41.06 | -69.10 | -60.95 | 73.64 |
| 28 | -110.51 | 68.14 | 50.08 | -42.46 | -57.38 | 77.07 |
| 29 | -24.27 | 21.91 | 1.05 | -138.33 | -16.74 | 29.73 |
| 30 | -19.23 | 18.32 | 10.05 | -111.66 | -13.15 | 33.14 |
| 31 | -34.99 | 34.34 | 5.77 | -153.40 | -29.17 | 39.01 |
| 32 | -29.98 | 30.77 | 14.78 | -126.77 | -25.60 | 42.44 |
| 33 | -6.43 | 22.20 | 3.88 | -16.17 | -11.71 | 11.08 |
| 34 | -1.39 | 18.61 | 12.88 | 10.51 | -8.12 | 14.49 |
| 35 | -17.15 | 34.63 | 8.61 | -31.24 | -24.14 | 20.36 |
| 36 | -12.14 | 31.06 | 17.62 | -4.60 | -20.57 | 23.79 |
| 37 | -97.05 | 41.86 | 23.88 | -141.79 | -38.80 | 62.81 |
| 38 | -92.02 | 38.27 | 32.89 | -115.11 | -35.22 | 66.22 |
| 39 | -107.78 | 54.29 | 28.61 | -156.86 | -51.23 | 72.08 |
| 40 | -102.77 | 50.72 | 37.62 | -130.22 | -47.66 | 75.51 |
| 41 | -92.01 | 50.72 | 31.53 | -36.83 | -41.15 | 54.26 |
| 42 | -86.97 | 47.13 | 40.53 | -10.15 | -37.56 | 57.66 |
| 43 | -102.73 | 63.15 | 36.25 | -51.90 | -53.58 | 63.53 |
| 44 | -97.72 | 59.58 | 45.27 | -25.26 | -50.01 | 66.96 |
| 45 | -11.47 | 13.34 | -3.76 | -121.13 | -9.36 | 19.63 |
| 46 | -6.44 | 9.75 | 5.24 | -94.45 | -5.78 | 23.04 |
| 47 | -22.20 | 25.77 | 0.96 | -136.20 | -21.80 | 28.91 |
| 48 | -17.19 | 22.20 | 9.98 | -109.56 | -18.22 | 32.34 |
| 49 | -10.23 | 16.98 | -0.80 | -29.15 | -7.24 | 8.39 |
| 50 | -1.84 | 11.00 | 14.20 | 15.31 | -1.27 | 14.07 |
| 51 | -28.11 | 37.69 | 7.07 | -54.26 | -27.96 | 23.85 |
| 52 | -19.75 | 31.74 | 22.09 | -9.87 | -22.01 | 29.57 |
| 53 | -73.67 | 30.73 | 13.20 | -117.08 | -26.21 | 44.60 |
| 54 | -65.28 | 24.76 | 28.20 | -72.62 | -20.23 | 50.28 |
| 55 | -91.55 | 51.45 | 21.07 | -142.19 | -46.93 | 60.06 |
| 56 | -83.19 | 45.50 | 36.10 | -97.80 | -40.98 | 65.78 |
| 57 | -70.14 | 36.94 | 18.55 | -43.61 | -27.85 | 38.62 |
| 58 | -61.74 | 30.96 | 33.55 | 0.85 | -21.87 | 44.29 |
| 59 | -88.02 | 57.65 | 26.42 | -68.72 | -48.57 | 54.08 |
| 60 | -79.66 | 51.70 | 41.45 | -24.33 | -42.62 | 59.79 |
| 61 | -13.77 | 10.77 | -6.15 | -102.62 | -5.60 | 14.38 |
| 62 | -5.37 | 4.80 | 8.85 | -58.16 | 0.37 | 20.06 |
| 63 | -31.64 | 31.49 | 1.72 | -127.73 | -26.32 | 29.84 |
| 64 | -23.29 | 25.54 | 16.74 | -83.34 | -20.37 | 35.55 |
| 65 | 2.56 | 8.41 | -5.61 | -11.95 | 0.13 | -1.71 |
| 66 | 10.96 | 2.43 | 9.39 | 32.52 | 6.11 | 3.97 |
| 67 | -15.31 | 29.13 | 2.26 | -37.06 | -20.59 | 13.75 |
| 68 | -6.96 | 23.17 | 17.28 | 7.34 | -14.64 | 19.47 |
| 69 | -60.88 | 22.17 | 8.39 | -99.88 | -18.84 | 34.50 |
| 70 | -52.48 | 16.19 | 23.39 | -55.42 | -12.86 | 40.18 |
| 71 | -78.75 | 42.88 | 16.26 | -124.99 | -39.56 | 49.96 |
| 72 | -70.40 | 36.93 | 31.29 | -80.60 | -33.60 | 55.68 |
| 73 | -57.34 | 28.37 | 13.74 | -26.41 | -20.48 | 28.52 |
| 74 | -48.95 | 22.39 | 28.74 | 18.06 | -14.50 | 34.19 |
| 75 | -75.22 | 49.09 | 21.61 | -51.52 | -41.20 | 43.97 |
| 76 | -66.86 | 43.13 | 36.64 | -7.12 | -35.24 | 49.69 |
| 77 | -0.97 | 2.21 | -10.96 | -85.42 | 1.77 | 4.28 |
| 78 | 7.43 | -3.77 | 4.04 | -40.96 | 7.75 | 9.95 |
| 79 | -18.85 | 22.92 | -3.09 | -110.53 | -18.95 | 19.74 |
| 80 | -10.49 | 16.97 | 11.93 | -66.14 | -13.00 | 25.45 |
| 81 | -55.43 | 40.83 | 20.55 | -67.70 | -32.84 | 43.67 |
| 82 | -41.84 | 41.99 | 22.38 | -60.55 | -34.00 | 41.84 |
| 83 | -94.70 | 49.35 | 29.22 | -122.14 | -44.58 | 66.08 |
| 84 | -81.11 | 50.51 | 31.05 | -114.99 | -45.74 | 64.25 |
| 85 | -92.51 | 53.19 | 32.53 | -76.65 | -45.59 | 62.38 |
| 86 | -78.93 | 54.35 | 34.36 | -69.51 | -46.76 | 60.55 |
| 87 | -57.62 | 36.99 | 17.24 | -113.18 | -31.82 | 47.37 |
| 88 | -44.03 | 38.15 | 19.07 | -106.04 | -32.99 | 45.54 |
| 89 | -44.20 | 31.27 | 15.60 | -52.90 | -25.12 | 33.80 |
| 90 | -30.61 | 32.44 | 17.43 | -45.75 | -26.29 | 31.97 |
| 91 | -74.41 | 37.83 | 22.27 | -94.77 | -34.16 | 51.04 |
| 92 | -60.82 | 38.99 | 24.09 | -87.63 | -35.32 | 49.21 |
| 93 | -72.73 | 40.78 | 24.81 | -59.79 | -34.94 | 48.19 |
| 94 | -59.14 | 41.94 | 26.64 | -52.64 | -36.10 | 46.36 |
| 95 | -45.88 | 28.32 | 13.05 | -87.89 | -24.34 | 36.65 |
| 96 | -32.30 | 29.48 | 14.88 | -80.74 | -25.51 | 34.82 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -130.39 | -198.50 | -229.28 | -217.71 | -163.78 | -83.34 | -32.52 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 10.96 | 3.04 | 12.40 | 19.65 | 24.79 | 28.29 | 176.14 |

强度计算应力比 =0.641

抗剪强度计算应力比 =0.268

平面内稳定计算最大应力对应组合号: 1, M=-39.77, N=47.01, M=-50.52, N=-35.32

平面内稳定最大应力 (N/mm\*mm) =214.46

平面内稳定计算最大应力比 =0.703

临界弯矩Mcr(kN\*m) =1161.91

平面外稳定计算最大应力比 =0.510

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 =0.641 < 1.0

抗剪强度计算应力比 =0.268 < 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 =0.510 < 1.0

腹板高厚比 H0/TW=80.00 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =10.70 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 57.63 | 72.60 | 80.10 | 78.95 | 69.65 | 54.32 | 36.73 |

最大挠度值 =80.61 最大挠度/梁跨度 =1/283.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.19

变形后斜梁坡度改变率 =0.117 < 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 | -37.42 | 31.85 | 16.51 | -49.34 | -25.71 | 32.89 |
| 2 | -67.63 | 38.41 | 23.18 | -91.21 | -34.74 | 50.13 |
| 3 | -65.95 | 41.36 | 25.73 | -56.22 | -35.52 | 47.28 |
| 4 | -39.11 | 28.90 | 13.96 | -84.32 | -24.92 | 35.74 |
| 5 | -33.16 | 29.00 | 14.91 | -43.60 | -23.25 | 29.52 |
| 6 | -63.37 | 35.55 | 21.57 | -85.47 | -32.28 | 46.76 |
| 7 | -61.69 | 38.50 | 24.12 | -50.49 | -33.06 | 43.91 |
| 8 | -34.84 | 26.04 | 12.36 | -78.59 | -22.47 | 32.37 |
| 9 | -33.52 | 21.34 | 9.99 | -49.72 | -17.36 | 24.68 |
| 10 | -31.28 | 19.75 | 13.99 | -37.86 | -15.77 | 26.19 |
| 11 | -38.29 | 26.87 | 12.09 | -56.42 | -22.89 | 28.80 |
| 12 | -36.06 | 25.28 | 16.09 | -44.58 | -21.30 | 30.32 |
| 13 | -29.26 | 18.48 | 8.39 | -43.99 | -14.91 | 21.31 |
| 14 | -27.02 | 16.89 | 12.39 | -32.13 | -13.31 | 22.82 |
| 15 | -34.02 | 24.01 | 10.49 | -50.68 | -20.43 | 25.43 |
| 16 | -31.80 | 22.42 | 14.49 | -38.85 | -18.84 | 26.95 |

--- 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 -67.63 -103.06 -117.18 -108.32 -76.46 -21.77 0.00

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 0.00 0.00 0.00 0.00 8.56 91.21

强度计算荷载比 =0.34

平面内稳定计算荷载比 =0.29

平面外稳定计算荷载比 =0.13

无防护下钢构件最大升温(Ts): 1004.71℃ ,按临界温度法求得临界温度(Td): 645.95℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2399(m^2\*℃/w)

构件重量 (Kg)=647.84

**8、 钢 梁 3
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=27.71

构件长度=7.11; 计算长度系数: Ux=3.89

支撑长度=9.00

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:L50X4 ; 布置间距: 1.20

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=280, B2=280, H1=500, H2=750 T1=6 T2=14 T3=14

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: 208.283005(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -96.57 | 58.69 | -32.18 | -247.25 | -51.09 | 71.76 |
| 2 | -232.82 | 94.46 | -66.86 | -598.63 | -110.48 | 159.60 |
| 3 | -157.41 | 58.55 | -23.21 | -321.17 | -64.16 | 111.33 |
| 4 | -171.98 | 94.60 | -75.83 | -524.70 | -97.41 | 120.02 |
| 5 | -71.34 | 46.99 | -24.62 | -182.45 | -38.74 | 54.01 |
| 6 | -207.58 | 82.75 | -59.30 | -533.83 | -98.13 | 141.84 |
| 7 | -132.17 | 46.85 | -15.65 | -256.38 | -51.81 | 93.58 |
| 8 | -146.75 | 82.89 | -68.27 | -459.90 | -85.05 | 102.27 |
| 9 | -34.68 | 16.45 | -19.35 | -180.63 | -19.27 | 41.18 |
| 10 | -39.41 | 8.79 | -1.86 | -5.00 | -11.61 | 10.63 |
| 11 | -69.91 | 41.23 | -30.73 | -278.43 | -44.04 | 67.20 |
| 12 | -74.77 | 33.62 | -13.27 | -103.04 | -36.43 | 36.72 |
| 13 | -9.44 | 4.75 | -11.79 | -115.83 | -6.91 | 23.42 |
| 14 | -14.17 | -2.91 | 5.70 | 59.80 | 0.75 | -7.13 |
| 15 | -44.68 | 29.52 | -23.17 | -213.63 | -31.69 | 49.44 |
| 16 | -49.54 | 21.91 | -5.71 | -38.25 | -24.07 | 18.97 |
| 17 | -51.77 | 38.13 | -24.14 | -187.15 | -30.53 | 50.30 |
| 18 | -54.60 | 33.53 | -13.65 | -81.77 | -25.93 | 31.97 |
| 19 | -72.91 | 52.99 | -30.97 | -245.83 | -45.39 | 65.92 |
| 20 | -75.82 | 48.43 | -20.49 | -140.60 | -40.83 | 47.63 |
| 21 | -188.01 | 73.89 | -58.82 | -538.53 | -89.92 | 138.14 |
| 22 | -190.85 | 69.30 | -48.33 | -433.16 | -85.32 | 119.81 |
| 23 | -209.15 | 88.76 | -65.65 | -597.21 | -104.78 | 153.75 |
| 24 | -212.07 | 84.19 | -55.17 | -491.98 | -100.21 | 135.47 |
| 25 | -112.60 | 37.99 | -15.17 | -261.08 | -43.60 | 89.88 |
| 26 | -115.44 | 33.39 | -4.68 | -155.70 | -39.00 | 71.55 |
| 27 | -133.74 | 52.85 | -22.00 | -319.76 | -58.47 | 105.49 |
| 28 | -136.66 | 48.29 | -11.52 | -214.53 | -53.90 | 87.20 |
| 29 | -127.17 | 74.03 | -67.79 | -464.61 | -76.85 | 98.57 |
| 30 | -130.01 | 69.44 | -57.30 | -359.23 | -72.25 | 80.24 |
| 31 | -148.32 | 88.90 | -74.62 | -523.29 | -91.71 | 114.18 |
| 32 | -151.23 | 84.33 | -64.14 | -418.05 | -87.14 | 95.89 |
| 33 | -26.53 | 26.42 | -16.59 | -122.36 | -18.17 | 32.55 |
| 34 | -29.37 | 21.83 | -6.09 | -16.98 | -13.58 | 14.22 |
| 35 | -47.67 | 41.29 | -23.41 | -181.04 | -33.04 | 48.16 |
| 36 | -50.59 | 36.72 | -12.94 | -75.80 | -28.47 | 29.88 |
| 37 | -162.77 | 62.19 | -51.27 | -473.74 | -77.56 | 120.39 |
| 38 | -165.61 | 57.59 | -40.77 | -368.36 | -72.97 | 102.06 |
| 39 | -183.91 | 77.05 | -58.09 | -532.42 | -92.43 | 136.00 |
| 40 | -186.83 | 72.49 | -47.62 | -427.19 | -87.86 | 117.71 |
| 41 | -87.36 | 26.28 | -7.62 | -196.28 | -31.24 | 72.12 |
| 42 | -90.20 | 21.69 | 2.88 | -90.91 | -26.65 | 53.79 |
| 43 | -108.51 | 41.15 | -14.44 | -254.96 | -46.11 | 87.74 |
| 44 | -111.42 | 36.58 | -3.97 | -149.73 | -41.54 | 69.45 |
| 45 | -101.94 | 62.33 | -60.24 | -399.81 | -64.49 | 80.81 |
| 46 | -104.78 | 57.73 | -49.74 | -294.43 | -59.89 | 62.48 |
| 47 | -123.08 | 77.19 | -67.07 | -458.49 | -79.36 | 96.43 |
| 48 | -125.99 | 72.62 | -56.59 | -353.26 | -74.79 | 78.14 |
| 49 | -25.73 | 22.03 | -18.96 | -157.15 | -17.55 | 37.55 |
| 50 | -30.46 | 14.37 | -1.46 | 18.48 | -9.89 | 7.00 |
| 51 | -60.97 | 46.80 | -30.33 | -254.95 | -42.33 | 63.57 |
| 52 | -65.82 | 39.19 | -12.87 | -79.56 | -34.72 | 33.10 |
| 53 | -121.10 | 47.07 | -43.23 | -403.12 | -59.13 | 99.04 |
| 54 | -125.83 | 39.41 | -25.74 | -227.49 | -51.47 | 68.49 |
| 55 | -156.34 | 71.84 | -54.61 | -500.92 | -83.90 | 125.06 |
| 56 | -161.19 | 64.23 | -37.15 | -325.53 | -76.29 | 94.58 |
| 57 | -68.31 | 21.93 | -12.68 | -208.90 | -26.70 | 65.25 |
| 58 | -73.04 | 14.27 | 4.82 | -33.27 | -19.04 | 34.70 |
| 59 | -103.55 | 46.71 | -24.05 | -306.70 | -51.48 | 91.28 |
| 60 | -108.41 | 39.10 | -6.59 | -131.31 | -43.87 | 60.80 |
| 61 | -78.51 | 47.16 | -49.51 | -351.37 | -49.98 | 71.34 |
| 62 | -83.25 | 39.50 | -32.02 | -175.74 | -42.32 | 40.79 |
| 63 | -113.75 | 71.94 | -60.89 | -449.17 | -74.75 | 97.36 |
| 64 | -118.61 | 64.32 | -43.43 | -273.78 | -67.14 | 66.88 |
| 65 | -0.49 | 10.32 | -11.40 | -92.36 | -5.20 | 19.80 |
| 66 | -5.22 | 2.66 | 6.09 | 83.28 | 2.46 | -10.75 |
| 67 | -35.73 | 35.10 | -22.78 | -190.15 | -29.97 | 45.82 |
| 68 | -40.59 | 27.49 | -5.32 | -14.77 | -22.36 | 15.34 |
| 69 | -95.86 | 35.36 | -35.68 | -338.32 | -46.77 | 81.28 |
| 70 | -100.59 | 27.70 | -18.18 | -162.69 | -39.11 | 50.73 |
| 71 | -131.10 | 60.13 | -47.06 | -436.12 | -71.55 | 107.31 |
| 72 | -135.96 | 52.52 | -29.59 | -260.73 | -63.93 | 76.83 |
| 73 | -43.08 | 10.23 | -5.12 | -144.10 | -14.35 | 47.50 |
| 74 | -47.81 | 2.57 | 12.37 | 31.53 | -6.69 | 16.95 |
| 75 | -78.31 | 35.00 | -16.50 | -241.90 | -39.12 | 73.52 |
| 76 | -83.17 | 27.39 | 0.96 | -66.52 | -31.51 | 43.04 |
| 77 | -53.28 | 35.46 | -41.96 | -286.57 | -37.62 | 53.58 |
| 78 | -58.01 | 27.80 | -24.46 | -110.94 | -29.96 | 23.03 |
| 79 | -88.52 | 60.23 | -53.33 | -384.37 | -62.40 | 79.60 |
| 80 | -93.37 | 52.62 | -35.87 | -208.99 | -54.78 | 49.13 |
| 81 | -94.93 | 58.43 | -33.22 | -280.30 | -56.73 | 75.42 |
| 82 | -112.75 | 49.91 | -31.77 | -252.14 | -48.21 | 73.97 |
| 83 | -153.97 | 73.92 | -48.25 | -432.56 | -82.46 | 113.48 |
| 84 | -171.79 | 65.41 | -46.80 | -404.40 | -73.95 | 112.03 |
| 85 | -121.29 | 58.37 | -29.33 | -312.33 | -62.39 | 92.57 |
| 86 | -139.11 | 49.85 | -27.88 | -284.17 | -53.88 | 91.11 |
| 87 | -127.61 | 73.98 | -52.14 | -400.53 | -76.80 | 96.33 |
| 88 | -145.43 | 65.47 | -50.68 | -372.37 | -68.28 | 94.88 |
| 89 | -70.97 | 45.92 | -25.72 | -218.85 | -44.62 | 58.18 |
| 90 | -88.79 | 37.41 | -24.27 | -190.70 | -36.10 | 56.73 |
| 91 | -116.39 | 57.85 | -37.28 | -335.98 | -64.41 | 87.46 |
| 92 | -134.21 | 49.33 | -35.83 | -307.82 | -55.90 | 86.01 |
| 93 | -91.25 | 45.88 | -22.73 | -243.50 | -48.97 | 71.37 |
| 94 | -109.07 | 37.36 | -21.28 | -215.34 | -40.46 | 69.92 |
| 95 | -96.11 | 57.89 | -40.27 | -311.34 | -60.06 | 74.27 |
| 96 | -113.93 | 49.37 | -38.82 | -283.18 | -51.54 | 72.82 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -232.82 | -121.18 | -77.92 | -65.74 | -60.13 | -51.49 | -83.28 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 0.00 | 5.69 | 23.13 | 57.88 | 128.13 | 208.82 | 598.63 |

强度计算应力比 =0.644

抗剪强度计算应力比 =0.636

平面内稳定计算最大应力对应组合号: 1, M=-96.57, N=58.69, M=-247.25, N=-51.09

平面内稳定最大应力 (N/mm\*mm) =203.60

平面内稳定计算最大应力比 =0.668

临界弯矩Mcr(kN\*m) =2062.29

平面外稳定计算最大应力比 =0.582

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 =0.644 < 1.0

抗剪强度计算应力比 =0.636 < 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 =0.582 < 1.0

腹板高厚比 H0/TW=99.50 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =9.79 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 91.87 | 77.30 | 61.77 | 45.79 | 29.87 | 14.47 | 0.00 |

最大挠度值 =91.87 最大挠度/梁跨度 =1/301.

斜梁坡度初始值: 1/15.71

变形后斜梁坡度最小值: 1/19.95

变形后斜梁坡度改变率 =0.213 < 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 | -79.86 | 41.68 | -25.00 | -204.81 | -40.37 | 57.46 |
| 2 | -125.27 | 53.60 | -36.56 | -321.94 | -60.16 | 86.74 |
| 3 | -100.14 | 41.63 | -22.01 | -229.45 | -44.73 | 70.65 |
| 4 | -105.00 | 53.64 | -39.55 | -297.29 | -55.81 | 73.55 |
| 5 | -71.45 | 37.77 | -22.48 | -183.21 | -36.25 | 51.54 |
| 6 | -116.86 | 49.69 | -34.04 | -300.34 | -56.05 | 80.82 |
| 7 | -91.73 | 37.73 | -19.49 | -207.85 | -40.61 | 64.73 |
| 8 | -96.58 | 49.74 | -37.03 | -275.69 | -51.69 | 67.63 |
| 9 | -64.21 | 29.88 | -21.61 | -189.28 | -32.04 | 49.65 |
| 10 | -65.47 | 27.84 | -16.95 | -142.45 | -30.00 | 41.50 |
| 11 | -73.60 | 36.49 | -24.65 | -215.36 | -38.65 | 56.59 |
| 12 | -74.90 | 34.46 | -19.99 | -168.59 | -36.62 | 48.46 |
| 13 | -55.79 | 25.98 | -19.10 | -167.68 | -27.93 | 43.73 |
| 14 | -57.06 | 23.94 | -14.43 | -120.85 | -25.88 | 35.58 |
| 15 | -65.19 | 32.59 | -22.13 | -193.76 | -34.53 | 50.67 |
| 16 | -66.49 | 30.56 | -17.47 | -146.99 | -32.50 | 42.54 |

--- 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 -125.27 -69.24 -28.73 0.00 0.00 0.00 0.00

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 0.00 0.00 37.61 89.08 150.49 321.94

强度计算荷载比 =0.35

平面内稳定计算荷载比 =0.35

平面外稳定计算荷载比 =0.23

无防护下钢构件最大升温(Ts): 1004.37℃ ,按临界温度法求得临界温度(Td): 626.08℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2047(m^2\*℃/w)

构件重量 (Kg)=637.89

**9、 钢 梁 4
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=27.71

构件长度=6.86; 计算长度系数: Ux=4.04

支撑长度=9.00

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:L50X4 ; 布置间距: 1.20

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=260, B2=260, H1=700, H2=500 T1=6 T2=12 T3=12

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: 231.300812(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -148.21 | 48.53 | 13.79 | 232.82 | -94.61 | 66.64 |
| 2 | -430.33 | 96.62 | 12.30 | 96.57 | -58.77 | 32.04 |
| 3 | -430.33 | 96.62 | 12.30 | 227.93 | -102.13 | 71.27 |
| 4 | -148.21 | 48.53 | 13.79 | 101.46 | -51.25 | 27.41 |
| 5 | -103.92 | 37.43 | 11.81 | 207.58 | -82.89 | 59.11 |
| 6 | -386.04 | 85.52 | 10.33 | 71.34 | -47.04 | 24.51 |
| 7 | -386.04 | 85.52 | 10.33 | 202.69 | -90.41 | 63.74 |
| 8 | -103.92 | 37.43 | 11.81 | 76.23 | -39.52 | 19.88 |
| 9 | -99.96 | 13.78 | 0.29 | 34.68 | -16.50 | 19.31 |
| 10 | -27.97 | 6.08 | 5.17 | 39.41 | -8.80 | 1.84 |
| 11 | -164.41 | 38.58 | 3.10 | 69.91 | -41.30 | 30.63 |
| 12 | -92.63 | 30.93 | 7.99 | 74.77 | -33.65 | 13.19 |
| 13 | -55.67 | 2.68 | -1.68 | 9.44 | -4.77 | 11.78 |
| 14 | 16.31 | -5.02 | 3.19 | 14.17 | 2.93 | -5.69 |
| 15 | -120.12 | 27.49 | 1.13 | 44.68 | -29.58 | 23.10 |
| 16 | -48.34 | 19.83 | 6.01 | 49.54 | -21.92 | 5.66 |
| 17 | -93.03 | 27.95 | 8.82 | 188.01 | -74.03 | 58.65 |
| 18 | -49.84 | 23.33 | 11.75 | 190.85 | -69.41 | 48.17 |
| 19 | -131.70 | 42.83 | 10.51 | 209.15 | -88.91 | 65.44 |
| 20 | -88.63 | 38.24 | 13.44 | 212.07 | -84.32 | 54.98 |
| 21 | -375.15 | 76.03 | 7.34 | 51.77 | -38.18 | 24.05 |
| 22 | -331.97 | 71.41 | 10.26 | 54.60 | -33.56 | 13.57 |
| 23 | -413.83 | 90.92 | 9.02 | 72.91 | -53.06 | 30.85 |
| 24 | -370.76 | 86.32 | 11.95 | 75.82 | -48.47 | 20.38 |
| 25 | -375.15 | 76.03 | 7.34 | 183.12 | -81.55 | 63.29 |
| 26 | -331.97 | 71.41 | 10.26 | 185.96 | -76.93 | 52.80 |
| 27 | -413.83 | 90.92 | 9.02 | 204.26 | -96.43 | 70.08 |
| 28 | -370.76 | 86.32 | 11.95 | 207.18 | -91.84 | 59.61 |
| 29 | -93.03 | 27.95 | 8.82 | 56.65 | -30.66 | 19.42 |
| 30 | -49.84 | 23.33 | 11.75 | 59.49 | -26.04 | 8.93 |
| 31 | -131.70 | 42.83 | 10.51 | 77.80 | -45.55 | 26.21 |
| 32 | -88.63 | 38.24 | 13.44 | 80.71 | -40.95 | 15.75 |
| 33 | -48.74 | 16.85 | 6.84 | 162.77 | -62.31 | 51.12 |
| 34 | -5.55 | 12.23 | 9.77 | 165.61 | -57.69 | 40.64 |
| 35 | -87.42 | 31.73 | 8.53 | 183.91 | -77.19 | 57.92 |
| 36 | -44.35 | 27.14 | 11.46 | 186.83 | -72.60 | 47.45 |
| 37 | -330.87 | 64.94 | 5.36 | 26.53 | -26.46 | 16.53 |
| 38 | -287.68 | 60.32 | 8.29 | 29.37 | -21.84 | 6.04 |
| 39 | -369.54 | 79.82 | 7.05 | 47.67 | -41.34 | 23.32 |
| 40 | -326.47 | 75.23 | 9.98 | 50.59 | -36.75 | 12.85 |
| 41 | -330.87 | 64.94 | 5.36 | 157.88 | -69.83 | 55.76 |
| 42 | -287.68 | 60.32 | 8.29 | 160.72 | -65.21 | 45.27 |
| 43 | -369.54 | 79.82 | 7.05 | 179.02 | -84.71 | 62.55 |
| 44 | -326.47 | 75.23 | 9.98 | 181.94 | -80.11 | 52.08 |
| 45 | -48.74 | 16.85 | 6.84 | 31.42 | -18.94 | 11.89 |
| 46 | -5.55 | 12.23 | 9.77 | 34.26 | -14.32 | 1.41 |
| 47 | -87.42 | 31.73 | 8.53 | 52.56 | -33.82 | 18.68 |
| 48 | -44.35 | 27.14 | 11.46 | 55.48 | -29.23 | 8.22 |
| 49 | -69.36 | 14.09 | 3.95 | 121.10 | -47.17 | 43.12 |
| 50 | 2.62 | 6.39 | 8.82 | 125.83 | -39.46 | 25.65 |
| 51 | -133.81 | 38.89 | 6.75 | 156.34 | -71.97 | 54.44 |
| 52 | -62.03 | 31.24 | 11.64 | 161.19 | -64.31 | 37.00 |
| 53 | -266.85 | 47.75 | 2.91 | 25.73 | -22.07 | 18.90 |
| 54 | -194.86 | 40.05 | 7.78 | 30.46 | -14.37 | 1.43 |
| 55 | -331.30 | 72.55 | 5.72 | 60.97 | -46.87 | 30.23 |
| 56 | -259.52 | 64.90 | 10.60 | 65.82 | -39.22 | 12.78 |
| 57 | -266.85 | 47.75 | 2.91 | 117.68 | -52.43 | 46.37 |
| 58 | -194.86 | 40.05 | 7.78 | 122.41 | -44.73 | 28.89 |
| 59 | -331.30 | 72.55 | 5.72 | 152.91 | -77.23 | 57.69 |
| 60 | -259.52 | 64.90 | 10.60 | 157.77 | -69.58 | 40.24 |
| 61 | -69.36 | 14.09 | 3.95 | 29.15 | -16.81 | 15.66 |
| 62 | 2.62 | 6.39 | 8.82 | 33.88 | -9.11 | -1.81 |
| 63 | -133.81 | 38.89 | 6.75 | 64.39 | -41.61 | 26.98 |
| 64 | -62.03 | 31.24 | 11.64 | 69.25 | -33.96 | 9.54 |
| 65 | -25.07 | 3.00 | 1.97 | 95.86 | -35.44 | 35.59 |
| 66 | 46.91 | -4.71 | 6.84 | 100.59 | -27.74 | 18.12 |
| 67 | -89.53 | 27.80 | 4.78 | 131.10 | -60.24 | 46.92 |
| 68 | -17.74 | 20.14 | 9.66 | 135.96 | -52.59 | 29.47 |
| 69 | -222.56 | 36.66 | 0.93 | 0.49 | -10.35 | 11.38 |
| 70 | -150.58 | 28.96 | 5.80 | 5.22 | -2.65 | -6.10 |
| 71 | -287.01 | 61.46 | 3.74 | 35.73 | -35.15 | 22.70 |
| 72 | -215.23 | 53.81 | 8.62 | 40.59 | -27.50 | 5.25 |
| 73 | -222.56 | 36.66 | 0.93 | 92.44 | -40.71 | 38.84 |
| 74 | -150.58 | 28.96 | 5.80 | 97.17 | -33.00 | 21.36 |
| 75 | -287.01 | 61.46 | 3.74 | 127.68 | -65.51 | 50.16 |
| 76 | -215.23 | 53.81 | 8.62 | 132.53 | -57.85 | 32.72 |
| 77 | -25.07 | 3.00 | 1.97 | 3.91 | -5.09 | 8.13 |
| 78 | 46.91 | -4.71 | 6.84 | 8.65 | 2.61 | -9.34 |
| 79 | -89.53 | 27.80 | 4.78 | 39.15 | -29.89 | 19.45 |
| 80 | -17.74 | 20.14 | 9.66 | 44.01 | -22.24 | 2.01 |
| 81 | -169.81 | 50.74 | 10.00 | 153.97 | -72.25 | 48.20 |
| 82 | -176.16 | 45.80 | 11.67 | 171.79 | -67.31 | 46.53 |
| 83 | -292.06 | 71.58 | 9.36 | 94.93 | -56.72 | 33.20 |
| 84 | -298.41 | 66.64 | 11.03 | 112.75 | -51.78 | 31.53 |
| 85 | -292.06 | 71.58 | 9.36 | 151.85 | -75.51 | 50.20 |
| 86 | -298.41 | 66.64 | 11.03 | 169.67 | -70.57 | 48.53 |
| 87 | -169.81 | 50.74 | 10.00 | 97.05 | -53.46 | 31.20 |
| 88 | -176.16 | 45.80 | 11.67 | 114.87 | -48.52 | 29.52 |
| 89 | -129.89 | 39.60 | 7.50 | 116.39 | -56.14 | 37.27 |
| 90 | -136.24 | 34.66 | 9.17 | 134.21 | -51.21 | 35.60 |
| 91 | -223.93 | 55.63 | 7.00 | 70.97 | -44.20 | 25.73 |
| 92 | -230.28 | 50.69 | 8.67 | 88.79 | -39.26 | 24.06 |
| 93 | -223.93 | 55.63 | 7.00 | 114.76 | -58.65 | 38.81 |
| 94 | -230.28 | 50.69 | 8.67 | 132.58 | -53.71 | 37.14 |
| 95 | -129.89 | 39.60 | 7.50 | 72.60 | -41.69 | 24.19 |
| 96 | -136.24 | 34.66 | 9.17 | 90.42 | -36.75 | 22.52 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -430.33 | -436.44 | -426.61 | -400.85 | -359.15 | -301.50 | -232.82 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 46.91 | 12.42 | 8.06 | 3.22 | 0.00 | 0.00 | 0.00 |

强度计算应力比 =0.679

抗剪强度计算应力比 =0.267

平面内稳定计算最大应力对应组合号: 1, M=-148.21, N=48.53, M=232.82, N=-94.61

平面内稳定最大应力 (N/mm\*mm) =212.34

平面内稳定计算最大应力比 =0.696

临界弯矩Mcr(kN\*m) =1687.28

平面外稳定计算最大应力比 =0.812

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 =0.679 < 1.0

抗剪强度计算应力比 =0.267 < 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 =0.812 < 1.0

腹板高厚比 H0/TW=96.00 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =10.58 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 125.46 | 126.56 | 125.21 | 121.15 | 114.25 | 104.44 | 91.87 |

最大挠度值 =126.56 最大挠度/梁跨度 =1/218.

斜梁坡度初始值: 1/15.15

变形后斜梁坡度最小值: 1/18.39

变形后斜梁坡度改变率 =0.176 < 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 | -133.06 | 37.14 | 8.33 | 125.27 | -53.68 | 36.43 |
| 2 | -227.10 | 53.16 | 7.84 | 79.86 | -41.73 | 24.90 |
| 3 | -227.10 | 53.16 | 7.84 | 123.64 | -56.19 | 37.98 |
| 4 | -133.06 | 37.14 | 8.33 | 81.49 | -39.23 | 23.36 |
| 5 | -118.30 | 33.44 | 7.67 | 116.86 | -49.77 | 33.92 |
| 6 | -212.34 | 49.47 | 7.18 | 71.45 | -37.83 | 22.39 |
| 7 | -212.34 | 49.47 | 7.18 | 115.23 | -52.28 | 35.47 |
| 8 | -118.30 | 33.44 | 7.67 | 73.08 | -35.32 | 20.85 |
| 9 | -123.11 | 27.84 | 4.39 | 64.21 | -29.93 | 21.55 |
| 10 | -103.91 | 25.79 | 5.69 | 65.47 | -27.88 | 16.89 |
| 11 | -140.29 | 34.45 | 5.13 | 73.60 | -36.54 | 24.56 |
| 12 | -121.15 | 32.41 | 6.44 | 74.90 | -34.50 | 19.91 |
| 13 | -108.34 | 24.14 | 3.73 | 55.79 | -26.02 | 19.04 |
| 14 | -89.15 | 22.09 | 5.03 | 57.06 | -23.97 | 14.38 |
| 15 | -125.53 | 30.75 | 4.48 | 65.19 | -32.64 | 22.05 |
| 16 | -106.39 | 28.71 | 5.78 | 66.49 | -30.60 | 17.40 |

--- 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 -227.10 -231.70 -227.56 -214.69 -193.08 -162.73 -125.27

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 0.00

强度计算荷载比 =0.37

平面内稳定计算荷载比 =0.36

平面外稳定计算荷载比 =0.40

无防护下钢构件最大升温(Ts): 1004.55℃ ,按临界温度法求得临界温度(Td): 609.13℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2444(m^2\*℃/w)

构件重量 (Kg)=522.51

**10、 钢 梁 5
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=22.87

构件长度=5.67; 计算长度系数: Ux=4.04

支撑长度=8.00

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:L50X4 ; 布置间距: 1.20

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=320, B2=320, H1=500, H2=800 T1=8 T2=14 T3=14

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: 185.028244(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 176.14 | 62.42 | -93.15 | -427.26 | -29.01 | 80.68 |
| 2 | 50.52 | 35.32 | -41.42 | -870.47 | -60.04 | 162.67 |
| 3 | 50.52 | 35.32 | -41.42 | -488.99 | -29.57 | 113.29 |
| 4 | 176.14 | 62.42 | -93.15 | -808.74 | -59.47 | 130.06 |
| 5 | 158.94 | 55.05 | -83.05 | -328.66 | -22.31 | 62.06 |
| 6 | 33.32 | 27.95 | -31.32 | -771.88 | -53.34 | 144.05 |
| 7 | 33.32 | 27.95 | -31.32 | -390.40 | -22.88 | 94.67 |
| 8 | 158.94 | 55.05 | -83.05 | -710.14 | -52.77 | 111.44 |
| 9 | 45.97 | 4.89 | -10.04 | -127.57 | -1.93 | 18.76 |
| 10 | 1.50 | -1.09 | -15.71 | -144.58 | 4.04 | 34.77 |
| 11 | 71.08 | 25.61 | -25.50 | -273.36 | -22.65 | 45.88 |
| 12 | 26.68 | 19.65 | -31.21 | -290.76 | -16.70 | 61.97 |
| 13 | 28.76 | -2.49 | 0.06 | -28.97 | 4.76 | 0.14 |
| 14 | -15.70 | -8.46 | -5.61 | -45.98 | 10.74 | 16.15 |
| 15 | 53.87 | 18.23 | -15.39 | -174.76 | -15.96 | 27.26 |
| 16 | 9.48 | 12.28 | -21.11 | -192.16 | -10.01 | 43.35 |
| 17 | 158.99 | 46.18 | -72.91 | -247.44 | -12.76 | 43.53 |
| 18 | 132.32 | 42.59 | -76.32 | -257.65 | -9.18 | 53.14 |
| 19 | 174.06 | 58.61 | -82.19 | -334.92 | -25.19 | 59.80 |
| 20 | 147.42 | 55.04 | -85.62 | -345.36 | -21.62 | 69.45 |
| 21 | 33.37 | 19.08 | -21.18 | -690.66 | -43.79 | 125.52 |
| 22 | 6.70 | 15.49 | -24.59 | -700.86 | -40.21 | 135.12 |
| 23 | 48.44 | 31.51 | -30.46 | -778.13 | -56.22 | 141.79 |
| 24 | 21.80 | 27.94 | -33.89 | -788.57 | -52.65 | 151.44 |
| 25 | 33.37 | 19.08 | -21.18 | -309.18 | -13.33 | 76.14 |
| 26 | 6.70 | 15.49 | -24.59 | -319.39 | -9.75 | 85.75 |
| 27 | 48.44 | 31.51 | -30.46 | -396.66 | -25.76 | 92.41 |
| 28 | 21.80 | 27.94 | -33.89 | -407.09 | -22.19 | 102.06 |
| 29 | 158.99 | 46.18 | -72.91 | -628.92 | -43.23 | 92.91 |
| 30 | 132.32 | 42.59 | -76.32 | -639.13 | -39.64 | 102.51 |
| 31 | 174.06 | 58.61 | -82.19 | -716.40 | -55.66 | 109.18 |
| 32 | 147.42 | 55.04 | -85.62 | -726.83 | -52.09 | 118.83 |
| 33 | 141.79 | 38.80 | -62.81 | -148.85 | -6.07 | 24.91 |
| 34 | 115.11 | 35.22 | -66.21 | -159.05 | -2.48 | 34.52 |
| 35 | 156.86 | 51.23 | -72.08 | -236.32 | -18.50 | 41.18 |
| 36 | 130.22 | 47.66 | -75.51 | -246.76 | -14.93 | 50.83 |
| 37 | 16.17 | 11.71 | -11.08 | -592.06 | -37.10 | 106.90 |
| 38 | -10.51 | 8.12 | -14.49 | -602.27 | -33.51 | 116.51 |
| 39 | 31.24 | 24.14 | -20.36 | -679.54 | -49.53 | 123.17 |
| 40 | 4.60 | 20.57 | -23.79 | -689.97 | -45.96 | 132.82 |
| 41 | 16.17 | 11.71 | -11.08 | -210.58 | -6.64 | 57.52 |
| 42 | -10.51 | 8.12 | -14.49 | -220.79 | -3.05 | 67.13 |
| 43 | 31.24 | 24.14 | -20.36 | -298.06 | -19.07 | 73.79 |
| 44 | 4.60 | 20.57 | -23.79 | -308.50 | -15.50 | 83.44 |
| 45 | 141.79 | 38.80 | -62.81 | -530.32 | -36.53 | 74.29 |
| 46 | 115.11 | 35.22 | -66.21 | -540.53 | -32.95 | 83.90 |
| 47 | 156.86 | 51.23 | -72.08 | -617.80 | -48.96 | 90.56 |
| 48 | 130.22 | 47.66 | -75.51 | -628.24 | -45.39 | 100.21 |
| 49 | 117.08 | 26.21 | -44.60 | -127.57 | -1.93 | 18.76 |
| 50 | 72.62 | 20.23 | -50.28 | -144.58 | 4.04 | 34.77 |
| 51 | 142.19 | 46.93 | -60.06 | -273.36 | -22.65 | 45.88 |
| 52 | 97.80 | 40.98 | -65.78 | -290.76 | -16.70 | 61.97 |
| 53 | 29.15 | 7.24 | -8.39 | -437.82 | -23.66 | 76.15 |
| 54 | -15.31 | 1.27 | -14.07 | -454.83 | -17.68 | 92.16 |
| 55 | 54.26 | 27.96 | -23.85 | -583.61 | -44.38 | 103.27 |
| 56 | 9.87 | 22.01 | -29.57 | -601.01 | -38.42 | 119.36 |
| 57 | 29.15 | 7.24 | -8.39 | -170.78 | -2.33 | 41.58 |
| 58 | -15.31 | 1.27 | -14.07 | -187.79 | 3.64 | 57.60 |
| 59 | 54.26 | 27.96 | -23.85 | -316.57 | -23.05 | 68.71 |
| 60 | 9.87 | 22.01 | -29.57 | -333.97 | -17.10 | 84.79 |
| 61 | 117.08 | 26.21 | -44.60 | -394.60 | -23.26 | 53.32 |
| 62 | 72.62 | 20.23 | -50.28 | -411.61 | -17.28 | 69.34 |
| 63 | 142.19 | 46.93 | -60.06 | -540.39 | -43.98 | 80.45 |
| 64 | 97.80 | 40.98 | -65.78 | -557.79 | -38.03 | 96.53 |
| 65 | 99.88 | 18.84 | -34.50 | -28.97 | 4.76 | 0.14 |
| 66 | 55.42 | 12.86 | -40.18 | -45.98 | 10.74 | 16.15 |
| 67 | 124.99 | 39.56 | -49.96 | -174.76 | -15.96 | 27.26 |
| 68 | 80.60 | 33.60 | -55.68 | -192.16 | -10.01 | 43.35 |
| 69 | 11.95 | -0.13 | 1.71 | -339.22 | -16.96 | 57.53 |
| 70 | -32.52 | -6.11 | -3.97 | -356.23 | -10.99 | 73.54 |
| 71 | 37.06 | 20.59 | -13.75 | -485.01 | -37.68 | 84.65 |
| 72 | -7.34 | 14.64 | -19.47 | -502.41 | -31.73 | 100.74 |
| 73 | 11.95 | -0.13 | 1.71 | -72.19 | 4.36 | 22.96 |
| 74 | -32.52 | -6.11 | -3.97 | -89.20 | 10.34 | 38.98 |
| 75 | 37.06 | 20.59 | -13.75 | -217.98 | -16.36 | 50.09 |
| 76 | -7.34 | 14.64 | -19.47 | -235.37 | -10.41 | 66.17 |
| 77 | 99.88 | 18.84 | -34.50 | -296.01 | -16.56 | 34.70 |
| 78 | 55.42 | 12.86 | -40.18 | -313.01 | -10.59 | 50.72 |
| 79 | 124.99 | 39.56 | -49.96 | -441.80 | -37.28 | 61.83 |
| 80 | 80.60 | 33.60 | -55.68 | -459.19 | -31.33 | 77.91 |
| 81 | 122.14 | 46.36 | -66.23 | -436.80 | -30.21 | 81.74 |
| 82 | 114.99 | 43.95 | -64.11 | -417.67 | -27.80 | 79.62 |
| 83 | 67.70 | 34.62 | -43.81 | -628.86 | -43.66 | 117.27 |
| 84 | 60.55 | 32.21 | -41.69 | -609.73 | -41.24 | 115.15 |
| 85 | 67.70 | 34.62 | -43.81 | -463.55 | -30.46 | 95.87 |
| 86 | 60.55 | 32.21 | -41.69 | -444.42 | -28.04 | 93.75 |
| 87 | 122.14 | 46.36 | -66.23 | -602.11 | -43.41 | 103.14 |
| 88 | 114.99 | 43.95 | -64.11 | -582.97 | -41.00 | 101.02 |
| 89 | 94.77 | 35.94 | -51.19 | -338.20 | -23.52 | 63.12 |
| 90 | 87.63 | 33.53 | -49.07 | -319.07 | -21.10 | 61.00 |
| 91 | 52.90 | 26.91 | -33.94 | -485.94 | -33.86 | 90.45 |
| 92 | 45.75 | 24.49 | -31.83 | -466.81 | -31.45 | 88.33 |
| 93 | 52.90 | 26.91 | -33.94 | -358.78 | -23.71 | 73.99 |
| 94 | 45.75 | 24.49 | -31.83 | -339.65 | -21.29 | 71.87 |
| 95 | 94.77 | 35.94 | -51.19 | -465.36 | -33.67 | 79.58 |
| 96 | 87.63 | 33.53 | -49.07 | -446.23 | -31.26 | 77.46 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -32.52 | -26.01 | -13.99 | 0.00 | 0.00 | 0.00 | 0.00 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 176.14 | 123.36 | 174.43 | 231.30 | 298.82 | 387.63 | 870.47 |

强度计算应力比 =0.720

抗剪强度计算应力比 =0.299

平面内稳定计算最大应力对应组合号: 1, M=176.14, N=62.42, M=-427.26, N=-29.01

平面内稳定最大应力 (N/mm\*mm) =214.28

平面内稳定计算最大应力比 =0.703

临界弯矩Mcr(kN\*m) =2535.57

平面外稳定计算最大应力比 =0.845

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 =0.720 < 1.0

抗剪强度计算应力比 =0.299 < 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 =0.845 < 1.0

腹板高厚比 H0/TW=77.75 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =11.14 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 36.73 | 29.11 | 21.93 | 15.32 | 9.40 | 4.26 | 0.00 |

最大挠度值 =36.73 最大挠度/梁跨度 =1/621.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.34

变形后斜梁坡度改变率 =0.102 < 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 | 91.21 | 34.74 | -50.13 | -328.66 | -22.31 | 62.06 |
| 2 | 49.34 | 25.71 | -32.89 | -476.40 | -32.66 | 89.39 |
| 3 | 49.34 | 25.71 | -32.89 | -349.24 | -22.50 | 72.93 |
| 4 | 91.21 | 34.74 | -50.13 | -455.82 | -32.47 | 78.52 |
| 5 | 85.47 | 32.28 | -46.76 | -295.79 | -20.08 | 55.86 |
| 6 | 43.60 | 23.25 | -29.52 | -443.53 | -30.42 | 83.19 |
| 7 | 43.60 | 23.25 | -29.52 | -316.37 | -20.27 | 66.73 |
| 8 | 85.47 | 32.28 | -46.76 | -422.95 | -30.23 | 72.32 |
| 9 | 49.72 | 17.36 | -24.68 | -248.74 | -15.09 | 45.55 |
| 10 | 37.86 | 15.77 | -26.19 | -253.28 | -13.50 | 49.82 |
| 11 | 56.42 | 22.89 | -28.80 | -287.62 | -20.62 | 52.78 |
| 12 | 44.58 | 21.30 | -30.32 | -292.26 | -19.03 | 57.07 |
| 13 | 43.99 | 14.91 | -21.31 | -215.88 | -12.86 | 39.34 |
| 14 | 32.13 | 13.31 | -22.82 | -220.41 | -11.27 | 43.61 |
| 15 | 50.68 | 20.43 | -25.43 | -254.75 | -18.39 | 46.58 |
| 16 | 38.85 | 18.84 | -26.95 | -259.39 | -16.80 | 50.87 |

--- 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 0.00 0.00

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 91.21 91.39 129.90 172.88 224.05 283.49 476.40

强度计算荷载比 =0.40

平面内稳定计算荷载比 =0.38

平面外稳定计算荷载比 =0.41

无防护下钢构件最大升温(Ts): 1004.14℃ ,按临界温度法求得临界温度(Td): 608.23℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.1999(m^2\*℃/w)

构件重量 (Kg)=620.07

**11、 钢 梁 6
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=27.71

构件长度=6.86; 计算长度系数: Ux=4.04

支撑长度=9.00

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:L50X4 ; 布置间距: 1.20

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=250, B2=250, H1=500, H2=700 T1=6 T2=12 T3=12

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: 232.916672(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 104.38 | 73.91 | 74.99 | 430.33 | -96.62 | -12.30 |
| 2 | -76.91 | 63.03 | 75.48 | 148.21 | -48.53 | -13.79 |
| 3 | -59.67 | 91.12 | 95.68 | 430.33 | -96.62 | -12.30 |
| 4 | 87.15 | 45.82 | 54.78 | 148.21 | -48.53 | -13.79 |
| 5 | 102.63 | 63.43 | 63.55 | 386.04 | -85.52 | -10.33 |
| 6 | -78.67 | 52.56 | 64.04 | 103.92 | -37.43 | -11.81 |
| 7 | -61.43 | 80.64 | 84.24 | 386.04 | -85.52 | -10.33 |
| 8 | 85.39 | 35.35 | 43.34 | 103.92 | -37.43 | -11.81 |
| 9 | -31.33 | 11.07 | 19.70 | 99.96 | -13.78 | -0.29 |
| 10 | 30.86 | 3.38 | 11.97 | 27.97 | -6.08 | -5.17 |
| 11 | -28.00 | 35.88 | 36.64 | 164.41 | -38.58 | -3.10 |
| 12 | 34.20 | 28.22 | 28.96 | 92.63 | -30.93 | -7.99 |
| 13 | -33.09 | 0.60 | 8.26 | 55.67 | -2.68 | 1.68 |
| 14 | 29.11 | -7.10 | 0.54 | -16.31 | 5.02 | -3.19 |
| 15 | -29.76 | 25.40 | 25.20 | 120.12 | -27.49 | -1.13 |
| 16 | 32.44 | 17.75 | 17.53 | 48.34 | -19.83 | -6.01 |
| 17 | 81.02 | 53.32 | 57.07 | 375.15 | -76.03 | -7.34 |
| 18 | 118.33 | 48.70 | 52.43 | 331.97 | -71.42 | -10.26 |
| 19 | 83.01 | 68.21 | 67.23 | 413.83 | -90.92 | -9.02 |
| 20 | 120.33 | 63.61 | 62.63 | 370.76 | -86.32 | -11.95 |
| 21 | -100.28 | 42.45 | 57.56 | 93.03 | -27.95 | -8.82 |
| 22 | -62.97 | 37.83 | 52.92 | 49.84 | -23.33 | -11.75 |
| 23 | -98.29 | 57.33 | 67.72 | 131.70 | -42.83 | -10.51 |
| 24 | -60.97 | 52.74 | 63.12 | 88.63 | -38.24 | -13.44 |
| 25 | -83.04 | 70.53 | 77.76 | 375.15 | -76.03 | -7.34 |
| 26 | -45.73 | 65.91 | 73.13 | 331.97 | -71.42 | -10.26 |
| 27 | -81.05 | 85.41 | 87.93 | 413.83 | -90.92 | -9.02 |
| 28 | -43.73 | 80.82 | 83.32 | 370.76 | -86.32 | -11.95 |
| 29 | 63.78 | 25.24 | 36.86 | 93.03 | -27.95 | -8.82 |
| 30 | 101.09 | 20.62 | 32.23 | 49.84 | -23.33 | -11.75 |
| 31 | 65.77 | 40.12 | 47.02 | 131.70 | -42.83 | -10.51 |
| 32 | 103.09 | 35.53 | 42.42 | 88.63 | -38.24 | -13.44 |
| 33 | 79.26 | 42.85 | 45.63 | 330.87 | -64.94 | -5.36 |
| 34 | 116.57 | 38.23 | 40.99 | 287.68 | -60.32 | -8.29 |
| 35 | 81.25 | 57.73 | 55.79 | 369.54 | -79.82 | -7.05 |
| 36 | 118.57 | 53.14 | 51.19 | 326.47 | -75.23 | -9.98 |
| 37 | -102.04 | 31.98 | 46.12 | 48.74 | -16.85 | -6.84 |
| 38 | -64.73 | 27.36 | 41.48 | 5.55 | -12.23 | -9.77 |
| 39 | -100.05 | 46.86 | 56.28 | 87.42 | -31.73 | -8.53 |
| 40 | -62.72 | 42.27 | 51.68 | 44.35 | -27.14 | -11.46 |
| 41 | -84.80 | 60.06 | 66.33 | 330.87 | -64.94 | -5.36 |
| 42 | -47.49 | 55.44 | 61.69 | 287.68 | -60.32 | -8.29 |
| 43 | -82.81 | 74.94 | 76.49 | 369.54 | -79.82 | -7.05 |
| 44 | -45.49 | 70.35 | 71.88 | 326.47 | -75.23 | -9.98 |
| 45 | 62.02 | 14.77 | 25.42 | 48.74 | -16.85 | -6.84 |
| 46 | 99.33 | 10.15 | 20.79 | 5.55 | -12.23 | -9.77 |
| 47 | 64.01 | 29.65 | 35.59 | 87.42 | -31.73 | -8.53 |
| 48 | 101.34 | 25.06 | 30.98 | 44.35 | -27.14 | -11.46 |
| 49 | 36.41 | 31.04 | 37.50 | 266.85 | -47.75 | -2.91 |
| 50 | 98.60 | 23.34 | 29.77 | 194.86 | -40.05 | -7.78 |
| 51 | 39.73 | 55.85 | 54.43 | 331.30 | -72.55 | -5.72 |
| 52 | 101.93 | 48.19 | 46.76 | 259.52 | -64.90 | -10.60 |
| 53 | -90.50 | 23.43 | 37.84 | 69.36 | -14.09 | -3.95 |
| 54 | -28.31 | 15.73 | 30.11 | -2.62 | -6.39 | -8.82 |
| 55 | -87.18 | 48.23 | 54.78 | 133.81 | -38.89 | -6.75 |
| 56 | -24.97 | 40.58 | 47.10 | 62.03 | -31.24 | -11.64 |
| 57 | -78.43 | 43.09 | 51.98 | 266.85 | -47.75 | -2.91 |
| 58 | -16.24 | 35.39 | 44.26 | 194.86 | -40.05 | -7.78 |
| 59 | -75.11 | 67.89 | 68.92 | 331.30 | -72.55 | -5.72 |
| 60 | -12.91 | 60.24 | 61.25 | 259.52 | -64.90 | -10.60 |
| 61 | 24.34 | 11.39 | 23.35 | 69.36 | -14.09 | -3.95 |
| 62 | 86.53 | 3.69 | 15.63 | -2.62 | -6.39 | -8.82 |
| 63 | 27.66 | 36.19 | 40.29 | 133.81 | -38.89 | -6.75 |
| 64 | 89.87 | 28.54 | 32.61 | 62.03 | -31.24 | -11.64 |
| 65 | 34.65 | 20.57 | 26.06 | 222.56 | -36.66 | -0.93 |
| 66 | 96.84 | 12.87 | 18.33 | 150.58 | -28.96 | -5.80 |
| 67 | 37.97 | 45.37 | 43.00 | 287.01 | -61.46 | -3.74 |
| 68 | 100.17 | 37.72 | 35.32 | 215.23 | -53.81 | -8.62 |
| 69 | -92.26 | 12.96 | 26.40 | 25.07 | -2.99 | -1.97 |
| 70 | -30.07 | 5.26 | 18.68 | -46.91 | 4.70 | -6.84 |
| 71 | -88.94 | 37.76 | 43.34 | 89.53 | -27.80 | -4.78 |
| 72 | -26.73 | 30.11 | 35.66 | 17.74 | -20.14 | -9.66 |
| 73 | -80.19 | 32.62 | 40.55 | 222.56 | -36.66 | -0.93 |
| 74 | -18.00 | 24.92 | 32.82 | 150.58 | -28.96 | -5.80 |
| 75 | -76.87 | 57.42 | 57.48 | 287.01 | -61.46 | -3.74 |
| 76 | -14.67 | 49.77 | 49.81 | 215.23 | -53.81 | -8.62 |
| 77 | 22.58 | 0.91 | 11.91 | 25.07 | -2.99 | -1.97 |
| 78 | 84.77 | -6.79 | 4.19 | -46.91 | 4.70 | -6.84 |
| 79 | 25.90 | 25.72 | 28.85 | 89.53 | -27.80 | -4.78 |
| 80 | 88.11 | 18.06 | 21.18 | 17.74 | -20.14 | -9.66 |
| 81 | 46.19 | 58.42 | 59.63 | 292.06 | -69.79 | -9.24 |
| 82 | 52.93 | 57.06 | 61.53 | 298.41 | -68.44 | -11.14 |
| 83 | -32.37 | 53.70 | 59.84 | 169.81 | -48.95 | -9.88 |
| 84 | -25.63 | 52.35 | 61.75 | 176.16 | -47.60 | -11.79 |
| 85 | -24.90 | 65.87 | 68.60 | 292.06 | -69.79 | -9.24 |
| 86 | -18.16 | 64.52 | 70.50 | 298.41 | -68.44 | -11.14 |
| 87 | 38.72 | 46.25 | 50.87 | 169.81 | -48.95 | -9.88 |
| 88 | 45.46 | 44.89 | 52.78 | 176.16 | -47.60 | -11.79 |
| 89 | 34.76 | 45.09 | 45.65 | 223.93 | -53.84 | -6.89 |
| 90 | 41.49 | 43.74 | 47.55 | 230.28 | -52.49 | -8.79 |
| 91 | -25.67 | 41.47 | 45.81 | 129.89 | -37.81 | -7.38 |
| 92 | -18.94 | 40.11 | 47.72 | 136.24 | -36.46 | -9.29 |
| 93 | -19.93 | 50.83 | 52.55 | 223.93 | -53.84 | -6.89 |
| 94 | -13.19 | 49.47 | 54.45 | 230.28 | -52.49 | -8.79 |
| 95 | 29.01 | 35.73 | 38.91 | 129.89 | -37.81 | -7.38 |
| 96 | 35.75 | 34.38 | 40.82 | 136.24 | -36.46 | -9.29 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -102.04 | -165.30 | -246.82 | -316.55 | -370.38 | -408.30 | -430.33 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 120.33 | 28.24 | 26.87 | 24.99 | 22.60 | 19.71 | 46.91 |

强度计算应力比 =0.626

抗剪强度计算应力比 =0.358

平面内稳定计算最大应力对应组合号: 1, M=104.38, N=73.91, M=430.33, N=-96.62

平面内稳定最大应力 (N/mm\*mm) =202.89

平面内稳定计算最大应力比 =0.665

临界弯矩Mcr(kN\*m) =1591.62

平面外稳定计算最大应力比 =0.789

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 =0.626 < 1.0

抗剪强度计算应力比 =0.358 < 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 =0.789 < 1.0

腹板高厚比 H0/TW=96.00 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =10.17 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 71.34 | 85.27 | 97.74 | 108.18 | 116.33 | 122.08 | 125.46 |

最大挠度值 =125.46 最大挠度/梁跨度 =1/220.

斜梁坡度初始值: 1/15.15

变形后斜梁坡度最小值: 1/12.75

变形后斜梁坡度改变率 =0.189 < 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 | 38.12 | 44.42 | 46.60 | 227.10 | -53.17 | -7.84 |
| 2 | -22.32 | 40.79 | 46.76 | 133.06 | -37.14 | -8.33 |
| 3 | -16.57 | 50.15 | 53.50 | 227.10 | -53.17 | -7.84 |
| 4 | 32.37 | 35.06 | 39.86 | 133.06 | -37.14 | -8.33 |
| 5 | 37.53 | 40.93 | 42.79 | 212.34 | -49.47 | -7.18 |
| 6 | -22.90 | 37.30 | 42.95 | 118.30 | -33.44 | -7.67 |
| 7 | -17.16 | 46.66 | 49.69 | 212.34 | -49.47 | -7.18 |
| 8 | 31.79 | 31.56 | 36.05 | 118.30 | -33.44 | -7.67 |
| 9 | -4.52 | 25.76 | 30.16 | 123.11 | -27.84 | -4.39 |
| 10 | 12.06 | 23.71 | 28.10 | 103.91 | -25.79 | -5.69 |
| 11 | -3.64 | 32.37 | 34.68 | 140.29 | -34.45 | -5.13 |
| 12 | 12.95 | 30.33 | 32.63 | 121.15 | -32.41 | -6.44 |
| 13 | -5.11 | 22.27 | 26.35 | 108.34 | -24.14 | -3.73 |
| 14 | 11.47 | 20.22 | 24.29 | 89.15 | -22.09 | -5.03 |
| 15 | -4.22 | 28.88 | 30.87 | 125.53 | -30.75 | -4.48 |
| 16 | 12.36 | 26.84 | 28.82 | 106.39 | -28.71 | -5.78 |

--- 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 -22.90 -73.43 -121.57 -161.02 -191.75 -213.78 -227.10

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 38.12 0.00 0.00 0.00 0.00 0.00 0.00

强度计算荷载比 =0.34

平面内稳定计算荷载比 =0.35

平面外稳定计算荷载比 =0.31

无防护下钢构件最大升温(Ts): 1004.56℃ ,按临界温度法求得临界温度(Td): 628.44℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2266(m^2\*℃/w)

构件重量 (Kg)=509.58

**12、 钢 梁 7
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=27.71

构件长度=6.86; 计算长度系数: Ux=4.04

支撑长度=9.40

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:L50X4 ; 布置间距: 1.20

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=320, B2=320, H1=800, H2=500 T1=8 T2=14 T3=14

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: 185.028244(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 1011.59 | 85.81 | 188.03 | 76.91 | -63.03 | -75.48 |
| 2 | 501.47 | 42.43 | 94.31 | -104.38 | -73.91 | -74.99 |
| 3 | 583.34 | 44.80 | 133.46 | 33.73 | -50.55 | -46.32 |
| 4 | 929.72 | 83.44 | 148.89 | -61.21 | -86.39 | -104.14 |
| 5 | 895.87 | 76.02 | 166.27 | 78.67 | -52.56 | -64.04 |
| 6 | 385.74 | 32.64 | 72.55 | -102.63 | -63.43 | -63.55 |
| 7 | 467.61 | 35.01 | 111.69 | 35.49 | -40.08 | -34.88 |
| 8 | 814.00 | 73.65 | 127.13 | -59.45 | -75.92 | -92.70 |
| 9 | 183.42 | 8.12 | 42.86 | 31.33 | -11.08 | -19.70 |
| 10 | 149.32 | 0.42 | 22.54 | -30.86 | -3.38 | -11.97 |
| 11 | 351.51 | 32.92 | 73.93 | 28.00 | -35.88 | -36.64 |
| 12 | 317.92 | 25.27 | 53.70 | -34.20 | -28.22 | -28.96 |
| 13 | 67.69 | -1.67 | 21.10 | 33.09 | -0.60 | -8.26 |
| 14 | 33.60 | -9.37 | 0.77 | -29.11 | 7.10 | -0.54 |
| 15 | 235.79 | 23.13 | 52.17 | 29.76 | -25.40 | -25.20 |
| 16 | 202.20 | 15.48 | 31.93 | -32.44 | -17.75 | -17.53 |
| 17 | 820.76 | 65.23 | 157.16 | 100.28 | -42.45 | -57.56 |
| 18 | 800.30 | 60.61 | 144.97 | 62.97 | -37.83 | -52.92 |
| 19 | 921.62 | 80.11 | 175.80 | 98.29 | -57.33 | -67.72 |
| 20 | 901.47 | 75.52 | 163.66 | 60.97 | -52.74 | -63.12 |
| 21 | 310.64 | 21.84 | 63.44 | -81.02 | -53.32 | -57.07 |
| 22 | 290.18 | 17.22 | 51.25 | -118.33 | -48.70 | -52.43 |
| 23 | 411.49 | 36.72 | 82.08 | -83.01 | -68.20 | -67.23 |
| 24 | 391.34 | 32.13 | 69.94 | -120.33 | -63.61 | -62.63 |
| 25 | 392.51 | 24.22 | 102.59 | 57.10 | -29.97 | -28.40 |
| 26 | 372.05 | 19.60 | 90.39 | 19.79 | -25.35 | -23.77 |
| 27 | 493.37 | 39.10 | 121.23 | 55.11 | -44.85 | -38.57 |
| 28 | 473.21 | 34.51 | 109.09 | 17.79 | -40.26 | -33.96 |
| 29 | 738.89 | 62.85 | 118.02 | -37.84 | -65.81 | -86.22 |
| 30 | 718.43 | 58.23 | 105.82 | -75.15 | -61.19 | -81.59 |
| 31 | 839.75 | 77.74 | 136.66 | -39.83 | -80.69 | -96.39 |
| 32 | 819.59 | 73.14 | 124.52 | -77.15 | -76.10 | -91.78 |
| 33 | 705.04 | 55.44 | 135.40 | 102.04 | -31.98 | -46.12 |
| 34 | 684.58 | 50.82 | 123.20 | 64.73 | -27.36 | -41.48 |
| 35 | 805.90 | 70.32 | 154.04 | 100.05 | -46.86 | -56.28 |
| 36 | 785.74 | 65.73 | 141.90 | 62.72 | -42.27 | -51.68 |
| 37 | 194.91 | 12.05 | 41.68 | -79.26 | -42.85 | -45.63 |
| 38 | 174.45 | 7.43 | 29.48 | -116.57 | -38.23 | -40.99 |
| 39 | 295.77 | 26.93 | 60.32 | -81.25 | -57.73 | -55.79 |
| 40 | 275.62 | 22.34 | 48.18 | -118.57 | -53.14 | -51.19 |
| 41 | 276.79 | 14.43 | 80.82 | 58.86 | -19.49 | -16.97 |
| 42 | 256.33 | 9.81 | 68.63 | 21.55 | -14.87 | -12.33 |
| 43 | 377.64 | 29.31 | 99.46 | 56.87 | -34.38 | -27.13 |
| 44 | 357.49 | 24.72 | 87.32 | 19.55 | -29.78 | -22.52 |
| 45 | 623.17 | 53.06 | 96.26 | -36.08 | -55.34 | -74.78 |
| 46 | 602.71 | 48.44 | 84.06 | -73.39 | -50.72 | -70.15 |
| 47 | 724.03 | 67.94 | 114.90 | -38.07 | -70.22 | -84.95 |
| 48 | 703.87 | 63.35 | 102.76 | -75.39 | -65.62 | -80.34 |
| 49 | 540.51 | 38.49 | 108.47 | 90.50 | -23.43 | -37.84 |
| 50 | 506.41 | 30.79 | 88.14 | 28.31 | -15.73 | -30.11 |
| 51 | 708.60 | 63.29 | 139.53 | 87.18 | -48.23 | -54.78 |
| 52 | 675.01 | 55.64 | 119.30 | 24.97 | -40.58 | -47.10 |
| 53 | 183.42 | 8.12 | 42.86 | -36.41 | -31.04 | -37.50 |
| 54 | 149.32 | 0.42 | 22.54 | -98.60 | -23.34 | -29.77 |
| 55 | 351.51 | 32.92 | 73.93 | -39.73 | -55.85 | -54.43 |
| 56 | 317.92 | 25.27 | 53.70 | -101.93 | -48.19 | -46.76 |
| 57 | 240.73 | 9.78 | 70.26 | 60.28 | -14.69 | -17.43 |
| 58 | 206.63 | 2.08 | 49.94 | -1.92 | -6.99 | -9.70 |
| 59 | 408.82 | 34.59 | 101.33 | 56.95 | -39.50 | -34.37 |
| 60 | 375.23 | 26.93 | 81.10 | -5.25 | -31.84 | -26.69 |
| 61 | 483.20 | 36.83 | 81.07 | -6.18 | -39.78 | -57.90 |
| 62 | 449.10 | 29.13 | 60.74 | -68.37 | -32.08 | -50.18 |
| 63 | 651.29 | 61.63 | 112.13 | -9.50 | -64.58 | -74.84 |
| 64 | 617.70 | 53.98 | 91.90 | -71.71 | -56.93 | -67.17 |
| 65 | 424.78 | 28.70 | 86.70 | 92.26 | -12.96 | -26.40 |
| 66 | 390.68 | 21.00 | 66.38 | 30.07 | -5.26 | -18.68 |
| 67 | 592.88 | 53.50 | 117.77 | 88.94 | -37.76 | -43.34 |
| 68 | 559.29 | 45.85 | 97.54 | 26.73 | -30.11 | -35.66 |
| 69 | 67.69 | -1.67 | 21.10 | -34.65 | -20.57 | -26.06 |
| 70 | 33.60 | -9.37 | 0.77 | -96.84 | -12.87 | -18.33 |
| 71 | 235.79 | 23.13 | 52.17 | -37.97 | -45.37 | -43.00 |
| 72 | 202.20 | 15.48 | 31.93 | -100.17 | -37.72 | -35.32 |
| 73 | 125.01 | -0.01 | 48.50 | 62.03 | -4.22 | -5.99 |
| 74 | 90.91 | -7.71 | 28.17 | -0.16 | 3.48 | 1.73 |
| 75 | 293.10 | 24.79 | 79.57 | 58.71 | -29.02 | -22.93 |
| 76 | 259.51 | 17.14 | 59.33 | -3.49 | -21.37 | -15.26 |
| 77 | 367.47 | 27.04 | 59.30 | -4.42 | -29.31 | -46.47 |
| 78 | 333.37 | 19.34 | 38.98 | -66.62 | -21.61 | -38.74 |
| 79 | 535.57 | 51.84 | 90.37 | -7.75 | -54.11 | -63.40 |
| 80 | 501.98 | 44.19 | 70.14 | -69.95 | -46.46 | -55.73 |
| 81 | 711.82 | 60.11 | 133.86 | 32.37 | -51.92 | -59.72 |
| 82 | 733.27 | 62.34 | 136.00 | 25.63 | -54.15 | -61.87 |
| 83 | 490.77 | 41.31 | 93.24 | -46.19 | -56.63 | -59.51 |
| 84 | 512.21 | 43.54 | 95.39 | -52.93 | -58.86 | -61.65 |
| 85 | 526.25 | 42.34 | 110.21 | 13.66 | -46.51 | -47.09 |
| 86 | 547.69 | 44.57 | 112.35 | 6.92 | -48.74 | -49.23 |
| 87 | 676.34 | 59.09 | 116.89 | -27.48 | -62.04 | -72.14 |
| 88 | 697.79 | 61.32 | 119.04 | -34.22 | -64.27 | -74.29 |
| 89 | 545.09 | 45.99 | 102.72 | 25.67 | -39.68 | -45.69 |
| 90 | 566.53 | 48.21 | 104.86 | 18.94 | -41.91 | -47.84 |
| 91 | 375.04 | 31.52 | 71.48 | -34.76 | -43.30 | -45.53 |
| 92 | 396.49 | 33.75 | 73.62 | -41.49 | -45.53 | -47.67 |
| 93 | 402.34 | 32.32 | 84.53 | 11.28 | -35.52 | -35.98 |
| 94 | 423.78 | 34.54 | 86.67 | 4.55 | -37.75 | -38.12 |
| 95 | 517.80 | 45.19 | 89.67 | -20.36 | -47.47 | -55.25 |
| 96 | 539.24 | 47.42 | 91.81 | -27.10 | -49.69 | -57.39 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 0.00 | 0.00 | 0.00 | -4.99 | -32.11 | -51.13 | -102.04 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 1011.59 | 438.95 | 314.68 | 223.21 | 143.94 | 73.20 | 120.33 |

强度计算应力比 =0.842

抗剪强度计算应力比 =0.346

平面内稳定计算最大应力对应组合号: 1, M=1011.59, N=85.81, M=76.91, N=-63.03

平面内稳定最大应力 (N/mm\*mm) =254.73

平面内稳定计算最大应力比 =0.835

临界弯矩Mcr(kN\*m) =2535.57

平面外稳定计算最大应力比 =0.984

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 =0.842 < 1.0

抗剪强度计算应力比 =0.346 < 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 =0.984 < 1.0

腹板高厚比 H0/TW=77.75 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =11.14 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0.00 | 9.19 | 19.82 | 31.65 | 44.41 | 57.77 | 71.34 |

最大挠度值 =71.34 最大挠度/梁跨度 =1/388.

斜梁坡度初始值: 1/15.15

变形后斜梁坡度最小值: 1/12.84

变形后斜梁坡度改变率 =0.180 < 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 | 555.78 | 47.10 | 103.79 | 22.31 | -40.79 | -46.76 |
| 2 | 385.74 | 32.64 | 72.55 | -38.12 | -44.42 | -46.60 |
| 3 | 413.03 | 33.43 | 85.60 | 7.92 | -36.63 | -37.04 |
| 4 | 528.49 | 46.31 | 90.74 | -23.72 | -48.58 | -56.32 |
| 5 | 517.21 | 43.83 | 96.53 | 22.90 | -37.30 | -42.95 |
| 6 | 347.17 | 29.37 | 65.29 | -37.53 | -40.93 | -42.79 |
| 7 | 374.46 | 30.16 | 78.34 | 8.51 | -33.14 | -33.23 |
| 8 | 489.92 | 43.04 | 83.49 | -23.14 | -45.09 | -52.51 |
| 9 | 300.93 | 23.49 | 58.83 | 4.52 | -25.76 | -30.16 |
| 10 | 291.84 | 21.43 | 53.41 | -12.06 | -23.71 | -28.10 |
| 11 | 345.76 | 30.10 | 67.11 | 3.64 | -32.37 | -34.68 |
| 12 | 336.80 | 28.06 | 61.72 | -12.95 | -30.33 | -32.63 |
| 13 | 262.36 | 20.22 | 51.57 | 5.11 | -22.27 | -26.35 |
| 14 | 253.26 | 18.17 | 46.15 | -11.47 | -20.22 | -24.29 |
| 15 | 307.18 | 26.84 | 59.86 | 4.22 | -28.88 | -30.87 |
| 16 | 298.22 | 24.80 | 54.46 | -12.36 | -26.84 | -28.82 |

--- 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 0.00 -22.90

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 555.78 319.73 235.68 166.26 106.23 52.77 38.12

强度计算荷载比 =0.46

平面内稳定计算荷载比 =0.46

平面外稳定计算荷载比 =0.45

无防护下钢构件最大升温(Ts): 1004.14℃ ,按临界温度法求得临界温度(Td): 590.06℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2074(m^2\*℃/w)

构件重量 (Kg)=751.00

风荷载作用下柱顶最大水平（X 向）位移:

节点( 2), 水平位移 dx=7.840(mm) =H /995.

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=3.137(mm) =H /2487.

梁的(恒+活)最大挠度:

梁( 4), 挠跨比 =1 /218.

风载作用下柱顶最大水平位移: H/995< 柱顶位移容许值: H/60

地震作用下柱顶最大水平位移: H/2487< 柱顶位移容许值: H/60

梁的(恒+活)最大挠跨比: 1/218< 梁的容许挠跨比: 1/180

所有钢柱的总重量 (Kg)=2321.

所有钢梁的总重量 (Kg)=4131.

钢梁与钢柱重量之和 (Kg)=6452.

**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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\CalcTemp\\荷载比图.T)



[图12-10 防火图](F:\\项目人\\大兵\\2025\\食用菌项目\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\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\\修改的施工图\\05原料车间\\原料车间\\GJ1\\CalcTemp\\平面外计算长度系数.T)