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 9分25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\*340\*340\*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\*340\*340\*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)\*260\*260\*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)\*340\*340\*8\*14\*14 |
| 8 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(800~500)\*340\*340\*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)\*300\*300\*6\*14\*14 |
| 11 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(500~700)\*285\*285\*6\*12\*12 |
| 12 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(700~500)\*285\*285\*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 | 170.0 | 200.0 | 38050.5 | 9171.6 | 117.5 |
| 2 | 90.0 | 100.0 | 2967.2 | 777.9 | 39.8 |
| 3 | 170.0 | 250.0 | 61487.9 | 9171.8 | 123.5 |
| 4 | 150.0 | 200.0 | 33876.8 | 6300.7 | 106.3 |
| 5 | 130.0 | 312.5 | 69481.5 | 3516.3 | 98.5 |
| 6 | 110.0 | 250.0 | 31944.3 | 1775.5 | 72.8 |
| 7 | 170.0 | 325.0 | 112328.4 | 9173.6 | 145.0 |
| 8 | 170.0 | 325.0 | 112328.4 | 9173.6 | 145.0 |
| 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 150.0 | 312.5 | 89049.9 | 6301.1 | 119.8 |
| 11 | 142.5 | 300.0 | 68685.6 | 4630.9 | 103.0 |
| 12 | 142.5 | 300.0 | 68685.6 | 4630.9 | 103.0 |

| 截面号 | ix (cm) | iy (cm) | W1x (cm3) | W2x (cm3) | W1y (cm3) | W2y (cm3) |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 18.0 | 8.8 | 1902.5 | 1902.5 | 539.5 | 539.5 |
| 2 | 8.6 | 4.4 | 296.7 | 296.7 | 86.4 | 86.4 |
| 3 | 22.3 | 8.6 | 2459.5 | 2459.5 | 539.5 | 539.5 |
| 4 | 17.9 | 7.7 | 1693.8 | 1693.8 | 420.0 | 420.0 |
| 5 | 26.6 | 6.0 | 2223.4 | 2223.4 | 270.5 | 270.5 |
| 6 | 20.9 | 4.9 | 1277.8 | 1277.8 | 161.4 | 161.4 |
| 7 | 27.8 | 8.0 | 3456.3 | 3456.3 | 539.6 | 539.6 |
| 8 | 27.8 | 8.0 | 3456.3 | 3456.3 | 539.6 | 539.6 |
| 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10 | 27.3 | 7.3 | 2849.6 | 2849.6 | 420.1 | 420.1 |
| 11 | 25.8 | 6.7 | 2289.5 | 2289.5 | 325.0 | 325.0 |
| 12 | 25.8 | 6.7 | 2289.5 | 2289.5 | 325.0 | 325.0 |

**防火材料信息**

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

**6. 荷载与效应组合**

## **1. 各工况荷载表**

**节点荷载**

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

**柱荷载**

| 工况 | 柱号 | 荷载类型 | 荷载值 | 荷载参数1 | 荷载参数2 |
| --- | --- | --- | --- | --- | --- |
| 左风1 | 1 | 1 | 0.91 | 0.00 | 0.00 |
| 3 | 1 | 1.95 | 0.00 | 0.00 |
| 4 | 1 | 5.41 | 0.00 | 0.00 |
| 5 | 1 | 5.41 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | -1.95 | 0.00 | 0.00 |
| 3 | 1 | -0.91 | 0.00 | 0.00 |
| 4 | 1 | -5.41 | 0.00 | 0.00 |
| 5 | 1 | -5.41 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 2.41 | 0.00 | 0.00 |
| 3 | 1 | 0.46 | 0.00 | 0.00 |
| 4 | 1 | 5.41 | 0.00 | 0.00 |
| 5 | 1 | 5.41 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | -0.46 | 0.00 | 0.00 |
| 3 | 1 | -2.41 | 0.00 | 0.00 |
| 4 | 1 | -5.41 | 0.00 | 0.00 |
| 5 | 1 | -5.41 | 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 | 4.05 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.05 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.05 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.05 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.05 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.05 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.05 | 0.00 | 0.00 | 0.00 |
| 活荷载 | 1 | 1 | 1 | 4.50 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.50 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.50 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.50 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.50 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.50 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.50 | 0.00 | 0.00 | 0.00 |
| 左风1 | 1 | 1 | 1 | -3.62 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.62 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.29 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.29 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.62 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.29 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.29 | 0.00 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | 1 | -2.29 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.29 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.62 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.62 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.29 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.62 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.62 | 0.00 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 1 | -2.12 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.12 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.79 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.79 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.12 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.79 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.79 | 0.00 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | 1 | -0.79 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.79 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.12 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.12 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.79 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.12 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.12 | 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 | 384.720 |
| 8 | 0.307 |
| 9 | 0.307 |

水平地震标准值作用底层剪力： 10.394

底层最小地震剪力(抗震规范5.2.5条): 3.083

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 | 0.542 |
| 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 | 384.720 |
| 8 | 0.307 |
| 9 | 0.307 |

水平地震标准值作用底层剪力： 10.394

底层最小地震剪力(抗震规范5.2.5条): 3.083

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 | 0.539 |
| 2 | 0.015 |
| 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 | 57.2 | -29.1 | -86.8 | -49.4 | 29.1 | -140.5 |
| 2 | 151.6 | -10.9 | -43.6 | -141.0 | 10.9 | -60.8 |
| 3 | 76.5 | 40.0 | 80.1 | -67.4 | -40.0 | 232.0 |
| 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 | -39.0 | 32.1 | 96.5 | 39.0 | -25.0 | 126.5 |
| 2 | -79.3 | 4.0 | 26.2 | 79.3 | -4.0 | 12.1 |
| 3 | -27.4 | 1.1 | 27.3 | 27.4 | 14.1 | -77.9 |
| 4 | 0.0 | 8.6 | 6.9 | -0.0 | -0.0 | 0.0 |
| 5 | 0.0 | 8.6 | 6.9 | -0.0 | 0.0 | 0.0 |
| 右风1 | 1 | -20.9 | -1.3 | 0.7 | 20.9 | -14.0 | 48.9 |
| 2 | -81.3 | 7.0 | 18.6 | 81.3 | -7.0 | 48.9 |
| 3 | -50.1 | -43.0 | -114.9 | 50.1 | 35.9 | -192.7 |
| 4 | 0.0 | -8.7 | -6.9 | -0.0 | -0.0 | -0.0 |
| 5 | -0.0 | -8.7 | -6.9 | 0.0 | -0.0 | 0.0 |
| 左风2 | 1 | -23.3 | 30.0 | 80.5 | 23.3 | -11.2 | 79.9 |
| 2 | -39.4 | 1.2 | 14.9 | 39.4 | -1.2 | -3.4 |
| 3 | -7.4 | 6.1 | 41.1 | 7.4 | -2.5 | -7.4 |
| 4 | -0.0 | 8.6 | 6.9 | 0.0 | 0.0 | -0.0 |
| 5 | -0.0 | 8.6 | 6.9 | 0.0 | 0.0 | -0.0 |
| 右风2 | 1 | -5.2 | -3.5 | -15.4 | 5.2 | -0.1 | 2.2 |
| 2 | -41.4 | 4.2 | 7.3 | 41.4 | -4.2 | 33.3 |
| 3 | -30.0 | -38.0 | -101.2 | 30.0 | 19.2 | -122.1 |
| 4 | 0.0 | -8.6 | -6.9 | -0.0 | -0.0 | 0.0 |
| 5 | -0.0 | -8.6 | -6.9 | 0.0 | 0.0 | -0.0 |
| 左地震 | 1 | -0.7 | 3.0 | 15.1 | 0.7 | -3.0 | 8.4 |
| 2 | -0.1 | 3.3 | 15.9 | 0.1 | -3.3 | 15.5 |
| 3 | 0.8 | 4.6 | 25.3 | -0.8 | -4.6 | 10.9 |
| 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 | -3.0 | -15.2 | -0.7 | 3.0 | -8.4 |
| 2 | 0.1 | -3.3 | -15.9 | -0.1 | 3.3 | -15.6 |
| 3 | -0.8 | -4.7 | -25.4 | 0.8 | 4.7 | -11.0 |
| 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 |

**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 | 32.8 | 46.4 | 140.7 | -30.6 | -17.2 | 45.9 |
| 2 | 30.6 | 17.2 | -45.9 | -26.3 | 36.4 | -63.0 |
| 3 | 41.8 | -27.4 | -93.3 | -44.2 | 64.1 | -232.2 |
| 4 | 39.6 | 7.1 | -162.5 | -41.9 | 27.3 | 93.3 |
| 5 | 26.3 | -36.4 | 63.0 | -23.9 | 67.0 | -355.8 |
| 6 | 37.4 | 41.5 | 4.3 | -39.6 | -7.1 | 162.5 |
| 7 | 34.9 | 78.6 | 416.6 | -37.4 | -41.5 | -4.3 |
| 左风1 | 1 | -19.3 | -37.6 | -133.4 | 19.3 | 16.4 | -25.1 |
| 2 | -19.4 | -16.3 | 25.1 | 19.4 | -24.7 | 22.2 |
| 3 | -24.4 | 9.6 | 55.5 | 24.4 | -25.9 | 71.0 |
| 4 | -24.5 | -6.1 | 67.4 | 24.5 | -9.6 | -55.5 |
| 5 | -19.4 | 24.7 | -22.2 | 19.4 | -45.2 | 220.1 |
| 6 | -24.5 | -21.8 | -28.5 | 24.5 | 6.1 | -67.4 |
| 7 | -24.5 | -37.5 | -232.2 | 24.5 | 21.8 | 28.5 |
| 右风1 | 1 | -24.2 | -19.1 | -41.9 | 24.2 | 5.7 | -30.8 |
| 2 | -24.2 | -5.6 | 30.8 | 24.2 | -20.3 | 52.7 |
| 3 | -30.4 | 22.5 | 52.1 | 30.4 | -48.3 | 199.6 |
| 4 | -30.4 | -2.4 | 120.7 | 30.4 | -22.4 | -52.1 |
| 5 | -24.2 | 20.3 | -52.7 | 24.2 | -33.3 | 204.9 |
| 6 | -30.4 | -27.3 | 18.8 | 30.4 | 2.4 | -120.7 |
| 7 | -30.4 | -52.1 | -253.7 | 30.4 | 27.3 | -18.8 |
| 左风2 | 1 | -4.3 | -23.1 | -86.9 | 4.3 | 10.6 | -12.1 |
| 2 | -4.3 | -10.6 | 12.1 | 4.3 | -13.4 | 3.7 |
| 3 | -6.6 | 1.4 | 29.3 | 6.6 | -7.0 | 0.5 |
| 4 | -6.6 | -4.1 | 20.0 | 6.6 | -1.4 | -29.3 |
| 5 | -4.3 | 13.4 | -3.7 | 4.3 | -25.4 | 113.7 |
| 6 | -6.6 | -9.5 | -26.5 | 6.6 | 4.1 | -20.0 |
| 7 | -6.6 | -14.9 | -110.3 | 6.6 | 9.5 | 26.5 |
| 右风2 | 1 | -9.1 | -4.6 | 4.7 | 9.1 | -0.1 | -17.8 |
| 2 | -9.1 | 0.1 | 17.8 | 9.1 | -9.1 | 34.2 |
| 3 | -12.5 | 14.2 | 25.8 | 12.5 | -29.3 | 129.0 |
| 4 | -12.5 | -0.4 | 73.3 | 12.5 | -14.2 | -25.8 |
| 5 | -9.1 | 9.1 | -34.2 | 9.1 | -13.5 | 98.3 |
| 6 | -12.5 | -14.9 | 20.8 | 12.5 | 0.4 | -73.3 |
| 7 | -12.5 | -29.5 | -131.6 | 12.5 | 14.9 | -20.8 |
| 左地震 | 1 | -1.7 | -0.6 | -8.4 | 1.7 | 0.6 | 5.0 |
| 2 | -0.3 | -0.7 | -5.0 | 0.3 | 0.7 | -2.7 |
| 3 | 3.3 | -0.6 | 6.9 | -3.3 | 0.6 | -10.9 |
| 4 | 1.9 | -0.6 | 2.4 | -1.9 | 0.6 | -6.9 |
| 5 | 1.0 | -0.8 | 2.7 | -1.0 | 0.8 | -7.2 |
| 6 | 0.6 | -0.7 | -2.6 | -0.6 | 0.7 | -2.4 |
| 7 | -0.8 | -0.8 | -8.3 | 0.8 | 0.8 | 2.6 |
| 右地震 | 1 | 1.7 | 0.6 | 8.4 | -1.7 | -0.6 | -5.0 |
| 2 | 0.3 | 0.7 | 5.0 | -0.3 | -0.7 | 2.7 |
| 3 | -3.3 | 0.6 | -6.9 | 3.3 | -0.6 | 11.0 |
| 4 | -2.0 | 0.7 | -2.5 | 2.0 | -0.7 | 6.9 |
| 5 | -1.0 | 0.8 | -2.7 | 1.0 | -0.8 | 7.2 |
| 6 | -0.6 | 0.7 | 2.6 | 0.6 | -0.7 | 2.5 |
| 7 | 0.8 | 0.8 | 8.3 | -0.8 | -0.8 | -2.6 |

**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 | -4.81 | 0.19 |
| 2 | -5.74 | 0.22 |
| 3 | -3.10 | 23.54 |
| 4 | -8.40 | 43.84 |
| 5 | -9.14 | 57.16 |
| 6 | -4.52 | 8.44 |
| 7 | -7.14 | 28.66 |
| 8 | -0.01 | 0.19 |
| 9 | -13.22 | 0.22 |
| 10 | -5.20 | 0.58 |

**活荷载工况下节点位移（mm）**

| 节点号 | X向位移 | Y向位移 |
| --- | --- | --- |
| 1 | -3.95 | 0.18 |
| 2 | -4.80 | 0.19 |
| 3 | -2.29 | 37.97 |
| 4 | -7.12 | 49.97 |
| 5 | -7.75 | 70.26 |
| 6 | -3.60 | 30.38 |
| 7 | -5.97 | 43.86 |
| 8 | 0.73 | 0.18 |
| 9 | -11.32 | 0.19 |
| 10 | -4.32 | 0.49 |

**节点侧向（水平向）位移(mm)**

| 工况 | 节点 | δx | 节点 | δx |
| --- | --- | --- | --- | --- |
| 左风1 | 1 | 7.64 | 2 | 8.23 |
| 3 | 6.19 | 4 | 9.45 |
| 5 | 9.50 | 6 | 6.84 |
| 7 | 8.43 | 8 | 4.85 |
| 9 | 13.16 | 10 | 7.92 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 右风1 | 1 | -2.59 | 2 | -1.87 |
| 3 | -3.30 | 4 | -0.07 |
| 5 | 0.70 | 6 | -2.17 |
| 7 | -0.60 | 8 | -5.86 |
| 9 | 1.69 | 10 | -2.29 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 左风2 | 1 | 6.45 | 2 | 6.62 |
| 3 | 5.51 | 4 | 7.10 |
| 5 | 6.95 | 6 | 5.70 |
| 7 | 6.48 | 8 | 5.04 |
| 9 | 9.51 | 10 | 6.53 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 右风2 | 1 | -3.78 | 2 | -3.49 |
| 3 | -3.98 | 4 | -2.42 |
| 5 | -1.86 | 6 | -3.32 |
| 7 | -2.55 | 8 | -5.67 |
| 9 | -1.98 | 10 | -3.67 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 左地震 | 1 | 3.18 | 2 | 3.17 |
| 3 | 3.30 | 4 | 3.31 |
| 5 | 3.28 | 6 | 3.20 |
| 7 | 3.21 | 8 | 3.79 |
| 9 | 3.88 | 10 | 3.18 |
| 11 | 0.00 | 12 | 0.00 |
| 13 | 0.00 |  |  |
| 右地震 | 1 | -3.20 | 2 | -3.19 |
| 3 | -3.32 | 4 | -3.33 |
| 5 | -3.30 | 6 | -3.22 |
| 7 | -3.23 | 8 | -3.81 |
| 9 | -3.90 | 10 | -3.20 |
| 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 | 0.89 | 0.23 | 0.89 | 0.81 | 62.00 | 10.50 | 64.03 | 101.32 | 651.7 | 通过 |
| 2 | 0.75 | 0.18 | 0.81 | 0.75 | 62.00 | 11.93 | 66.21 | 108.76 | 886.4 | 通过 |
| 3 | 0.95 | 0.32 | 0.94 | 0.94 | 78.67 | 11.93 | 53.76 | 90.52 | 757.1 | 通过 |
| 4 | 0.12 | 0.07 | 0.12 | 0.06 | 30.67 | 10.88 | 37.96 | 36.21 | 51.2 | 通过 |
| 5 | 0.12 | 0.07 | 0.12 | 0.06 | 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 | 0.54 | 0.52 | 0.55 | 0.49 | 100.17 | 10.58 | 453.5 | 通过 |
| 2 | 0.69 | 0.29 | 0.76 | 0.53 | 80.00 | 10.70 | 647.8 | 通过 |
| 3 | 0.66 | 0.69 | 0.68 | 0.58 | 99.50 | 10.50 | 669.2 | 通过 |
| 4 | 0.69 | 0.29 | 0.71 | 0.80 | 96.00 | 11.63 | 554.8 | 通过 |
| 5 | 0.75 | 0.32 | 0.73 | 0.86 | 77.75 | 11.86 | 645.0 | 通过 |
| 6 | 0.62 | 0.39 | 0.66 | 0.74 | 96.00 | 11.63 | 554.8 | 通过 |
| 7 | 0.87 | 0.38 | 0.86 | 0.99 | 77.75 | 11.86 | 781.2 | 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=11.43, Ly=7.80; 长细比：λx=64.0,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 | -105.60 | 71.91 | -34.98 | -147.19 | -58.16 | 32.50 |
| 2 | -239.40 | 144.57 | -81.44 | -415.91 | -137.98 | 83.92 |
| 3 | -214.41 | 149.12 | -80.79 | -415.75 | -138.96 | 80.79 |
| 4 | -130.58 | 67.36 | -35.63 | -147.35 | -57.19 | 35.63 |
| 5 | -79.56 | 54.76 | -26.24 | -105.05 | -43.36 | 23.76 |
| 6 | -213.36 | 127.41 | -72.70 | -373.77 | -123.17 | 75.18 |
| 7 | -188.38 | 131.97 | -72.05 | -373.60 | -124.15 | 72.05 |
| 8 | -104.54 | 50.20 | -26.89 | -105.21 | -42.38 | 26.89 |
| 9 | 31.87 | 15.85 | 10.35 | 7.08 | -5.68 | 0.36 |
| 10 | -111.81 | 42.96 | -39.76 | -109.30 | -32.79 | 16.94 |
| 11 | 7.93 | 39.31 | 7.09 | -62.71 | -29.15 | 21.13 |
| 12 | -135.89 | 66.47 | -43.08 | -179.25 | -56.31 | 37.73 |
| 13 | 57.90 | -1.31 | 19.09 | 49.23 | 9.13 | -8.38 |
| 14 | -85.77 | 25.80 | -31.01 | -67.16 | -17.98 | 8.20 |
| 15 | 33.97 | 22.16 | 15.83 | -20.57 | -14.34 | 12.39 |
| 16 | -109.85 | 49.32 | -34.34 | -137.11 | -41.50 | 28.99 |
| 17 | -18.78 | 36.82 | -6.05 | -33.37 | -23.07 | 9.99 |
| 18 | -104.98 | 53.09 | -36.11 | -103.21 | -39.34 | 19.94 |
| 19 | -33.14 | 50.90 | -8.00 | -75.25 | -37.15 | 22.45 |
| 20 | -119.43 | 67.19 | -38.10 | -145.17 | -53.45 | 32.41 |
| 21 | -152.58 | 109.47 | -52.51 | -302.09 | -102.89 | 61.41 |
| 22 | -238.78 | 125.74 | -82.57 | -371.92 | -119.16 | 71.36 |
| 23 | -166.94 | 123.55 | -54.46 | -343.97 | -116.97 | 73.87 |
| 24 | -253.23 | 139.85 | -84.56 | -413.89 | -133.27 | 83.83 |
| 25 | -127.59 | 114.03 | -51.86 | -301.93 | -103.86 | 58.28 |
| 26 | -213.80 | 130.30 | -81.92 | -371.76 | -120.13 | 68.23 |
| 27 | -141.95 | 128.11 | -53.81 | -343.80 | -117.94 | 70.74 |
| 28 | -228.25 | 144.41 | -83.91 | -413.73 | -134.24 | 80.70 |
| 29 | -43.76 | 32.26 | -6.70 | -33.54 | -22.10 | 13.12 |
| 30 | -129.97 | 48.53 | -36.76 | -103.37 | -38.36 | 23.07 |
| 31 | -58.12 | 46.34 | -8.65 | -75.41 | -36.18 | 25.58 |
| 32 | -144.42 | 62.64 | -38.75 | -145.34 | -52.47 | 35.54 |
| 33 | 7.26 | 19.66 | 2.69 | 8.77 | -8.26 | 1.25 |
| 34 | -78.95 | 35.93 | -27.37 | -61.06 | -24.53 | 11.20 |
| 35 | -7.10 | 33.74 | 0.74 | -33.11 | -22.34 | 13.71 |
| 36 | -93.40 | 50.04 | -29.36 | -103.03 | -38.64 | 23.67 |
| 37 | -126.54 | 92.32 | -43.77 | -259.95 | -88.08 | 52.67 |
| 38 | -212.74 | 108.59 | -73.83 | -329.78 | -104.35 | 62.62 |
| 39 | -140.90 | 106.40 | -45.72 | -301.82 | -102.16 | 65.13 |
| 40 | -227.19 | 122.70 | -75.82 | -371.75 | -118.46 | 75.09 |
| 41 | -101.56 | 96.88 | -43.11 | -259.78 | -89.06 | 49.54 |
| 42 | -187.76 | 113.14 | -73.18 | -329.62 | -105.32 | 59.49 |
| 43 | -115.92 | 110.96 | -45.07 | -301.66 | -103.14 | 62.00 |
| 44 | -202.21 | 127.25 | -75.17 | -371.58 | -119.43 | 71.96 |
| 45 | -17.72 | 15.11 | 2.04 | 8.61 | -7.29 | 4.38 |
| 46 | -103.93 | 31.37 | -28.02 | -61.23 | -23.56 | 14.33 |
| 47 | -32.08 | 29.19 | 0.09 | -33.27 | -21.37 | 16.84 |
| 48 | -118.38 | 45.48 | -30.01 | -103.19 | -37.66 | 26.80 |
| 49 | 36.93 | 14.15 | 12.37 | 31.88 | -1.48 | -3.41 |
| 50 | -106.74 | 41.26 | -37.73 | -84.51 | -28.59 | 13.18 |
| 51 | 13.00 | 37.62 | 9.11 | -37.91 | -24.94 | 17.37 |
| 52 | -130.83 | 64.78 | -41.05 | -154.45 | -52.10 | 33.96 |
| 53 | -56.73 | 65.01 | -20.15 | -156.22 | -57.35 | 32.59 |
| 54 | -200.40 | 92.12 | -70.25 | -272.61 | -84.46 | 49.17 |
| 55 | -80.66 | 88.48 | -23.41 | -226.02 | -80.82 | 53.36 |
| 56 | -224.48 | 115.63 | -73.57 | -342.55 | -107.98 | 69.96 |
| 57 | -39.24 | 68.20 | -19.69 | -156.11 | -58.03 | 30.40 |
| 58 | -182.91 | 95.31 | -69.79 | -272.50 | -85.14 | 46.98 |
| 59 | -63.17 | 91.66 | -22.95 | -225.90 | -81.50 | 51.17 |
| 60 | -207.00 | 118.82 | -73.12 | -342.44 | -108.66 | 67.76 |
| 61 | 19.44 | 10.96 | 11.92 | 31.77 | -0.79 | -1.21 |
| 62 | -124.23 | 38.07 | -38.18 | -84.62 | -27.91 | 15.37 |
| 63 | -4.49 | 34.43 | 8.66 | -38.03 | -24.26 | 19.56 |
| 64 | -148.31 | 61.59 | -41.51 | -154.57 | -51.42 | 36.16 |
| 65 | 62.97 | -3.00 | 21.11 | 74.02 | 13.33 | -12.15 |
| 66 | -80.71 | 24.11 | -28.99 | -42.37 | -13.78 | 4.44 |
| 67 | 39.03 | 20.46 | 17.85 | 4.23 | -10.14 | 8.63 |
| 68 | -104.79 | 47.62 | -32.31 | -112.31 | -37.30 | 25.22 |
| 69 | -30.69 | 47.85 | -11.41 | -114.08 | -42.54 | 23.85 |
| 70 | -174.36 | 74.97 | -61.51 | -230.47 | -69.65 | 40.43 |
| 71 | -54.62 | 71.32 | -14.67 | -183.87 | -66.01 | 44.62 |
| 72 | -198.44 | 98.48 | -64.83 | -300.41 | -93.17 | 61.22 |
| 73 | -13.20 | 51.04 | -10.95 | -113.97 | -43.22 | 21.65 |
| 74 | -156.88 | 78.16 | -61.05 | -230.35 | -70.34 | 38.24 |
| 75 | -37.13 | 74.51 | -14.21 | -183.76 | -66.69 | 42.43 |
| 76 | -180.96 | 101.67 | -64.38 | -300.30 | -93.85 | 59.02 |
| 77 | 45.48 | -6.19 | 20.66 | 73.91 | 14.01 | -9.95 |
| 78 | -98.19 | 20.92 | -29.44 | -42.48 | -13.10 | 6.63 |
| 79 | 21.55 | 17.27 | 17.40 | 4.11 | -9.45 | 10.82 |
| 80 | -122.28 | 44.43 | -32.77 | -112.43 | -36.61 | 27.41 |
| 81 | -88.50 | 72.30 | -32.40 | -155.53 | -60.58 | 31.33 |
| 82 | -131.01 | 74.28 | -40.87 | -179.07 | -62.56 | 39.79 |
| 83 | -146.48 | 103.78 | -52.53 | -271.97 | -95.17 | 53.61 |
| 84 | -188.99 | 105.76 | -61.00 | -295.51 | -97.15 | 62.08 |
| 85 | -135.66 | 105.75 | -52.25 | -271.90 | -95.59 | 52.25 |
| 86 | -178.17 | 107.74 | -60.72 | -295.44 | -97.57 | 60.72 |
| 87 | -99.33 | 70.32 | -32.68 | -155.60 | -60.16 | 32.68 |
| 88 | -141.84 | 72.30 | -41.15 | -179.14 | -62.14 | 41.15 |
| 89 | -63.19 | 55.38 | -23.95 | -116.93 | -46.37 | 23.12 |
| 90 | -105.70 | 57.37 | -32.42 | -140.47 | -48.35 | 31.59 |
| 91 | -107.79 | 79.60 | -39.44 | -206.50 | -72.98 | 40.26 |
| 92 | -150.30 | 81.59 | -47.90 | -230.04 | -74.96 | 48.73 |
| 93 | -99.46 | 81.12 | -39.22 | -206.45 | -73.30 | 39.22 |
| 94 | -141.97 | 83.10 | -47.69 | -229.99 | -75.28 | 47.69 |
| 95 | -71.52 | 53.86 | -24.17 | -116.98 | -46.05 | 24.17 |
| 96 | -114.03 | 55.85 | -32.63 | -140.52 | -48.03 | 32.63 |

强度计算控制组合号: 2, M=-239.40, N=144.57, M=-415.91, N=-137.98

强度计算应力比 =0.885

抗剪强度计算控制组合号: 24, V=-84.56

抗剪强度计算应力比 =0.233

平面内稳定计算最大应力对应组合号: 3, M=-214.41, N=149.12, M=-415.75, N=-138.96

平面内稳定计算最大应力 (N/mm\*mm) =270.86

平面内稳定计算最大应力比 =0.888

临界弯矩Mcr(kN\*m) =1393.50

平面外稳定计算最大应力比 =0.809

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 =0.885 < 1.0

抗剪强度计算应力比 =0.233 < 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 | -84.38 | 56.37 | -28.17 | -128.66 | -47.36 | 27.34 |
| 2 | -128.98 | 80.59 | -43.66 | -218.24 | -73.97 | 44.48 |
| 3 | -120.65 | 82.11 | -43.44 | -218.18 | -74.29 | 43.44 |
| 4 | -92.71 | 54.85 | -28.39 | -128.72 | -47.03 | 28.39 |
| 5 | -75.70 | 50.65 | -25.26 | -114.62 | -42.42 | 24.43 |
| 6 | -120.30 | 74.87 | -40.74 | -204.19 | -69.03 | 41.57 |
| 7 | -111.98 | 76.39 | -40.53 | -204.14 | -69.35 | 40.53 |
| 8 | -84.03 | 49.14 | -25.47 | -114.67 | -42.10 | 25.47 |
| 9 | -48.21 | 41.58 | -16.28 | -89.89 | -33.76 | 19.13 |
| 10 | -86.52 | 48.81 | -29.64 | -120.92 | -40.99 | 23.55 |
| 11 | -54.59 | 47.84 | -17.15 | -108.50 | -40.02 | 24.67 |
| 12 | -92.94 | 55.08 | -30.52 | -139.57 | -47.26 | 29.10 |
| 13 | -39.53 | 35.87 | -13.36 | -75.84 | -28.83 | 16.22 |
| 14 | -77.84 | 43.10 | -26.72 | -106.88 | -36.06 | 20.64 |
| 15 | -45.91 | 42.12 | -14.23 | -94.45 | -35.09 | 21.76 |
| 16 | -84.26 | 49.37 | -27.61 | -125.53 | -42.33 | 26.18 |

防火设计控制的偶然组合号: 3, M=-120.65, N=82.11, M=-218.18, N=-74.29

强度计算荷载比 =0.45

平面内稳定计算荷载比 =0.46

平面外稳定计算荷载比 =0.33

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): 589.75℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.3891(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=66.2,λy=108.8

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=340, B2=340, 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: 182.777405(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 81.66 | 283.14 | 24.55 | 154.20 | -269.32 | -24.55 |
| 2 | -246.49 | 296.61 | -65.41 | -381.98 | -282.78 | 65.41 |
| 3 | -108.09 | 382.67 | -26.73 | -148.73 | -368.84 | 26.73 |
| 4 | -56.74 | 197.09 | -14.13 | -79.04 | -183.26 | 14.13 |
| 5 | 94.76 | 237.66 | 27.81 | 172.44 | -227.03 | -27.81 |
| 6 | -233.40 | 251.13 | -62.15 | -363.74 | -240.49 | 62.15 |
| 7 | -94.99 | 337.19 | -23.47 | -130.49 | -326.55 | 23.47 |
| 8 | -43.65 | 151.60 | -10.87 | -60.80 | -140.97 | 10.87 |
| 9 | -17.46 | 78.12 | -8.16 | -60.96 | -64.29 | 8.16 |
| 10 | -28.83 | 75.13 | -3.60 | -5.75 | -61.30 | 3.60 |
| 11 | -34.36 | 137.92 | -12.34 | -84.21 | -124.09 | 12.34 |
| 12 | -45.77 | 135.04 | -7.78 | -29.02 | -121.21 | 7.78 |
| 13 | -4.37 | 32.64 | -4.90 | -42.72 | -22.00 | 4.90 |
| 14 | -15.74 | 29.65 | -0.34 | 12.49 | -19.01 | 0.34 |
| 15 | -21.27 | 92.43 | -9.08 | -65.97 | -81.80 | 9.08 |
| 16 | -32.67 | 89.56 | -4.52 | -10.78 | -78.92 | 4.52 |
| 17 | 105.23 | 211.77 | 28.13 | 165.05 | -197.94 | -28.13 |
| 18 | 98.41 | 209.97 | 30.87 | 198.18 | -196.14 | -30.87 |
| 19 | 95.09 | 247.64 | 25.62 | 151.10 | -233.82 | -25.62 |
| 20 | 88.25 | 245.92 | 28.36 | 184.22 | -232.09 | -28.36 |
| 21 | -222.92 | 225.23 | -61.83 | -371.13 | -211.40 | 61.83 |
| 22 | -229.74 | 223.43 | -59.09 | -338.01 | -209.61 | 59.09 |
| 23 | -233.06 | 261.10 | -64.34 | -385.08 | -247.28 | 64.34 |
| 24 | -239.90 | 259.38 | -61.60 | -351.97 | -245.55 | 61.60 |
| 25 | -84.52 | 311.29 | -23.15 | -137.89 | -297.46 | 23.15 |
| 26 | -91.34 | 309.49 | -20.41 | -104.76 | -295.67 | 20.41 |
| 27 | -94.66 | 347.16 | -25.65 | -151.83 | -333.34 | 25.65 |
| 28 | -101.50 | 345.44 | -22.92 | -118.72 | -331.61 | 22.92 |
| 29 | -33.17 | 125.71 | -10.55 | -68.20 | -111.88 | 10.55 |
| 30 | -40.00 | 123.91 | -7.81 | -35.07 | -110.08 | 7.81 |
| 31 | -43.31 | 161.58 | -13.06 | -82.14 | -147.76 | 13.06 |
| 32 | -50.16 | 159.86 | -10.32 | -49.03 | -146.03 | 10.32 |
| 33 | 118.33 | 166.29 | 31.39 | 183.29 | -155.65 | -31.39 |
| 34 | 111.50 | 164.49 | 34.13 | 216.42 | -153.85 | -34.13 |
| 35 | 108.19 | 202.16 | 28.89 | 169.35 | -191.53 | -28.89 |
| 36 | 101.34 | 200.44 | 31.62 | 202.46 | -189.80 | -31.62 |
| 37 | -209.83 | 179.75 | -58.57 | -352.89 | -169.11 | 58.57 |
| 38 | -216.65 | 177.95 | -55.83 | -319.77 | -167.32 | 55.83 |
| 39 | -219.97 | 215.62 | -61.07 | -366.84 | -204.99 | 61.07 |
| 40 | -226.81 | 213.90 | -58.34 | -333.73 | -203.26 | 58.34 |
| 41 | -71.42 | 265.81 | -19.89 | -119.64 | -255.17 | 19.89 |
| 42 | -78.24 | 264.01 | -17.15 | -86.52 | -253.38 | 17.15 |
| 43 | -81.56 | 301.68 | -22.39 | -133.59 | -291.05 | 22.39 |
| 44 | -88.40 | 299.96 | -19.66 | -100.48 | -289.32 | 19.66 |
| 45 | -20.08 | 80.23 | -7.29 | -49.96 | -69.59 | 7.29 |
| 46 | -26.90 | 78.43 | -4.55 | -16.83 | -67.79 | 4.55 |
| 47 | -30.22 | 116.10 | -9.80 | -63.90 | -105.47 | 9.80 |
| 48 | -37.06 | 114.38 | -7.06 | -30.79 | -103.74 | 7.06 |
| 49 | 79.42 | 138.36 | 18.91 | 102.31 | -124.54 | -18.91 |
| 50 | 68.05 | 135.37 | 23.48 | 157.52 | -121.54 | -23.48 |
| 51 | 62.52 | 198.16 | 14.74 | 79.06 | -184.33 | -14.74 |
| 52 | 51.12 | 195.28 | 19.29 | 134.25 | -181.45 | -19.29 |
| 53 | -150.28 | 147.79 | -44.06 | -273.02 | -133.96 | 44.06 |
| 54 | -161.65 | 144.79 | -39.49 | -217.81 | -130.97 | 39.49 |
| 55 | -167.18 | 207.58 | -48.24 | -296.26 | -193.75 | 48.24 |
| 56 | -178.59 | 204.70 | -43.68 | -241.08 | -190.88 | 43.68 |
| 57 | -53.40 | 208.03 | -16.98 | -109.75 | -194.20 | 16.98 |
| 58 | -64.77 | 205.04 | -12.42 | -54.54 | -191.21 | 12.42 |
| 59 | -70.30 | 267.82 | -21.16 | -132.99 | -253.99 | 21.16 |
| 60 | -81.71 | 264.94 | -16.60 | -77.81 | -251.12 | 16.60 |
| 61 | -17.46 | 78.12 | -8.16 | -60.96 | -64.29 | 8.16 |
| 62 | -28.83 | 75.13 | -3.60 | -5.75 | -61.30 | 3.60 |
| 63 | -34.36 | 137.92 | -12.34 | -84.21 | -124.09 | 12.34 |
| 64 | -45.77 | 135.04 | -7.78 | -29.02 | -121.21 | 7.78 |
| 65 | 92.52 | 92.88 | 22.18 | 120.55 | -82.25 | -22.18 |
| 66 | 81.15 | 89.89 | 26.74 | 175.76 | -79.25 | -26.74 |
| 67 | 75.62 | 152.68 | 18.00 | 97.31 | -142.04 | -18.00 |
| 68 | 64.21 | 149.80 | 22.55 | 152.49 | -139.16 | -22.55 |
| 69 | -137.19 | 102.31 | -40.80 | -254.78 | -91.67 | 40.80 |
| 70 | -148.56 | 99.31 | -36.23 | -199.57 | -88.68 | 36.23 |
| 71 | -154.09 | 162.10 | -44.97 | -278.02 | -151.46 | 44.97 |
| 72 | -165.49 | 159.22 | -40.42 | -222.84 | -148.59 | 40.42 |
| 73 | -40.31 | 162.55 | -13.72 | -91.51 | -151.91 | 13.72 |
| 74 | -51.68 | 159.55 | -9.16 | -36.29 | -148.92 | 9.16 |
| 75 | -57.21 | 222.34 | -17.90 | -114.75 | -211.70 | 17.90 |
| 76 | -68.61 | 219.46 | -13.34 | -59.57 | -208.83 | 13.34 |
| 77 | -4.37 | 32.64 | -4.90 | -42.72 | -22.00 | 4.90 |
| 78 | -15.74 | 29.65 | -0.34 | 12.49 | -19.01 | 0.34 |
| 79 | -21.27 | 92.43 | -9.08 | -65.97 | -81.80 | 9.08 |
| 80 | -32.67 | 89.56 | -4.52 | -10.78 | -78.92 | 4.52 |
| 81 | 25.43 | 234.28 | 7.20 | 43.72 | -220.46 | -7.20 |
| 82 | -19.09 | 234.47 | -1.96 | 0.21 | -220.65 | 1.96 |
| 83 | -116.77 | 240.12 | -31.79 | -188.62 | -226.29 | 31.79 |
| 84 | -161.29 | 240.31 | -40.95 | -232.13 | -226.48 | 40.95 |
| 85 | -56.79 | 277.41 | -15.02 | -87.55 | -263.58 | 15.02 |
| 86 | -101.32 | 277.60 | -24.19 | -131.06 | -263.77 | 24.19 |
| 87 | -34.54 | 196.99 | -9.56 | -57.35 | -183.16 | 9.56 |
| 88 | -79.07 | 197.18 | -18.73 | -100.86 | -183.35 | 18.73 |
| 89 | 24.69 | 180.20 | 6.59 | 38.64 | -169.56 | -6.59 |
| 90 | -19.84 | 180.39 | -2.57 | -4.87 | -169.75 | 2.57 |
| 91 | -84.70 | 184.68 | -23.40 | -140.09 | -174.05 | 23.40 |
| 92 | -129.22 | 184.87 | -32.56 | -183.60 | -174.24 | 32.56 |
| 93 | -38.56 | 213.37 | -10.50 | -62.34 | -202.73 | 10.50 |
| 94 | -83.09 | 213.56 | -19.66 | -105.85 | -202.92 | 19.66 |
| 95 | -21.45 | 151.51 | -6.30 | -39.11 | -140.87 | 6.30 |
| 96 | -65.97 | 151.70 | -15.47 | -82.62 | -141.06 | 15.47 |

强度计算控制组合号: 2, M=-246.49, N=296.61, M=-381.98, N=-282.78

强度计算应力比 =0.752

抗剪强度计算控制组合号: 2, V=-65.41

抗剪强度计算应力比 =0.180

平面内稳定计算最大应力对应组合号: 2, M=-246.49, N=296.61, M=-381.98, N=-282.78

平面内稳定计算最大应力 (N/mm\*mm) =247.22

平面内稳定计算最大应力比 =0.811

临界弯矩Mcr(kN\*m) =1388.93

平面外稳定计算最大应力比 =0.751

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 =0.752 < 1.0

抗剪强度计算应力比 =0.180 < 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 =11.93 < [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=109. ≤ [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 | 2.49 | 180.29 | 2.02 | 16.95 | -169.65 | -2.02 |
| 2 | -106.90 | 184.78 | -27.96 | -161.78 | -174.14 | 27.96 |
| 3 | -60.76 | 213.46 | -15.07 | -84.03 | -202.83 | 15.07 |
| 4 | -43.65 | 151.60 | -10.87 | -60.80 | -140.97 | 10.87 |
| 5 | 6.85 | 165.13 | 3.11 | 23.03 | -155.56 | -3.11 |
| 6 | -102.53 | 169.62 | -26.88 | -155.70 | -160.04 | 26.88 |
| 7 | -56.40 | 198.30 | -13.98 | -77.95 | -188.73 | 13.98 |
| 8 | -39.28 | 136.44 | -9.78 | -54.72 | -126.87 | 9.78 |
| 9 | -33.17 | 119.88 | -9.28 | -55.98 | -109.24 | 9.28 |
| 10 | -36.21 | 119.08 | -8.06 | -41.26 | -108.45 | 8.06 |
| 11 | -37.68 | 135.83 | -10.39 | -62.18 | -125.19 | 10.39 |
| 12 | -40.72 | 135.06 | -9.18 | -47.46 | -124.42 | 9.18 |
| 13 | -28.81 | 104.72 | -8.19 | -49.90 | -95.15 | 8.19 |
| 14 | -31.84 | 103.92 | -6.98 | -35.18 | -94.35 | 6.98 |
| 15 | -33.31 | 120.67 | -9.31 | -56.10 | -111.09 | 9.31 |
| 16 | -36.36 | 119.90 | -8.09 | -41.38 | -110.32 | 8.09 |

防火设计控制的偶然组合号: 2, M=-106.90, N=184.78, M=-161.78, N=-174.14

强度计算荷载比 =0.31

平面内稳定计算荷载比 =0.36

平面外稳定计算荷载比 =0.29

无防护下钢构件最大升温(Ts): 1081.51℃ ,按临界温度法求得临界温度(Td): 627.38℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.3517(m^2\*℃/w)

构件重量 (Kg)=886.37

**3. 钢 柱 3
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=12.00, Ly=7.80; 长细比：λx=53.8,λy=90.5

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=340, B2=340, 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: 190.090668(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 219.40 | 189.23 | 107.80 | 646.22 | -181.71 | -107.89 |
| 2 | 97.40 | 97.74 | 49.48 | 263.81 | -81.63 | -49.39 |
| 3 | 195.33 | 193.52 | 107.89 | 646.22 | -181.71 | -107.89 |
| 4 | 121.46 | 93.44 | 49.39 | 263.81 | -81.63 | -49.39 |
| 5 | 195.36 | 166.27 | 95.80 | 576.64 | -161.48 | -95.89 |
| 6 | 73.37 | 74.78 | 37.48 | 194.22 | -61.40 | -37.39 |
| 7 | 171.30 | 170.57 | 95.89 | 576.64 | -161.48 | -95.89 |
| 8 | 97.43 | 70.49 | 37.39 | 194.22 | -61.40 | -37.39 |
| 9 | 145.15 | 58.35 | 53.72 | 184.71 | -46.54 | -30.86 |
| 10 | -68.28 | 24.34 | -12.47 | 12.55 | -12.53 | 1.82 |
| 11 | 165.80 | 88.37 | 61.16 | 290.38 | -76.56 | -55.81 |
| 12 | -47.66 | 54.41 | -5.04 | 118.37 | -42.60 | -23.17 |
| 13 | 121.12 | 35.40 | 41.72 | 115.13 | -26.31 | -18.86 |
| 14 | -92.31 | 1.39 | -24.47 | -57.04 | 7.70 | 13.82 |
| 15 | 141.77 | 65.42 | 49.16 | 220.80 | -56.33 | -43.81 |
| 16 | -71.69 | 31.45 | -17.05 | 48.78 | -22.37 | -11.17 |
| 17 | 244.00 | 164.56 | 108.83 | 576.12 | -157.04 | -95.20 |
| 18 | 115.95 | 144.15 | 69.12 | 472.82 | -136.64 | -75.59 |
| 19 | 256.39 | 182.57 | 113.29 | 639.53 | -175.05 | -110.17 |
| 20 | 128.32 | 162.19 | 73.57 | 536.32 | -154.68 | -90.59 |
| 21 | 122.00 | 73.07 | 50.51 | 193.71 | -56.96 | -36.70 |
| 22 | -6.05 | 52.66 | 10.79 | 90.41 | -36.56 | -17.09 |
| 23 | 134.39 | 91.08 | 54.97 | 257.11 | -74.97 | -51.67 |
| 24 | 6.32 | 70.70 | 15.25 | 153.90 | -54.60 | -32.09 |
| 25 | 219.94 | 168.85 | 108.92 | 576.12 | -157.04 | -95.20 |
| 26 | 91.88 | 148.45 | 69.20 | 472.82 | -136.64 | -75.59 |
| 27 | 232.33 | 186.86 | 113.38 | 639.53 | -175.05 | -110.17 |
| 28 | 104.25 | 166.49 | 73.66 | 536.32 | -154.68 | -90.59 |
| 29 | 146.07 | 68.77 | 50.42 | 193.71 | -56.96 | -36.70 |
| 30 | 18.01 | 48.37 | 10.71 | 90.41 | -36.56 | -17.09 |
| 31 | 158.46 | 86.78 | 54.88 | 257.11 | -74.97 | -51.67 |
| 32 | 30.38 | 66.41 | 15.16 | 153.90 | -54.60 | -32.09 |
| 33 | 219.97 | 141.60 | 96.83 | 506.54 | -136.82 | -83.20 |
| 34 | 91.91 | 121.20 | 57.11 | 403.24 | -116.41 | -63.59 |
| 35 | 232.36 | 159.61 | 101.29 | 569.94 | -154.83 | -98.17 |
| 36 | 104.28 | 139.24 | 61.57 | 466.73 | -134.45 | -78.59 |
| 37 | 97.97 | 50.12 | 38.51 | 124.12 | -36.73 | -24.70 |
| 38 | -30.09 | 29.71 | -1.21 | 20.82 | -16.33 | -5.09 |
| 39 | 110.36 | 68.13 | 42.97 | 187.53 | -54.74 | -39.67 |
| 40 | -17.72 | 47.75 | 3.25 | 84.31 | -34.37 | -20.09 |
| 41 | 195.91 | 145.90 | 96.92 | 506.54 | -136.82 | -83.20 |
| 42 | 67.85 | 125.49 | 57.20 | 403.24 | -116.41 | -63.59 |
| 43 | 208.29 | 163.91 | 101.38 | 569.94 | -154.83 | -98.17 |
| 44 | 80.22 | 143.53 | 61.66 | 466.73 | -134.45 | -78.59 |
| 45 | 122.04 | 45.82 | 38.42 | 124.12 | -36.73 | -24.70 |
| 46 | -6.02 | 25.41 | -1.30 | 20.82 | -16.33 | -5.09 |
| 47 | 134.43 | 63.83 | 42.88 | 187.53 | -54.74 | -39.67 |
| 48 | 6.35 | 43.45 | 3.16 | 84.31 | -34.37 | -20.09 |
| 49 | 225.83 | 121.18 | 92.78 | 425.99 | -112.38 | -69.97 |
| 50 | 12.40 | 87.17 | 26.59 | 253.82 | -78.37 | -37.29 |
| 51 | 246.48 | 151.20 | 100.22 | 531.66 | -142.40 | -94.93 |
| 52 | 33.02 | 117.24 | 34.01 | 359.64 | -108.44 | -62.29 |
| 53 | 140.43 | 57.14 | 51.95 | 158.30 | -42.33 | -29.03 |
| 54 | -73.00 | 23.13 | -14.24 | -13.87 | -8.31 | 3.65 |
| 55 | 161.08 | 87.16 | 59.39 | 263.97 | -72.34 | -53.98 |
| 56 | -52.38 | 53.20 | -6.81 | 91.95 | -38.38 | -21.34 |
| 57 | 208.99 | 124.19 | 92.84 | 425.99 | -112.38 | -69.97 |
| 58 | -4.45 | 90.18 | 26.65 | 253.82 | -78.37 | -37.29 |
| 59 | 229.63 | 154.21 | 100.28 | 531.66 | -142.40 | -94.93 |
| 60 | 16.17 | 120.25 | 34.07 | 359.64 | -108.44 | -62.29 |
| 61 | 157.28 | 54.14 | 51.89 | 158.30 | -42.33 | -29.03 |
| 62 | -56.15 | 20.13 | -14.30 | -13.87 | -8.31 | 3.65 |
| 63 | 177.93 | 84.15 | 59.33 | 263.97 | -72.34 | -53.98 |
| 64 | -35.54 | 50.19 | -6.88 | 91.95 | -38.38 | -21.34 |
| 65 | 201.80 | 98.23 | 80.78 | 356.40 | -92.15 | -57.97 |
| 66 | -11.63 | 64.22 | 14.58 | 184.24 | -58.14 | -25.29 |
| 67 | 222.45 | 128.25 | 88.21 | 462.07 | -122.17 | -82.92 |
| 68 | 8.99 | 94.28 | 22.01 | 290.06 | -88.21 | -50.29 |
| 69 | 116.40 | 34.19 | 39.95 | 88.71 | -22.10 | -17.02 |
| 70 | -97.03 | 0.18 | -26.24 | -83.46 | 11.91 | 15.66 |
| 71 | 137.05 | 64.21 | 47.39 | 194.38 | -52.11 | -41.98 |
| 72 | -76.41 | 30.24 | -18.82 | 22.37 | -18.15 | -9.34 |
| 73 | 184.95 | 101.24 | 80.84 | 356.40 | -92.15 | -57.97 |
| 74 | -28.48 | 67.23 | 14.65 | 184.24 | -58.14 | -25.29 |
| 75 | 205.60 | 131.25 | 88.27 | 462.07 | -122.17 | -82.92 |
| 76 | -7.86 | 97.29 | 22.07 | 290.06 | -88.21 | -50.29 |
| 77 | 133.25 | 31.18 | 39.89 | 88.71 | -22.10 | -17.02 |
| 78 | -80.19 | -2.83 | -26.30 | -83.46 | 11.91 | 15.66 |
| 79 | 153.89 | 61.20 | 47.33 | 194.38 | -52.11 | -41.98 |
| 80 | -59.57 | 27.24 | -18.88 | 22.37 | -18.15 | -9.34 |
| 81 | 189.45 | 139.45 | 82.68 | 466.16 | -129.50 | -82.72 |
| 82 | 118.52 | 137.27 | 69.66 | 435.56 | -127.32 | -69.70 |
| 83 | 136.58 | 99.80 | 57.40 | 300.45 | -86.13 | -57.37 |
| 84 | 65.66 | 97.63 | 44.39 | 269.85 | -83.96 | -44.35 |
| 85 | 179.02 | 141.31 | 82.72 | 466.16 | -129.50 | -82.72 |
| 86 | 108.09 | 139.13 | 69.70 | 435.56 | -127.32 | -69.70 |
| 87 | 147.01 | 97.94 | 57.37 | 300.45 | -86.13 | -57.37 |
| 88 | 76.08 | 95.77 | 44.35 | 269.85 | -83.96 | -44.35 |
| 89 | 153.89 | 107.52 | 65.10 | 362.11 | -99.87 | -65.12 |
| 90 | 82.96 | 105.34 | 52.08 | 331.50 | -97.69 | -52.11 |
| 91 | 113.22 | 77.02 | 45.65 | 234.63 | -66.50 | -45.63 |
| 92 | 42.30 | 74.85 | 32.64 | 204.03 | -64.33 | -32.61 |
| 93 | 145.87 | 108.95 | 65.12 | 362.11 | -99.87 | -65.12 |
| 94 | 74.94 | 106.77 | 52.11 | 331.50 | -97.69 | -52.11 |
| 95 | 121.24 | 75.59 | 45.63 | 234.63 | -66.50 | -45.63 |
| 96 | 50.32 | 73.41 | 32.61 | 204.03 | -64.33 | -32.61 |

强度计算控制组合号: 1, M=219.40, N=189.23, M=646.22, N=-181.71

强度计算应力比 =0.953

抗剪强度计算控制组合号: 27, V=113.38

抗剪强度计算应力比 =0.324

平面内稳定计算最大应力对应组合号: 1, M=219.40, N=189.23, M=646.22, N=-181.71

平面内稳定计算最大应力 (N/mm\*mm) =287.37

平面内稳定计算最大应力比 =0.942

平面外稳定计算最大应力对应组合号: 3, M=195.33, N=193.52, M=646.22, N=-181.71

临界弯矩Mcr(kN\*m) =1964.03

平面外稳定计算最大应力比 =0.945

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 =0.953 < 1.0

抗剪强度计算应力比 =0.324 < 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 =11.93 < [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=91. ≤ [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 | 118.53 | 106.43 | 58.61 | 346.85 | -98.78 | -58.64 |
| 2 | 77.86 | 75.94 | 39.16 | 219.38 | -65.42 | -39.14 |
| 3 | 110.50 | 107.87 | 58.64 | 346.85 | -98.78 | -58.64 |
| 4 | 85.88 | 74.51 | 39.14 | 219.38 | -65.42 | -39.14 |
| 5 | 110.52 | 98.78 | 54.61 | 323.65 | -92.04 | -54.63 |
| 6 | 69.85 | 68.29 | 35.16 | 196.18 | -58.68 | -35.13 |
| 7 | 102.49 | 100.21 | 54.63 | 323.65 | -92.04 | -54.63 |
| 8 | 77.87 | 66.85 | 35.13 | 196.18 | -58.68 | -35.13 |
| 9 | 91.04 | 65.55 | 40.46 | 200.80 | -56.47 | -34.37 |
| 10 | 34.13 | 56.48 | 22.81 | 154.89 | -47.40 | -25.65 |
| 11 | 96.55 | 73.55 | 42.45 | 228.98 | -64.47 | -41.02 |
| 12 | 39.63 | 64.50 | 24.79 | 183.11 | -55.41 | -32.32 |
| 13 | 83.03 | 57.90 | 36.46 | 177.61 | -49.72 | -30.37 |
| 14 | 26.12 | 48.83 | 18.81 | 131.69 | -40.65 | -21.65 |
| 15 | 88.54 | 65.90 | 38.45 | 205.78 | -57.73 | -37.02 |
| 16 | 31.62 | 56.85 | 20.79 | 159.91 | -48.67 | -28.32 |

防火设计控制的偶然组合号: 1, M=118.53, N=106.43, M=346.85, N=-98.78

强度计算荷载比 =0.50

平面内稳定计算荷载比 =0.50

平面外稳定计算荷载比 =0.40

无防护下钢构件最大升温(Ts): 1081.55℃ ,按临界温度法求得临界温度(Td): 575.11℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4183(m^2\*℃/w)

构件重量 (Kg)=757.07

**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 | 10.38 | 0.80 | 12.97 | 0.00 | 0.00 | -0.00 |
| 10 | -10.39 | 0.80 | -12.98 | -0.00 | 0.00 | -0.00 |
| 11 | 10.38 | 0.80 | 12.97 | -0.00 | 0.00 | 0.00 |
| 12 | -10.38 | 0.80 | -12.97 | -0.00 | 0.00 | -0.00 |
| 13 | 10.38 | 0.61 | 12.97 | 0.00 | 0.00 | -0.00 |
| 14 | -10.39 | 0.61 | -12.98 | -0.00 | 0.00 | -0.00 |
| 15 | 10.38 | 0.61 | 12.97 | -0.00 | 0.00 | 0.00 |
| 16 | -10.38 | 0.61 | -12.97 | -0.00 | 0.00 | -0.00 |
| 17 | 6.23 | 0.80 | 7.78 | 0.00 | 0.00 | -0.00 |
| 18 | -6.23 | 0.80 | -7.79 | 0.00 | 0.00 | -0.00 |
| 19 | 6.23 | 0.80 | 7.78 | 0.00 | 0.00 | -0.00 |
| 20 | -6.23 | 0.80 | -7.78 | 0.00 | 0.00 | -0.00 |
| 21 | 6.23 | 0.80 | 7.78 | -0.00 | 0.00 | -0.00 |
| 22 | -6.23 | 0.80 | -7.79 | -0.00 | 0.00 | -0.00 |
| 23 | 6.23 | 0.80 | 7.78 | -0.00 | 0.00 | 0.00 |
| 24 | -6.23 | 0.80 | -7.78 | -0.00 | 0.00 | -0.00 |
| 25 | 6.23 | 0.80 | 7.78 | 0.00 | 0.00 | -0.00 |
| 26 | -6.23 | 0.80 | -7.79 | -0.00 | 0.00 | -0.00 |
| 27 | 6.23 | 0.80 | 7.78 | -0.00 | 0.00 | 0.00 |
| 28 | -6.23 | 0.80 | -7.78 | -0.00 | 0.00 | -0.00 |
| 29 | 6.23 | 0.80 | 7.78 | 0.00 | 0.00 | -0.00 |
| 30 | -6.23 | 0.80 | -7.79 | 0.00 | 0.00 | -0.00 |
| 31 | 6.23 | 0.80 | 7.78 | 0.00 | 0.00 | 0.00 |
| 32 | -6.23 | 0.80 | -7.78 | 0.00 | 0.00 | -0.00 |
| 33 | 6.23 | 0.61 | 7.78 | 0.00 | 0.00 | -0.00 |
| 34 | -6.23 | 0.61 | -7.79 | 0.00 | 0.00 | -0.00 |
| 35 | 6.23 | 0.61 | 7.78 | 0.00 | 0.00 | -0.00 |
| 36 | -6.23 | 0.61 | -7.78 | 0.00 | 0.00 | -0.00 |
| 37 | 6.23 | 0.61 | 7.78 | -0.00 | 0.00 | -0.00 |
| 38 | -6.23 | 0.61 | -7.79 | -0.00 | 0.00 | -0.00 |
| 39 | 6.23 | 0.61 | 7.78 | -0.00 | 0.00 | 0.00 |
| 40 | -6.23 | 0.61 | -7.78 | -0.00 | 0.00 | -0.00 |
| 41 | 6.23 | 0.61 | 7.78 | 0.00 | 0.00 | -0.00 |
| 42 | -6.23 | 0.61 | -7.79 | -0.00 | 0.00 | -0.00 |
| 43 | 6.23 | 0.61 | 7.78 | -0.00 | 0.00 | 0.00 |
| 44 | -6.23 | 0.61 | -7.78 | -0.00 | 0.00 | -0.00 |
| 45 | 6.23 | 0.61 | 7.78 | 0.00 | 0.00 | -0.00 |
| 46 | -6.23 | 0.61 | -7.79 | 0.00 | 0.00 | -0.00 |
| 47 | 6.23 | 0.61 | 7.78 | 0.00 | 0.00 | 0.00 |
| 48 | -6.23 | 0.61 | -7.78 | 0.00 | 0.00 | -0.00 |
| 49 | 10.38 | 0.80 | 12.97 | 0.00 | 0.00 | -0.00 |
| 50 | -10.39 | 0.80 | -12.98 | 0.00 | 0.00 | -0.00 |
| 51 | 10.38 | 0.80 | 12.97 | 0.00 | 0.00 | 0.00 |
| 52 | -10.38 | 0.80 | -12.97 | 0.00 | 0.00 | -0.00 |
| 53 | 10.38 | 0.80 | 12.97 | 0.00 | 0.00 | -0.00 |
| 54 | -10.39 | 0.80 | -12.98 | -0.00 | 0.00 | -0.00 |
| 55 | 10.38 | 0.80 | 12.97 | -0.00 | 0.00 | 0.00 |
| 56 | -10.38 | 0.80 | -12.97 | -0.00 | 0.00 | -0.00 |
| 57 | 10.38 | 0.80 | 12.97 | 0.00 | 0.00 | -0.00 |
| 58 | -10.39 | 0.80 | -12.98 | -0.00 | 0.00 | -0.00 |
| 59 | 10.38 | 0.80 | 12.97 | -0.00 | 0.00 | 0.00 |
| 60 | -10.38 | 0.80 | -12.97 | -0.00 | 0.00 | -0.00 |
| 61 | 10.38 | 0.80 | 12.97 | 0.00 | 0.00 | -0.00 |
| 62 | -10.39 | 0.80 | -12.98 | 0.00 | 0.00 | -0.00 |
| 63 | 10.38 | 0.80 | 12.97 | -0.00 | 0.00 | 0.00 |
| 64 | -10.38 | 0.80 | -12.97 | 0.00 | 0.00 | -0.00 |
| 65 | 10.38 | 0.61 | 12.97 | 0.00 | 0.00 | -0.00 |
| 66 | -10.39 | 0.61 | -12.98 | 0.00 | 0.00 | -0.00 |
| 67 | 10.38 | 0.61 | 12.97 | 0.00 | 0.00 | 0.00 |
| 68 | -10.38 | 0.61 | -12.97 | 0.00 | 0.00 | -0.00 |
| 69 | 10.38 | 0.61 | 12.97 | 0.00 | 0.00 | -0.00 |
| 70 | -10.39 | 0.61 | -12.98 | -0.00 | 0.00 | -0.00 |
| 71 | 10.38 | 0.61 | 12.97 | -0.00 | 0.00 | 0.00 |
| 72 | -10.38 | 0.61 | -12.97 | -0.00 | 0.00 | -0.00 |
| 73 | 10.38 | 0.61 | 12.97 | 0.00 | 0.00 | -0.00 |
| 74 | -10.39 | 0.61 | -12.98 | -0.00 | -0.00 | -0.00 |
| 75 | 10.38 | 0.61 | 12.97 | -0.00 | 0.00 | 0.00 |
| 76 | -10.38 | 0.61 | -12.97 | -0.00 | 0.00 | -0.00 |
| 77 | 10.38 | 0.61 | 12.97 | 0.00 | 0.00 | -0.00 |
| 78 | -10.39 | 0.61 | -12.98 | 0.00 | 0.00 | -0.00 |
| 79 | 10.38 | 0.61 | 12.97 | -0.00 | 0.00 | 0.00 |
| 80 | -10.38 | 0.61 | -12.97 | 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: 54, M=-10.39, N=0.80, M=-0.00, N=0.00

强度计算应力比 =0.121

抗剪强度计算控制组合号: 10, V=-12.98

抗剪强度计算应力比 =0.067

平面内稳定计算最大应力对应组合号: 54, M=-10.39, N=0.80, M=-0.00, N=0.00

平面内稳定计算最大应力 (N/mm\*mm) =35.24

平面内稳定计算最大应力比 =0.116

临界弯矩Mcr(kN\*m) =1157.60

平面外稳定计算最大应力比 =0.057

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 =0.121 < 1.0

抗剪强度计算应力比 =0.067 < 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 | 2.77 | 0.61 | 3.46 | 0.00 | 0.00 | -0.00 |
| 10 | -2.77 | 0.61 | -3.46 | -0.00 | 0.00 | -0.00 |
| 11 | 2.77 | 0.61 | 3.46 | -0.00 | 0.00 | 0.00 |
| 12 | -2.77 | 0.61 | -3.46 | -0.00 | 0.00 | -0.00 |
| 13 | 2.77 | 0.55 | 3.46 | 0.00 | 0.00 | -0.00 |
| 14 | -2.77 | 0.55 | -3.46 | -0.00 | 0.00 | -0.00 |
| 15 | 2.77 | 0.55 | 3.46 | -0.00 | 0.00 | 0.00 |
| 16 | -2.77 | 0.55 | -3.46 | -0.00 | 0.00 | -0.00 |

防火设计控制的偶然组合号: 10, M=-2.77, 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 | 10.38 | 0.80 | 12.97 | 0.00 | -0.00 | -0.00 |
| 10 | -10.39 | 0.80 | -12.98 | 0.00 | -0.00 | -0.00 |
| 11 | 10.38 | 0.80 | 12.97 | -0.00 | -0.00 | -0.00 |
| 12 | -10.38 | 0.80 | -12.97 | -0.00 | -0.00 | -0.00 |
| 13 | 10.38 | 0.61 | 12.97 | 0.00 | -0.00 | 0.00 |
| 14 | -10.39 | 0.61 | -12.98 | 0.00 | -0.00 | -0.00 |
| 15 | 10.38 | 0.61 | 12.97 | -0.00 | -0.00 | -0.00 |
| 16 | -10.38 | 0.61 | -12.97 | -0.00 | -0.00 | -0.00 |
| 17 | 6.23 | 0.80 | 7.78 | 0.00 | -0.00 | -0.00 |
| 18 | -6.23 | 0.80 | -7.79 | 0.00 | -0.00 | -0.00 |
| 19 | 6.23 | 0.80 | 7.78 | 0.00 | -0.00 | -0.00 |
| 20 | -6.23 | 0.80 | -7.78 | 0.00 | -0.00 | -0.00 |
| 21 | 6.23 | 0.80 | 7.78 | -0.00 | -0.00 | -0.00 |
| 22 | -6.23 | 0.80 | -7.79 | -0.00 | -0.00 | -0.00 |
| 23 | 6.23 | 0.80 | 7.78 | -0.00 | -0.00 | -0.00 |
| 24 | -6.23 | 0.80 | -7.78 | -0.00 | -0.00 | -0.00 |
| 25 | 6.23 | 0.80 | 7.78 | -0.00 | -0.00 | -0.00 |
| 26 | -6.23 | 0.80 | -7.79 | -0.00 | -0.00 | -0.00 |
| 27 | 6.23 | 0.80 | 7.78 | -0.00 | -0.00 | -0.00 |
| 28 | -6.23 | 0.80 | -7.78 | -0.00 | -0.00 | -0.00 |
| 29 | 6.23 | 0.80 | 7.78 | 0.00 | -0.00 | -0.00 |
| 30 | -6.23 | 0.80 | -7.79 | 0.00 | -0.00 | -0.00 |
| 31 | 6.23 | 0.80 | 7.78 | 0.00 | -0.00 | -0.00 |
| 32 | -6.23 | 0.80 | -7.78 | 0.00 | -0.00 | -0.00 |
| 33 | 6.23 | 0.61 | 7.78 | 0.00 | -0.00 | -0.00 |
| 34 | -6.23 | 0.61 | -7.79 | 0.00 | -0.00 | -0.00 |
| 35 | 6.23 | 0.61 | 7.78 | 0.00 | -0.00 | -0.00 |
| 36 | -6.23 | 0.61 | -7.78 | 0.00 | -0.00 | -0.00 |
| 37 | 6.23 | 0.61 | 7.78 | -0.00 | -0.00 | -0.00 |
| 38 | -6.23 | 0.61 | -7.79 | -0.00 | -0.00 | -0.00 |
| 39 | 6.23 | 0.61 | 7.78 | -0.00 | -0.00 | -0.00 |
| 40 | -6.23 | 0.61 | -7.78 | -0.00 | -0.00 | -0.00 |
| 41 | 6.23 | 0.61 | 7.78 | -0.00 | -0.00 | -0.00 |
| 42 | -6.23 | 0.61 | -7.79 | -0.00 | -0.00 | -0.00 |
| 43 | 6.23 | 0.61 | 7.78 | -0.00 | -0.00 | -0.00 |
| 44 | -6.23 | 0.61 | -7.78 | -0.00 | -0.00 | -0.00 |
| 45 | 6.23 | 0.61 | 7.78 | 0.00 | -0.00 | -0.00 |
| 46 | -6.23 | 0.61 | -7.79 | 0.00 | -0.00 | -0.00 |
| 47 | 6.23 | 0.61 | 7.78 | 0.00 | -0.00 | -0.00 |
| 48 | -6.23 | 0.61 | -7.78 | 0.00 | -0.00 | -0.00 |
| 49 | 10.38 | 0.80 | 12.97 | 0.00 | -0.00 | -0.00 |
| 50 | -10.39 | 0.80 | -12.98 | 0.00 | -0.00 | -0.00 |
| 51 | 10.38 | 0.80 | 12.97 | 0.00 | -0.00 | -0.00 |
| 52 | -10.38 | 0.80 | -12.97 | 0.00 | -0.00 | -0.00 |
| 53 | 10.38 | 0.80 | 12.97 | -0.00 | -0.00 | -0.00 |
| 54 | -10.39 | 0.80 | -12.98 | -0.00 | -0.00 | -0.00 |
| 55 | 10.38 | 0.80 | 12.97 | -0.00 | -0.00 | -0.00 |
| 56 | -10.38 | 0.80 | -12.97 | -0.00 | -0.00 | -0.00 |
| 57 | 10.38 | 0.80 | 12.97 | -0.00 | -0.00 | -0.00 |
| 58 | -10.39 | 0.80 | -12.98 | -0.00 | -0.00 | -0.00 |
| 59 | 10.38 | 0.80 | 12.97 | -0.00 | -0.00 | -0.00 |
| 60 | -10.38 | 0.80 | -12.97 | -0.00 | -0.00 | -0.00 |
| 61 | 10.38 | 0.80 | 12.97 | 0.00 | -0.00 | 0.00 |
| 62 | -10.39 | 0.80 | -12.98 | 0.00 | -0.00 | -0.00 |
| 63 | 10.38 | 0.80 | 12.97 | -0.00 | -0.00 | -0.00 |
| 64 | -10.38 | 0.80 | -12.97 | -0.00 | -0.00 | -0.00 |
| 65 | 10.38 | 0.61 | 12.97 | 0.00 | -0.00 | -0.00 |
| 66 | -10.39 | 0.61 | -12.98 | 0.00 | -0.00 | -0.00 |
| 67 | 10.38 | 0.61 | 12.97 | 0.00 | -0.00 | -0.00 |
| 68 | -10.38 | 0.61 | -12.97 | 0.00 | -0.00 | -0.00 |
| 69 | 10.38 | 0.61 | 12.97 | -0.00 | -0.00 | -0.00 |
| 70 | -10.39 | 0.61 | -12.98 | -0.00 | -0.00 | -0.00 |
| 71 | 10.38 | 0.61 | 12.97 | -0.00 | -0.00 | -0.00 |
| 72 | -10.38 | 0.61 | -12.97 | -0.00 | -0.00 | -0.00 |
| 73 | 10.38 | 0.61 | 12.97 | -0.00 | -0.00 | -0.00 |
| 74 | -10.39 | 0.61 | -12.98 | -0.00 | -0.00 | -0.00 |
| 75 | 10.38 | 0.61 | 12.97 | -0.00 | -0.00 | -0.00 |
| 76 | -10.38 | 0.61 | -12.97 | -0.00 | -0.00 | -0.00 |
| 77 | 10.38 | 0.61 | 12.97 | 0.00 | -0.00 | 0.00 |
| 78 | -10.39 | 0.61 | -12.98 | 0.00 | -0.00 | -0.00 |
| 79 | 10.38 | 0.61 | 12.97 | -0.00 | -0.00 | 0.00 |
| 80 | -10.38 | 0.61 | -12.97 | 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: 54, M=-10.39, N=0.80, M=-0.00, N=-0.00

强度计算应力比 =0.121

抗剪强度计算控制组合号: 70, V=-12.98

抗剪强度计算应力比 =0.067

平面内稳定计算最大应力对应组合号: 54, M=-10.39, N=0.80, M=-0.00, N=-0.00

平面内稳定计算最大应力 (N/mm\*mm) =35.24

平面内稳定计算最大应力比 =0.116

临界弯矩Mcr(kN\*m) =1157.60

平面外稳定计算最大应力比 =0.057

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 =0.121 < 1.0

抗剪强度计算应力比 =0.067 < 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 | 2.77 | 0.61 | 3.46 | -0.00 | -0.00 | -0.00 |
| 10 | -2.77 | 0.61 | -3.46 | -0.00 | -0.00 | -0.00 |
| 11 | 2.77 | 0.61 | 3.46 | -0.00 | -0.00 | -0.00 |
| 12 | -2.77 | 0.61 | -3.46 | -0.00 | -0.00 | -0.00 |
| 13 | 2.77 | 0.55 | 3.46 | -0.00 | -0.00 | -0.00 |
| 14 | -2.77 | 0.55 | -3.46 | -0.00 | -0.00 | -0.00 |
| 15 | 2.77 | 0.55 | 3.46 | -0.00 | -0.00 | -0.00 |
| 16 | -2.77 | 0.55 | -3.46 | -0.00 | -0.00 | -0.00 |

防火设计控制的偶然组合号: 10, M=-2.77, 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=260, B2=260, 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: 232.832840(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 416.19 | 94.24 | 130.31 | 140.75 | -72.06 | -45.80 |
| 2 | 147.47 | 36.82 | 54.69 | 43.13 | -50.10 | -24.00 |
| 3 | 199.31 | 48.21 | 89.79 | 100.61 | -42.23 | -12.45 |
| 4 | 364.35 | 82.86 | 95.22 | 83.27 | -79.93 | -57.36 |
| 5 | 373.98 | 84.40 | 116.40 | 126.98 | -62.90 | -40.63 |
| 6 | 105.27 | 26.98 | 40.78 | 29.37 | -40.93 | -18.83 |
| 7 | 157.10 | 38.37 | 75.88 | 86.85 | -33.07 | -7.27 |
| 8 | 322.14 | 73.01 | 81.31 | 69.50 | -70.76 | -52.19 |
| 9 | -17.18 | 13.67 | 3.84 | 22.06 | -10.74 | 2.18 |
| 10 | 119.97 | 6.41 | 31.59 | 13.47 | -3.48 | -13.89 |
| 11 | 52.61 | 36.19 | 25.64 | 41.51 | -33.26 | -6.45 |
| 12 | 189.91 | 28.96 | 53.44 | 32.97 | -26.03 | -22.54 |
| 13 | -59.39 | 3.82 | -10.07 | 8.30 | -1.57 | 7.35 |
| 14 | 77.77 | -3.43 | 17.69 | -0.29 | 5.68 | -8.72 |
| 15 | 10.40 | 26.34 | 11.73 | 27.75 | -24.09 | -1.28 |
| 16 | 147.70 | 19.11 | 39.53 | 19.21 | -16.86 | -17.36 |
| 17 | 296.14 | 76.85 | 96.46 | 118.19 | -54.67 | -31.05 |
| 18 | 378.43 | 72.50 | 113.11 | 113.04 | -50.32 | -40.69 |
| 19 | 338.02 | 90.36 | 109.54 | 129.87 | -68.19 | -36.23 |
| 20 | 420.40 | 86.03 | 126.22 | 124.74 | -63.85 | -45.88 |
| 21 | 27.43 | 19.44 | 20.84 | 20.58 | -32.71 | -9.25 |
| 22 | 109.72 | 15.08 | 37.49 | 15.43 | -28.36 | -18.89 |
| 23 | 69.30 | 32.95 | 33.91 | 32.25 | -46.22 | -14.43 |
| 24 | 151.68 | 28.61 | 50.59 | 27.13 | -41.89 | -24.08 |
| 25 | 79.26 | 30.82 | 55.93 | 78.06 | -24.84 | 2.31 |
| 26 | 161.55 | 26.46 | 72.58 | 72.91 | -20.49 | -7.34 |
| 27 | 121.14 | 44.33 | 69.01 | 89.73 | -38.36 | -2.87 |
| 28 | 203.52 | 39.99 | 85.69 | 84.61 | -34.02 | -12.52 |
| 29 | 244.30 | 65.47 | 61.36 | 60.71 | -62.54 | -42.61 |
| 30 | 326.60 | 61.11 | 78.01 | 55.56 | -58.19 | -52.25 |
| 31 | 286.18 | 78.98 | 74.44 | 72.38 | -76.06 | -47.78 |
| 32 | 368.56 | 74.64 | 91.12 | 67.26 | -71.72 | -57.44 |
| 33 | 253.94 | 67.01 | 82.55 | 104.43 | -45.51 | -25.88 |
| 34 | 336.23 | 62.66 | 99.20 | 99.28 | -41.15 | -35.52 |
| 35 | 295.81 | 80.52 | 95.63 | 116.10 | -59.02 | -31.05 |
| 36 | 378.19 | 76.18 | 112.31 | 110.98 | -54.68 | -40.71 |
| 37 | -14.78 | 9.59 | 6.93 | 6.82 | -23.55 | -4.08 |
| 38 | 67.51 | 5.24 | 23.58 | 1.66 | -19.19 | -13.72 |
| 39 | 27.10 | 23.11 | 20.01 | 18.49 | -37.06 | -9.25 |
| 40 | 109.47 | 18.77 | 36.69 | 13.36 | -32.72 | -18.91 |
| 41 | 37.06 | 20.98 | 42.03 | 64.30 | -15.68 | 7.48 |
| 42 | 119.35 | 16.62 | 58.68 | 59.14 | -11.32 | -2.16 |
| 43 | 78.93 | 34.49 | 55.10 | 75.97 | -29.19 | 2.30 |
| 44 | 161.31 | 30.15 | 71.78 | 70.84 | -24.85 | -7.35 |
| 45 | 202.10 | 55.63 | 47.45 | 46.95 | -53.38 | -37.44 |
| 46 | 284.39 | 51.27 | 64.11 | 41.80 | -49.02 | -47.08 |
| 47 | 243.98 | 69.14 | 60.53 | 58.62 | -66.89 | -42.61 |
| 48 | 326.35 | 64.80 | 77.21 | 53.50 | -62.55 | -52.27 |
| 49 | 146.12 | 49.78 | 52.87 | 78.83 | -33.38 | -14.20 |
| 50 | 283.28 | 42.52 | 80.63 | 70.24 | -26.12 | -30.27 |
| 51 | 215.92 | 72.30 | 74.67 | 98.28 | -55.90 | -22.82 |
| 52 | 353.21 | 65.07 | 102.47 | 89.74 | -48.67 | -38.91 |
| 53 | -41.98 | 9.59 | -0.06 | 10.50 | -18.01 | 1.06 |
| 54 | 95.18 | 2.33 | 27.69 | 1.91 | -10.75 | -15.01 |
| 55 | 27.82 | 32.11 | 21.74 | 29.95 | -40.53 | -7.56 |
| 56 | 165.11 | 24.88 | 49.53 | 21.41 | -33.30 | -23.65 |
| 57 | -5.69 | 17.56 | 24.51 | 50.74 | -12.50 | 9.15 |
| 58 | 131.46 | 10.30 | 52.26 | 42.15 | -5.24 | -6.92 |
| 59 | 64.10 | 40.08 | 46.30 | 70.19 | -35.02 | 0.53 |
| 60 | 201.40 | 32.85 | 74.10 | 61.65 | -27.79 | -15.56 |
| 61 | 109.84 | 41.81 | 28.31 | 38.59 | -38.89 | -22.29 |
| 62 | 246.99 | 34.56 | 56.06 | 30.01 | -31.63 | -38.36 |
| 63 | 179.63 | 64.33 | 50.10 | 58.05 | -61.41 | -30.91 |
| 64 | 316.93 | 57.10 | 77.90 | 49.51 | -54.18 | -47.00 |
| 65 | 103.92 | 39.94 | 38.97 | 65.07 | -24.21 | -9.03 |
| 66 | 241.07 | 32.68 | 66.72 | 56.48 | -16.96 | -25.10 |
| 67 | 173.71 | 62.46 | 60.76 | 84.52 | -46.73 | -17.65 |
| 68 | 311.01 | 55.23 | 88.56 | 75.98 | -39.50 | -33.74 |
| 69 | -84.18 | -0.25 | -13.97 | -3.26 | -8.84 | 6.23 |
| 70 | 52.97 | -7.51 | 13.78 | -11.85 | -1.58 | -9.84 |
| 71 | -14.39 | 22.27 | 7.83 | 16.19 | -31.36 | -2.39 |
| 72 | 122.91 | 15.04 | 35.63 | 7.65 | -24.13 | -18.48 |
| 73 | -47.90 | 7.72 | 10.60 | 36.97 | -3.33 | 14.32 |
| 74 | 89.26 | 0.46 | 38.35 | 28.39 | 3.93 | -1.75 |
| 75 | 21.90 | 30.24 | 32.40 | 56.42 | -25.85 | 5.70 |
| 76 | 159.19 | 23.01 | 60.20 | 47.88 | -18.62 | -10.39 |
| 77 | 67.63 | 31.97 | 14.40 | 24.83 | -29.72 | -17.12 |
| 78 | 204.79 | 24.71 | 42.15 | 16.24 | -22.46 | -33.19 |
| 79 | 137.43 | 54.49 | 36.20 | 44.28 | -52.24 | -25.74 |
| 80 | 274.72 | 47.26 | 64.00 | 35.74 | -45.01 | -41.83 |
| 81 | 272.23 | 62.63 | 89.81 | 101.80 | -51.37 | -31.74 |
| 82 | 295.81 | 67.39 | 91.43 | 87.74 | -56.12 | -33.36 |
| 83 | 155.78 | 37.75 | 57.04 | 59.50 | -41.85 | -22.29 |
| 84 | 179.37 | 42.51 | 58.66 | 45.44 | -46.60 | -23.91 |
| 85 | 178.25 | 42.69 | 72.25 | 84.41 | -38.44 | -17.28 |
| 86 | 201.83 | 47.44 | 73.87 | 70.34 | -43.19 | -18.91 |
| 87 | 249.77 | 57.70 | 74.60 | 76.90 | -54.78 | -36.75 |
| 88 | 273.35 | 62.46 | 76.22 | 62.83 | -59.53 | -38.37 |
| 89 | 206.69 | 47.63 | 68.90 | 79.93 | -38.96 | -24.23 |
| 90 | 230.28 | 52.39 | 70.52 | 65.86 | -43.72 | -25.85 |
| 91 | 117.12 | 28.49 | 43.69 | 47.39 | -31.64 | -16.96 |
| 92 | 140.71 | 33.25 | 45.31 | 33.32 | -36.40 | -18.58 |
| 93 | 134.40 | 32.29 | 55.39 | 66.55 | -29.02 | -13.11 |
| 94 | 157.99 | 37.04 | 57.01 | 52.48 | -33.78 | -14.73 |
| 95 | 189.41 | 43.84 | 57.20 | 60.77 | -41.59 | -28.08 |
| 96 | 213.00 | 48.59 | 58.82 | 46.70 | -46.34 | -29.70 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -84.18 | -56.23 | -60.50 | -60.71 | -63.59 | -82.14 | -140.75 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 420.40 | 138.08 | 87.60 | 43.30 | 20.27 | 9.55 | 11.85 |

强度计算应力比 =0.538

抗剪强度计算应力比 =0.522

平面内稳定计算最大应力对应组合号: 1, M=416.19, N=94.24, M=140.75, N=-72.06

平面内稳定最大应力 (N/mm\*mm) =168.52

平面内稳定计算最大应力比 =0.553

临界弯矩Mcr(kN\*m) =1697.44

平面外稳定计算最大应力比 =0.486

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 =0.538 < 1.0

抗剪强度计算应力比 =0.522 < 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 =0.486 < 1.0

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

翼缘宽厚比 B/T =10.58 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0.00 | 9.89 | 20.25 | 30.84 | 41.42 | 51.73 | 61.51 |

最大挠度值 =61.51 最大挠度/梁跨度 =1/371.

斜梁坡度初始值: 1/12.94

变形后斜梁坡度最小值: 1/15.07

变形后斜梁坡度改变率 =0.141 < 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 | 218.45 | 50.00 | 69.71 | 72.91 | -41.34 | -25.04 |
| 2 | 128.88 | 30.86 | 44.50 | 40.38 | -34.02 | -17.77 |
| 3 | 146.16 | 34.66 | 56.20 | 59.54 | -31.39 | -13.92 |
| 4 | 201.17 | 46.21 | 58.01 | 53.75 | -43.96 | -28.89 |
| 5 | 204.38 | 46.72 | 65.07 | 68.33 | -38.28 | -23.31 |
| 6 | 114.81 | 27.58 | 39.86 | 35.79 | -30.96 | -16.05 |
| 7 | 132.09 | 31.38 | 51.56 | 54.95 | -28.34 | -12.19 |
| 8 | 187.10 | 42.93 | 53.37 | 49.17 | -40.90 | -27.16 |
| 9 | 87.33 | 25.08 | 31.31 | 35.86 | -22.83 | -10.68 |
| 10 | 123.91 | 23.14 | 38.71 | 33.57 | -20.89 | -14.97 |
| 11 | 105.95 | 31.08 | 37.12 | 41.05 | -28.83 | -12.98 |
| 12 | 142.56 | 29.15 | 44.54 | 38.77 | -26.90 | -17.27 |
| 13 | 73.26 | 21.80 | 26.67 | 31.27 | -19.77 | -8.96 |
| 14 | 109.84 | 19.86 | 34.08 | 28.98 | -17.84 | -13.24 |
| 15 | 91.88 | 27.80 | 32.49 | 36.46 | -25.78 | -11.26 |
| 16 | 128.49 | 25.87 | 39.90 | 34.18 | -23.85 | -15.55 |

--- 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 -18.54 -42.48 -72.91

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 218.45 97.73 59.51 27.75 3.71 0.00 0.00

强度计算荷载比 =0.29

平面内稳定计算荷载比 =0.29

平面外稳定计算荷载比 =0.19

无防护下钢构件最大升温(Ts): 1004.56℃ ,按临界温度法求得临界温度(Td): 649.86℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2169(m^2\*℃/w)

构件重量 (Kg)=453.50

**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 | -43.13 | 50.16 | 23.87 | -56.35 | -37.83 | 44.76 |
| 2 | -140.75 | 72.19 | 45.61 | -193.17 | -67.29 | 101.17 |
| 3 | -135.17 | 81.64 | 53.67 | -83.11 | -69.97 | 92.18 |
| 4 | -48.71 | 40.71 | 15.81 | -166.41 | -35.15 | 53.76 |
| 5 | -29.37 | 40.98 | 18.72 | -37.46 | -29.94 | 33.86 |
| 6 | -126.98 | 63.01 | 40.46 | -174.28 | -59.39 | 90.27 |
| 7 | -121.40 | 72.46 | 48.52 | -64.22 | -62.08 | 81.27 |
| 8 | -34.95 | 31.53 | 10.66 | -147.52 | -27.25 | 42.85 |
| 9 | -22.06 | 10.74 | -2.21 | -48.61 | -5.17 | 10.26 |
| 10 | -13.47 | 3.52 | 13.88 | -2.74 | 2.04 | 16.74 |
| 11 | -41.51 | 33.28 | 6.36 | -76.37 | -27.71 | 27.15 |
| 12 | -32.97 | 26.09 | 22.46 | -30.54 | -20.53 | 33.67 |
| 13 | -8.30 | 1.56 | -7.35 | -29.72 | 2.73 | -0.65 |
| 14 | 0.29 | -5.66 | 8.74 | 16.15 | 9.94 | 5.84 |
| 15 | -27.75 | 24.10 | 1.21 | -57.48 | -19.82 | 16.25 |
| 16 | -19.21 | 16.91 | 17.32 | -11.65 | -12.63 | 22.76 |
| 17 | -20.58 | 32.74 | 9.16 | -36.40 | -20.40 | 22.56 |
| 18 | -15.43 | 28.41 | 18.82 | -8.88 | -16.07 | 26.45 |
| 19 | -32.25 | 46.26 | 14.30 | -53.06 | -33.93 | 32.70 |
| 20 | -27.13 | 41.95 | 23.96 | -25.56 | -29.62 | 36.61 |
| 21 | -118.19 | 54.76 | 30.90 | -173.22 | -49.86 | 78.97 |
| 22 | -113.04 | 50.43 | 40.56 | -145.70 | -45.53 | 82.86 |
| 23 | -129.87 | 68.28 | 36.04 | -189.88 | -63.39 | 89.11 |
| 24 | -124.74 | 63.97 | 45.71 | -162.38 | -59.07 | 93.02 |
| 25 | -112.62 | 64.21 | 38.96 | -63.16 | -52.54 | 69.97 |
| 26 | -107.46 | 59.88 | 48.62 | -35.64 | -48.22 | 73.86 |
| 27 | -124.29 | 77.74 | 44.10 | -79.82 | -66.07 | 80.11 |
| 28 | -119.16 | 73.43 | 53.76 | -52.32 | -61.76 | 84.02 |
| 29 | -26.16 | 23.28 | 1.10 | -146.46 | -17.72 | 31.56 |
| 30 | -21.01 | 18.96 | 10.76 | -118.94 | -13.39 | 35.45 |
| 31 | -37.83 | 36.81 | 6.24 | -163.12 | -31.24 | 41.69 |
| 32 | -32.71 | 32.50 | 15.91 | -135.62 | -26.93 | 45.60 |
| 33 | -6.82 | 23.56 | 4.02 | -17.51 | -12.51 | 11.65 |
| 34 | -1.66 | 19.23 | 13.67 | 10.01 | -8.18 | 15.54 |
| 35 | -18.49 | 37.08 | 9.15 | -34.17 | -26.03 | 21.79 |
| 36 | -13.36 | 32.77 | 18.82 | -6.67 | -21.72 | 25.70 |
| 37 | -104.43 | 45.58 | 25.76 | -154.33 | -41.96 | 68.06 |
| 38 | -99.28 | 41.25 | 35.41 | -126.81 | -37.63 | 71.95 |
| 39 | -116.10 | 59.10 | 30.89 | -170.99 | -55.49 | 78.20 |
| 40 | -110.98 | 54.79 | 40.56 | -143.49 | -51.18 | 82.11 |
| 41 | -98.85 | 55.03 | 33.82 | -44.27 | -44.65 | 59.07 |
| 42 | -93.70 | 50.70 | 43.47 | -16.75 | -40.32 | 62.96 |
| 43 | -110.52 | 68.56 | 38.95 | -60.93 | -58.17 | 69.20 |
| 44 | -105.40 | 64.24 | 48.62 | -33.43 | -53.86 | 73.11 |
| 45 | -12.40 | 14.10 | -4.04 | -127.57 | -9.82 | 20.65 |
| 46 | -7.24 | 9.77 | 5.61 | -100.05 | -5.49 | 24.54 |
| 47 | -24.07 | 27.63 | 1.09 | -144.23 | -23.35 | 30.79 |
| 48 | -18.94 | 23.32 | 10.76 | -116.73 | -19.04 | 34.70 |
| 49 | -10.50 | 18.00 | -1.11 | -30.76 | -7.70 | 8.51 |
| 50 | -1.91 | 10.79 | 14.98 | 15.12 | -0.49 | 14.99 |
| 51 | -29.95 | 40.55 | 7.45 | -58.52 | -30.24 | 25.40 |
| 52 | -21.41 | 33.36 | 23.56 | -12.69 | -23.06 | 31.92 |
| 53 | -78.83 | 33.42 | 14.11 | -126.53 | -28.32 | 48.00 |
| 54 | -70.24 | 26.20 | 30.20 | -80.66 | -21.11 | 54.48 |
| 55 | -98.28 | 55.96 | 22.67 | -154.29 | -50.86 | 64.89 |
| 56 | -89.74 | 48.78 | 38.78 | -108.46 | -43.68 | 71.40 |
| 57 | -74.93 | 40.04 | 19.75 | -49.49 | -30.20 | 41.70 |
| 58 | -66.34 | 32.82 | 35.84 | -3.61 | -22.98 | 48.18 |
| 59 | -94.38 | 62.58 | 28.31 | -77.25 | -52.74 | 58.59 |
| 60 | -85.84 | 55.39 | 44.42 | -31.42 | -45.56 | 65.11 |
| 61 | -14.41 | 11.39 | -6.75 | -107.80 | -5.82 | 14.81 |
| 62 | -5.82 | 4.17 | 9.34 | -61.93 | 1.39 | 21.29 |
| 63 | -33.86 | 33.93 | 1.81 | -135.56 | -28.36 | 31.70 |
| 64 | -25.32 | 26.74 | 17.92 | -89.73 | -21.18 | 38.22 |
| 65 | 3.26 | 8.82 | -6.26 | -11.87 | 0.20 | -2.40 |
| 66 | 11.85 | 1.61 | 9.83 | 34.01 | 7.41 | 4.09 |
| 67 | -16.19 | 31.37 | 2.31 | -39.63 | -22.35 | 14.49 |
| 68 | -7.65 | 24.18 | 18.41 | 6.20 | -15.16 | 21.01 |
| 69 | -65.07 | 24.24 | 8.96 | -107.64 | -20.42 | 37.09 |
| 70 | -56.48 | 17.02 | 25.05 | -61.77 | -13.21 | 43.57 |
| 71 | -84.52 | 46.78 | 17.52 | -135.40 | -42.97 | 53.98 |
| 72 | -75.98 | 39.59 | 33.63 | -89.57 | -35.78 | 60.50 |
| 73 | -61.16 | 30.86 | 14.60 | -30.60 | -22.30 | 30.79 |
| 74 | -52.57 | 23.64 | 30.69 | 15.28 | -15.09 | 37.27 |
| 75 | -80.61 | 53.40 | 23.17 | -58.36 | -44.85 | 47.68 |
| 76 | -72.07 | 46.21 | 39.27 | -12.53 | -37.66 | 54.20 |
| 77 | -0.64 | 2.21 | -11.90 | -88.91 | 2.07 | 3.90 |
| 78 | 7.94 | -5.01 | 4.19 | -43.03 | 9.29 | 10.38 |
| 79 | -20.09 | 24.75 | -3.34 | -116.67 | -20.47 | 20.79 |
| 80 | -11.55 | 17.56 | 12.77 | -70.84 | -13.28 | 27.31 |
| 81 | -59.50 | 43.81 | 22.03 | -74.61 | -35.31 | 47.14 |
| 82 | -45.44 | 44.76 | 23.94 | -66.98 | -36.26 | 45.22 |
| 83 | -101.80 | 53.35 | 31.45 | -133.90 | -48.08 | 71.58 |
| 84 | -87.74 | 54.30 | 33.36 | -126.27 | -49.02 | 69.67 |
| 85 | -99.39 | 57.45 | 34.94 | -86.21 | -49.24 | 67.68 |
| 86 | -85.32 | 58.40 | 36.85 | -78.58 | -50.19 | 65.77 |
| 87 | -61.92 | 39.71 | 18.53 | -122.30 | -34.15 | 51.04 |
| 88 | -47.85 | 40.66 | 20.45 | -114.67 | -35.10 | 49.12 |
| 89 | -47.39 | 33.59 | 16.72 | -58.27 | -27.05 | 36.48 |
| 90 | -33.32 | 34.54 | 18.64 | -50.64 | -28.00 | 34.57 |
| 91 | -79.93 | 40.93 | 23.97 | -103.88 | -36.87 | 55.28 |
| 92 | -65.86 | 41.88 | 25.88 | -96.25 | -37.82 | 53.37 |
| 93 | -78.07 | 44.08 | 26.66 | -67.19 | -37.77 | 52.28 |
| 94 | -64.00 | 45.03 | 28.57 | -59.56 | -38.71 | 50.37 |
| 95 | -49.25 | 30.44 | 14.04 | -94.96 | -26.16 | 39.48 |
| 96 | -35.18 | 31.39 | 15.95 | -87.33 | -27.11 | 37.56 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -140.75 | -213.60 | -246.11 | -232.69 | -173.35 | -85.44 | -34.01 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 11.85 | 4.34 | 14.45 | 22.04 | 27.12 | 30.49 | 193.17 |

强度计算应力比 =0.690

抗剪强度计算应力比 =0.291

平面内稳定计算最大应力对应组合号: 1, M=-43.13, N=50.16, M=-56.35, N=-37.83

平面内稳定最大应力 (N/mm\*mm) =231.39

平面内稳定计算最大应力比 =0.759

临界弯矩Mcr(kN\*m) =1161.91

平面外稳定计算最大应力比 =0.528

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 =0.690 < 1.0

抗剪强度计算应力比 =0.291 < 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 =0.528 < 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 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 61.51 | 77.48 | 85.39 | 84.04 | 73.97 | 57.53 | 38.83 |

最大挠度值 =85.88 最大挠度/梁跨度 =1/265.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.11

变形后斜梁坡度改变率 =0.125 < 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 | -40.38 | 34.06 | 17.68 | -54.47 | -27.53 | 35.53 |
| 2 | -72.91 | 41.40 | 24.92 | -100.07 | -37.34 | 54.33 |
| 3 | -71.05 | 44.55 | 27.61 | -63.39 | -38.24 | 51.33 |
| 4 | -42.24 | 30.91 | 14.99 | -91.15 | -26.63 | 38.52 |
| 5 | -35.79 | 31.00 | 15.96 | -48.17 | -24.89 | 31.89 |
| 6 | -68.33 | 38.34 | 23.21 | -93.78 | -34.71 | 50.69 |
| 7 | -66.47 | 41.49 | 25.89 | -57.09 | -35.61 | 47.69 |
| 8 | -37.65 | 27.85 | 13.27 | -84.86 | -24.00 | 34.89 |
| 9 | -35.86 | 22.86 | 10.62 | -54.10 | -18.58 | 26.49 |
| 10 | -33.57 | 20.93 | 14.91 | -41.87 | -16.65 | 28.22 |
| 11 | -41.05 | 28.87 | 12.90 | -61.51 | -24.59 | 31.00 |
| 12 | -38.77 | 26.95 | 17.20 | -49.28 | -22.67 | 32.73 |
| 13 | -31.27 | 19.80 | 8.90 | -47.81 | -15.94 | 22.86 |
| 14 | -28.98 | 17.87 | 13.19 | -35.57 | -14.02 | 24.58 |
| 15 | -36.46 | 25.81 | 11.19 | -55.21 | -21.95 | 27.36 |
| 16 | -34.18 | 23.89 | 15.48 | -42.99 | -20.04 | 29.10 |

--- 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 -72.91 -110.79 -125.67 -115.69 -80.86 -21.43 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 9.89 100.07

强度计算荷载比 =0.36

平面内稳定计算荷载比 =0.32

平面外稳定计算荷载比 =0.14

无防护下钢构件最大升温(Ts): 1004.71℃ ,按临界温度法求得临界温度(Td): 636.78℃

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)=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=300, B2=300, 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: 205.267487(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -107.31 | 62.86 | -34.84 | -264.09 | -54.43 | 77.53 |
| 2 | -258.87 | 101.60 | -72.86 | -646.50 | -119.17 | 173.69 |
| 3 | -173.97 | 62.45 | -24.96 | -344.10 | -68.55 | 120.68 |
| 4 | -192.21 | 102.01 | -82.74 | -566.49 | -105.05 | 130.54 |
| 5 | -79.31 | 50.31 | -26.63 | -194.43 | -41.18 | 58.29 |
| 6 | -230.87 | 89.05 | -64.65 | -576.85 | -105.92 | 154.45 |
| 7 | -145.97 | 49.90 | -16.75 | -274.45 | -55.30 | 101.44 |
| 8 | -164.21 | 89.46 | -74.53 | -496.83 | -91.80 | 111.30 |
| 9 | -38.11 | 17.71 | -21.12 | -195.37 | -20.76 | 44.52 |
| 10 | -43.21 | 8.84 | -1.83 | -2.44 | -11.88 | 11.00 |
| 11 | -77.45 | 44.52 | -33.52 | -301.04 | -47.56 | 72.89 |
| 12 | -82.63 | 35.68 | -14.25 | -108.27 | -38.73 | 39.42 |
| 13 | -10.11 | 5.16 | -12.91 | -125.72 | -7.50 | 25.27 |
| 14 | -15.21 | -3.71 | 6.38 | 67.21 | 1.37 | -8.24 |
| 15 | -49.45 | 31.97 | -25.31 | -231.39 | -34.31 | 53.64 |
| 16 | -54.63 | 23.14 | -6.04 | -38.62 | -25.48 | 20.18 |
| 17 | -57.37 | 40.86 | -26.17 | -200.22 | -32.43 | 54.21 |
| 18 | -60.43 | 35.54 | -14.59 | -84.46 | -27.11 | 34.10 |
| 19 | -80.98 | 56.95 | -33.60 | -263.62 | -48.51 | 71.24 |
| 20 | -84.08 | 51.65 | -22.04 | -147.95 | -43.21 | 51.15 |
| 21 | -208.94 | 79.60 | -64.18 | -582.63 | -97.17 | 150.38 |
| 22 | -212.00 | 74.27 | -52.61 | -466.87 | -91.84 | 130.27 |
| 23 | -232.54 | 95.68 | -71.62 | -646.03 | -113.25 | 167.40 |
| 24 | -235.65 | 90.38 | -60.06 | -530.37 | -107.95 | 147.32 |
| 25 | -124.03 | 40.45 | -16.28 | -280.23 | -46.55 | 97.36 |
| 26 | -127.09 | 35.13 | -4.71 | -164.47 | -41.22 | 77.26 |
| 27 | -147.64 | 56.54 | -23.72 | -343.63 | -62.63 | 114.39 |
| 28 | -150.74 | 51.24 | -12.16 | -227.97 | -57.33 | 94.31 |
| 29 | -142.28 | 80.01 | -74.07 | -502.62 | -83.05 | 107.22 |
| 30 | -145.34 | 74.68 | -62.50 | -386.86 | -77.73 | 87.12 |
| 31 | -165.88 | 96.09 | -81.51 | -566.02 | -99.13 | 124.25 |
| 32 | -168.99 | 90.79 | -69.94 | -450.35 | -93.83 | 104.17 |
| 33 | -29.37 | 28.31 | -17.96 | -130.57 | -19.18 | 34.97 |
| 34 | -32.43 | 22.99 | -6.38 | -14.81 | -13.85 | 14.86 |
| 35 | -52.98 | 44.40 | -25.39 | -193.97 | -35.26 | 51.99 |
| 36 | -56.08 | 39.10 | -13.83 | -78.30 | -29.96 | 31.91 |
| 37 | -180.94 | 67.05 | -55.97 | -512.98 | -83.92 | 131.13 |
| 38 | -184.00 | 61.72 | -44.40 | -397.22 | -78.59 | 111.03 |
| 39 | -204.54 | 83.13 | -63.41 | -576.38 | -100.00 | 148.16 |
| 40 | -207.65 | 77.83 | -51.85 | -460.72 | -94.70 | 128.08 |
| 41 | -96.03 | 27.90 | -8.07 | -210.58 | -33.30 | 78.12 |
| 42 | -99.09 | 22.58 | 3.50 | -94.82 | -27.97 | 58.01 |
| 43 | -119.64 | 43.99 | -15.51 | -273.98 | -49.38 | 95.15 |
| 44 | -122.74 | 38.69 | -3.95 | -158.32 | -44.08 | 75.06 |
| 45 | -114.28 | 67.46 | -65.86 | -432.97 | -69.80 | 87.98 |
| 46 | -117.34 | 62.13 | -54.28 | -317.21 | -64.47 | 67.87 |
| 47 | -137.88 | 83.54 | -73.30 | -496.37 | -85.88 | 105.01 |
| 48 | -140.99 | 78.24 | -61.73 | -380.70 | -80.58 | 84.92 |
| 49 | -28.29 | 23.65 | -20.60 | -168.96 | -18.66 | 40.42 |
| 50 | -33.39 | 14.78 | -1.32 | 23.98 | -9.79 | 6.91 |
| 51 | -67.63 | 50.46 | -33.00 | -274.63 | -45.47 | 68.79 |
| 52 | -72.81 | 41.62 | -13.73 | -81.85 | -36.63 | 35.32 |
| 53 | -134.39 | 50.76 | -47.22 | -436.65 | -63.98 | 107.74 |
| 54 | -139.49 | 41.89 | -27.93 | -243.71 | -55.11 | 74.22 |
| 55 | -173.73 | 77.57 | -59.61 | -542.32 | -90.78 | 136.11 |
| 56 | -178.90 | 68.74 | -40.34 | -349.54 | -81.95 | 102.64 |
| 57 | -74.95 | 23.36 | -13.69 | -224.97 | -28.54 | 70.63 |
| 58 | -80.06 | 14.49 | 5.60 | -32.03 | -19.67 | 37.11 |
| 59 | -114.29 | 50.17 | -26.08 | -330.64 | -55.35 | 99.00 |
| 60 | -119.47 | 41.34 | -6.81 | -137.86 | -46.51 | 65.53 |
| 61 | -87.72 | 51.05 | -54.14 | -380.64 | -54.09 | 77.53 |
| 62 | -92.83 | 42.18 | -34.85 | -187.70 | -45.22 | 44.02 |
| 63 | -127.07 | 77.86 | -66.53 | -486.31 | -80.90 | 105.90 |
| 64 | -132.24 | 69.02 | -47.26 | -293.53 | -72.07 | 72.43 |
| 65 | -0.29 | 11.10 | -12.39 | -99.31 | -5.41 | 21.18 |
| 66 | -5.39 | 2.23 | 6.89 | 93.63 | 3.46 | -12.33 |
| 67 | -39.63 | 37.91 | -24.79 | -204.98 | -32.22 | 49.55 |
| 68 | -44.81 | 29.07 | -5.52 | -12.20 | -23.38 | 16.08 |
| 69 | -106.39 | 38.21 | -39.01 | -367.00 | -50.72 | 88.49 |
| 70 | -111.49 | 29.34 | -19.72 | -174.06 | -41.85 | 54.98 |
| 71 | -145.73 | 65.02 | -51.40 | -472.67 | -77.53 | 116.86 |
| 72 | -150.90 | 56.19 | -32.13 | -279.89 | -68.70 | 83.40 |
| 73 | -46.95 | 10.81 | -5.48 | -155.32 | -15.29 | 51.39 |
| 74 | -52.06 | 1.94 | 13.81 | 37.62 | -6.42 | 17.87 |
| 75 | -86.29 | 37.62 | -17.87 | -260.99 | -42.10 | 79.76 |
| 76 | -91.47 | 28.79 | 1.40 | -68.21 | -33.26 | 46.29 |
| 77 | -59.72 | 38.50 | -45.93 | -310.99 | -40.84 | 58.29 |
| 78 | -64.83 | 29.63 | -26.64 | -118.05 | -31.97 | 24.77 |
| 79 | -99.07 | 65.31 | -58.32 | -416.66 | -67.65 | 86.66 |
| 80 | -104.24 | 56.47 | -39.05 | -223.88 | -58.81 | 53.19 |
| 81 | -105.61 | 62.68 | -36.05 | -300.75 | -60.75 | 81.64 |
| 82 | -124.96 | 53.40 | -34.46 | -270.10 | -51.47 | 80.05 |
| 83 | -171.29 | 79.47 | -52.53 | -466.46 | -88.81 | 123.31 |
| 84 | -190.63 | 70.19 | -50.94 | -435.81 | -79.52 | 121.72 |
| 85 | -134.50 | 62.51 | -31.77 | -335.42 | -66.87 | 100.34 |
| 86 | -153.84 | 53.22 | -30.18 | -304.77 | -57.59 | 98.75 |
| 87 | -142.40 | 79.65 | -56.81 | -431.79 | -82.69 | 104.61 |
| 88 | -161.75 | 70.36 | -55.22 | -401.14 | -73.41 | 103.02 |
| 89 | -79.01 | 49.29 | -27.91 | -234.87 | -47.80 | 62.98 |
| 90 | -98.36 | 40.00 | -26.33 | -204.22 | -38.52 | 61.39 |
| 91 | -129.53 | 62.20 | -40.59 | -362.34 | -69.38 | 95.03 |
| 92 | -148.88 | 52.92 | -39.00 | -331.70 | -60.10 | 93.45 |
| 93 | -101.23 | 49.15 | -24.62 | -261.54 | -52.51 | 77.36 |
| 94 | -120.58 | 39.87 | -23.03 | -230.90 | -43.23 | 75.78 |
| 95 | -107.31 | 62.33 | -43.88 | -335.67 | -64.68 | 80.65 |
| 96 | -126.66 | 53.05 | -42.29 | -305.02 | -55.39 | 79.06 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -258.87 | -134.92 | -87.25 | -73.01 | -67.48 | -57.63 | -93.63 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 0.00 | 6.42 | 25.39 | 60.20 | 136.39 | 223.23 | 646.50 |

强度计算应力比 =0.662

抗剪强度计算应力比 =0.692

平面内稳定计算最大应力对应组合号: 1, M=-107.31, N=62.86, M=-264.09, N=-54.43

平面内稳定最大应力 (N/mm\*mm) =207.50

平面内稳定计算最大应力比 =0.680

临界弯矩Mcr(kN\*m) =2285.10

平面外稳定计算最大应力比 =0.576

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 =0.662 < 1.0

抗剪强度计算应力比 =0.692 < 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 =0.576 < 1.0

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

翼缘宽厚比 B/T =10.50 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 93.80 | 78.99 | 63.16 | 46.85 | 30.58 | 14.82 | 0.00 |

最大挠度值 =93.80 最大挠度/梁跨度 =1/295.

斜梁坡度初始值: 1/15.71

变形后斜梁坡度最小值: 1/20.07

变形后斜梁坡度改变率 =0.217 < 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 | -88.66 | 44.66 | -27.12 | -219.59 | -43.17 | 62.19 |
| 2 | -139.18 | 57.57 | -39.80 | -347.06 | -64.75 | 94.24 |
| 3 | -110.88 | 44.52 | -23.83 | -246.26 | -47.88 | 76.57 |
| 4 | -116.96 | 57.71 | -43.09 | -320.39 | -60.05 | 79.86 |
| 5 | -79.32 | 40.48 | -24.39 | -196.37 | -38.76 | 55.77 |
| 6 | -129.85 | 53.39 | -37.06 | -323.85 | -60.34 | 87.83 |
| 7 | -101.54 | 40.34 | -21.09 | -223.05 | -43.46 | 70.16 |
| 8 | -107.63 | 53.52 | -40.35 | -297.17 | -55.63 | 73.44 |
| 9 | -71.14 | 32.05 | -23.51 | -203.78 | -34.39 | 53.77 |
| 10 | -72.50 | 29.69 | -18.37 | -152.33 | -32.03 | 44.84 |
| 11 | -81.63 | 39.20 | -26.82 | -231.96 | -41.54 | 61.34 |
| 12 | -83.01 | 36.85 | -21.68 | -180.56 | -39.19 | 52.41 |
| 13 | -61.81 | 27.87 | -20.78 | -180.57 | -29.98 | 47.36 |
| 14 | -63.17 | 25.50 | -15.63 | -129.12 | -27.61 | 38.42 |
| 15 | -72.30 | 35.02 | -24.08 | -208.75 | -37.13 | 54.93 |
| 16 | -73.68 | 32.66 | -18.94 | -157.34 | -34.77 | 46.00 |

--- 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 -139.18 -77.41 -33.52 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 39.41 94.60 160.68 347.06

强度计算荷载比 =0.36

平面内稳定计算荷载比 =0.36

平面外稳定计算荷载比 =0.23

无防护下钢构件最大升温(Ts): 1004.34℃ ,按临界温度法求得临界温度(Td): 623.96℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2028(m^2\*℃/w)

构件重量 (Kg)=669.17

**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=285, B2=285, 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: 227.586212(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -161.75 | 51.67 | 15.16 | 258.87 | -101.76 | 72.62 |
| 2 | -475.58 | 104.09 | 13.17 | 107.31 | -62.94 | 34.70 |
| 3 | -475.58 | 104.09 | 13.17 | 253.82 | -110.09 | 77.77 |
| 4 | -161.75 | 51.67 | 15.16 | 112.36 | -54.62 | 29.55 |
| 5 | -113.00 | 39.78 | 13.02 | 230.87 | -89.20 | 64.44 |
| 6 | -426.83 | 92.21 | 11.03 | 79.31 | -50.38 | 26.51 |
| 7 | -426.83 | 92.21 | 11.03 | 225.82 | -97.53 | 69.59 |
| 8 | -113.00 | 39.78 | 13.02 | 84.36 | -42.05 | 21.36 |
| 9 | -110.21 | 14.81 | 0.07 | 38.11 | -17.76 | 21.08 |
| 10 | -30.17 | 5.90 | 5.61 | 43.21 | -8.85 | 1.81 |
| 11 | -181.32 | 41.65 | 3.15 | 77.45 | -44.60 | 33.41 |
| 12 | -101.38 | 32.77 | 8.70 | 82.63 | -35.72 | 14.17 |
| 13 | -61.46 | 2.92 | -2.06 | 10.11 | -5.19 | 12.90 |
| 14 | 18.59 | -5.99 | 3.48 | 15.21 | 3.72 | -6.37 |
| 15 | -132.56 | 29.76 | 1.02 | 49.45 | -32.03 | 25.23 |
| 16 | -52.63 | 20.88 | 6.57 | 54.63 | -23.15 | 5.98 |
| 17 | -101.11 | 29.64 | 9.65 | 208.94 | -79.74 | 64.00 |
| 18 | -53.08 | 24.30 | 12.98 | 212.00 | -74.39 | 52.44 |
| 19 | -143.78 | 45.75 | 11.50 | 232.54 | -95.85 | 71.40 |
| 20 | -95.82 | 40.42 | 14.83 | 235.65 | -90.52 | 59.85 |
| 21 | -414.94 | 82.07 | 7.66 | 57.37 | -40.92 | 26.07 |
| 22 | -366.92 | 76.72 | 10.98 | 60.43 | -35.57 | 14.51 |
| 23 | -457.61 | 98.17 | 9.51 | 80.98 | -57.03 | 33.47 |
| 24 | -409.65 | 92.85 | 12.84 | 84.08 | -51.70 | 21.92 |
| 25 | -414.94 | 82.07 | 7.66 | 203.88 | -88.07 | 69.15 |
| 26 | -366.92 | 76.72 | 10.98 | 206.94 | -82.72 | 57.59 |
| 27 | -457.61 | 98.17 | 9.51 | 227.49 | -104.17 | 76.55 |
| 28 | -409.65 | 92.85 | 12.84 | 230.59 | -98.85 | 65.00 |
| 29 | -101.11 | 29.64 | 9.65 | 62.43 | -32.59 | 20.92 |
| 30 | -53.08 | 24.30 | 12.98 | 65.49 | -27.25 | 9.36 |
| 31 | -143.78 | 45.75 | 11.50 | 86.03 | -48.70 | 28.32 |
| 32 | -95.82 | 40.42 | 14.83 | 89.14 | -43.37 | 16.77 |
| 33 | -52.36 | 17.76 | 7.52 | 180.94 | -67.17 | 55.82 |
| 34 | -4.33 | 12.41 | 10.84 | 184.00 | -61.83 | 44.26 |
| 35 | -95.02 | 33.86 | 9.36 | 204.54 | -83.28 | 63.22 |
| 36 | -47.06 | 28.53 | 12.69 | 207.65 | -77.95 | 51.67 |
| 37 | -366.19 | 70.18 | 5.53 | 29.37 | -28.35 | 17.89 |
| 38 | -318.16 | 64.84 | 8.85 | 32.43 | -23.01 | 6.33 |
| 39 | -408.85 | 86.29 | 7.37 | 52.98 | -44.46 | 25.29 |
| 40 | -360.89 | 80.96 | 10.70 | 56.08 | -39.13 | 13.74 |
| 41 | -366.19 | 70.18 | 5.53 | 175.88 | -75.50 | 60.97 |
| 42 | -318.16 | 64.84 | 8.85 | 178.94 | -70.16 | 49.41 |
| 43 | -408.85 | 86.29 | 7.37 | 199.49 | -91.61 | 68.37 |
| 44 | -360.89 | 80.96 | 10.70 | 202.59 | -86.28 | 56.82 |
| 45 | -52.36 | 17.76 | 7.52 | 34.43 | -20.03 | 12.74 |
| 46 | -4.33 | 12.41 | 10.84 | 37.49 | -14.68 | 1.18 |
| 47 | -95.02 | 33.86 | 9.36 | 58.03 | -36.13 | 20.14 |
| 48 | -47.06 | 28.53 | 12.69 | 61.14 | -30.80 | 8.59 |
| 49 | -75.55 | 14.92 | 4.21 | 134.39 | -50.87 | 47.10 |
| 50 | 4.50 | 6.00 | 9.75 | 139.49 | -41.96 | 27.83 |
| 51 | -146.65 | 41.75 | 7.29 | 173.73 | -77.71 | 59.43 |
| 52 | -66.72 | 32.88 | 12.84 | 178.90 | -68.83 | 40.18 |
| 53 | -295.23 | 51.62 | 2.81 | 28.29 | -23.70 | 20.55 |
| 54 | -215.18 | 42.70 | 8.36 | 33.39 | -14.78 | 1.28 |
| 55 | -366.33 | 78.45 | 5.89 | 67.63 | -50.53 | 32.88 |
| 56 | -286.40 | 69.57 | 11.44 | 72.81 | -41.66 | 13.64 |
| 57 | -295.23 | 51.62 | 2.81 | 130.85 | -56.70 | 50.70 |
| 58 | -215.18 | 42.70 | 8.36 | 135.95 | -47.79 | 31.44 |
| 59 | -366.33 | 78.45 | 5.89 | 170.19 | -83.54 | 63.04 |
| 60 | -286.40 | 69.57 | 11.44 | 175.37 | -74.66 | 43.79 |
| 61 | -75.55 | 14.92 | 4.21 | 31.83 | -17.87 | 16.94 |
| 62 | 4.50 | 6.00 | 9.75 | 36.93 | -8.95 | -2.32 |
| 63 | -146.65 | 41.75 | 7.29 | 71.17 | -44.70 | 29.28 |
| 64 | -66.72 | 32.88 | 12.84 | 76.35 | -35.83 | 10.03 |
| 65 | -26.79 | 3.03 | 2.07 | 106.39 | -38.30 | 38.92 |
| 66 | 53.26 | -5.88 | 7.61 | 111.49 | -29.39 | 19.65 |
| 67 | -97.89 | 29.87 | 5.15 | 145.73 | -65.14 | 51.25 |
| 68 | -17.96 | 20.99 | 10.70 | 150.90 | -56.26 | 32.00 |
| 69 | -246.47 | 39.73 | 0.68 | 0.29 | -11.13 | 12.37 |
| 70 | -166.42 | 30.81 | 6.22 | 5.39 | -2.22 | -6.90 |
| 71 | -317.58 | 66.57 | 3.76 | 39.63 | -37.97 | 24.70 |
| 72 | -237.64 | 57.69 | 9.31 | 44.81 | -29.09 | 5.45 |
| 73 | -246.47 | 39.73 | 0.68 | 102.85 | -44.13 | 42.52 |
| 74 | -166.42 | 30.81 | 6.22 | 107.95 | -35.22 | 23.26 |
| 75 | -317.58 | 66.57 | 3.76 | 142.19 | -70.97 | 54.86 |
| 76 | -237.64 | 57.69 | 9.31 | 147.37 | -62.09 | 35.61 |
| 77 | -26.79 | 3.03 | 2.07 | 3.83 | -5.30 | 8.76 |
| 78 | 53.26 | -5.88 | 7.61 | 8.93 | 3.62 | -10.50 |
| 79 | -97.89 | 29.87 | 5.15 | 43.17 | -32.14 | 21.10 |
| 80 | -17.96 | 20.99 | 10.70 | 48.35 | -23.26 | 1.85 |
| 81 | -186.40 | 54.31 | 10.90 | 171.29 | -77.69 | 52.47 |
| 82 | -193.26 | 48.84 | 12.72 | 190.63 | -72.22 | 50.65 |
| 83 | -322.39 | 77.03 | 10.04 | 105.61 | -60.87 | 36.03 |
| 84 | -329.25 | 71.55 | 11.86 | 124.96 | -55.40 | 34.21 |
| 85 | -322.39 | 77.03 | 10.04 | 169.10 | -81.30 | 54.70 |
| 86 | -329.25 | 71.55 | 11.86 | 188.44 | -75.83 | 52.88 |
| 87 | -186.40 | 54.31 | 10.90 | 107.80 | -57.26 | 33.80 |
| 88 | -193.26 | 48.84 | 12.72 | 127.15 | -51.79 | 31.98 |
| 89 | -142.59 | 42.40 | 8.18 | 129.53 | -60.39 | 40.57 |
| 90 | -149.45 | 36.93 | 10.00 | 148.88 | -54.92 | 38.75 |
| 91 | -247.21 | 59.88 | 7.51 | 79.01 | -47.45 | 27.93 |
| 92 | -254.06 | 54.41 | 9.33 | 98.36 | -41.98 | 26.11 |
| 93 | -247.21 | 59.88 | 7.51 | 127.85 | -63.17 | 42.29 |
| 94 | -254.06 | 54.41 | 9.33 | 147.20 | -57.70 | 40.47 |
| 95 | -142.59 | 42.40 | 8.18 | 80.70 | -44.67 | 26.21 |
| 96 | -149.45 | 36.93 | 10.00 | 100.04 | -39.20 | 24.39 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -475.58 | -481.98 | -471.03 | -442.74 | -397.10 | -334.13 | -258.87 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 53.26 | 14.34 | 9.53 | 4.17 | 0.00 | 0.00 | 0.00 |

强度计算应力比 =0.694

抗剪强度计算应力比 =0.291

平面内稳定计算最大应力对应组合号: 1, M=-161.75, N=51.67, M=258.87, N=-101.76

平面内稳定最大应力 (N/mm\*mm) =216.62

平面内稳定计算最大应力比 =0.710

临界弯矩Mcr(kN\*m) =1934.43

平面外稳定计算最大应力比 =0.800

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 =0.694 < 1.0

抗剪强度计算应力比 =0.291 < 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 =0.800 < 1.0

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

翼缘宽厚比 B/T =11.62 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 127.41 | 128.66 | 127.39 | 123.37 | 116.43 | 106.54 | 93.80 |

最大挠度值 =128.66 最大挠度/梁跨度 =1/215.

斜梁坡度初始值: 1/15.15

变形后斜梁坡度最小值: 1/18.44

变形后斜梁坡度改变率 =0.178 < 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 | -146.01 | 39.68 | 9.08 | 139.18 | -57.66 | 39.66 |
| 2 | -250.62 | 57.15 | 8.42 | 88.66 | -44.72 | 27.02 |
| 3 | -250.62 | 57.15 | 8.42 | 137.49 | -60.44 | 41.38 |
| 4 | -146.01 | 39.68 | 9.08 | 90.34 | -41.95 | 25.30 |
| 5 | -129.76 | 35.71 | 8.37 | 129.85 | -53.47 | 36.93 |
| 6 | -234.37 | 53.19 | 7.71 | 79.32 | -40.53 | 24.29 |
| 7 | -234.37 | 53.19 | 7.71 | 128.16 | -56.25 | 38.65 |
| 8 | -129.76 | 35.71 | 8.37 | 81.01 | -37.76 | 22.58 |
| 9 | -135.57 | 29.84 | 4.67 | 71.14 | -32.11 | 23.44 |
| 10 | -114.23 | 27.46 | 6.15 | 72.50 | -29.73 | 18.30 |
| 11 | -154.53 | 36.99 | 5.49 | 81.63 | -39.26 | 26.73 |
| 12 | -133.22 | 34.63 | 6.97 | 83.01 | -36.90 | 21.59 |
| 13 | -119.32 | 25.88 | 3.96 | 61.81 | -27.92 | 20.71 |
| 14 | -97.97 | 23.50 | 5.43 | 63.17 | -25.54 | 15.57 |
| 15 | -138.28 | 33.03 | 4.78 | 72.30 | -35.07 | 24.00 |
| 16 | -116.97 | 30.66 | 6.26 | 73.68 | -32.71 | 18.87 |

--- 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 -250.62 -255.51 -250.90 -236.79 -213.19 -180.09 -139.18

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 =0.38

平面内稳定计算荷载比 =0.37

平面外稳定计算荷载比 =0.40

无防护下钢构件最大升温(Ts): 1004.52℃ ,按临界温度法求得临界温度(Td): 610.89℃

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)=554.85

**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=340, B2=340, 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: 183.423920(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 193.17 | 67.29 | -101.17 | -462.50 | -31.04 | 87.04 |
| 2 | 56.35 | 37.83 | -44.76 | -947.75 | -64.67 | 176.59 |
| 3 | 56.35 | 37.83 | -44.76 | -530.90 | -31.60 | 122.68 |
| 4 | 193.17 | 67.29 | -101.17 | -879.35 | -64.11 | 140.95 |
| 5 | 174.28 | 59.39 | -90.27 | -355.77 | -23.87 | 66.96 |
| 6 | 37.46 | 29.94 | -33.86 | -841.02 | -57.51 | 156.50 |
| 7 | 37.46 | 29.94 | -33.86 | -424.16 | -24.44 | 102.59 |
| 8 | 174.28 | 59.39 | -90.27 | -772.62 | -56.94 | 120.86 |
| 9 | 48.61 | 5.17 | -10.26 | -132.35 | -1.99 | 19.28 |
| 10 | 2.74 | -2.04 | -16.74 | -155.20 | 5.23 | 37.05 |
| 11 | 76.37 | 27.71 | -27.15 | -291.91 | -24.53 | 48.90 |
| 12 | 30.54 | 20.53 | -33.67 | -315.08 | -17.34 | 66.73 |
| 13 | 29.72 | -2.73 | 0.65 | -25.61 | 5.17 | -0.80 |
| 14 | -16.15 | -9.94 | -5.84 | -48.47 | 12.39 | 16.96 |
| 15 | 57.48 | 19.82 | -16.25 | -185.18 | -17.37 | 28.81 |
| 16 | 11.65 | 12.63 | -22.76 | -208.35 | -10.18 | 46.64 |
| 17 | 173.22 | 49.86 | -78.97 | -264.41 | -13.61 | 46.39 |
| 18 | 145.70 | 45.53 | -82.86 | -278.12 | -9.28 | 57.05 |
| 19 | 189.88 | 63.39 | -89.11 | -360.15 | -27.13 | 64.16 |
| 20 | 162.38 | 59.07 | -93.02 | -374.05 | -22.82 | 74.86 |
| 21 | 36.40 | 20.40 | -22.56 | -749.65 | -47.24 | 135.93 |
| 22 | 8.88 | 16.07 | -26.45 | -763.37 | -42.91 | 146.59 |
| 23 | 53.06 | 33.93 | -32.70 | -845.39 | -60.77 | 153.70 |
| 24 | 25.56 | 29.62 | -36.61 | -859.30 | -56.45 | 164.40 |
| 25 | 36.40 | 20.40 | -22.56 | -332.80 | -14.17 | 82.02 |
| 26 | 8.88 | 16.07 | -26.45 | -346.51 | -9.84 | 92.68 |
| 27 | 53.06 | 33.93 | -32.70 | -428.54 | -27.70 | 99.79 |
| 28 | 25.56 | 29.62 | -36.61 | -442.44 | -23.38 | 110.49 |
| 29 | 173.22 | 49.86 | -78.97 | -681.26 | -46.68 | 100.29 |
| 30 | 145.70 | 45.53 | -82.86 | -694.97 | -42.35 | 110.95 |
| 31 | 189.88 | 63.39 | -89.11 | -777.00 | -60.20 | 118.06 |
| 32 | 162.38 | 59.07 | -93.02 | -790.90 | -55.89 | 128.76 |
| 33 | 154.33 | 41.96 | -68.06 | -157.68 | -6.45 | 26.30 |
| 34 | 126.81 | 37.64 | -71.95 | -171.39 | -2.12 | 36.96 |
| 35 | 170.99 | 55.49 | -78.20 | -253.42 | -19.97 | 44.07 |
| 36 | 143.49 | 51.18 | -82.11 | -267.32 | -15.66 | 54.77 |
| 37 | 17.51 | 12.51 | -11.65 | -642.92 | -40.08 | 115.84 |
| 38 | -10.01 | 8.18 | -15.54 | -656.64 | -35.75 | 126.50 |
| 39 | 34.17 | 26.03 | -21.79 | -738.66 | -53.60 | 133.61 |
| 40 | 6.67 | 21.72 | -25.70 | -752.57 | -49.29 | 144.31 |
| 41 | 17.51 | 12.51 | -11.65 | -226.07 | -7.01 | 61.94 |
| 42 | -10.01 | 8.18 | -15.54 | -239.78 | -2.68 | 72.60 |
| 43 | 34.17 | 26.03 | -21.79 | -321.81 | -20.53 | 79.71 |
| 44 | 6.67 | 21.72 | -25.70 | -335.71 | -16.22 | 90.40 |
| 45 | 154.33 | 41.96 | -68.06 | -574.53 | -39.52 | 80.21 |
| 46 | 126.81 | 37.64 | -71.95 | -588.24 | -35.19 | 90.87 |
| 47 | 170.99 | 55.49 | -78.20 | -670.27 | -53.04 | 97.98 |
| 48 | 143.49 | 51.18 | -82.11 | -684.17 | -48.73 | 108.67 |
| 49 | 126.53 | 28.32 | -48.00 | -132.35 | -1.99 | 19.28 |
| 50 | 80.66 | 21.11 | -54.48 | -155.20 | 5.23 | 37.05 |
| 51 | 154.29 | 50.86 | -64.89 | -291.91 | -24.53 | 48.90 |
| 52 | 108.46 | 43.68 | -71.40 | -315.08 | -17.34 | 66.73 |
| 53 | 30.76 | 7.70 | -8.51 | -472.02 | -25.53 | 81.96 |
| 54 | -15.12 | 0.49 | -14.99 | -494.87 | -18.32 | 99.73 |
| 55 | 58.52 | 30.24 | -25.40 | -631.59 | -48.07 | 111.58 |
| 56 | 12.69 | 23.06 | -31.92 | -654.76 | -40.89 | 129.41 |
| 57 | 30.76 | 7.70 | -8.51 | -180.22 | -2.38 | 44.23 |
| 58 | -15.12 | 0.49 | -14.99 | -203.08 | 4.83 | 62.00 |
| 59 | 58.52 | 30.24 | -25.40 | -339.79 | -24.93 | 73.85 |
| 60 | 12.69 | 23.06 | -31.92 | -362.96 | -17.74 | 91.68 |
| 61 | 126.53 | 28.32 | -48.00 | -424.14 | -25.14 | 57.02 |
| 62 | 80.66 | 21.11 | -54.48 | -447.00 | -17.92 | 74.79 |
| 63 | 154.29 | 50.86 | -64.89 | -583.71 | -47.68 | 86.64 |
| 64 | 108.46 | 43.68 | -71.40 | -606.88 | -40.49 | 104.46 |
| 65 | 107.64 | 20.42 | -37.09 | -25.61 | 5.17 | -0.80 |
| 66 | 61.76 | 13.21 | -43.57 | -48.47 | 12.39 | 16.96 |
| 67 | 135.40 | 42.97 | -53.98 | -185.18 | -17.37 | 28.81 |
| 68 | 89.57 | 35.78 | -60.50 | -208.35 | -10.18 | 46.64 |
| 69 | 11.87 | -0.20 | 2.40 | -365.29 | -18.37 | 61.88 |
| 70 | -34.01 | -7.41 | -4.09 | -388.14 | -11.16 | 79.64 |
| 71 | 39.63 | 22.35 | -14.49 | -524.85 | -40.91 | 91.49 |
| 72 | -6.20 | 15.16 | -21.01 | -548.02 | -33.73 | 109.32 |
| 73 | 11.87 | -0.20 | 2.40 | -73.49 | 4.78 | 24.14 |
| 74 | -34.01 | -7.41 | -4.09 | -96.34 | 11.99 | 41.91 |
| 75 | 39.63 | 22.35 | -14.49 | -233.06 | -17.76 | 53.76 |
| 76 | -6.20 | 15.16 | -21.01 | -256.23 | -10.58 | 71.59 |
| 77 | 107.64 | 20.42 | -37.09 | -317.41 | -17.98 | 36.93 |
| 78 | 61.76 | 13.21 | -43.57 | -340.27 | -10.76 | 54.70 |
| 79 | 135.40 | 42.97 | -53.98 | -476.98 | -40.52 | 66.55 |
| 80 | 89.57 | 35.78 | -60.50 | -500.15 | -33.33 | 84.38 |
| 81 | 133.90 | 49.98 | -71.73 | -472.58 | -32.46 | 88.15 |
| 82 | 126.27 | 47.11 | -69.51 | -452.37 | -29.60 | 85.93 |
| 83 | 74.61 | 37.21 | -47.29 | -682.85 | -47.04 | 126.95 |
| 84 | 66.98 | 34.35 | -45.07 | -662.64 | -44.17 | 124.73 |
| 85 | 74.61 | 37.21 | -47.29 | -502.21 | -32.71 | 103.59 |
| 86 | 66.98 | 34.35 | -45.07 | -482.00 | -29.84 | 101.37 |
| 87 | 133.90 | 49.98 | -71.73 | -653.21 | -46.79 | 111.51 |
| 88 | 126.27 | 47.11 | -69.51 | -633.00 | -43.93 | 109.29 |
| 89 | 103.88 | 38.77 | -55.43 | -365.85 | -25.30 | 68.06 |
| 90 | 96.25 | 35.91 | -53.22 | -345.64 | -22.44 | 65.84 |
| 91 | 58.27 | 28.95 | -36.63 | -527.59 | -36.51 | 97.91 |
| 92 | 50.64 | 26.09 | -34.41 | -507.39 | -33.65 | 95.69 |
| 93 | 58.27 | 28.95 | -36.63 | -388.64 | -25.49 | 79.94 |
| 94 | 50.64 | 26.09 | -34.41 | -368.43 | -22.63 | 77.72 |
| 95 | 103.88 | 38.77 | -55.43 | -504.80 | -36.32 | 86.03 |
| 96 | 96.25 | 35.91 | -53.22 | -484.59 | -33.46 | 83.81 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -34.01 | -27.17 | -14.38 | 0.00 | 0.00 | 0.00 | 0.00 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 193.17 | 134.49 | 189.58 | 250.94 | 324.22 | 421.14 | 947.75 |

强度计算应力比 =0.747

抗剪强度计算应力比 =0.325

平面内稳定计算最大应力对应组合号: 1, M=193.17, N=67.29, M=-462.50, N=-31.04

平面内稳定最大应力 (N/mm\*mm) =221.97

平面内稳定计算最大应力比 =0.728

临界弯矩Mcr(kN\*m) =2774.45

平面外稳定计算最大应力比 =0.859

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 =0.747 < 1.0

抗剪强度计算应力比 =0.325 < 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 =0.859 < 1.0

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

翼缘宽厚比 B/T =11.86 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 38.83 | 30.80 | 23.24 | 16.26 | 10.00 | 4.55 | 0.00 |

最大挠度值 =38.83 最大挠度/梁跨度 =1/587.

斜梁坡度初始值: 1/12.50

变形后斜梁坡度最小值: 1/11.28

变形后斜梁坡度改变率 =0.108 < 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 | 100.07 | 37.34 | -54.33 | -355.77 | -23.87 | 66.96 |
| 2 | 54.47 | 27.53 | -35.53 | -517.52 | -35.08 | 96.80 |
| 3 | 54.47 | 27.53 | -35.53 | -378.57 | -24.06 | 78.84 |
| 4 | 100.07 | 37.34 | -54.33 | -494.72 | -34.90 | 84.93 |
| 5 | 93.78 | 34.71 | -50.69 | -320.19 | -21.49 | 60.26 |
| 6 | 48.17 | 24.89 | -31.89 | -481.94 | -32.70 | 90.11 |
| 7 | 48.17 | 24.89 | -31.89 | -342.99 | -21.67 | 72.14 |
| 8 | 93.78 | 34.71 | -50.69 | -459.14 | -32.51 | 78.23 |
| 9 | 54.10 | 18.58 | -26.49 | -267.73 | -16.13 | 48.89 |
| 10 | 41.87 | 16.65 | -28.22 | -273.82 | -14.20 | 53.63 |
| 11 | 61.51 | 24.59 | -31.00 | -310.28 | -22.14 | 56.79 |
| 12 | 49.28 | 22.67 | -32.73 | -316.46 | -20.22 | 61.54 |
| 13 | 47.81 | 15.94 | -22.86 | -232.15 | -13.74 | 42.19 |
| 14 | 35.57 | 14.02 | -24.58 | -238.25 | -11.82 | 46.93 |
| 15 | 55.21 | 21.95 | -27.36 | -274.70 | -19.75 | 50.09 |
| 16 | 42.99 | 20.04 | -29.10 | -280.88 | -17.84 | 54.84 |

--- 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 100.07 99.73 141.30 187.69 243.26 307.50 517.52

强度计算荷载比 =0.41

平面内稳定计算荷载比 =0.40

平面外稳定计算荷载比 =0.41

无防护下钢构件最大升温(Ts): 1003.37℃ ,按临界温度法求得临界温度(Td): 606.61℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.1989(m^2\*℃/w)

构件重量 (Kg)=644.99

**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=285, B2=285, 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: 227.586212(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 112.85 | 78.99 | 81.91 | 475.58 | -104.09 | -13.17 |
| 2 | -90.18 | 67.82 | 82.06 | 161.75 | -51.67 | -15.16 |
| 3 | -73.06 | 98.09 | 104.10 | 475.58 | -104.09 | -13.17 |
| 4 | 95.73 | 48.72 | 59.86 | 161.75 | -51.67 | -15.16 |
| 5 | 111.54 | 67.78 | 69.45 | 426.83 | -92.21 | -11.03 |
| 6 | -91.48 | 56.61 | 69.61 | 113.00 | -39.78 | -13.02 |
| 7 | -74.37 | 86.89 | 91.65 | 426.83 | -92.21 | -11.03 |
| 8 | 94.43 | 37.51 | 47.41 | 113.00 | -39.78 | -13.02 |
| 9 | -37.11 | 11.86 | 21.23 | 110.21 | -14.81 | -0.07 |
| 10 | 33.86 | 2.95 | 13.04 | 30.17 | -5.90 | -5.61 |
| 11 | -34.16 | 38.70 | 39.72 | 181.32 | -41.65 | -3.15 |
| 12 | 36.83 | 29.82 | 31.57 | 101.38 | -32.77 | -8.70 |
| 13 | -38.41 | 0.65 | 8.78 | 61.46 | -2.92 | 2.06 |
| 14 | 32.56 | -8.26 | 0.59 | -18.59 | 5.99 | -3.48 |
| 15 | -35.46 | 27.49 | 27.27 | 132.56 | -29.76 | -1.02 |
| 16 | 35.53 | 18.61 | 19.12 | 52.63 | -20.88 | -6.57 |
| 17 | 87.20 | 56.97 | 62.27 | 414.94 | -82.07 | -7.66 |
| 18 | 129.77 | 51.62 | 57.36 | 366.91 | -76.72 | -10.98 |
| 19 | 88.96 | 73.07 | 73.37 | 457.61 | -98.17 | -9.51 |
| 20 | 131.56 | 67.74 | 68.47 | 409.65 | -92.85 | -12.84 |
| 21 | -115.83 | 45.80 | 62.42 | 101.11 | -29.64 | -9.65 |
| 22 | -73.25 | 40.45 | 57.51 | 53.08 | -24.30 | -12.98 |
| 23 | -114.06 | 61.90 | 73.52 | 143.78 | -45.75 | -11.50 |
| 24 | -71.47 | 56.57 | 68.63 | 95.82 | -40.42 | -14.83 |
| 25 | -98.71 | 76.07 | 84.47 | 414.94 | -82.07 | -7.66 |
| 26 | -56.14 | 70.72 | 79.56 | 366.91 | -76.72 | -10.98 |
| 27 | -96.95 | 92.17 | 95.57 | 457.61 | -98.17 | -9.51 |
| 28 | -54.35 | 86.85 | 90.67 | 409.65 | -92.85 | -12.84 |
| 29 | 70.08 | 26.69 | 40.22 | 101.11 | -29.64 | -9.65 |
| 30 | 112.66 | 21.35 | 35.31 | 53.08 | -24.30 | -12.98 |
| 31 | 71.85 | 42.80 | 51.32 | 143.78 | -45.75 | -11.50 |
| 32 | 114.44 | 37.47 | 46.43 | 95.82 | -40.42 | -14.83 |
| 33 | 85.89 | 45.76 | 49.82 | 366.19 | -70.18 | -5.53 |
| 34 | 128.47 | 40.41 | 44.91 | 318.16 | -64.84 | -8.85 |
| 35 | 87.66 | 61.86 | 60.92 | 408.85 | -86.29 | -7.37 |
| 36 | 130.25 | 56.54 | 56.02 | 360.89 | -80.96 | -10.70 |
| 37 | -117.14 | 34.59 | 49.97 | 52.36 | -17.76 | -7.52 |
| 38 | -74.56 | 29.24 | 45.06 | 4.33 | -12.41 | -10.84 |
| 39 | -115.37 | 50.69 | 61.07 | 95.02 | -33.86 | -9.36 |
| 40 | -72.77 | 45.36 | 56.18 | 47.06 | -28.53 | -12.69 |
| 41 | -100.02 | 64.86 | 72.02 | 366.19 | -70.18 | -5.53 |
| 42 | -57.44 | 59.52 | 67.11 | 318.16 | -64.84 | -8.85 |
| 43 | -98.25 | 80.97 | 83.12 | 408.85 | -86.29 | -7.37 |
| 44 | -55.66 | 75.64 | 78.22 | 360.89 | -80.96 | -10.70 |
| 45 | 68.77 | 15.49 | 27.77 | 52.36 | -17.76 | -7.52 |
| 46 | 111.35 | 10.14 | 22.86 | 4.33 | -12.41 | -10.84 |
| 47 | 70.54 | 31.59 | 38.87 | 95.02 | -33.86 | -9.36 |
| 48 | 113.14 | 26.26 | 33.98 | 47.06 | -28.53 | -12.69 |
| 49 | 37.93 | 33.16 | 40.79 | 295.23 | -51.62 | -2.81 |
| 50 | 108.90 | 24.25 | 32.61 | 215.18 | -42.70 | -8.36 |
| 51 | 40.88 | 60.00 | 59.29 | 366.33 | -78.45 | -5.89 |
| 52 | 111.87 | 51.12 | 51.13 | 286.40 | -69.57 | -11.44 |
| 53 | -104.18 | 25.34 | 40.90 | 75.55 | -14.92 | -4.21 |
| 54 | -33.22 | 16.43 | 32.71 | -4.50 | -6.00 | -9.75 |
| 55 | -101.24 | 52.18 | 59.40 | 146.65 | -41.75 | -7.29 |
| 56 | -30.25 | 43.30 | 51.24 | 66.72 | -32.87 | -12.84 |
| 57 | -92.20 | 46.53 | 56.33 | 295.23 | -51.62 | -2.81 |
| 58 | -21.24 | 37.62 | 48.15 | 215.18 | -42.70 | -8.36 |
| 59 | -89.26 | 73.37 | 74.83 | 366.33 | -78.45 | -5.89 |
| 60 | -18.27 | 64.49 | 66.67 | 286.40 | -69.57 | -11.44 |
| 61 | 25.95 | 11.97 | 25.36 | 75.55 | -14.92 | -4.21 |
| 62 | 96.92 | 3.05 | 17.17 | -4.50 | -6.00 | -9.75 |
| 63 | 28.90 | 38.80 | 43.86 | 146.65 | -41.75 | -7.29 |
| 64 | 99.89 | 29.92 | 35.70 | 66.72 | -32.87 | -12.84 |
| 65 | 36.63 | 21.95 | 28.34 | 246.47 | -39.73 | -0.68 |
| 66 | 107.60 | 13.04 | 20.16 | 166.42 | -30.81 | -6.22 |
| 67 | 39.58 | 48.79 | 46.84 | 317.58 | -66.57 | -3.76 |
| 68 | 110.57 | 39.91 | 38.68 | 237.64 | -57.69 | -9.31 |
| 69 | -105.49 | 14.13 | 28.45 | 26.79 | -3.03 | -2.07 |
| 70 | -34.52 | 5.22 | 20.26 | -53.26 | 5.88 | -7.61 |
| 71 | -102.54 | 40.97 | 46.94 | 97.89 | -29.87 | -5.15 |
| 72 | -31.55 | 32.09 | 38.79 | 17.96 | -20.99 | -10.70 |
| 73 | -93.51 | 35.32 | 43.88 | 246.47 | -39.73 | -0.68 |
| 74 | -22.54 | 26.41 | 35.70 | 166.42 | -30.81 | -6.22 |
| 75 | -90.56 | 62.16 | 62.38 | 317.58 | -66.57 | -3.76 |
| 76 | -19.57 | 53.28 | 54.22 | 237.64 | -57.69 | -9.31 |
| 77 | 24.65 | 0.76 | 12.91 | 26.79 | -3.03 | -2.07 |
| 78 | 95.61 | -8.15 | 4.72 | -53.26 | 5.88 | -7.61 |
| 79 | 27.59 | 27.60 | 31.41 | 97.89 | -29.87 | -5.15 |
| 80 | 98.58 | 18.72 | 23.25 | 17.96 | -20.99 | -10.70 |
| 81 | 48.43 | 62.57 | 65.03 | 322.39 | -75.12 | -9.91 |
| 82 | 55.79 | 60.92 | 67.10 | 329.25 | -73.47 | -11.98 |
| 83 | -39.55 | 57.73 | 65.10 | 186.40 | -52.41 | -10.78 |
| 84 | -32.19 | 56.08 | 67.17 | 193.26 | -50.75 | -12.85 |
| 85 | -32.13 | 70.85 | 74.65 | 322.39 | -75.12 | -9.91 |
| 86 | -24.77 | 69.20 | 76.72 | 329.25 | -73.47 | -11.98 |
| 87 | 41.02 | 49.46 | 55.48 | 186.40 | -52.41 | -10.78 |
| 88 | 48.37 | 47.80 | 57.55 | 193.26 | -50.75 | -12.85 |
| 89 | 36.41 | 48.32 | 49.79 | 247.21 | -57.98 | -7.39 |
| 90 | 43.77 | 46.67 | 51.86 | 254.06 | -56.32 | -9.46 |
| 91 | -31.27 | 44.60 | 49.84 | 142.59 | -40.50 | -8.05 |
| 92 | -23.91 | 42.94 | 51.91 | 149.45 | -38.85 | -10.12 |
| 93 | -25.56 | 54.69 | 57.19 | 247.21 | -57.98 | -7.39 |
| 94 | -18.20 | 53.04 | 59.26 | 254.06 | -56.32 | -9.46 |
| 95 | 30.70 | 38.23 | 42.44 | 142.59 | -40.50 | -8.05 |
| 96 | 38.06 | 36.58 | 44.51 | 149.45 | -38.85 | -10.12 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -117.14 | -188.04 | -276.60 | -352.36 | -410.78 | -451.85 | -475.58 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 131.56 | 31.61 | 30.11 | 28.05 | 25.45 | 22.30 | 53.26 |

强度计算应力比 =0.621

抗剪强度计算应力比 =0.390

平面内稳定计算最大应力对应组合号: 1, M=112.85, N=78.99, M=475.58, N=-104.09

平面内稳定最大应力 (N/mm\*mm) =200.49

平面内稳定计算最大应力比 =0.657

临界弯矩Mcr(kN\*m) =1934.43

平面外稳定计算最大应力比 =0.743

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 =0.621 < 1.0

抗剪强度计算应力比 =0.390 < 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 =0.743 < 1.0

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

翼缘宽厚比 B/T =11.62 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 72.53 | 86.60 | 99.17 | 109.73 | 118.00 | 123.88 | 127.41 |

最大挠度值 =127.41 最大挠度/梁跨度 =1/217.

斜梁坡度初始值: 1/15.15

变形后斜梁坡度最小值: 1/12.73

变形后斜梁坡度改变率 =0.191 < 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 | 40.08 | 47.50 | 50.82 | 250.62 | -57.15 | -8.42 |
| 2 | -27.60 | 43.77 | 50.87 | 146.01 | -39.68 | -9.08 |
| 3 | -21.89 | 53.87 | 58.22 | 250.62 | -57.15 | -8.42 |
| 4 | 34.37 | 37.41 | 43.47 | 146.01 | -39.68 | -9.08 |
| 5 | 39.64 | 43.76 | 46.67 | 234.37 | -53.19 | -7.71 |
| 6 | -28.03 | 40.04 | 46.72 | 129.76 | -35.71 | -8.37 |
| 7 | -22.33 | 50.13 | 54.07 | 234.37 | -53.19 | -7.71 |
| 8 | 33.94 | 33.67 | 39.32 | 129.76 | -35.71 | -8.37 |
| 9 | -7.06 | 27.57 | 32.77 | 135.57 | -29.84 | -4.67 |
| 10 | 11.87 | 25.19 | 30.59 | 114.23 | -27.46 | -6.14 |
| 11 | -6.27 | 34.73 | 37.71 | 154.53 | -36.99 | -5.49 |
| 12 | 12.66 | 32.36 | 35.53 | 133.22 | -34.63 | -6.97 |
| 13 | -7.49 | 23.83 | 28.62 | 119.32 | -25.88 | -3.96 |
| 14 | 11.43 | 21.46 | 26.44 | 97.97 | -23.50 | -5.43 |
| 15 | -6.70 | 30.99 | 33.56 | 138.28 | -33.03 | -4.78 |
| 16 | 12.23 | 28.62 | 31.38 | 116.97 | -30.66 | -6.26 |

--- 梁的弯矩包络(偶然组合) ---

梁下部受拉:

截面 1 2 3 4 5 6 7

弯矩 -28.03 -83.75 -136.12 -178.99 -212.37 -236.24 -250.62

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 40.08 0.00 0.00 0.00 0.00 0.00 0.00

强度计算荷载比 =0.33

平面内稳定计算荷载比 =0.34

平面外稳定计算荷载比 =0.29

无防护下钢构件最大升温(Ts): 1004.52℃ ,按临界温度法求得临界温度(Td): 630.32℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2208(m^2\*℃/w)

构件重量 (Kg)=554.85

**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=340, B2=340, 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: 183.423920(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 1096.48 | 92.01 | 204.47 | 90.18 | -67.82 | -82.06 |
| 2 | 541.54 | 45.38 | 102.18 | -112.85 | -78.99 | -81.90 |
| 3 | 629.48 | 48.02 | 144.82 | 40.47 | -54.25 | -50.36 |
| 4 | 1008.54 | 89.37 | 161.83 | -63.14 | -92.55 | -113.60 |
| 5 | 971.51 | 81.54 | 180.90 | 91.48 | -56.61 | -69.61 |
| 6 | 416.57 | 34.91 | 78.60 | -111.54 | -67.78 | -69.45 |
| 7 | 504.51 | 37.55 | 121.24 | 41.77 | -43.05 | -37.91 |
| 8 | 883.57 | 78.90 | 138.25 | -61.83 | -81.35 | -101.15 |
| 9 | 193.31 | 8.68 | 45.90 | 37.11 | -11.86 | -21.23 |
| 10 | 160.95 | -0.24 | 23.99 | -33.86 | -2.95 | -13.04 |
| 11 | 376.12 | 35.52 | 79.81 | 34.16 | -38.70 | -39.72 |
| 12 | 344.11 | 26.64 | 57.96 | -36.83 | -29.82 | -31.57 |
| 13 | 68.34 | -1.79 | 22.32 | 38.41 | -0.65 | -8.78 |
| 14 | 35.98 | -10.71 | 0.41 | -32.56 | 8.26 | -0.59 |
| 15 | 251.15 | 25.04 | 56.23 | 35.46 | -27.49 | -27.27 |
| 16 | 219.14 | 16.16 | 34.38 | -35.53 | -18.61 | -19.12 |
| 17 | 887.54 | 69.99 | 170.71 | 115.83 | -45.80 | -62.42 |
| 18 | 868.13 | 64.64 | 157.56 | 73.25 | -40.45 | -57.51 |
| 19 | 997.23 | 86.09 | 191.06 | 114.06 | -61.90 | -73.52 |
| 20 | 978.02 | 80.76 | 177.94 | 71.47 | -56.57 | -68.63 |
| 21 | 332.60 | 23.36 | 68.41 | -87.20 | -56.97 | -62.27 |
| 22 | 313.19 | 18.01 | 55.26 | -129.77 | -51.62 | -57.36 |
| 23 | 442.29 | 39.46 | 88.76 | -88.96 | -73.07 | -73.37 |
| 24 | 423.08 | 34.13 | 75.64 | -131.56 | -67.74 | -68.47 |
| 25 | 420.54 | 26.00 | 111.06 | 66.12 | -32.23 | -30.72 |
| 26 | 401.13 | 20.65 | 97.91 | 23.54 | -26.88 | -25.81 |
| 27 | 530.23 | 42.10 | 131.40 | 64.35 | -48.33 | -41.82 |
| 28 | 511.02 | 36.77 | 118.29 | 21.76 | -43.01 | -36.93 |
| 29 | 799.60 | 67.35 | 128.06 | -37.48 | -70.53 | -93.97 |
| 30 | 780.19 | 62.00 | 114.92 | -80.06 | -65.18 | -89.06 |
| 31 | 909.29 | 83.45 | 148.41 | -39.25 | -86.63 | -105.07 |
| 32 | 890.08 | 78.12 | 135.30 | -81.84 | -81.31 | -100.17 |
| 33 | 762.57 | 59.52 | 147.13 | 117.14 | -34.59 | -49.97 |
| 34 | 743.15 | 54.17 | 133.98 | 74.56 | -29.24 | -45.06 |
| 35 | 872.25 | 75.62 | 167.48 | 115.37 | -50.69 | -61.07 |
| 36 | 853.05 | 70.29 | 154.36 | 72.77 | -45.36 | -56.18 |
| 37 | 207.63 | 12.89 | 44.83 | -85.89 | -45.76 | -49.82 |
| 38 | 188.22 | 7.54 | 31.68 | -128.47 | -40.41 | -44.91 |
| 39 | 317.32 | 28.99 | 65.18 | -87.66 | -61.86 | -60.92 |
| 40 | 298.11 | 23.66 | 52.06 | -130.25 | -56.54 | -56.02 |
| 41 | 295.57 | 15.53 | 87.48 | 67.42 | -21.03 | -18.27 |
| 42 | 276.15 | 10.18 | 74.33 | 24.84 | -15.68 | -13.36 |
| 43 | 405.26 | 31.63 | 107.82 | 65.66 | -37.13 | -29.37 |
| 44 | 386.05 | 26.30 | 94.71 | 23.06 | -31.80 | -24.48 |
| 45 | 674.63 | 56.88 | 104.49 | -36.18 | -59.33 | -81.52 |
| 46 | 655.22 | 51.53 | 91.34 | -78.76 | -53.98 | -76.61 |
| 47 | 784.32 | 72.98 | 124.83 | -37.95 | -75.43 | -92.62 |
| 48 | 765.11 | 67.65 | 111.72 | -80.54 | -70.10 | -87.72 |
| 49 | 581.76 | 41.32 | 117.51 | 104.18 | -25.34 | -40.90 |
| 50 | 549.41 | 32.41 | 95.60 | 33.22 | -16.42 | -32.71 |
| 51 | 764.58 | 68.16 | 151.42 | 101.24 | -52.18 | -59.40 |
| 52 | 732.56 | 59.28 | 129.56 | 30.25 | -43.30 | -51.24 |
| 53 | 193.31 | 8.68 | 45.90 | -37.93 | -33.16 | -40.79 |
| 54 | 160.95 | -0.24 | 23.99 | -108.90 | -24.24 | -32.61 |
| 55 | 376.12 | 35.52 | 79.81 | -40.88 | -60.00 | -59.29 |
| 56 | 344.11 | 26.64 | 57.96 | -111.87 | -51.12 | -51.13 |
| 57 | 254.87 | 10.53 | 75.75 | 69.39 | -15.84 | -18.71 |
| 58 | 222.51 | 1.61 | 53.84 | -1.58 | -6.93 | -10.53 |
| 59 | 437.68 | 37.36 | 109.66 | 66.44 | -42.68 | -37.21 |
| 60 | 405.66 | 28.48 | 87.81 | -4.55 | -33.80 | -29.05 |
| 61 | 520.21 | 39.47 | 87.66 | -3.14 | -42.65 | -62.98 |
| 62 | 487.85 | 30.56 | 65.75 | -74.10 | -33.74 | -54.80 |
| 63 | 703.02 | 66.31 | 121.57 | -6.08 | -69.49 | -81.48 |
| 64 | 671.01 | 57.43 | 99.71 | -77.07 | -60.61 | -73.32 |
| 65 | 456.79 | 30.85 | 93.93 | 105.49 | -14.13 | -28.45 |
| 66 | 424.44 | 21.93 | 72.02 | 34.52 | -5.22 | -20.26 |
| 67 | 639.61 | 57.68 | 127.84 | 102.54 | -40.97 | -46.94 |
| 68 | 607.59 | 48.80 | 105.99 | 31.55 | -32.09 | -38.79 |
| 69 | 68.34 | -1.79 | 22.32 | -36.63 | -21.95 | -28.34 |
| 70 | 35.98 | -10.71 | 0.41 | -107.60 | -13.04 | -20.16 |
| 71 | 251.15 | 25.04 | 56.23 | -39.58 | -48.79 | -46.84 |
| 72 | 219.14 | 16.16 | 34.38 | -110.57 | -39.91 | -38.68 |
| 73 | 129.89 | 0.05 | 52.18 | 70.69 | -4.64 | -6.26 |
| 74 | 97.54 | -8.86 | 30.26 | -0.27 | 4.28 | 1.93 |
| 75 | 312.71 | 26.89 | 86.08 | 67.74 | -31.47 | -24.76 |
| 76 | 280.69 | 18.01 | 64.23 | -3.25 | -22.59 | -16.60 |
| 77 | 395.24 | 29.00 | 64.08 | -1.83 | -31.45 | -50.53 |
| 78 | 362.88 | 20.09 | 42.17 | -72.80 | -22.53 | -42.35 |
| 79 | 578.05 | 55.84 | 97.99 | -4.78 | -58.28 | -69.03 |
| 80 | 546.03 | 46.96 | 76.13 | -75.77 | -49.40 | -60.87 |
| 81 | 770.40 | 64.51 | 145.35 | 39.55 | -55.83 | -64.97 |
| 82 | 793.70 | 66.67 | 147.67 | 32.19 | -57.99 | -67.29 |
| 83 | 529.93 | 44.30 | 101.02 | -48.43 | -60.67 | -64.91 |
| 84 | 553.23 | 46.46 | 103.34 | -55.79 | -62.83 | -67.23 |
| 85 | 568.03 | 45.45 | 119.50 | 18.00 | -49.95 | -51.24 |
| 86 | 591.33 | 47.61 | 121.82 | 10.65 | -52.11 | -53.56 |
| 87 | 732.29 | 63.37 | 126.87 | -26.89 | -66.55 | -78.64 |
| 88 | 755.59 | 65.53 | 129.19 | -34.25 | -68.71 | -80.96 |
| 89 | 589.93 | 49.38 | 111.54 | 31.27 | -42.70 | -49.71 |
| 90 | 613.23 | 51.53 | 113.86 | 23.91 | -44.86 | -52.03 |
| 91 | 404.96 | 33.83 | 77.44 | -36.41 | -46.42 | -49.66 |
| 92 | 428.26 | 35.99 | 79.76 | -43.77 | -48.58 | -51.98 |
| 93 | 434.27 | 34.71 | 91.65 | 14.70 | -38.18 | -39.15 |
| 94 | 457.57 | 36.87 | 93.98 | 7.34 | -40.34 | -41.47 |
| 95 | 560.62 | 48.50 | 97.32 | -19.84 | -50.94 | -60.23 |
| 96 | 583.92 | 50.65 | 99.65 | -27.20 | -53.10 | -62.55 |

**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 | -9.80 | -38.85 | -59.15 | -117.14 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 1096.48 | 472.79 | 338.61 | 239.90 | 153.85 | 77.00 | 131.56 |

强度计算应力比 =0.868

抗剪强度计算应力比 =0.376

平面内稳定计算最大应力对应组合号: 1, M=1096.48, N=92.01, M=90.18, N=-67.82

平面内稳定最大应力 (N/mm\*mm) =262.72

平面内稳定计算最大应力比 =0.861

临界弯矩Mcr(kN\*m) =2774.45

平面外稳定计算最大应力比 =0.993

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 =0.868 < 1.0

抗剪强度计算应力比 =0.376 < 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 =0.993 < 1.0

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

翼缘宽厚比 B/T =11.86 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0.00 | 9.33 | 20.15 | 32.19 | 45.17 | 58.75 | 72.53 |

最大挠度值 =72.53 最大挠度/梁跨度 =1/381.

斜梁坡度初始值: 1/15.15

变形后斜梁坡度最小值: 1/12.81

变形后斜梁坡度改变率 =0.183 < 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 | 601.55 | 50.45 | 112.70 | 27.60 | -43.77 | -50.87 |
| 2 | 416.57 | 34.91 | 78.60 | -40.08 | -47.50 | -50.82 |
| 3 | 445.88 | 35.79 | 92.81 | 11.03 | -39.25 | -40.30 |
| 4 | 572.24 | 49.57 | 98.48 | -23.51 | -52.02 | -61.38 |
| 5 | 559.89 | 46.96 | 104.84 | 28.03 | -40.04 | -46.72 |
| 6 | 374.92 | 31.42 | 70.74 | -39.64 | -43.76 | -46.67 |
| 7 | 404.23 | 32.30 | 84.95 | 11.46 | -35.52 | -36.15 |
| 8 | 530.58 | 46.08 | 90.62 | -23.07 | -48.28 | -57.23 |
| 9 | 323.71 | 25.12 | 63.59 | 7.06 | -27.57 | -32.77 |
| 10 | 315.08 | 22.74 | 57.75 | -11.87 | -25.19 | -30.59 |
| 11 | 372.46 | 32.28 | 72.63 | 6.27 | -34.73 | -37.71 |
| 12 | 363.92 | 29.91 | 66.80 | -12.66 | -32.36 | -35.53 |
| 13 | 282.05 | 21.63 | 55.73 | 7.49 | -23.83 | -28.62 |
| 14 | 273.42 | 19.25 | 49.89 | -11.43 | -21.46 | -26.44 |
| 15 | 330.80 | 28.79 | 64.77 | 6.70 | -30.99 | -33.56 |
| 16 | 322.27 | 26.42 | 58.94 | -12.23 | -28.62 | -31.38 |

--- 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 -28.03

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 601.55 344.70 253.53 178.63 113.46 55.36 40.08

强度计算荷载比 =0.48

平面内稳定计算荷载比 =0.47

平面外稳定计算荷载比 =0.46

无防护下钢构件最大升温(Ts): 1003.37℃ ,按临界温度法求得临界温度(Td): 584.94℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2080(m^2\*℃/w)

构件重量 (Kg)=781.18

风荷载作用下柱顶最大水平（X 向）位移:

节点( 2), 水平位移 dx=8.233(mm) =H /947.

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=3.199(mm) =H /2438.

梁的(恒+活)最大挠度:

梁( 4), 挠跨比 =1 /215.

风载作用下柱顶最大水平位移: H/947< 柱顶位移容许值: H/60

地震作用下柱顶最大水平位移: H/2438< 柱顶位移容许值: H/60

梁的(恒+活)最大挠跨比: 1/215< 梁的容许挠跨比: 1/180

所有钢柱的总重量 (Kg)=2398.

所有钢梁的总重量 (Kg)=4306.

钢梁与钢柱重量之和 (Kg)=6704.

**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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\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\\GJ2\\CalcTemp\\平面外计算长度系数.T)