

## **Dane: Klasyfikacja przekrojów w podwyższonej temperaturze**

*Dokument zawiera dane tabelaryczne służące do klasyfikacji przekrojów w podwyższonej temperaturze. Dane dotyczą powszechnie używanych kształtowników walcowanych na gorąco.*

### **Zawartość**

|                        |    |
|------------------------|----|
| 1. Opis                | 2  |
| 2. Tablice             | 3  |
| 3. Podłoże teoretyczne | 16 |
| 4. Literatura          | 17 |

## 1. Opis

W podwyższonych temperaturach klasyfikacja przekrojów według PN-EN 1993-1-1 §5.5.2 uwzględnia dodatkowo §4.2.2 normy PN-EN 1993-1-2.5, który podaje zredukowaną wartość współczynnika  $\varepsilon$ .

W niniejszym opracowaniu podano w stabelaryzowanej postaci klasyfikację przekrojów kształtowników walcowanych na gorąco, poddanych osiowemu ścisnieniu lub zginaniu, wykonanych z gatunków stali S235 to S460, o następujących rozmiarach:

### **Kształtowniki europejskie:**

IPE 80 IPE 750

IPN 80 do IPN 550

HE 100 do HE 1000

HL 920 do HL 1100

HD 260 do HD 400

UPE 80 do UPE 400

UPN 80 do UPN 400

### **Kształtowniki brytyjskie:**

UB 127 do UB 1016

UC 152 do UC 356

## 2. Tablice

Tablica 2.1 *Klasyfikacja przekrojów IPE 80 – 270 w podwyższonej temperaturze*

| Kształtownik | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|--------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|              | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|              | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| IPE 80 A     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| IPE 80       | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| IPE A 100    | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 2         |
| IPE 100      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| IPE A 120    | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |
| IPE 120      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPE A 140    | 1               | 2         | 1        | 2         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE 140      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |
| IPE A 160    | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE 160      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |
| IPE A 180    | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE 180      | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| IPE O 180    | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |
| IPE A 200    | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE 200      | 1               | 2         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| IPE O 200    | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 4         |
| IPE A 220    | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE 220      | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 220    | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| IPE A 240    | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE 240      | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 240    | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| IPE A 270    | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| IPE 270      | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 270    | 1               | 2         | 1        | 2         | 1        | 4         | 1        | 4         | 1        | 4         |

**Tablica 2.2 Klasyfikacja przekrojów IPE 300-750 w podwyższonej temperaturze**

| Kształtownik  | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|---------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|               | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|               | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| IPE A 300     | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 3        | 4         |
| IPE 300       | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 300     | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE A 330     | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| IPE 330       | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 330     | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE A 360     | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| IPE 360       | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 360     | 1               | 3         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE A 400     | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| IPE 400       | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 400     | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE A 450     | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 2        | 4         |
| IPE 450       | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 450     | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE A 500     | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| IPE 500       | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 500     | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE A 550     | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| IPE 550       | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 550     | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE A 600     | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| IPE 600       | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE O 600     | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| IPE 750 x 137 | 1               | 4         | 2        | 4         | 3        | 4         | 3        | 4         | 3        | 4         |
| IPE 750 x 147 | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| IPE 750 x 173 | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| IPE 750 x 196 | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |

**Tablica 2.3**     **Klasyfikacja przekrojów IPN w podwyższonej temperaturze**

| Kształtownik | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|--------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|              | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|              | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| IPN 80       | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| IPN 100      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| IPN 120      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| IPN 140      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| IPN 160      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| IPN 180      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 2         |
| IPN 200      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 220      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 240      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 260      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 280      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 300      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 320      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 340      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 360      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 380      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 400      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 450      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 500      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| IPN 550      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |

**Tablica 2.4 Klasyfikacja przekrojów HE 100 – 280 w podwyższonej temperaturze**

| Kształtownik | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|--------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|              | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|              | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| HE 100 AA    | 1               | 1         | 1        | 1         | 2        | 2         | 3        | 3         | 3        | 3         |
| HE 100 A     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 100 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 100 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 120 AA    | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| HE 120 A     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 2        | 2         |
| HE 120 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 120 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 140 AA    | 3               | 3         | 3        | 3         | 3        | 3         | 4        | 4         | 4        | 4         |
| HE 140 A     | 1               | 1         | 1        | 1         | 2        | 2         | 3        | 3         | 3        | 3         |
| HE 140 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 140 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 160 AA    | 3               | 3         | 3        | 3         | 3        | 3         | 4        | 4         | 4        | 4         |
| HE 160 A     | 1               | 1         | 1        | 1         | 2        | 2         | 3        | 3         | 3        | 3         |
| HE 160 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 160 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 180 AA    | 3               | 3         | 3        | 3         | 3        | 3         | 4        | 4         | 4        | 4         |
| HE 180 A     | 1               | 1         | 2        | 2         | 3        | 3         | 3        | 3         | 3        | 3         |
| HE 180 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 180 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 200 AA    | 3               | 3         | 3        | 3         | 4        | 4         | 4        | 4         | 4        | 4         |
| HE 200 A     | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| HE 200 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 200 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 220 AA    | 3               | 3         | 3        | 3         | 4        | 4         | 4        | 4         | 4        | 4         |
| HE 220 A     | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| HE 220 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 220 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 240 AA    | 3               | 3         | 3        | 3         | 4        | 4         | 4        | 4         | 4        | 4         |
| HE 240 A     | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| HE 240 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 2        | 2         |
| HE 240 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 260 AA    | 3               | 3         | 3        | 3         | 4        | 4         | 4        | 4         | 4        | 4         |
| HE 260 A     | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| HE 260 B     | 1               | 1         | 1        | 1         | 1        | 1         | 2        | 2         | 2        | 2         |
| HE 260 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 280 AA    | 3               | 3         | 4        | 4         | 4        | 4         | 4        | 4         | 4        | 4         |
| HE 280 A     | 3               | 3         | 3        | 3         | 3        | 3         | 3        | 3         | 4        | 4         |
| HE 280 B     | 1               | 1         | 1        | 1         | 1        | 1         | 2        | 2         | 3        | 3         |
| HE 280 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |

**Tablica 2.5 Klasyfikacja przekrojów HE 300 –600 w podwyższonej temperaturze**

| Kształtownik | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|--------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|              | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|              | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| HE 300 AA    | 3               | 3         | 4        | 4         | 4        | 4         | 4        | 4         | 4        | 4         |
| HE 300 A     | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| HE 300 B     | 1               | 1         | 1        | 1         | 1        | 1         | 2        | 2         | 3        | 3         |
| HE 300 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 320 AA    | 3               | 3         | 3        | 3         | 4        | 4         | 4        | 4         | 4        | 4         |
| HE 320 A     | 1               | 1         | 2        | 2         | 3        | 3         | 3        | 3         | 3        | 3         |
| HE 320 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 2        | 2         |
| HE 320 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 340 AA    | 3               | 3         | 3        | 3         | 4        | 4         | 4        | 4         | 4        | 4         |
| HE 340 A     | 1               | 1         | 2        | 2         | 3        | 3         | 3        | 3         | 3        | 4         |
| HE 340 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 2         |
| HE 340 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 360 AA    | 3               | 3         | 3        | 3         | 4        | 4         | 4        | 4         | 4        | 4         |
| HE 360 A     | 1               | 1         | 1        | 2         | 2        | 2         | 3        | 3         | 3        | 4         |
| HE 360 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 2         |
| HE 360 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 400 AA    | 3               | 3         | 3        | 3         | 3        | 4         | 4        | 4         | 4        | 4         |
| HE 400 A     | 1               | 1         | 1        | 2         | 1        | 3         | 2        | 4         | 3        | 4         |
| HE 400 B     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| HE 400 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 450 AA    | 3               | 3         | 3        | 4         | 3        | 4         | 3        | 4         | 4        | 4         |
| HE 450 A     | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 2        | 4         |
| HE 450 B     | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |
| HE 450 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 500 AA    | 2               | 4         | 3        | 4         | 3        | 4         | 3        | 4         | 3        | 4         |
| HE 500 A     | 1               | 3         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 500 B     | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| HE 500 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 550 AA    | 2               | 4         | 2        | 4         | 3        | 4         | 3        | 4         | 3        | 4         |
| HE 550 A     | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 550 B     | 1               | 2         | 1        | 2         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 550 M     | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 2         |
| HE 600 AA    | 1               | 4         | 2        | 4         | 3        | 4         | 3        | 4         | 3        | 4         |
| HE 600 A     | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 600 B     | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 600 M     | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |
| HE 600 × 337 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 600 × 399 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |

**Tablica 2.6 Klasyfikacja przekrojów HE 650 –1000 w podwyższonej temperaturze**

| Kształtownik  | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|---------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|               | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|               | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| HE 650 AA     | 1               | 4         | 2        | 4         | 3        | 4         | 3        | 4         | 3        | 4         |
| HE 650 A      | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 650 B      | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 650 M      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |
| HE 650 × 343  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| HE 650 × 407  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 700 AA     | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| HE 700 A      | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 700 B      | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 700 M      | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| HE 700 × 352  | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |
| HE 700 × 418  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HE 800 AA     | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| HE 800 A      | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 800 B      | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 800 M      | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 800 × 373  | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| HE 800 × 444  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| HE 900 AA     | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| HE 900 A      | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| HE 900 B      | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 900 M      | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 900 × 391  | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 900 × 466  | 1               | 1         | 1        | 14        | 1        | 2         | 1        | 3         | 1        | 4         |
| HE 1000 AA    | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| HE 1000 A     | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| HE 1000 B     | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| HE 1000 M     | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 1000 × 249 | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| HE 1000 × 393 | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 1000 × 415 | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 1000 × 438 | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| HE 1000 × 494 | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| HE 1000 × 584 | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |

**Tablica 2.7 Klasyfikacja przekrojów HL w podwyższonej temperaturze**

| Kształtownik  | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|---------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|               | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|               | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| HL 920 × 345  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 920 × 368  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 920 × 390  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 920 × 420  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 920 × 449  | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 920 × 491  | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 920 × 537  | 1               | 2         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| HL 920 × 588  | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 3         | 1        | 4         |
| HL 920 × 656  | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |
| HL 920 × 725  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| HL 920 × 787  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 2         |
| HL 920 × 970  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HL 1000 AA    | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| HL 1000 A     | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| HL 1000 B     | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| HL 1000 M     | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 1000 × 443 | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 1000 × 483 | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 1000 × 539 | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 1000 × 554 | 1               | 2         | 1        | 2         | 1        | 4         | 1        | 4         | 1        | 4         |
| HL 1000 × 591 | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| HL 1000 × 642 | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 4         |
| HL 1000 × 748 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| HL 1000 × 883 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HL 1100 A     | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| HL 1100 B     | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| HL 1100 M     | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| HL 1100 R     | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |

**Tablica 2.8 Klasyfikacja przekrojów HD w podwyższonej temperaturze**

| Kształtownik  | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|---------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|               | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|               | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| HD 260 × 54,1 | 3               | 3         | 3        | 3         | 4        | 4         | 4        | 4         | 4        | 4         |
| HD 260 × 68,2 | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| HD 260 × 93,0 | 1               | 1         | 1        | 1         | 1        | 1         | 2        | 2         | 2        | 2         |
| HD 260 × 114  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 260 × 142  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 260 × 172  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 320 × 74,2 | 3               | 3         | 3        | 3         | 4        | 4         | 4        | 4         | 4        | 4         |
| HD 320 × 97,6 | 1               | 1         | 2        | 2         | 3        | 3         | 3        | 3         | 3        | 3         |
| HD 320 × 127  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 2        | 2         |
| HD 320 × 158  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 320 × 198  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 320 × 245  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 320 × 300  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 360 × 134  | 3               | 3         | 3        | 3         | 3        | 3         | 4        | 4         | 4        | 4         |
| HD 360 × 147  | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| HD 360 × 162  | 1               | 1         | 2        | 2         | 3        | 3         | 3        | 3         | 3        | 3         |
| HD 360 × 179  | 1               | 1         | 1        | 1         | 2        | 2         | 3        | 3         | 3        | 3         |
| HD 360 × 196  | 1               | 1         | 1        | 1         | 2        | 2         | 2        | 2         | 3        | 3         |
| HD 400 × 187  | 1               | 1         | 2        | 2         | 3        | 3         | 3        | 3         | 3        | 3         |
| HD 400 × 216  | 1               | 1         | 1        | 1         | 2        | 2         | 2        | 2         | 3        | 3         |
| HD 400 × 237  | 1               | 1         | 1        | 1         | 1        | 1         | 2        | 2         | 2        | 2         |
| HD 400 × 262  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 287  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 314  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 347  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 382  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 421  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 463  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 509  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 551  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 592  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 634  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 677  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 744  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 818  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 900  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 990  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| HD 400 × 1086 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |

**Tablica 2.9 Klasyfikacja przekrojów UPE w podwyższonej temperaturze**

| Kształtownik | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|--------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|              | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|              | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| UPE 80       | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPE 100      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPE 120      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPE 140      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPE 160      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| UPE 180      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |
| UPE 200      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |
| UPE 220      | 1               | 1         | 1        | 2         | 1        | 2         | 1        | 3         | 1        | 4         |
| UPE 240      | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 3         | 1        | 4         |
| UPE 270      | 1               | 2         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| UPE 300      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |
| UPE 330      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |
| UPE 360      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |
| UPE 400      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 3         | 1        | 3         |

**Tablica 2.10 Klasyfikacja przekrojów UPN w podwyższonej temperaturze**

| Kształtownik | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|--------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|              | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|              | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| UPN 80       | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 100      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 120      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 140      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 160      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 180      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 200      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 220      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 240      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 260      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 2         |
| UPN 280      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 2         | 1        | 2         |
| UPN 300      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |
| UPN 320      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UPN 350      | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 2         |
| UPN 380      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |
| UPN 400      | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |

**Tablica 2.11 Klasyfikacja przekrojów UB 127 - -533 w podwyższonej temperaturze**

| Kształtownik       | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|--------------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|                    | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|                    | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| UB 127 x 76 x 13   | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |
| UB 152 x 89 x 16   | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| UB 178 x 102 x 19  | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 203 x 102 x 23  | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 203 x 133 x 25  | 1               | 2         | 2        | 3         | 3        | 4         | 3        | 4         | 3        | 4         |
| UB 203 x 133 x 30  | 1               | 1         | 1        | 2         | 1        | 3         | 2        | 4         | 2        | 4         |
| UB 254 x 102 x 22  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 254 x 102 x 25  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 254 x 102 x 28  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 254 x 146 x 31  | 1               | 4         | 2        | 4         | 3        | 4         | 3        | 4         | 3        | 4         |
| UB 254 x 146 x 37  | 1               | 3         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 254 x 146 x 43  | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 305 x 165 x 40  | 1               | 4         | 1        | 4         | 3        | 4         | 3        | 4         | 3        | 4         |
| UB 305 x 165 x 46  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 305 x 165 x 54  | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 356 x 171 x 45  | 1               | 4         | 2        | 4         | 3        | 4         | 3        | 4         | 3        | 4         |
| UB 356 x 171 x 51  | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| UB 356 x 171 x 57  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| UB 356 x 171 x 67  | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 406 x 178 x 54  | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 406 x 178 x 60  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 406 x 178 x 67  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 406 x 178 x 74  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 457 x 152 x 52  | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 457 x 152 x 60  | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 2        | 4         |
| UB 457 x 152 x 67  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| UB 457 x 152 x 74  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 457 x 152 x 82  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 457 x 191 x 67  | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| UB 457 x 191 x 74  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| UB 457 x 191 x 82  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 457 x 191 x 89  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 457 x 191 x 98  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 533 x 210 x 82  | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 533 x 210 x 92  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 533 x 210 x 101 | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| UB 533 x 210 x 109 | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 533 x 210 x 122 | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |

**Tablica 2.12 Klasyfikacja przekrojów UP 610-914 w podwyższonej temperaturze**

| Kształtownik        | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|---------------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|                     | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|                     | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| UB 610 x 229 x 101  | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 610 x 229 x 113  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 610 x 229 x 125  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 610 x 229 x 140  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 610 x 305 x 149  | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 610 x 305 x 179  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| UB 610 x 305 x 238  | 1               | 2         | 1        | 2         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 686 x 254 x 125  | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 686 x 254 x 140  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 686 x 254 x 152  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 686 x 254 x 170  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 762 x 267 x 134  | 1               | 4         | 2        | 4         | 3        | 4         | 3        | 4         | 3        | 4         |
| UB 762 x 267 x 147  | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 762 x 267 x 173  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 762 x 267 x 197  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| UB 838 x 292 x 176  | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 838 x 292 x 194  | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| UB 838 x 292 x 226  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 914 x 305 x 201  | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 914 x 305 x 224  | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| UB 914 x 305 x 253  | 1               | 4         | 1        | 4         | 1        | 4         | 2        | 4         | 2        | 4         |
| UB 914 x 305 x 289  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 914 x 419 x 343  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| UB 914 x 419 x 388  | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 1016 x 305 x 222 | 1               | 4         | 1        | 4         | 2        | 4         | 3        | 4         | 3        | 4         |
| UB 1016 x 305 x 249 | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| UB 1016 x 305 x 272 | 1               | 4         | 1        | 4         | 2        | 4         | 2        | 4         | 3        | 4         |
| UB 1016 x 305 x 314 | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 2        | 4         |
| UB 1016 x 305 x 349 | 1               | 4         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 1016 x 305 x 393 | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 1016 x 305 x 415 | 1               | 3         | 1        | 4         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 1016 x 305 x 438 | 1               | 2         | 1        | 3         | 1        | 4         | 1        | 4         | 1        | 4         |
| UB 1016 x 305 x 494 | 1               | 1         | 1        | 2         | 1        | 3         | 1        | 4         | 1        | 4         |
| UB 1016 x 305 x 584 | 1               | 1         | 1        | 1         | 1        | 2         | 1        | 2         | 1        | 3         |

**Tablica 2.13 Klasyfikacja przekrojów UC w podwyższonej temperaturze**

| Kształtownik       | Klasa przekroju |           |          |           |          |           |          |           |          |           |
|--------------------|-----------------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|                    | S235            |           | S275     |           | S355     |           | S420     |           | S460     |           |
|                    | Zginanie        | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie | Zginanie | Ściskanie |
| UC 152 x 152 x 23  | 3               | 3         | 3        | 3         | 3        | 3         | 4        | 4         | 4        | 4         |
| UC 152 x 152 x 30  | 1               | 1         | 1        | 1         | 3        | 3         | 3        | 3         | 3        | 3         |
| UC 152 x 152 x 37  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 2        | 2         |
| UC 203 x 203 x 46  | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| UC 203 x 203 x 52  | 1               | 1         | 1        | 1         | 3        | 3         | 3        | 3         | 3        | 3         |
| UC 203 x 203 x 60  | 1               | 1         | 1        | 1         | 1        | 1         | 2        | 2         | 3        | 3         |
| UC 203 x 203 x 71  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 203 x 203 x 86  | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 254 x 254 x 73  | 2               | 2         | 2        | 2         | 3        | 3         | 3        | 3         | 3        | 3         |
| UC 254 x 254 x 89  | 1               | 1         | 1        | 1         | 2        | 2         | 3        | 3         | 3        | 3         |
| UC 254 x 254 x 107 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 254 x 254 x 132 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 254 x 254 x 167 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 305 x 305 x 97  | 3               | 3         | 3        | 3         | 3        | 3         | 3        | 3         | 4        | 4         |
| UC 305 x 305 x 118 | 1               | 1         | 2        | 2         | 3        | 3         | 3        | 3         | 3        | 3         |
| UC 305 x 305 x 137 | 1               | 1         | 1        | 1         | 1        | 1         | 2        | 2         | 3        | 3         |
| UC 305 x 305 x 158 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 305 x 305 x 198 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 305 x 305 x 240 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 305 x 305 x 283 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 356 x 368 x 129 | 3               | 3         | 3        | 3         | 3        | 3         | 4        | 4         | 4        | 4         |
| UC 356 x 368 x 153 | 2               | 2         | 3        | 3         | 3        | 3         | 3        | 3         | 3        | 3         |
| UC 356 x 368 x 177 | 1               | 1         | 1        | 1         | 2        | 2         | 3        | 3         | 3        | 3         |
| UC 356 x 368 x 202 | 1               | 1         | 1        | 1         | 1        | 1         | 2        | 2         | 2        | 2         |
| UC 356 x 406 x 235 | 1               | 1         | 1        | 1         | 1        | 1         | 2        | 2         | 2        | 2         |
| UC 356 x 406 x 287 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 356 x 406 x 340 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 356 x 406 x 393 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 356 x 406 x 467 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 356 x 406 x 551 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |
| UC 356 x 406 x 634 | 1               | 1         | 1        | 1         | 1        | 1         | 1        | 1         | 1        | 1         |

### 3. Podłoże teoretyczne

Przekrój poprzeczny jest klasyfikowany w podwyższonej temperaturze, tak jak w obliczeniach przy temperaturze pokojowej stosownie do PN-EN 1993-1-1 §5.5.2 [2], lecz z uwzględnieniem zredukowanej wartości współczynnika  $\varepsilon$ , patrz PN-EN1993-1-2 §4.2.2 [1]. Smukłość płytowa ścianki ściskanej może zostać wyrażona jako

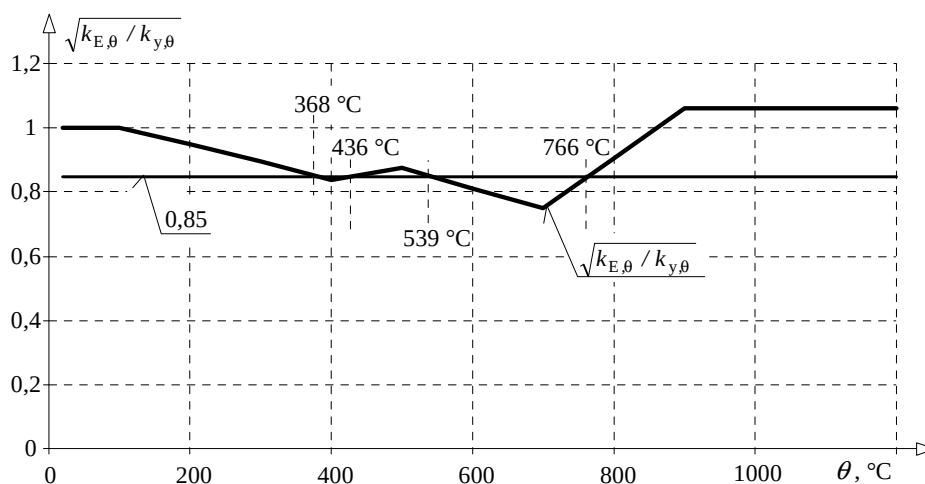
$$\begin{aligned}\bar{\lambda}_p &= \frac{\bar{b}}{28,4 t \varepsilon \sqrt{k_\sigma}} = \frac{\bar{b}}{\sqrt{\frac{\pi^2}{12 \cdot 235 \cdot (1-\mu^2)} \sqrt{E} \varepsilon \sqrt{k_\sigma}}} = \\ &= \frac{\bar{b}}{\sqrt{\frac{\pi^2}{12 \cdot 235 \cdot (1-\mu^2)} \sqrt{E} \varepsilon \sqrt{k_\sigma}}} = \frac{\bar{b}}{0,0620 t \sqrt{\frac{235 E}{f_y} \sqrt{k_\sigma}}} = \frac{\bar{b}}{0,950 t \sqrt{\frac{E}{f_y} \sqrt{k_\sigma}}}\end{aligned}\quad (3.1)$$

gdzie  $t$  jest grubością ścianki,  $\bar{b}$  jest miarodajną szerokością ścianki,  $\mu$  jest współczynnikiem Poison'a,  $E$  jest modułem sprężystości podłużnej,  $f_y$  granicą plastyczności w temperaturze pokojowej, zaś  $k_\sigma$  jest parametrem niestateczności. Wpływ granicy plastyczności jest uwzględniony przez współczynnik  $\varepsilon$ , który w temperaturze pokojowej wyznaczony jest przez

$$\varepsilon = \sqrt{235 / f_y} \quad (3.2)$$

W podwyższonej temperaturze moduł sprężystości podłużnej stali  $E$  i granica plastyczności  $f_y$  są zredukowane. Redukcję modułu sprężystości przeprowadza się za pomocą współczynnika  $k_{E,\theta}$ , zaś granicy plastyczności za pomocą współczynnika  $k_{y,\theta}$ . Redukcja w podwyższonej temperaturze  $\theta$  może zostać określona jako, patrz Rys. 3.1

$$\sqrt{\frac{E_\theta}{f_{y,\theta}}} = \sqrt{\frac{k_{E,\theta} E}{k_{y,\theta} f_y}} = \sqrt{\frac{k_{E,\theta}}{k_{y,\theta}}} \sqrt{\frac{E}{f_y}} \cong 0,85 \sqrt{\frac{E}{f_y}} \quad (3.3)$$



Uwaga: Wartość 0,85 zastosowana w PN-EN1993-1-2 §4.2.2 jest pokazana jako linia pozioma

Rys. 3.1 Zmiana wartości wyrażenia  $\sqrt{k_{E,\theta} / k_{y,\theta}}$

## 4. Literatura

- 1 PN-EN 1993-1-2 Eurokod 3: Projektowanie konstrukcji stalowych, Część 1-2: Reguły ogólne – obliczanie konstrukcji ze względu na warunki pożarowe.
- 2 PN-EN 1993-1-1 Eurokod 3: Projektowanie konstrukcji stalowych, Część 1-1: Reguły ogólne i reguły dla budynków.
- 3 Franssen J. M. Zaharia R.: Design of steel structures subject to fire, Les Éditions de l'Université de Liège, Liège 2005, p. 184, ISBN 2-930322-99-3.

# Protokół jakości

|                                                    |                                                           |                 |            |
|----------------------------------------------------|-----------------------------------------------------------|-----------------|------------|
| Tytuł zasobu                                       | Dane: Klasyfikacja przekrojów w podwyższonej temperaturze |                 |            |
| Odniesienie                                        |                                                           |                 |            |
| ORYGINAŁ DOKUMENTU                                 |                                                           |                 |            |
|                                                    | Imię i nazwisko                                           | Instytucja      | Data       |
| Stworzony przez                                    | Wald F.                                                   | CTU in Prague   | 21/01/2006 |
| Zawartość techniczna sprawdzona przez              | Sokol Z.                                                  | CTU in Prague   | 21/01/2006 |
| Zawartość redakcyjna sprawdzona przez              |                                                           |                 |            |
| Zawartość techniczna zaaprobowana przez:           |                                                           |                 |            |
| 1. Wielka Brytania                                 | G W Owens                                                 | SCI             | 9/6/06     |
| 2. Francja                                         | A Bureau                                                  | CTICM           | 9/6/06     |
| 3. Szwecja                                         | B Uppfeldt                                                | SBI             | 9/6/06     |
| 4. Niemcy                                          | C Müller                                                  | RWTH            | 9/6/06     |
| 5. Hiszpania                                       | J Chica                                                   | Labein          | 9/6/06     |
| Zasób zatwierdzony przez Koordynatora Technicznego | M Haller                                                  | PARE            | 9/6/06     |
| Stworzony przez                                    | G W Owens                                                 | SCI             | 12/7/06    |
| TŁUMACZENIE DOKUMENTU                              |                                                           |                 |            |
| Tłumaczenie wykonał i sprawdził:                   |                                                           | L. Ślęczka, PRz |            |
| Tłumaczenie zatwierdzone przez:                    | B. Stankiewicz                                            | PRz             |            |
|                                                    |                                                           |                 |            |

Errata 10/1/08: Tablica 2.5 - 2.10

## Informacje ramowe

|                              |                                                                                                                                                                             |                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| <b>Tytuł*</b>                | <b>Dane: Klasyfikacja przekrojów w podwyższonej temperaturze</b>                                                                                                            |                                           |
| <b>Seria</b>                 | Projektowanie z uwagi na warunki pożarowe                                                                                                                                   |                                           |
| <b>Opis*</b>                 | Dokument zawiera dane tabelaryczne służące do klasyfikacji przekrojów w podwyższonej temperaturze. Dane dotyczą powszechnie używanych kształtowników walcowanych na gorąco. |                                           |
| <b>Poziom dostępu*</b>       | Umiejętności specjalistyczne                                                                                                                                                | Specjalista                               |
| <b>Identyfikator*</b>        | Nazwa pliku                                                                                                                                                                 | SD002a-PL-EU                              |
| <b>Format</b>                |                                                                                                                                                                             | Microsoft Word 9.0; 198 stron; 717 kb     |
| <b>Kategoria*</b>            | Typ zasobu                                                                                                                                                                  | Dane projektowe                           |
|                              | Punkt widzenia                                                                                                                                                              | Inżynier                                  |
| <b>Temat*</b>                | Obszar stosowania                                                                                                                                                           | Projektowanie z uwagi na warunki pożarowe |
| <b>Daty</b>                  | Data utworzenia                                                                                                                                                             | 21/01/2006                                |
|                              | Data ostatniej modyfikacji                                                                                                                                                  | 01/06/2006                                |
|                              | Data sprawdzenia                                                                                                                                                            |                                           |
|                              | Ważny od                                                                                                                                                                    |                                           |
|                              | Ważny do                                                                                                                                                                    |                                           |
| <b>Język(i)*</b>             |                                                                                                                                                                             | Polski                                    |
| <b>Kontakt</b>               | Autor                                                                                                                                                                       | Wald F. CTU in Prague                     |
|                              | Sprawdził                                                                                                                                                                   | Sokol Z. CTU in Prague                    |
|                              | Zatwierdził                                                                                                                                                                 |                                           |
|                              | Redaktor                                                                                                                                                                    |                                           |
|                              | Ostatnia modyfikacja                                                                                                                                                        |                                           |
| <b>Słowa kluczowe*</b>       | Nośność elementów z uwagi na warunki pożarowe                                                                                                                               |                                           |
| <b>Zobacz też</b>            | Odniesienie do Eurokodu                                                                                                                                                     |                                           |
|                              | Przykład(y) obliczeniowy                                                                                                                                                    |                                           |
|                              | Komentarz                                                                                                                                                                   |                                           |
|                              | Dyskusja                                                                                                                                                                    |                                           |
|                              | Inne                                                                                                                                                                        |                                           |
| <b>Sprawozdanie</b>          | Przydatność krajowa                                                                                                                                                         | EU                                        |
| <b>Instrukcje szczególne</b> |                                                                                                                                                                             |                                           |