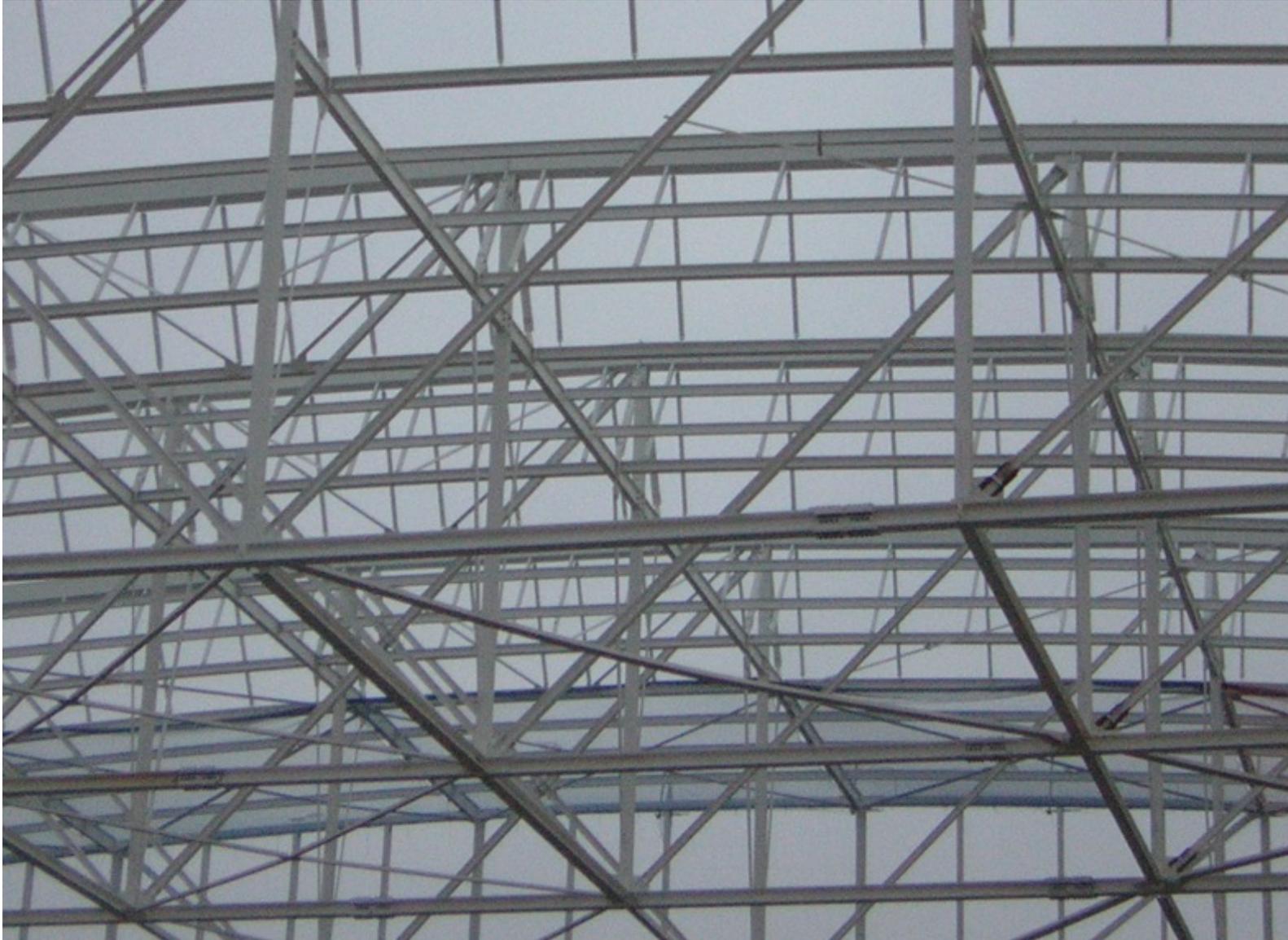


Bemessung und Fügung im Stahlbau



Themen der heutigen Vorlesung

Bemessung	Trägeranschlüsse Trägerauflagerung
Schrauben	Anschluss Träger – Stütze Stützenstoß
Schweißen	Rohrstoß Stützenfuß
Konstruktive Fügung	Anschlüsse im Fachwerkträger Dachverbände Unterspannte Träger Rahmenecken

Bemessung und Fügung im Stahlbau

1.1 MATERIALKENNWERTE FÜR BAUTEILE IN kN/cm²

		Baustahl		Stahlguß	Gußeisen	Stahlseile	Aluminium	
		St 37 (S235)	St 52 (S355)	GS 52	GGG 40	z. B.	z. Vgl.	
f	Streckgrenze $f_{y,k}$	24	36	26	28	140	27	
	Zugfestigkeit $f_{u,k}$	36	51	52	40	157	40	
σ	Grenzspannungen $\sigma_{Rd} = \frac{f_{yk}}{\gamma_M}$ für Biegung, Druck, Zug	21,8	32,7	23,6	21,8	~ 75	~ 20	
τ	Schub τ_{Rd}	12,6	18,9	13,6	12,6			
E	Elastizitätsmodul E	21 000	21 000	21 000	10 000 ... 15 000	10 000 ... 17 000	7 000	
α_T	Temperaturdehnzahl α_T	12 · 10 ⁻⁶ /°K					12 · 10 ⁻⁶ /°K	

1.2 EMPFOHLENE MAXIMALE DURCHBIEGUNG

		zul δ
δ	Deckenträger und Unterzüge mit einer Stützweite von mehr als 5,0 m	1/300
	Kragträger: am Kragarmende	1/200

Der Einfluß der Eigengewichte g darf durch Überhöhung ausgeglichen werden.

Bemessung und Fügung im Stahlbau

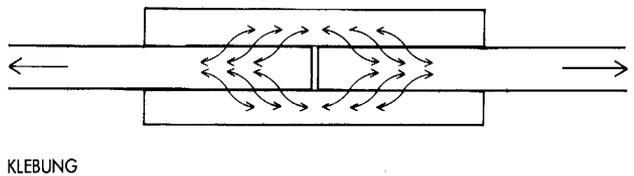
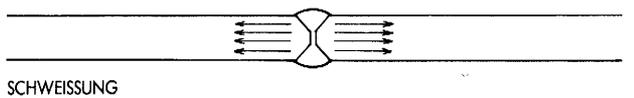
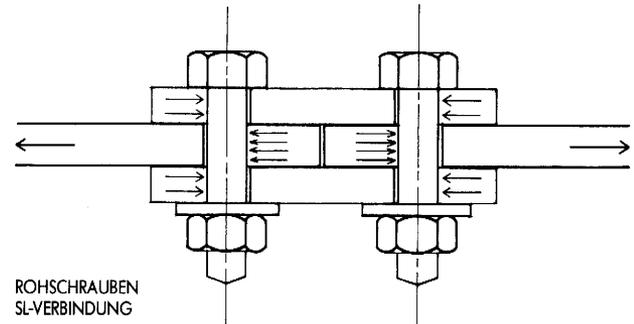
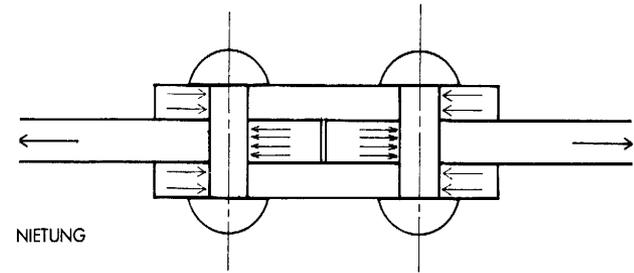


Verbindungsmittel



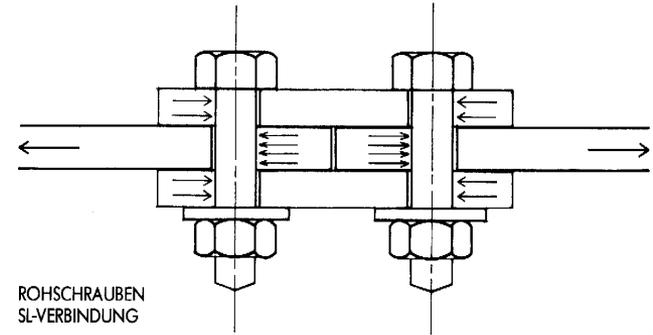
Bemessung und Fügung im Stahlbau

VERBINDUNGSMITTEL
UND KRAFTEFLUSS

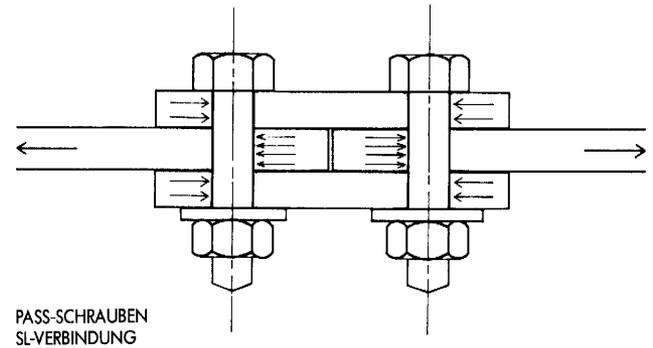


Fügung im Stahlbau

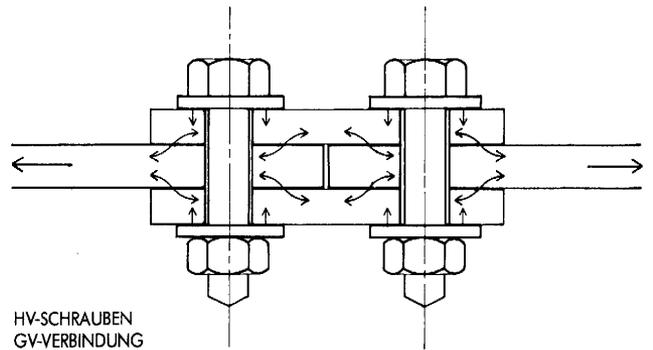
Verschraubung Rohe Schrauben



Pass-Schrauben



Hochfeste Schrauben



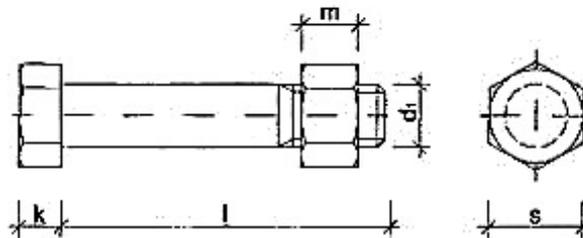
GESCHRAUBTE VERBINDUNGEN

Fügung im Stahlbau

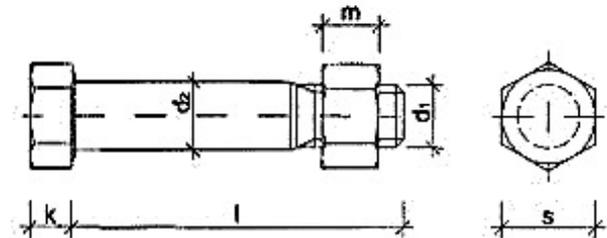
a) Festigkeitsklassen der Schrauben

	4.6	5.6	8.8	10.9
	normalfest		hochfest	
Streckgrenze $f_{y, b, k}$ kN/cm ²	24	30	64	90
Zugfestigkeit $f_{u, b, k}$ kN/cm ²	40	50	80	100
Grenzspannung für Abscheren $\tau_{a, R, d}$ Lochleibung, abhängig von Loch- und Randabständen	21,8	27,3 (=1,25 · 21,8)	43,6	50,0
Ausführungsformen der Schraubenverbindungen und Festigkeitsklassen, darin bedeuten	passend zu St 37	passend zu St 52		
SL Scher-Lochleibungs-Verbindung	SL	SL	SLV	SLV
... P Paßverbindung (ohne Lochspiel)	SLP	SLP	SLVP	SLVP
... V planmäßig vorgespannte Verbindung			GV	GV
... G gleitfeste vorgespannte Verbindung			GVP	GVP

Rohe Schraube



Paßschraube



b) Abmessungen und Grenztragfähigkeiten der Schrauben für einschnittige Beanspruchung

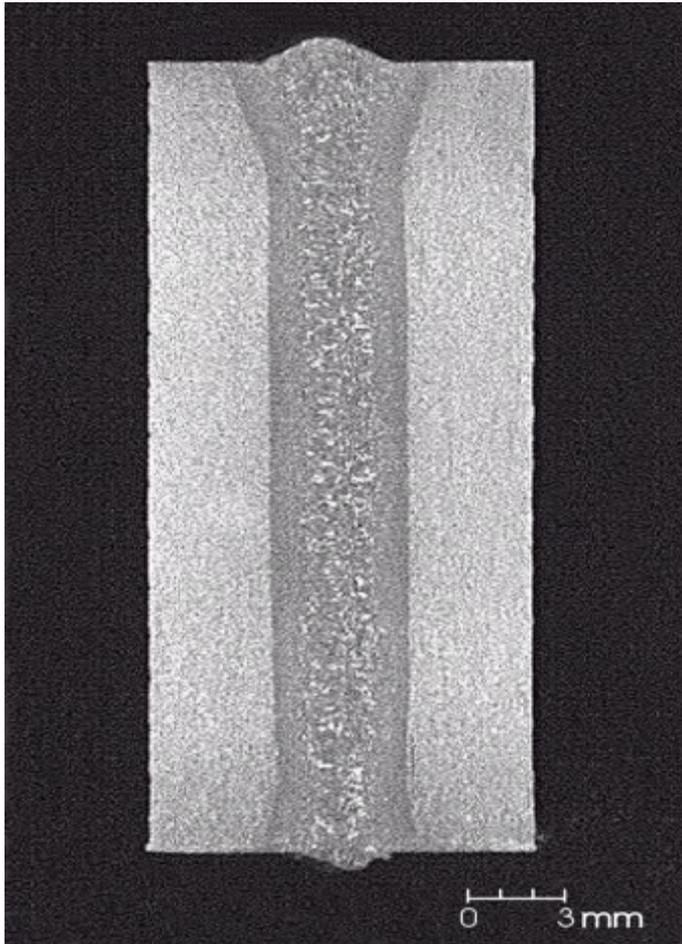
Gewinde = d_1 mm	M 12	M 16	M 20	M 22	M 24	M 27	M 30
Schaft- \varnothing = d_1 der Rohe Schraube*	12	16	20	22	24	27	30
Loch- \varnothing d_2 = Schaft der Paßschraube	13	17	21	23	25	28	31
Kopfhöhe k	8	10	13	14	15	17	19
Schlüsselweite s**	19	24	30	32	36	41	46
Mutterhöhe m	10	13	16	18	19	22	24
Symbol	✱	✱	✱	✱	✱	✱	✱
geeignete für Blechdicke (mm)	5-6	6-8	8-11	10-14	13-17	16-21	20-24
$V_{a, R, d}$ einer Rohe Schraube 4.6 SL***	24,7	43,7	68,5	82,9	98,8	124,8	154,2
$V_{a, R, d}$ einer Paßschraube 4.6 SLP*** (einschnittige Beanspruchung)	29,0	49,5	75,5	90,6	107,1	134,4	164,7
Zugkraft der Rohe Schraube 4.6***	22,4	39,9	62,2	75,4	89,7	113,6	140,2
Zugkraft der Paßschraube 4.6 SL***	24,5	45,0	68,6	82,3	97,4	122,2	149,7

Verschraubung

- Rohe Schrauben
- Pass-Schrauben
- Hochfeste Schrauben

Fügung im Stahlbau

Schweißen

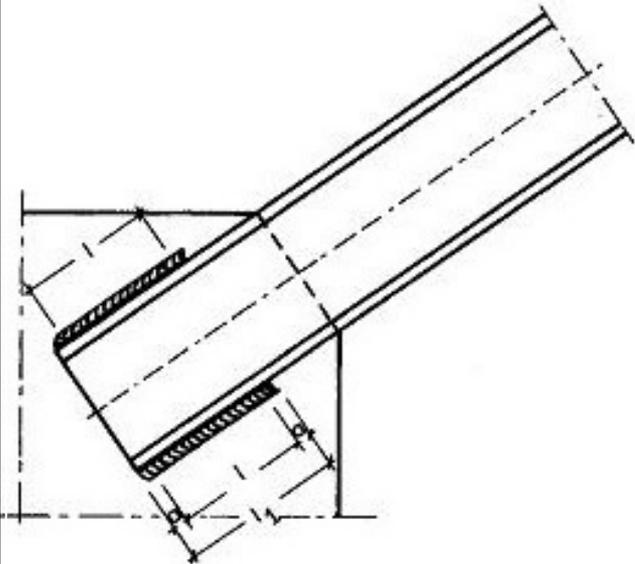


Nicht durchgeschweißte Nähte	HY-Naht mit Kehlnaht	<p>eventuell Kapplage</p>
	D(oppel)-HY-Naht mit Doppelkehlnaht	
	D(oppel)-HY-Naht	
Kehlnähte	Kehlnaht	<p>theoretischer Wurzelpunkt</p>
	Doppelkehlnaht	<p>theoretische Wurzelpunkte</p>

Fügung im Stahlbau

Schweißen

wirksame Schweißnahtlänge



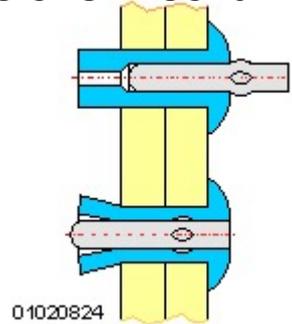
$$\sigma_{Schw} = \frac{F}{\Sigma(a \cdot l)} \leq \text{Grenzspannung}$$

- τ_{Schw}
- F** = die zu übertragende Kraft
 - a** = Schweißnahtdicke
 - l** = wirksame Schweißnahtlänge (ohne Endkrater)
 - Σ** = Summe aller wirksamen Schweißnähte am Knoten

Durch- oder gegene-schweißte Nähte	Stumpfnah	
	D(oppel)-HV-Nah (K-Nah)	
HV-Nah	Kaplage gegene-schweiß	
	Wurzel durchge-schweiß	

Fügung im Stahlbau

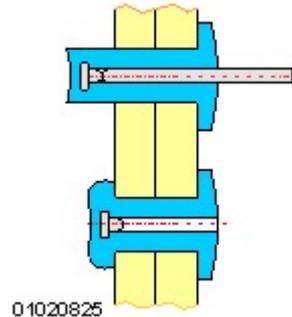
Nieten: Einsetzen von gestanzten oder geschmiedeten Eisenelementen, welche mechanisch zur Fixierung geformt werden



01020824

Spreizniet

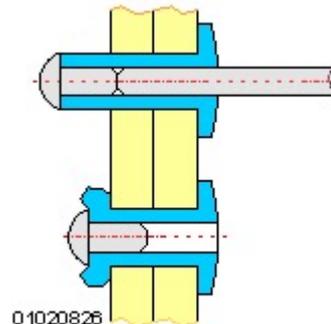
Durch Einschlagen eines Dornes wird der herausragende Teil der Niet gespreizt.
Der Dorn bleibt im Niet und verschließt die Öffnung.



01020825

Becherniet

Durch Ziehen des Dornes wird die Niet am herausstehenden Schaftende gestaucht bis der Dorn selbst an einer Sollbruchstelle abreißt.
Das Schaftende ist geschlossen.

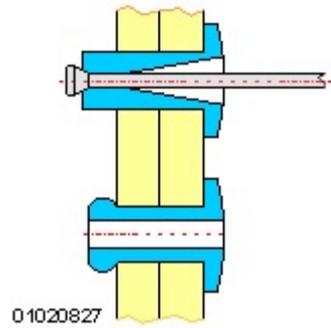


01020826

Zugdornniet (allgem. Blindniet)

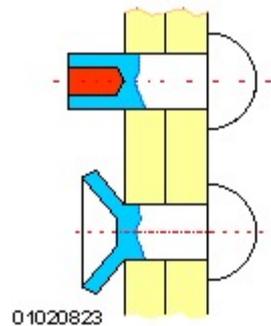
Durch Ziehen des Dornes wird die Niet am herausstehenden Schaftende gestaucht bis der Dorn selbst an einer Sollbruchstelle abreißt.
Das Schaftende ist "offen". Bis ca. 6mm Durchmesser

Fügung im Stahlbau



Durchziehniet

Ein Dorn wird durch die Niethülse gezogen und staucht diese. Die Niet verschließt nicht die Bohrung.



Sprengniet

Eine kleine Sprengladung, die durch Hitze gezündet wird, spreizt die Niet.
Wird nicht mehr angewendet.

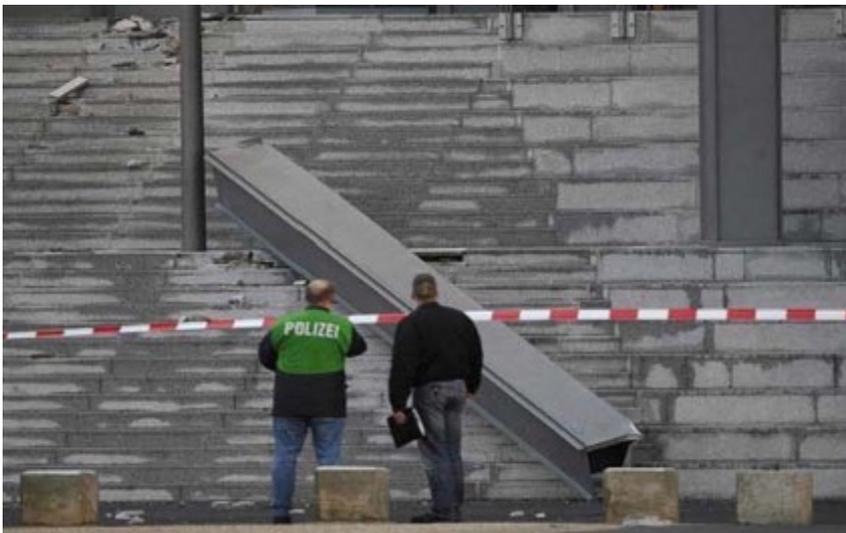
Konstruktive Fügung



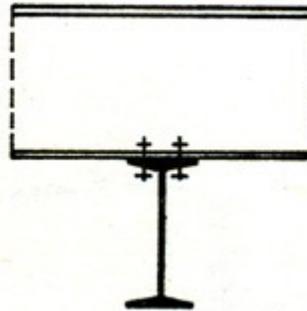
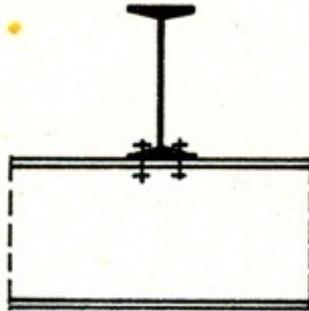
Konstruktive Fügung



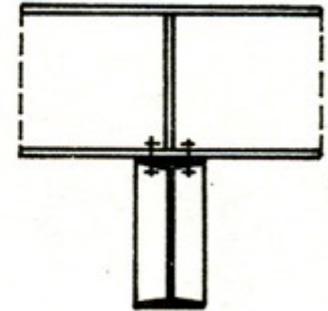
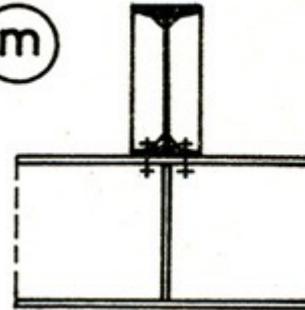
Lehrter Bahnhof – Absturz von Fassadenträgern im Dezember 2006



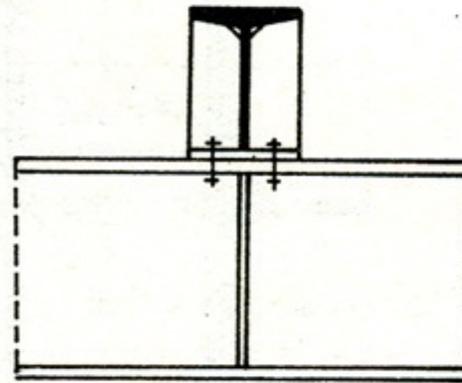
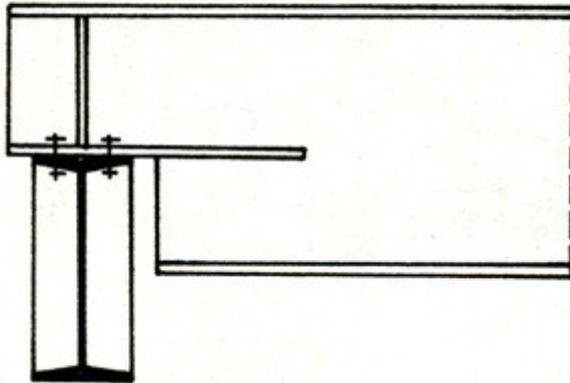
l



m

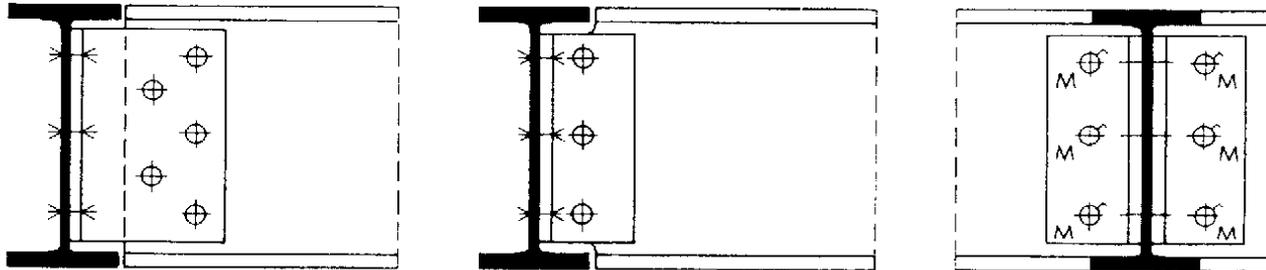


o



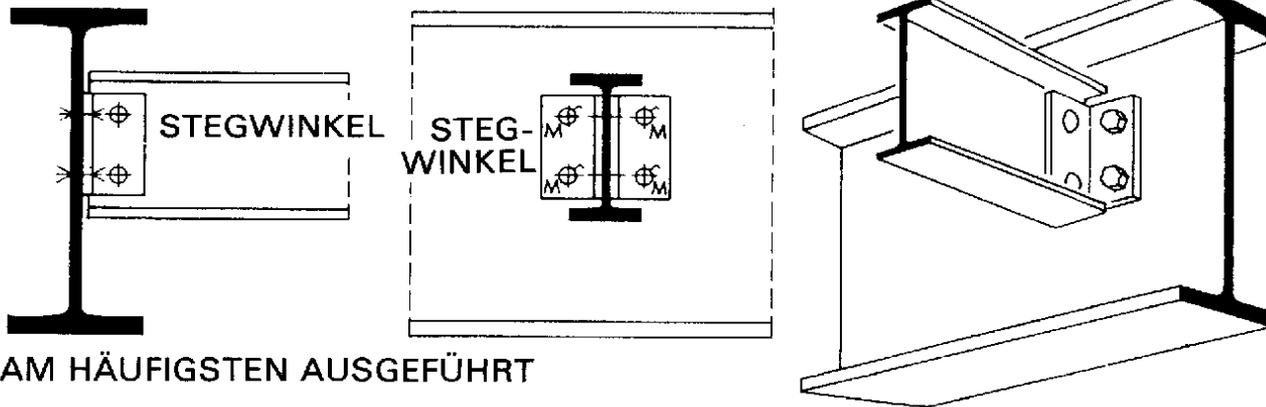
ANSCHLUSS GLEICHHOHER TRÄGER

**NEBENTRÄGER OHNE AUSKLIN-
KUNG NUR BIS AN FLANSCHEN
DES HAUPTTRÄGERS HERANGE-
FÜHRT**



**FLANSCHEN DES NEBENTRÄGERS AUSGEKLIN-
KUNG NUR BIS AN FLANSCHEN
DES HAUPTTRÄGERS HERANGE-
GEFÜHRT, BESSERE VERBINDUNG**

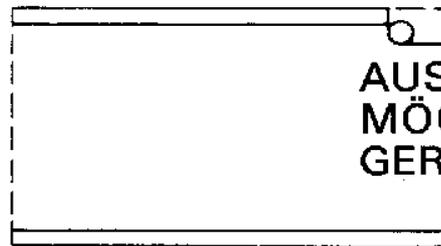
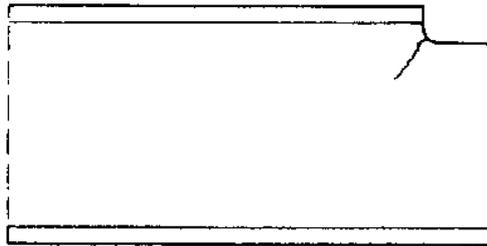
STEGANSCHLUSS



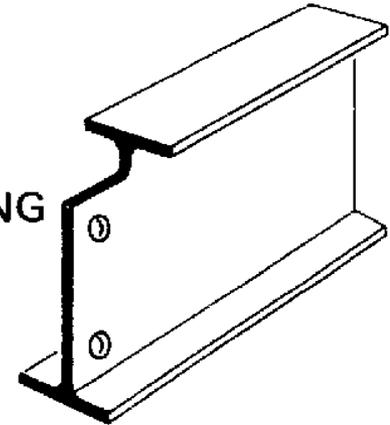
AM HÄUFIGSTEN AUSGEFÜHRT

**ANSCHLUSS DER NEBENTRÄGER AN DIE HAUPTTRÄGER ALS TRÄGER
AUF ZWEI STÜTZEN (GESCHRAUBT)**

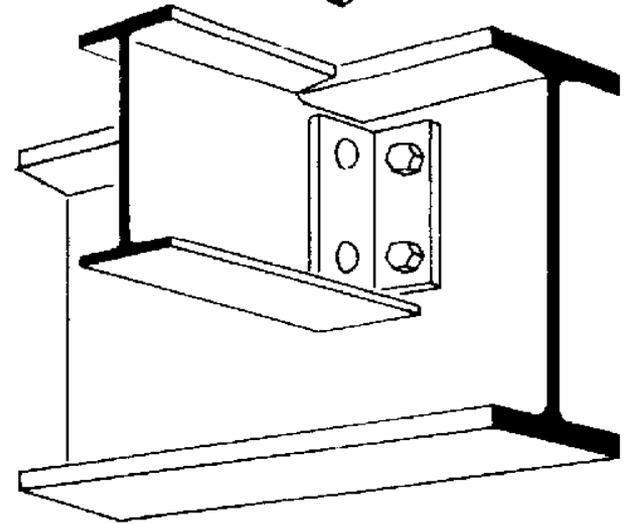
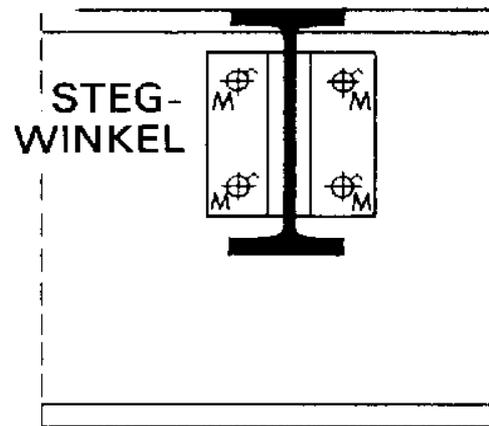
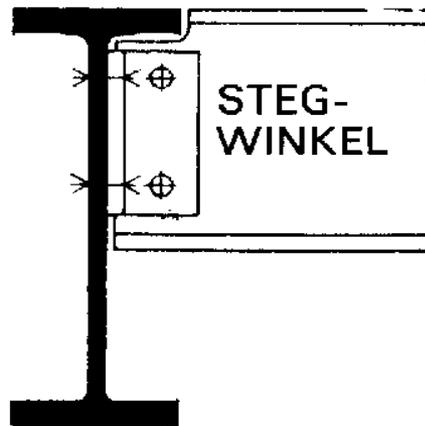
RISSGEFAHR



**AUSKLINKUNG
MÖGLICHSST
GERUNDET**

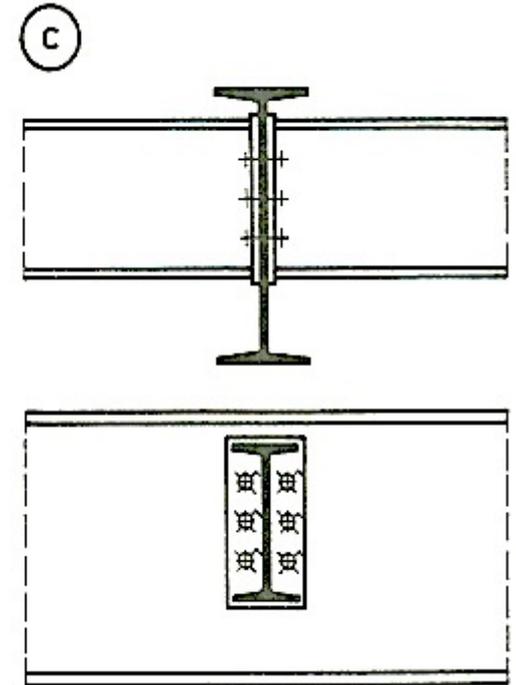
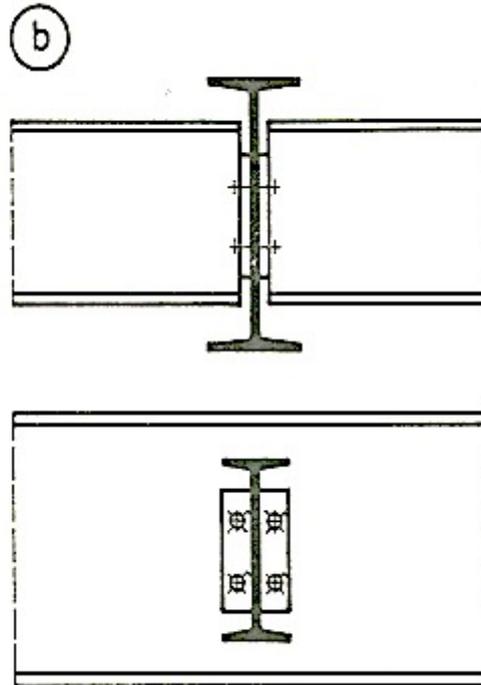
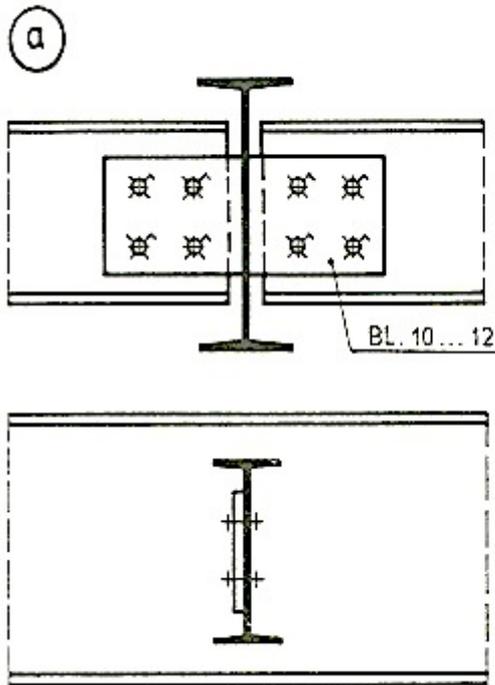


STEGANSCHLUSS



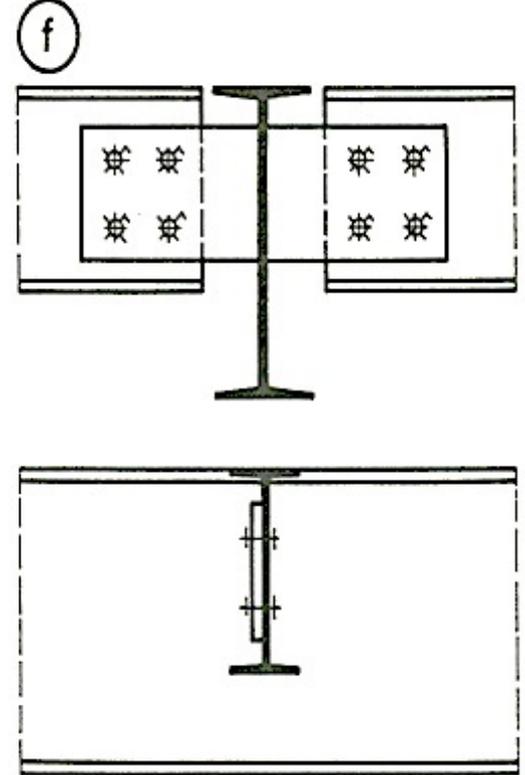
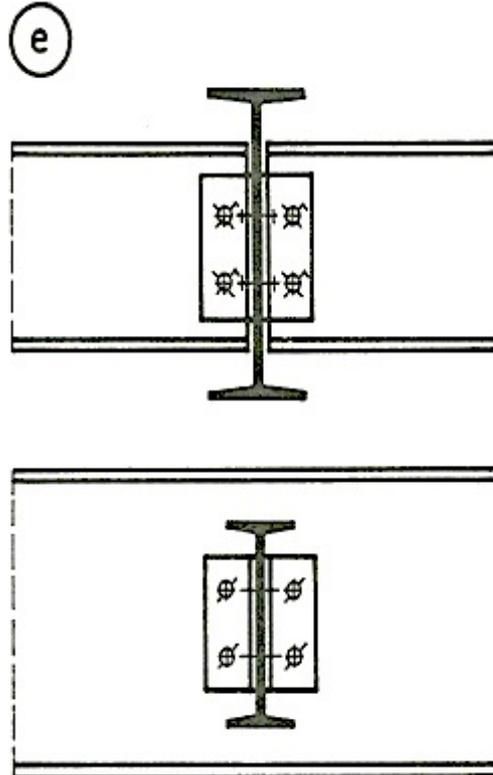
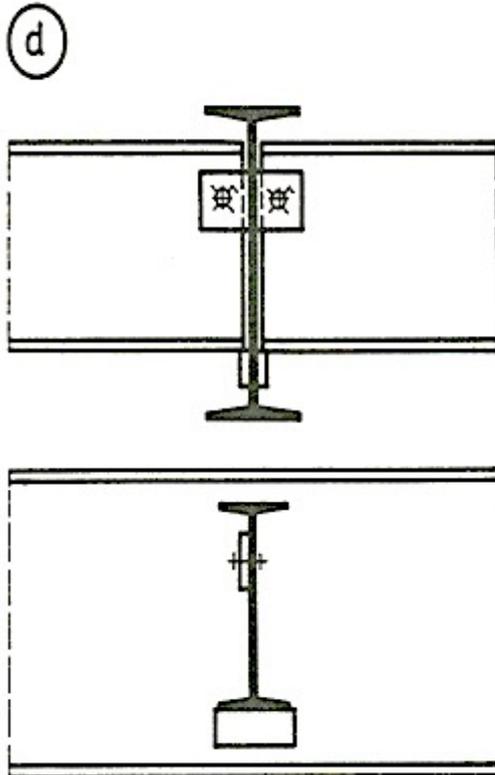
Fügung im Stahlbau

Trägeranschlüsse gelenkig - a, b
biegesteif - c



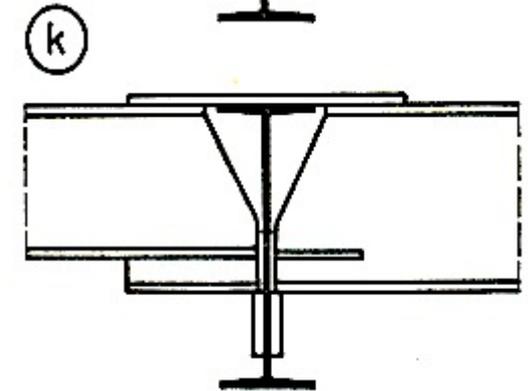
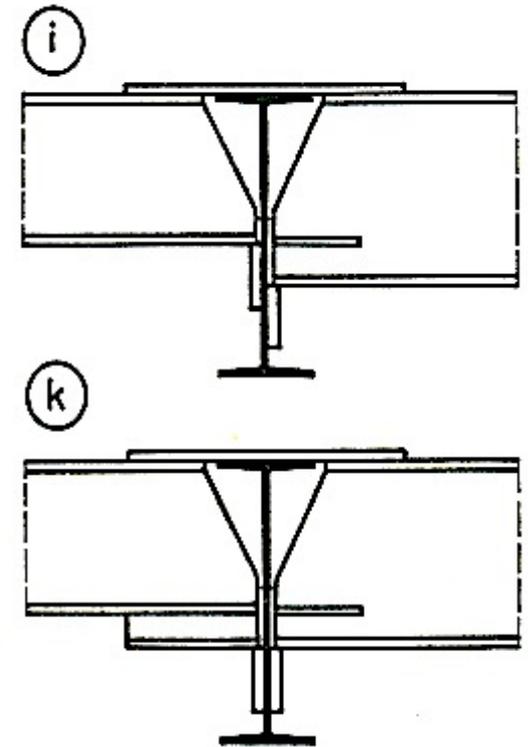
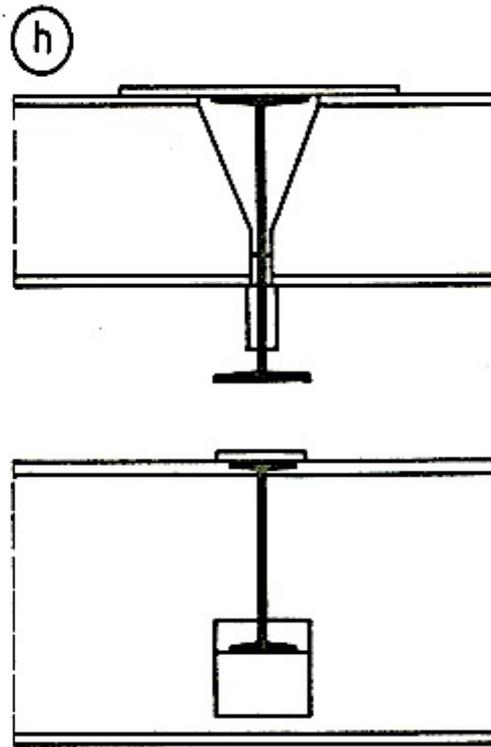
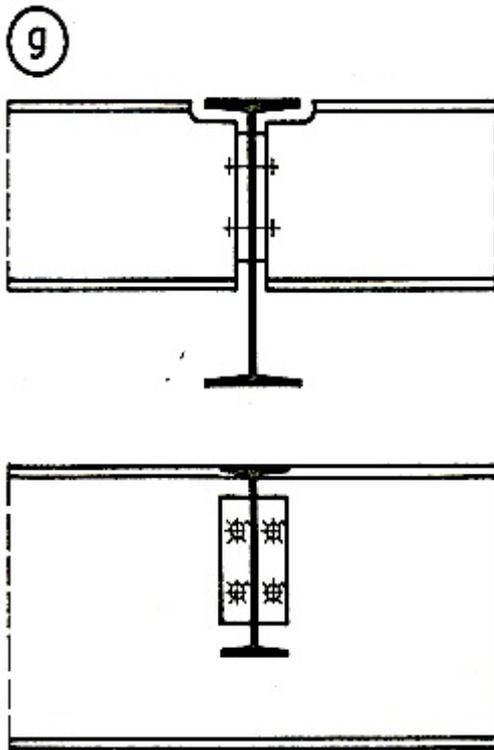
Fügung im Stahlbau

Trägeranschlüsse gelenkig - d, e, f



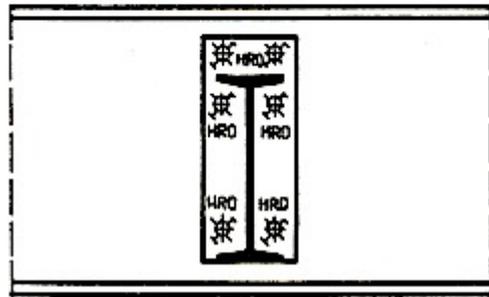
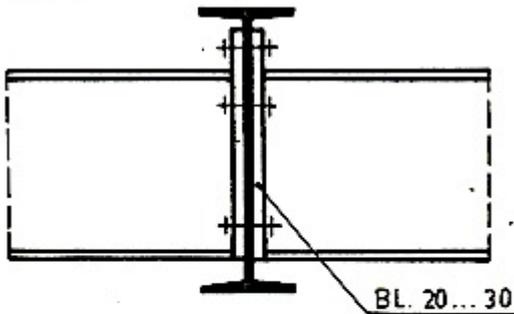
Fügung im Stahlbau

Trägeranschlüsse gelenkig - g
biegesteif - h, i, k



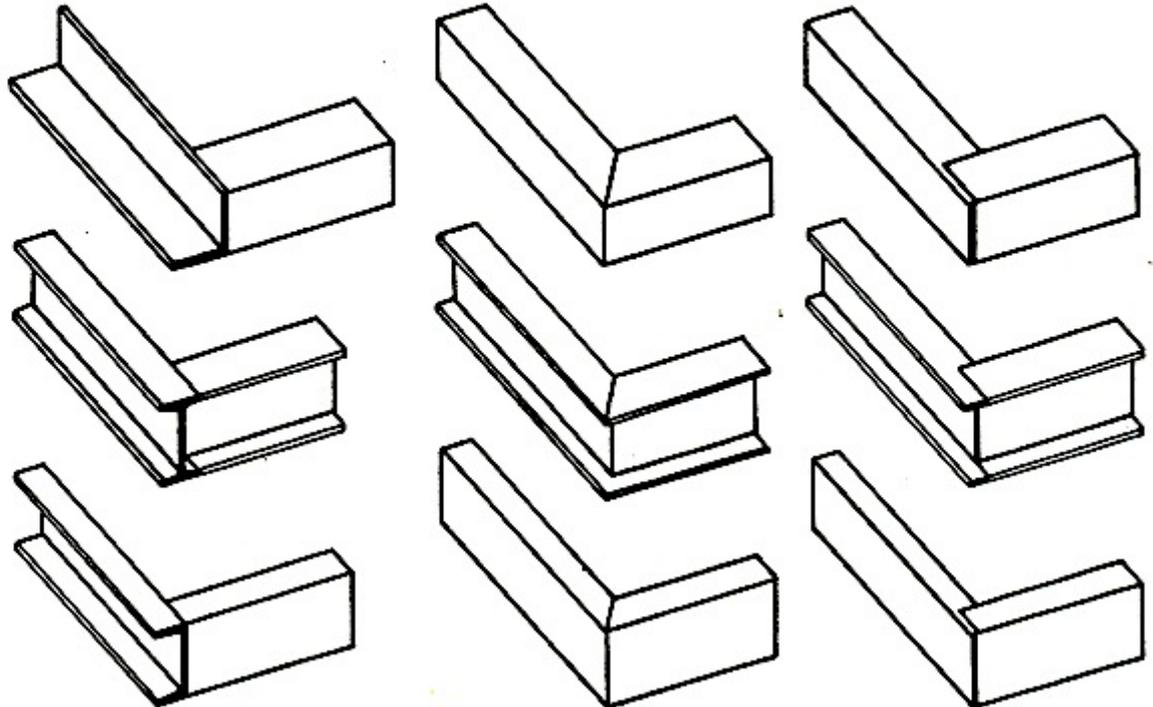
Trägeranschlüsse biegesteif - l, m

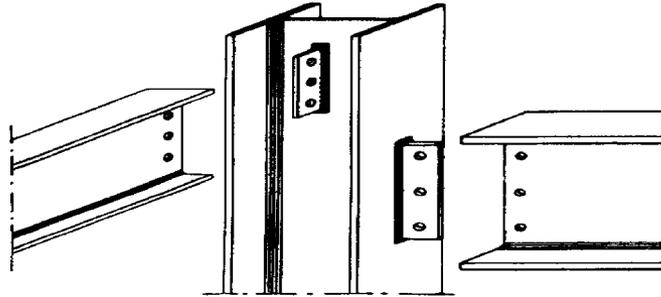
l



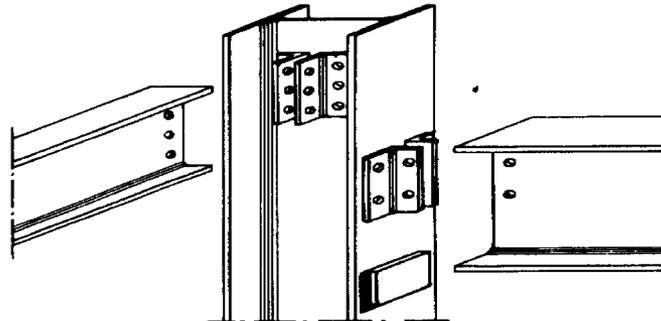
m

ECKVERBINDUNGEN - GESCHWEISST

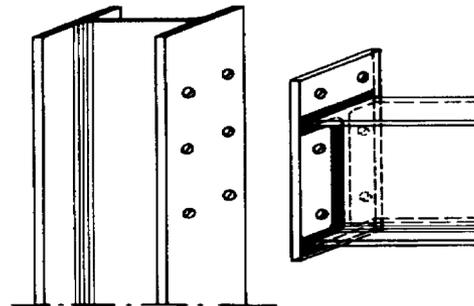




e. angeschweißte
Anschlußbleche

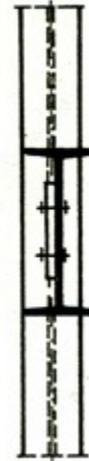
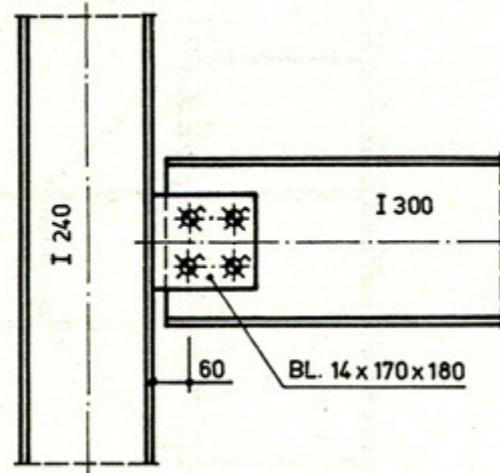


f. Anschlußwinkel mit
oder ohne Knagge

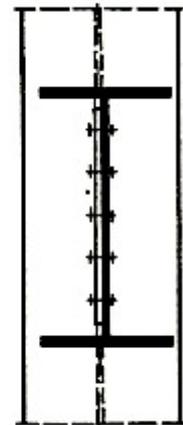
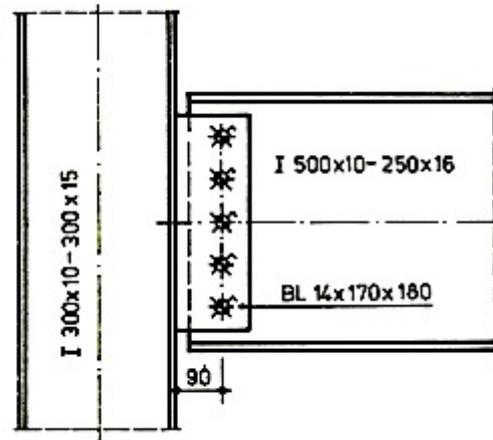


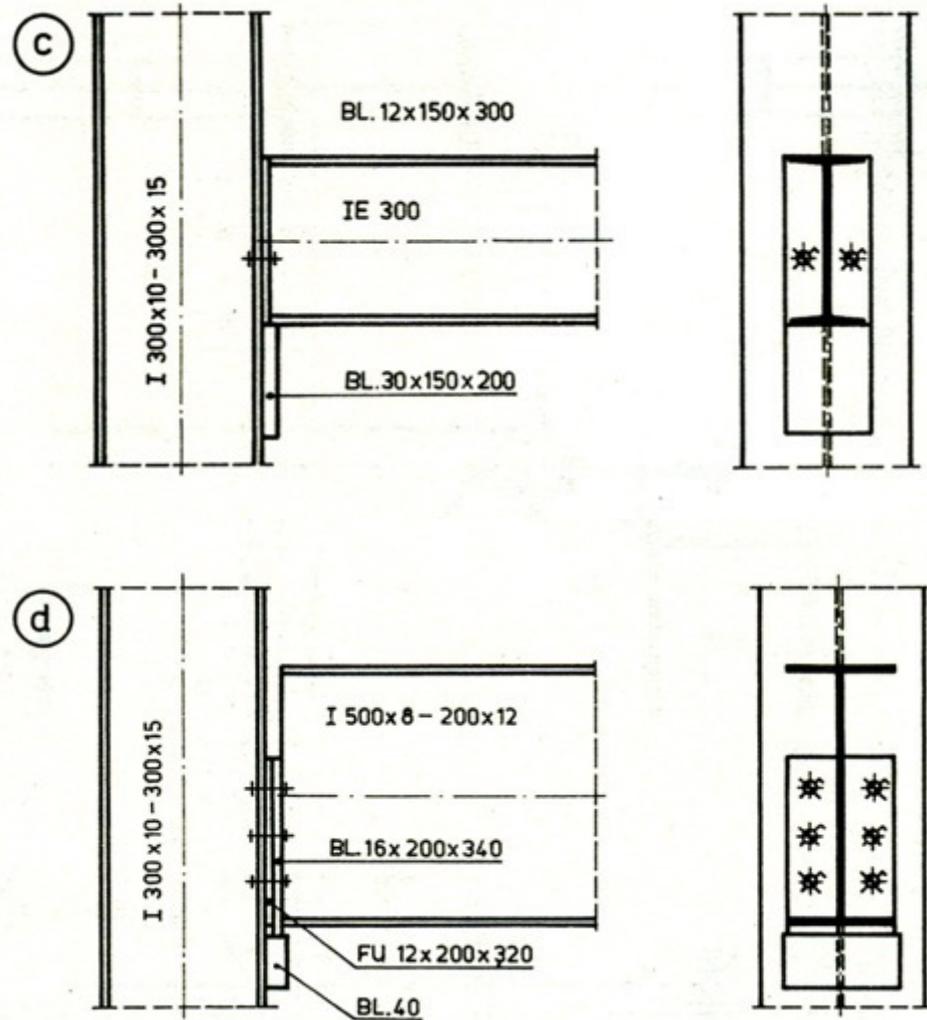
g. Kopfplatten
am Träger

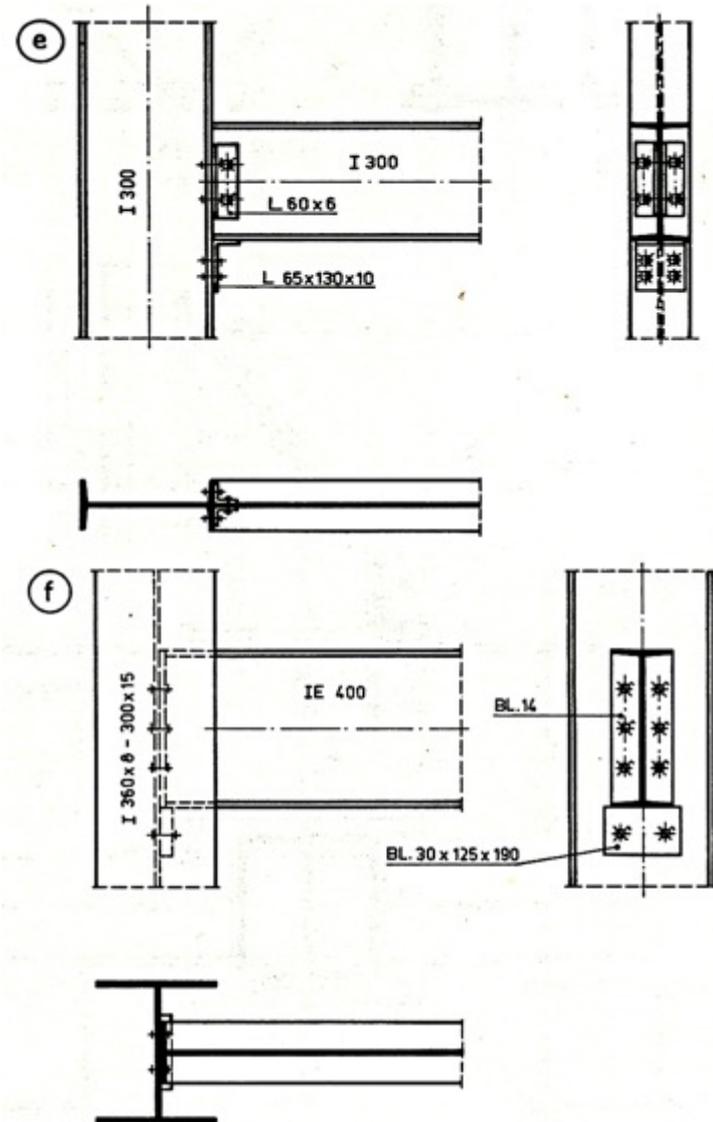
a

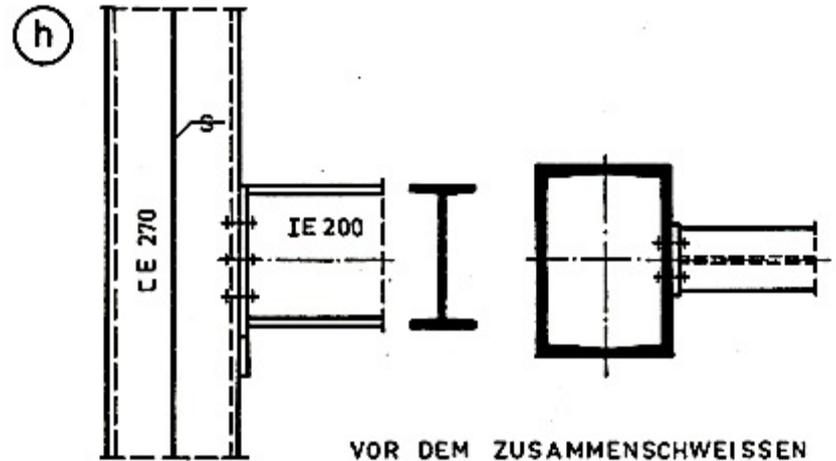
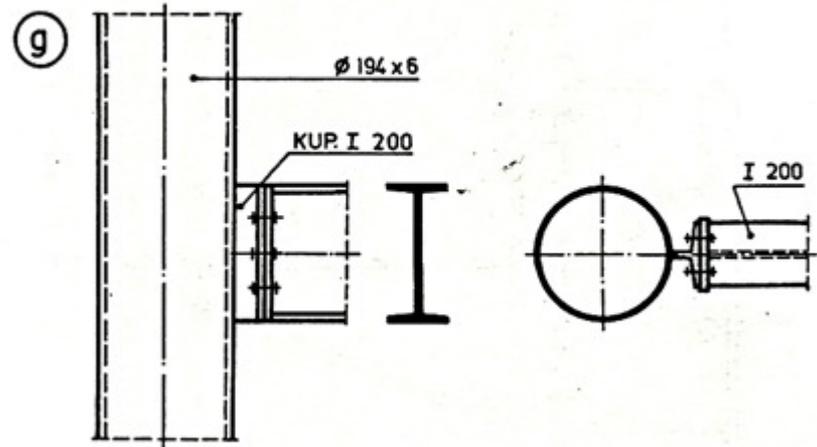


b

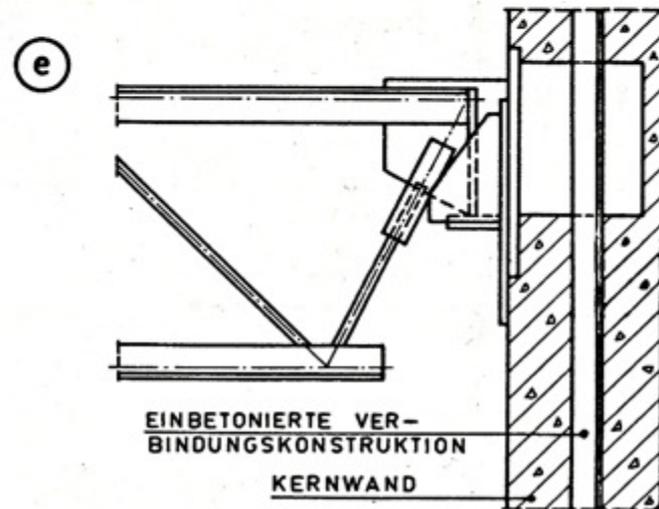
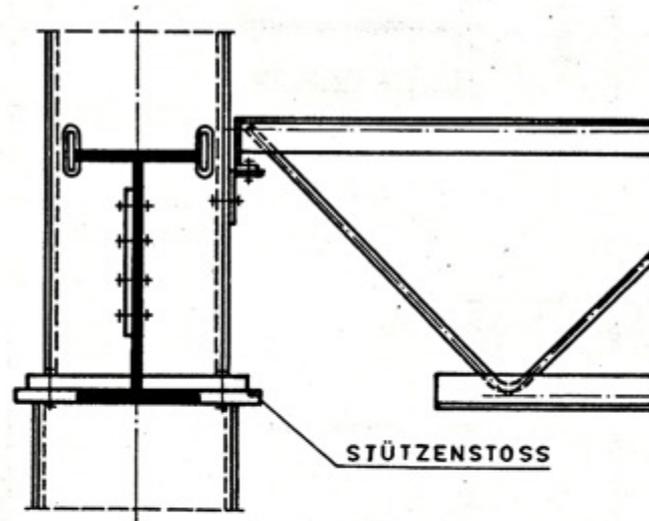


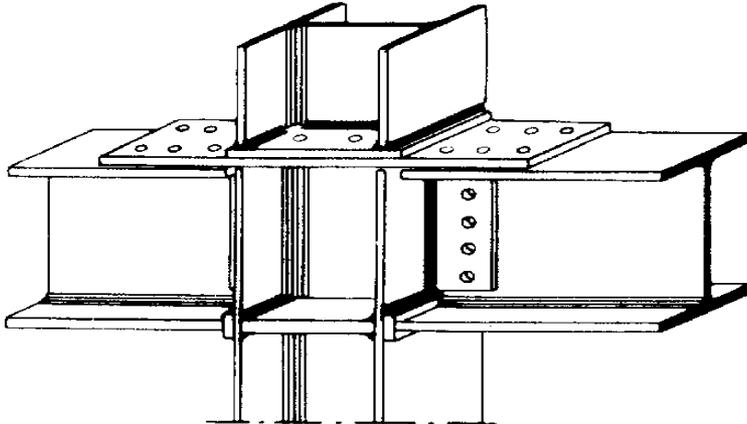




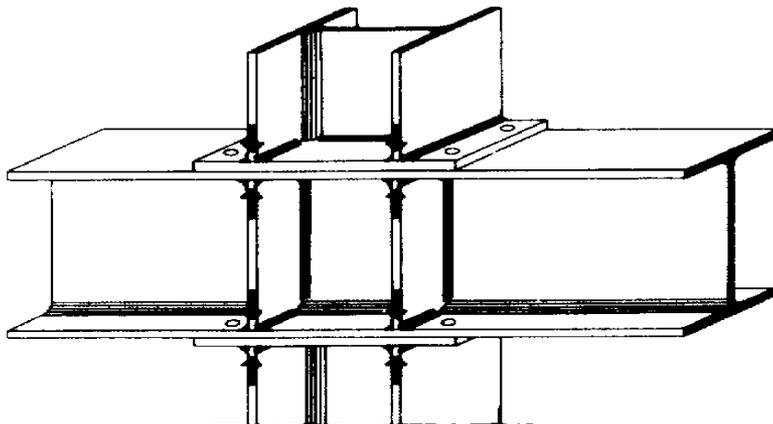


VOR DEM ZUSAMMENSCHWEISSEN
SCHRAUBENKÖPFE ANSCHWEISSEN,
GEWINDE SICHERN.

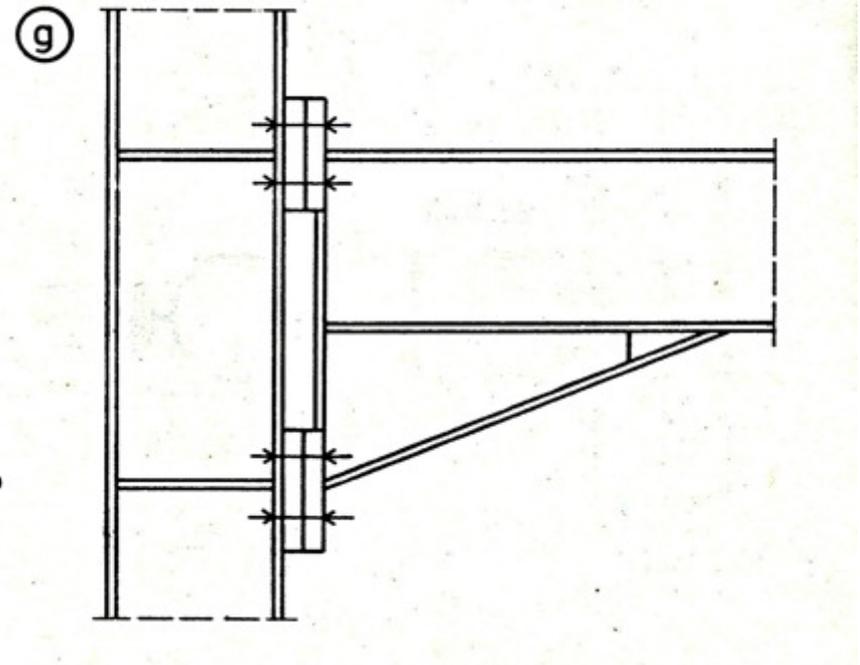
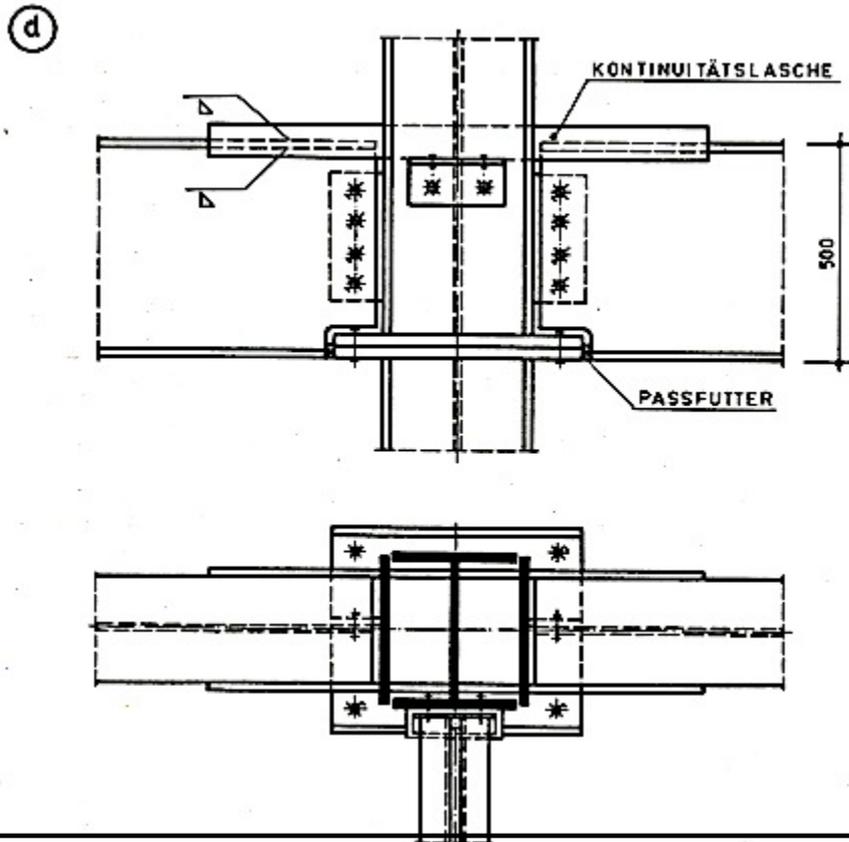


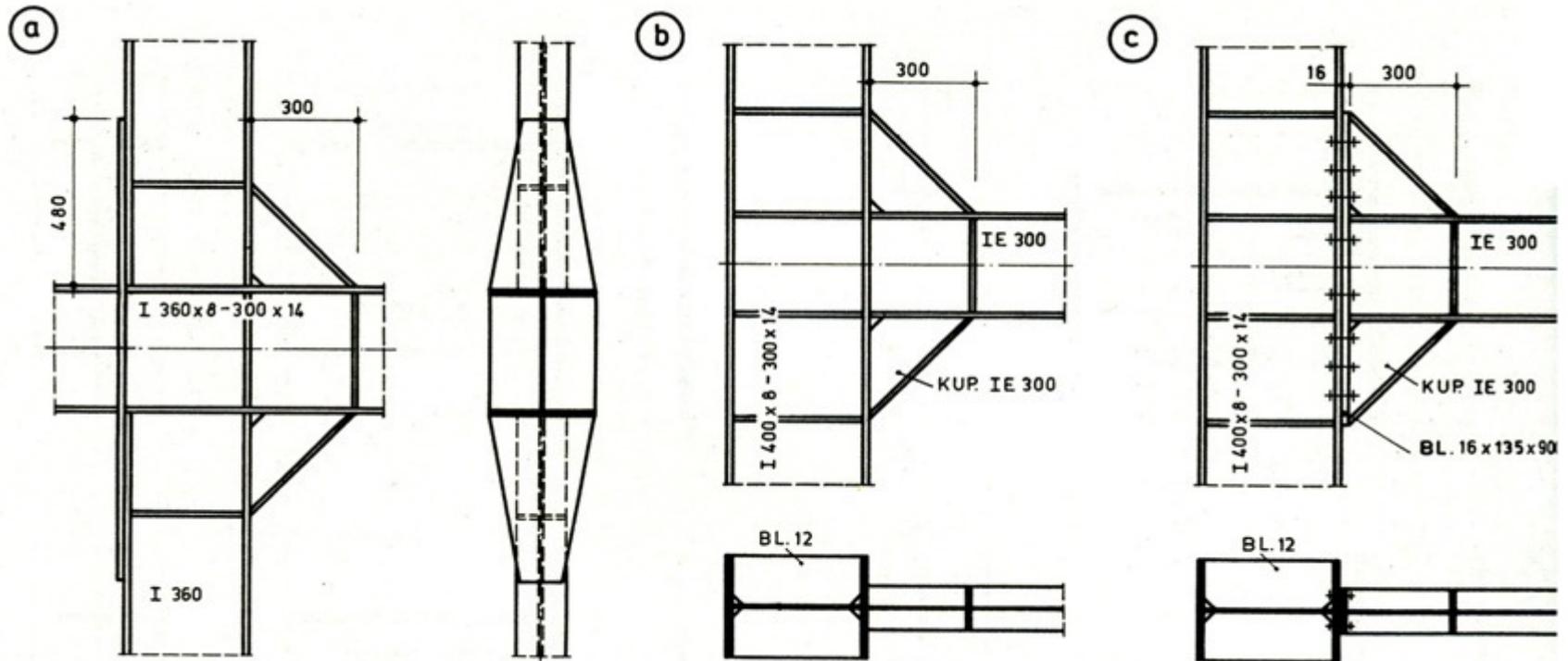


h. Durchbindung des Zug- und Druckgurtes am Träger



i. Durchlaufen des Trägers





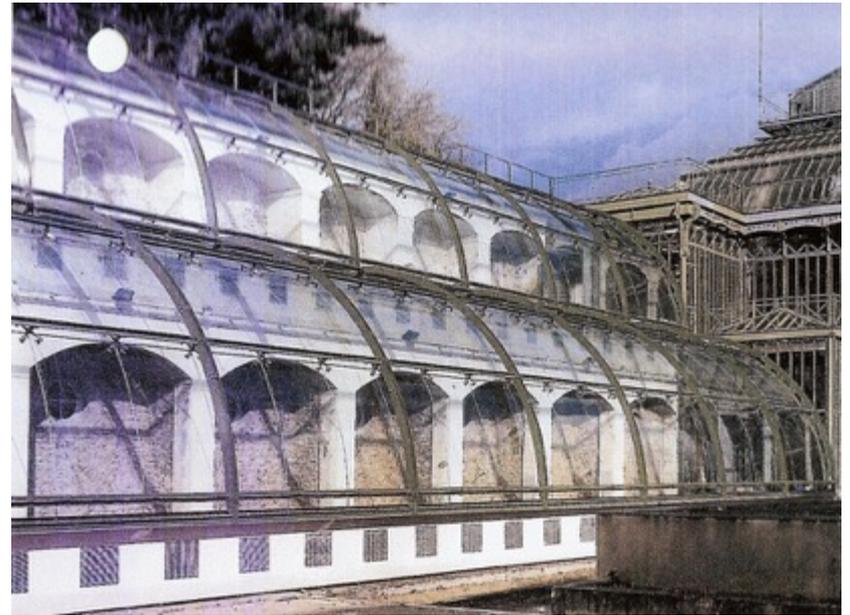
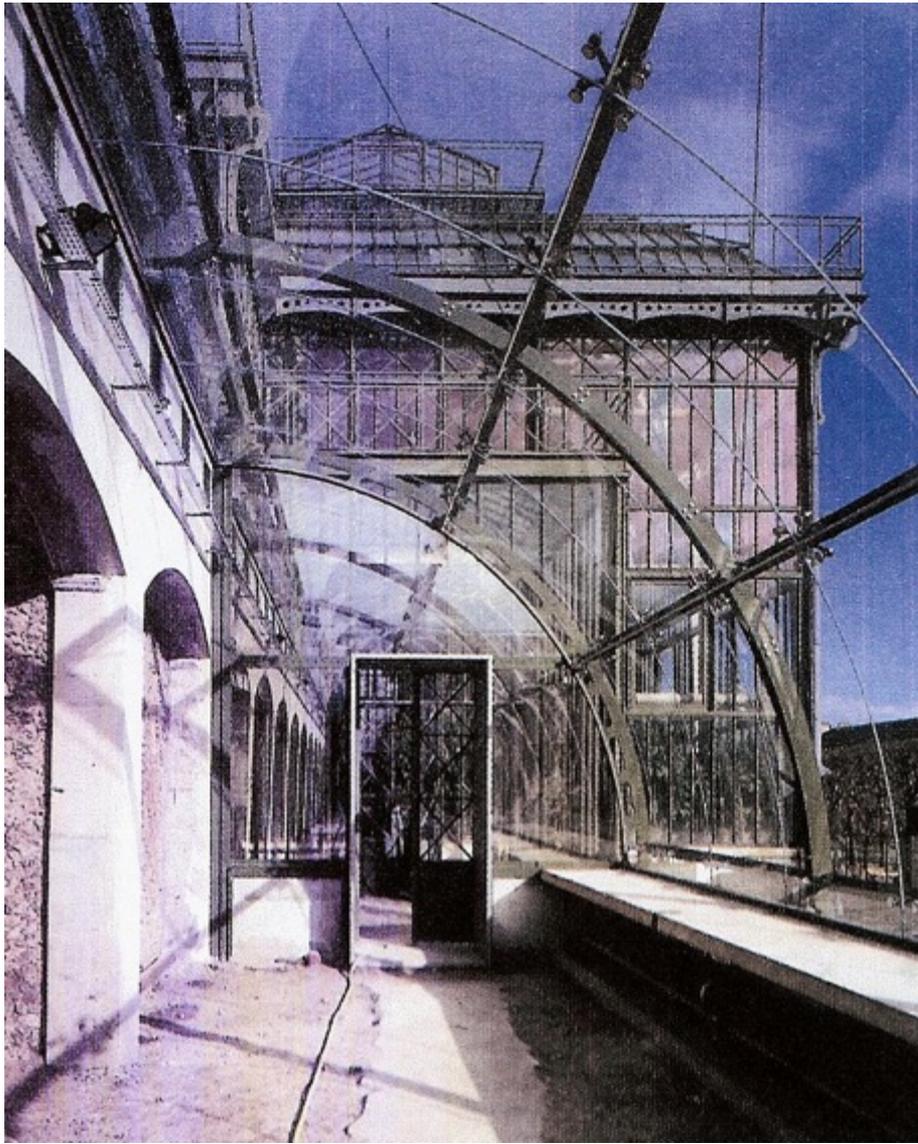


Claydon House - Green House, 19. Jh

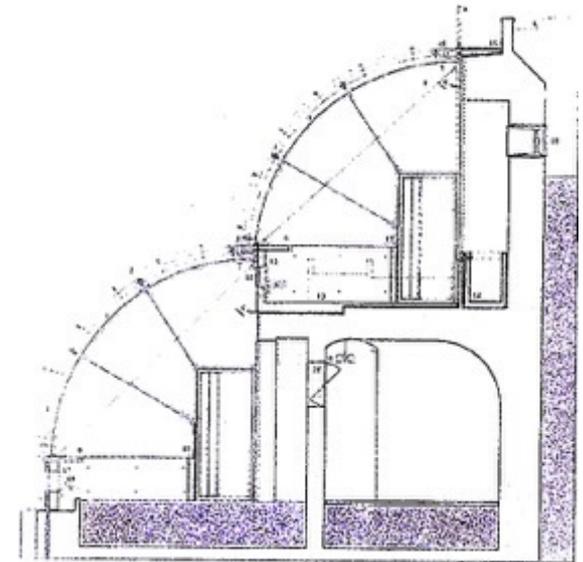


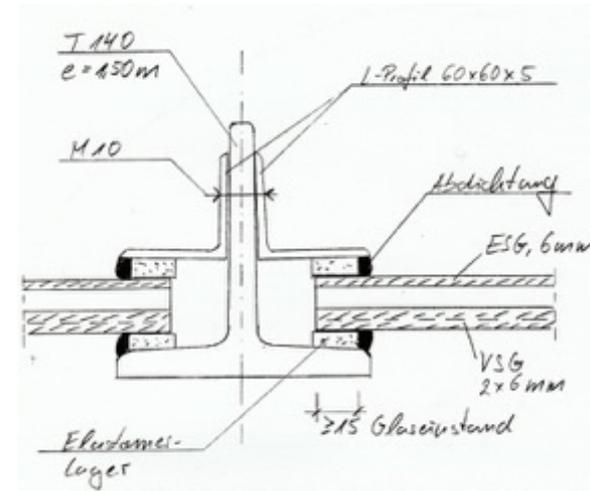
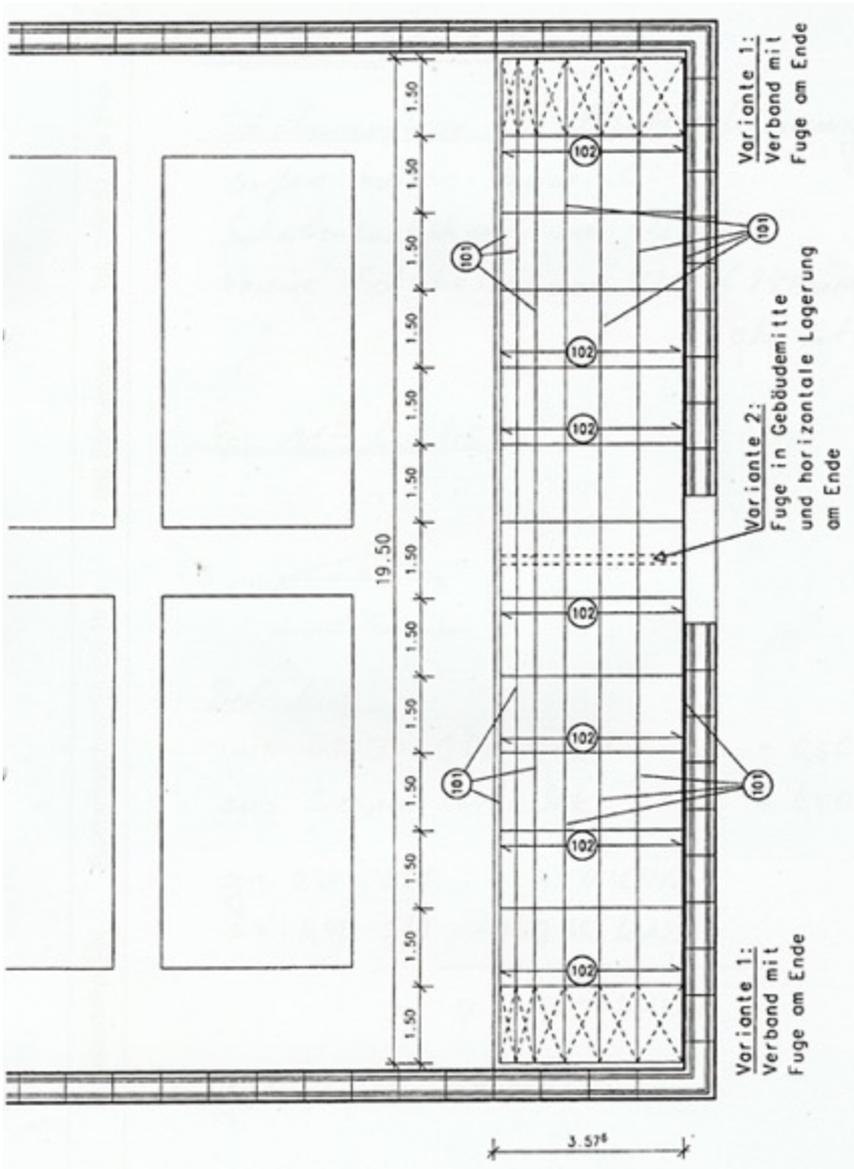
Claydon House - Green House, 19. Jh





Galeries de Zoologie, Paris
Saniert 2007





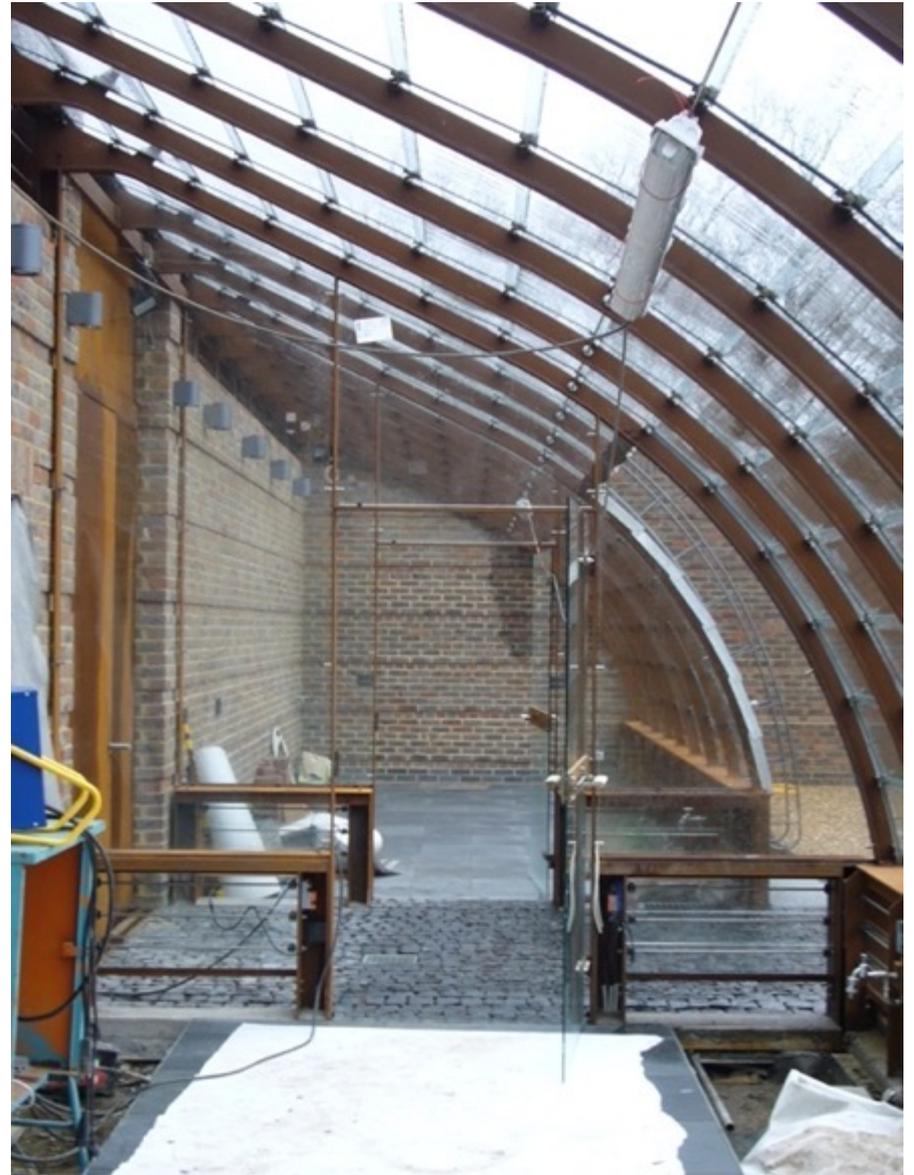
Walls Grove - Green House, London
A: Tony Hunt



Wallsgrove - Green House, London
A: Tony Hunt



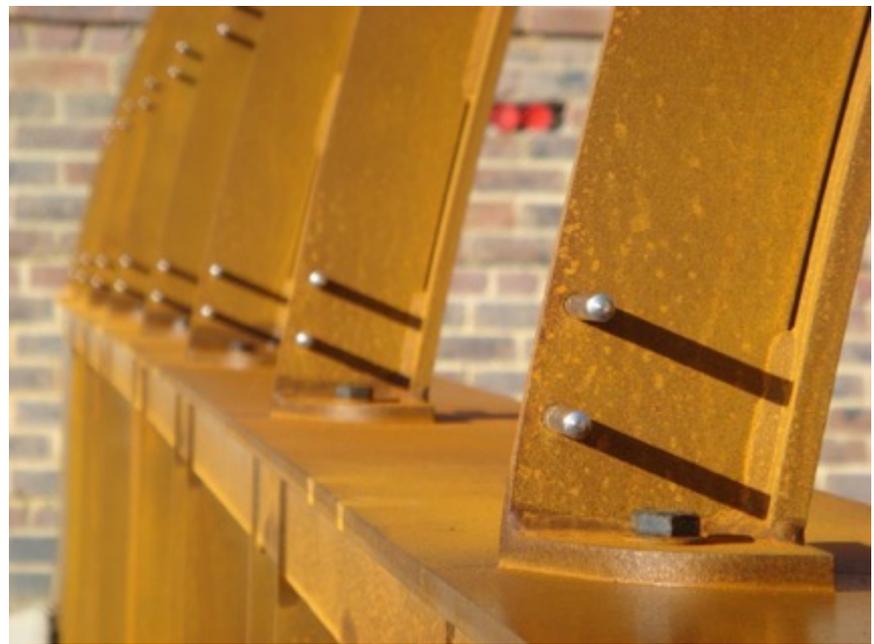
Walls Grove - Green House, London
A: Tony Hunt



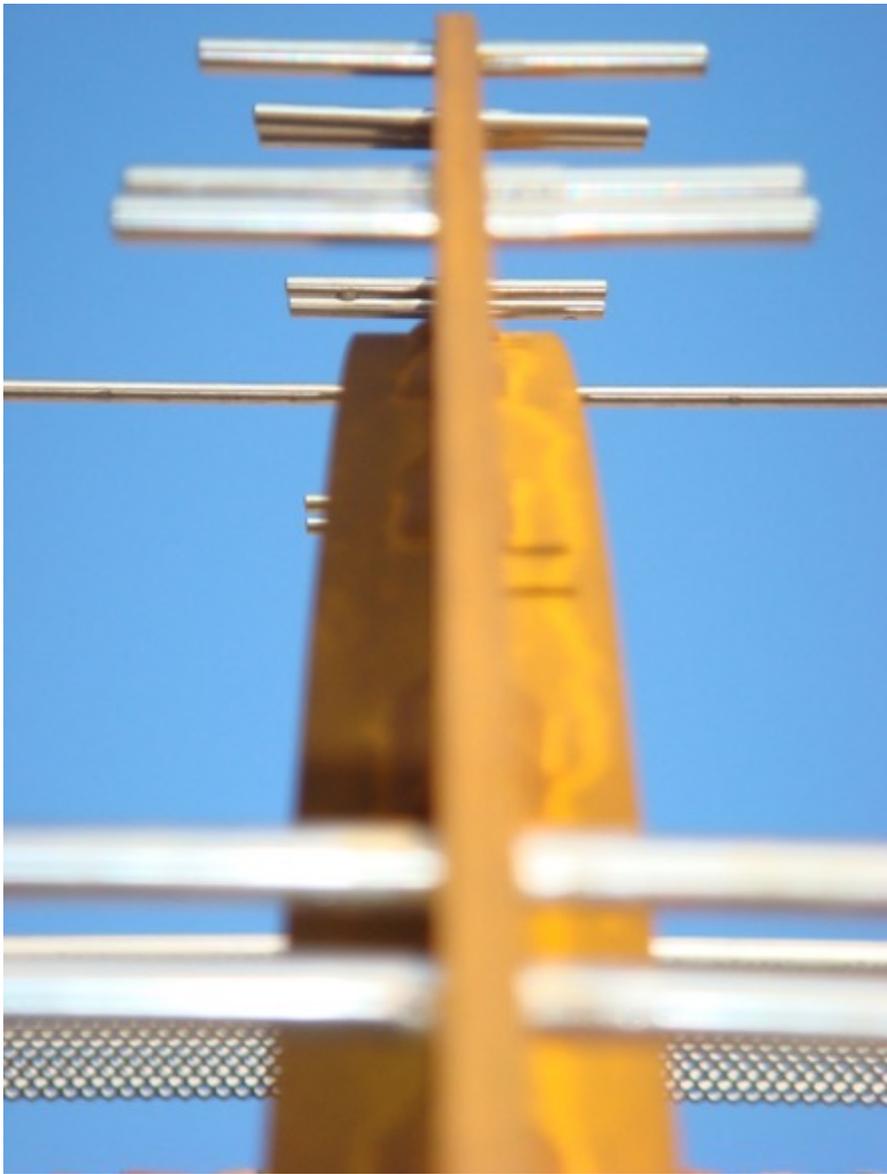
Wallsgrave - Green House, London
A: Tony Hunt



Walls Grove - Green House, London
A: Tony Hunt



Wallsgrove - Green House, London
A: Tony Hunt



Wallsgrave - Green House, London
A: Tony Hunt



Wallsgrave - Green House, London
A: Tony Hunt



Walls Grove - Green House, London
A: Tony Hunt

Claydon House - Green House, 19. Jh

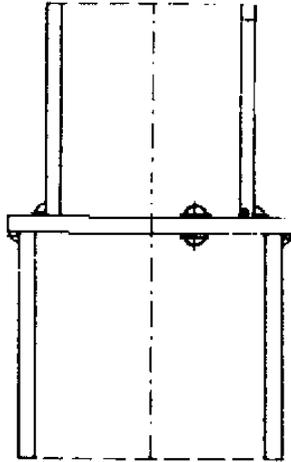


Wallsgrave - Green House, London
A: Tony Hunt

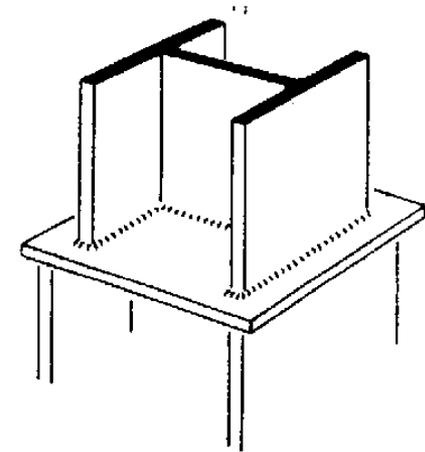
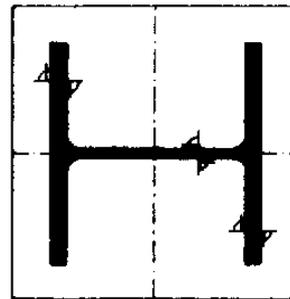


Wallsgrave - Green House, London
A: Tony Hunt

WERKSTATTSTOSS

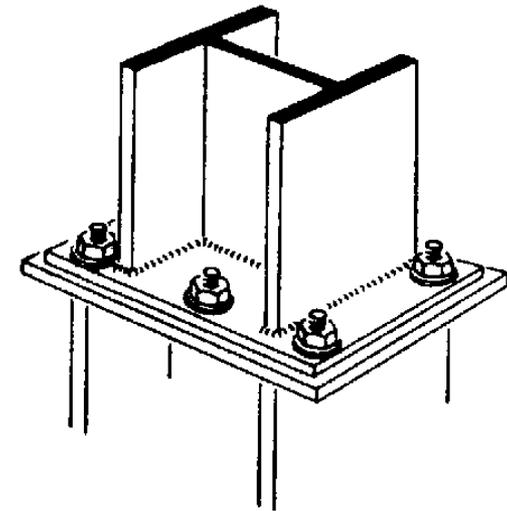
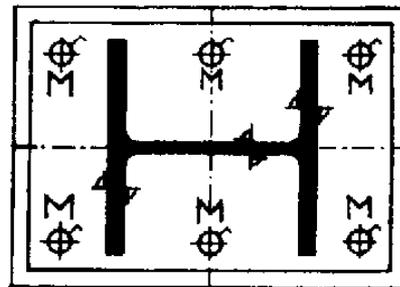
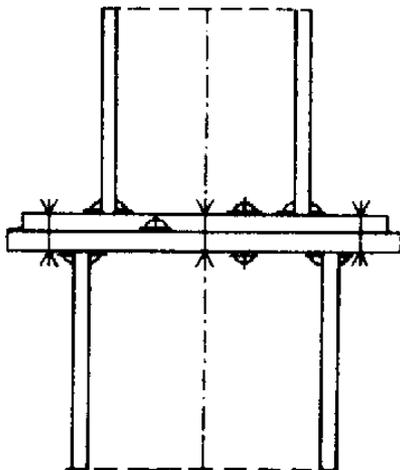


Kreuzstoß bei ungleichen Profilstärken

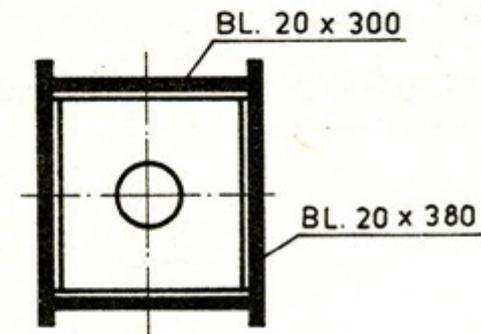
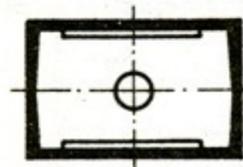
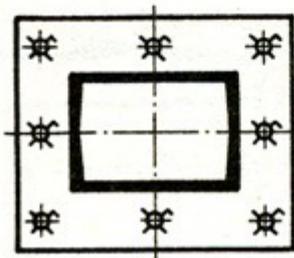
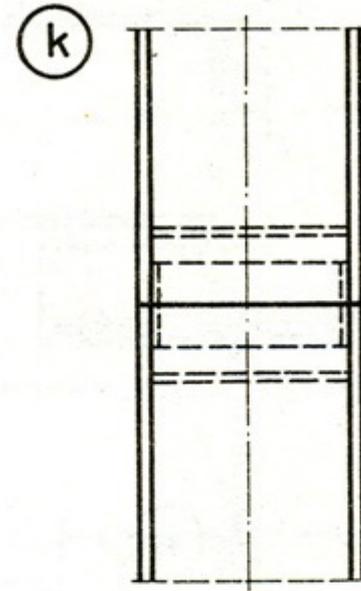
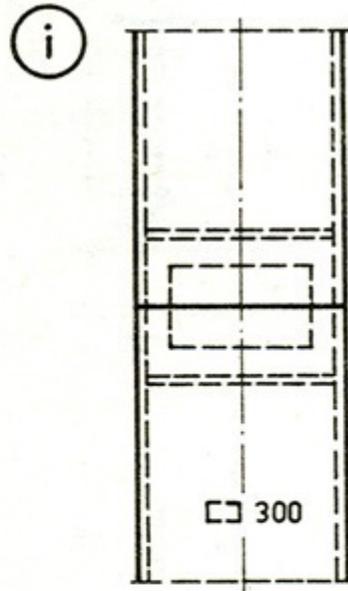
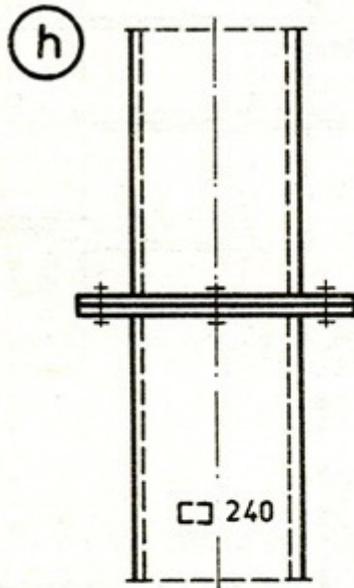


BAUSTELLENSTOSS

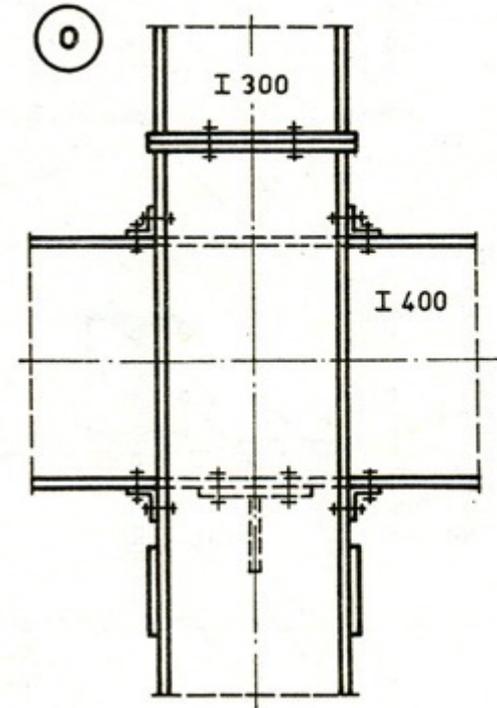
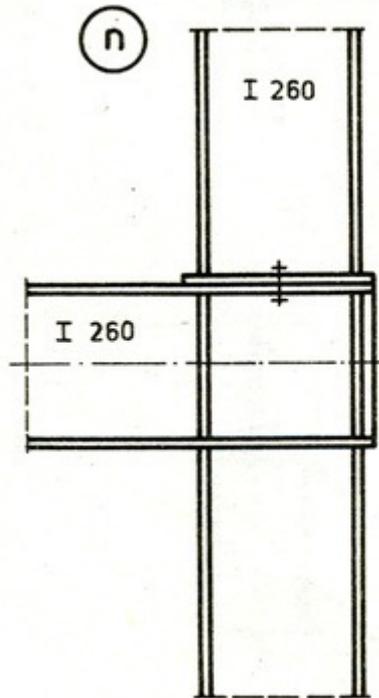
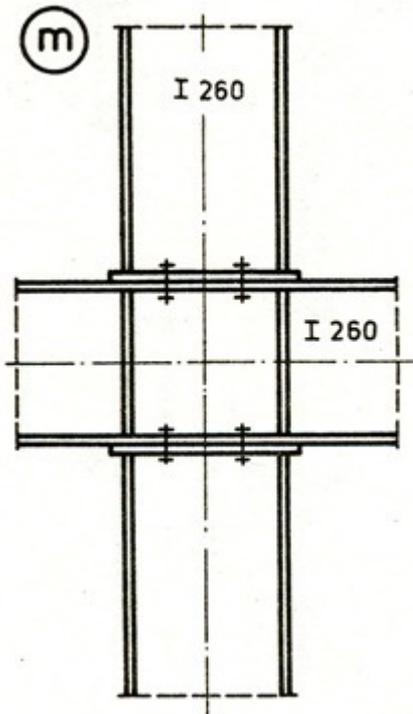
An beide Profile in der Werkstatt Kreuzplatten geschweißt, auf Baustelle verschraubt.



STÖSSE VON KASTENSTÜTZEN

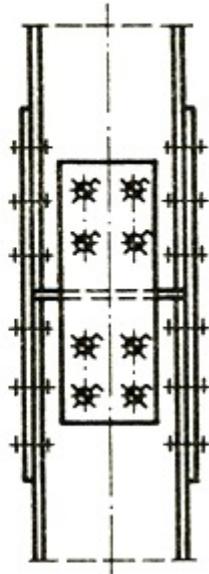
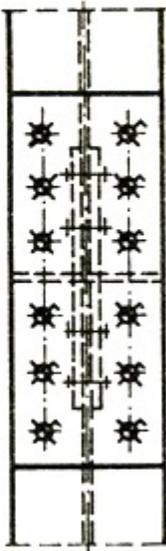


GESCHRAUBTE STÖSSE MIT STIRNPLATTEN

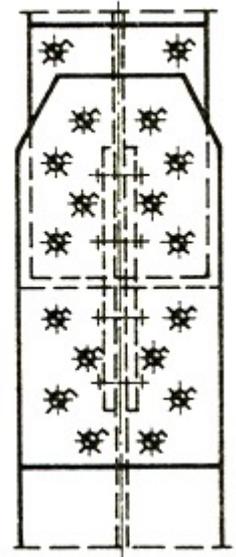
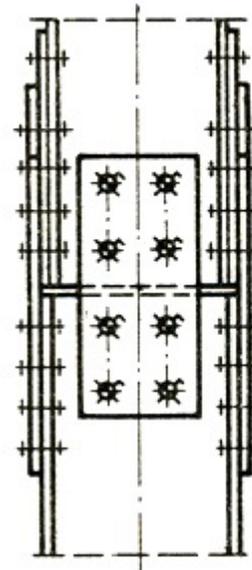


GESCHRAUBTE STÖSSE MIT VERLASCHUNGEN

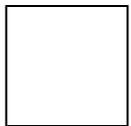
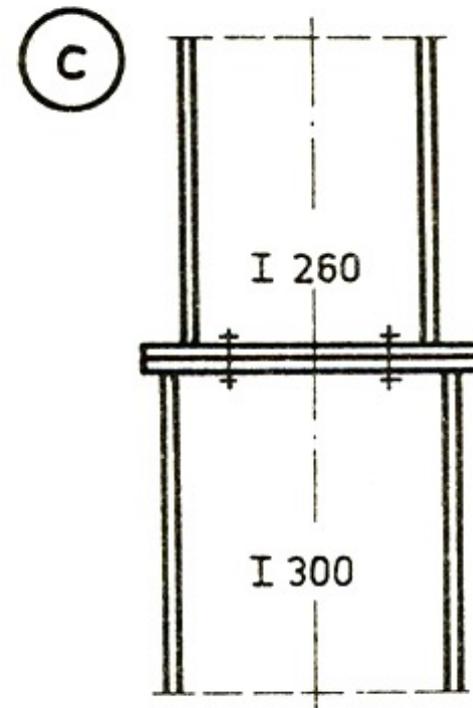
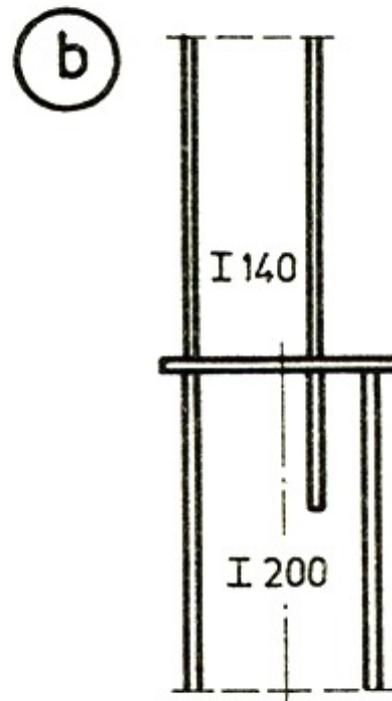
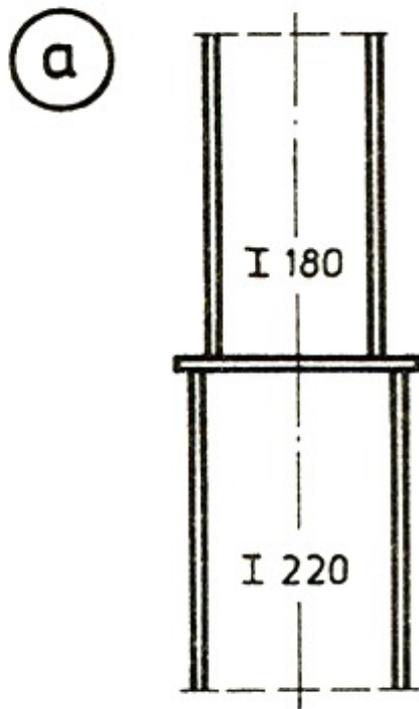
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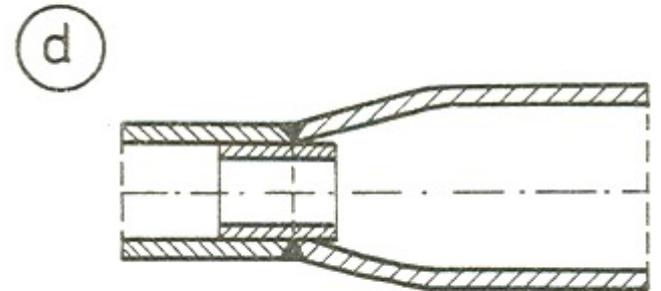
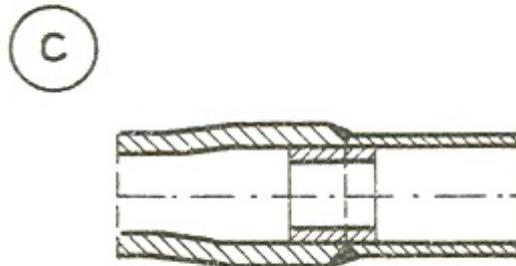
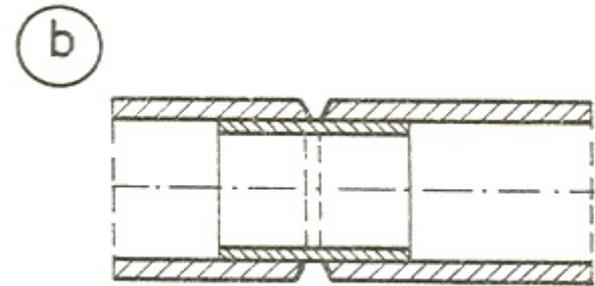
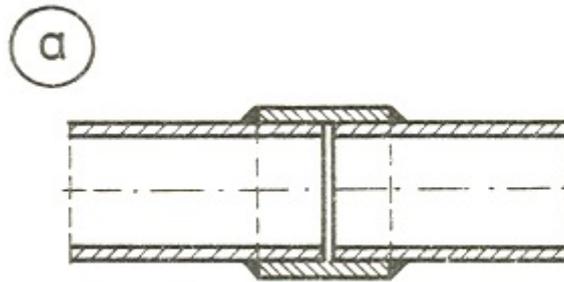


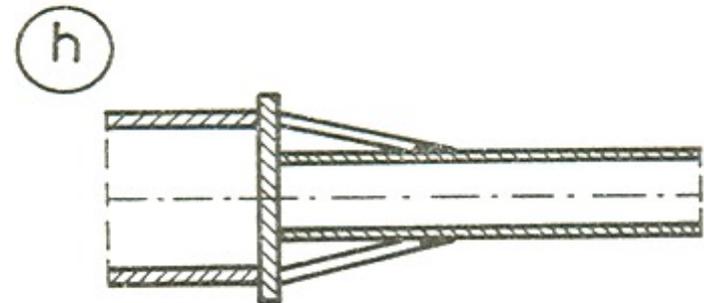
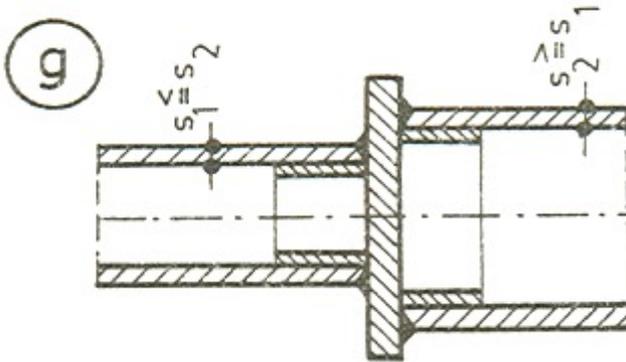
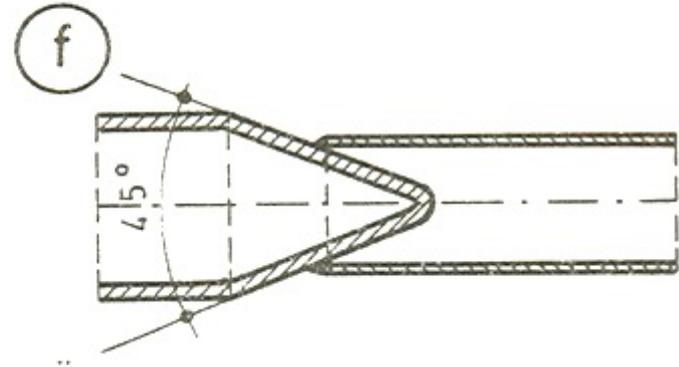
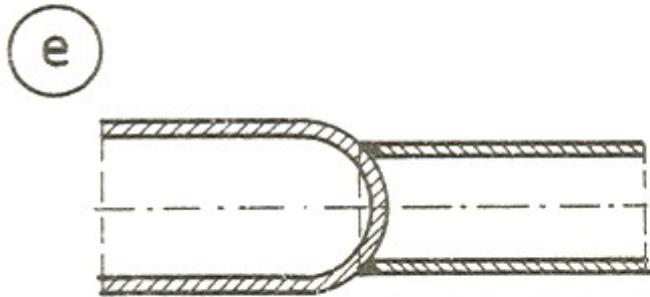
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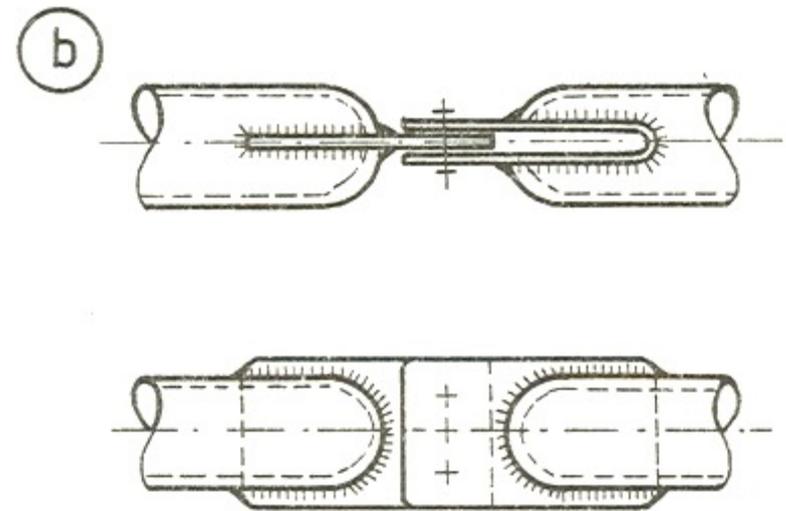
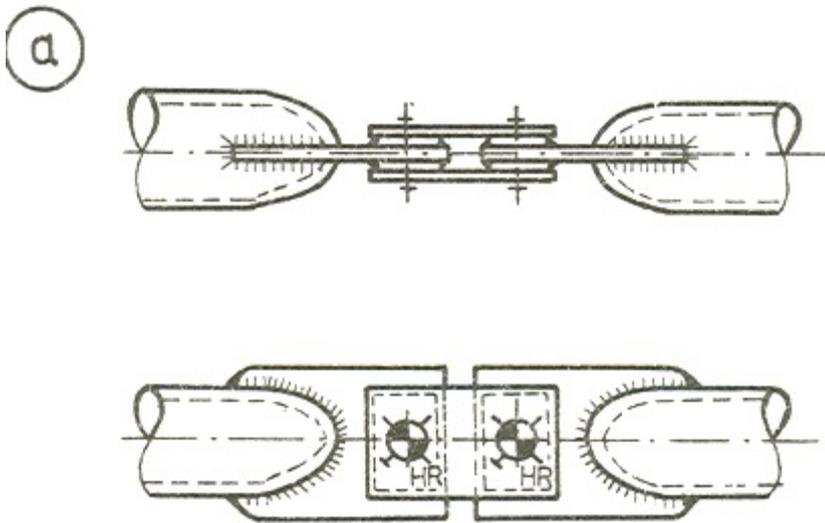


GESCHWEISSTE UND GESCHRAUBTE STÖSSE MIT STIRNPLATTEN

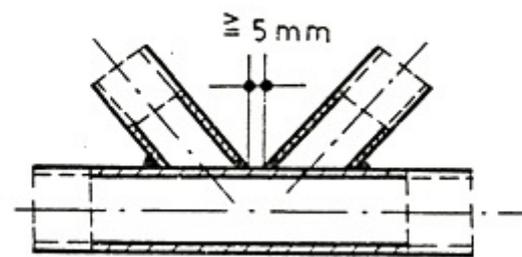
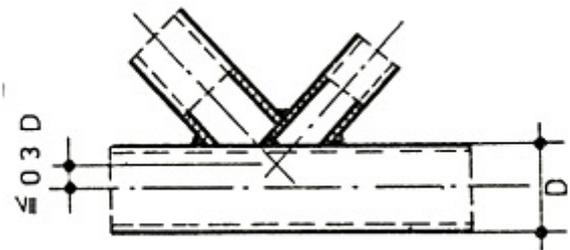
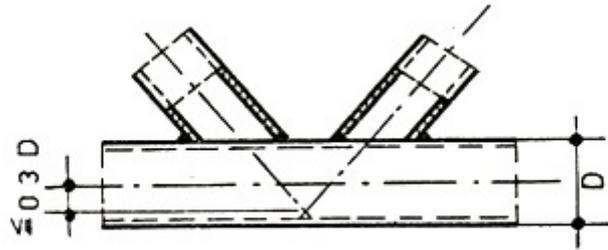




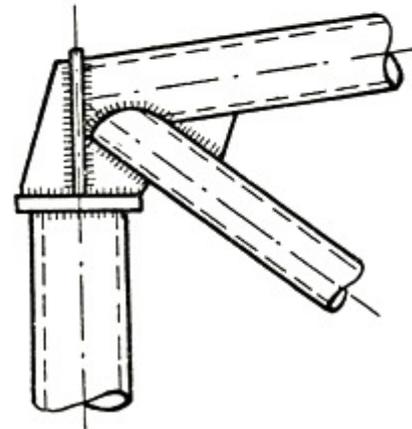
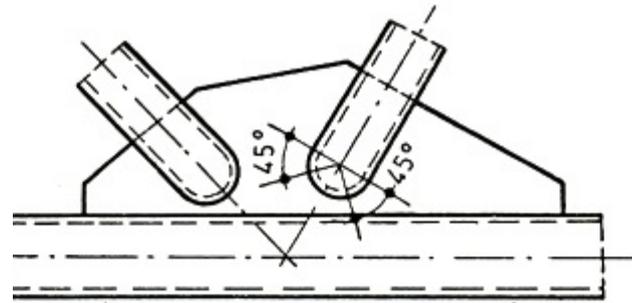


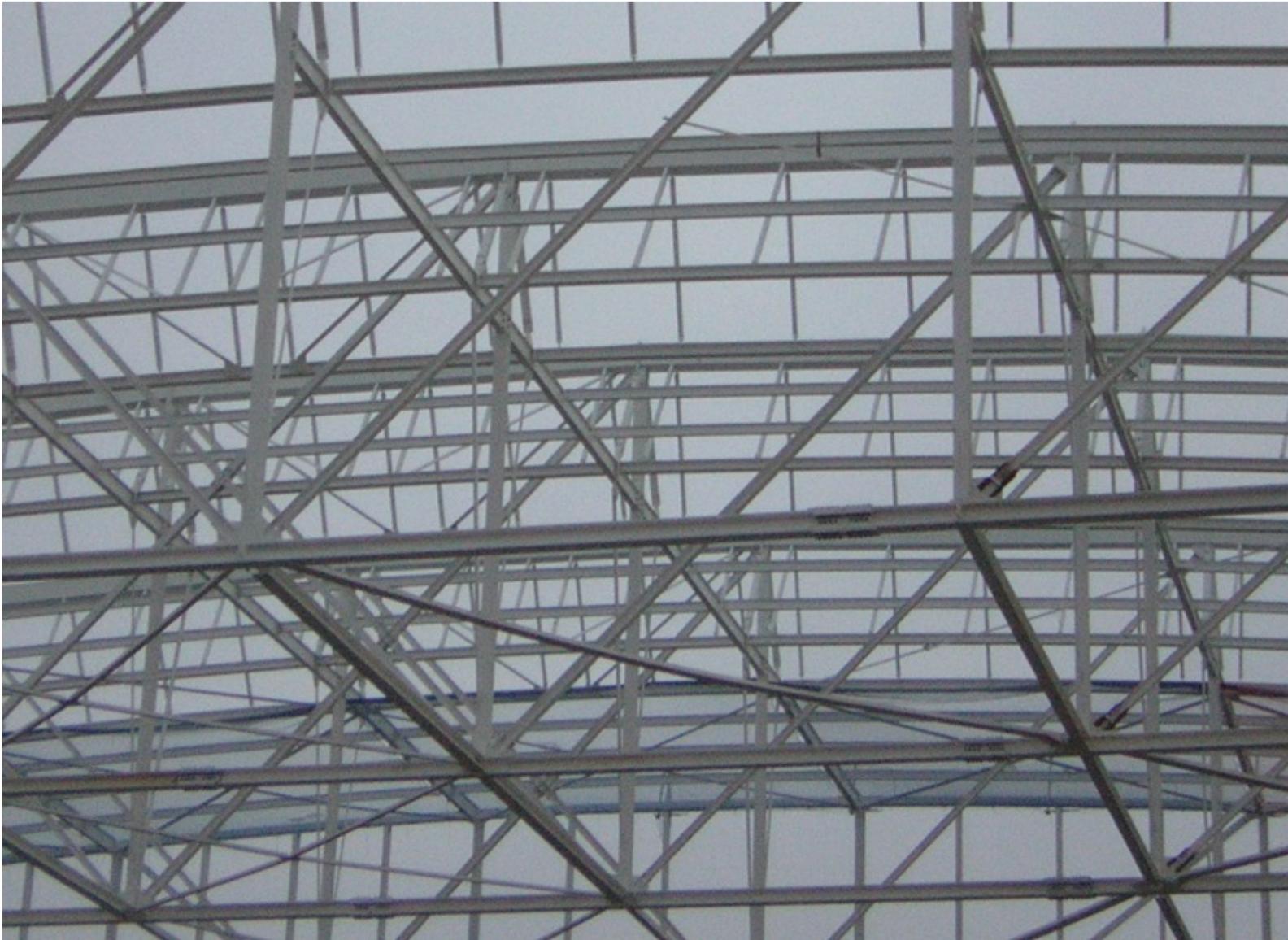


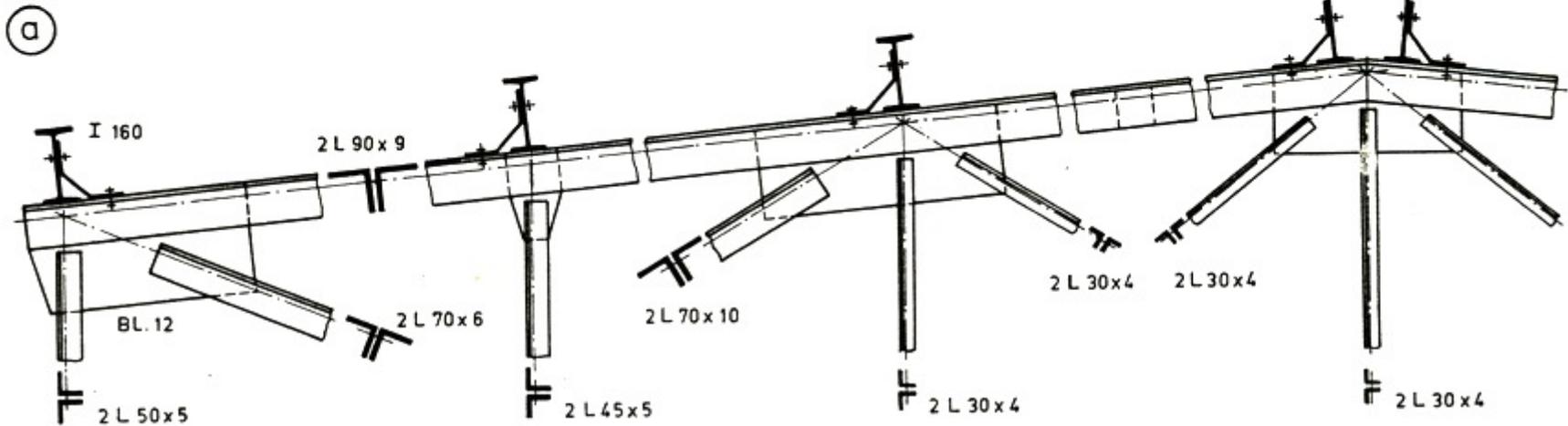
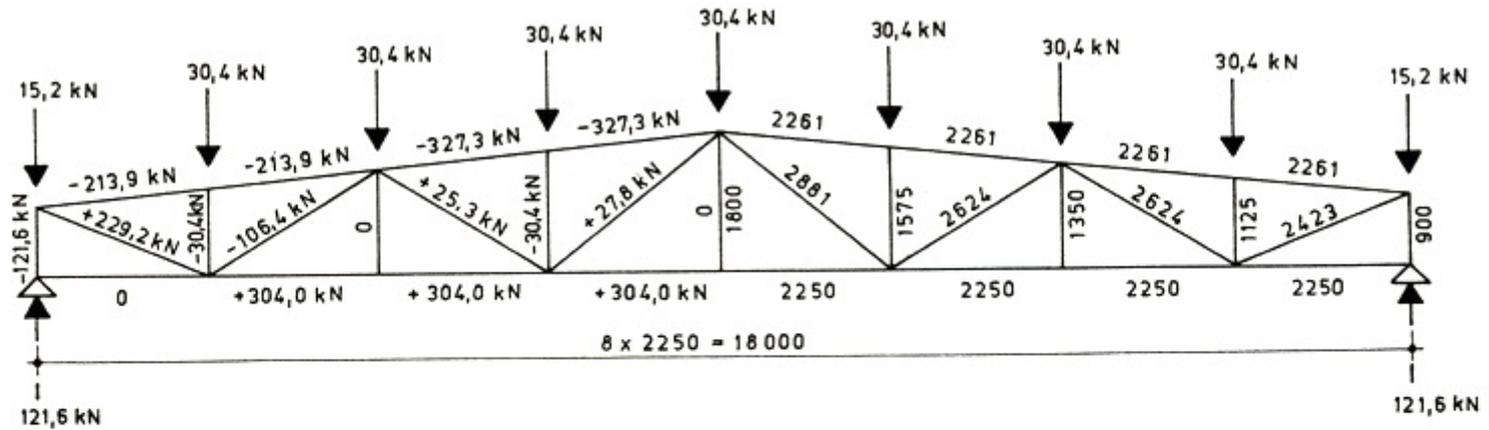
Fügung im Stahlbau



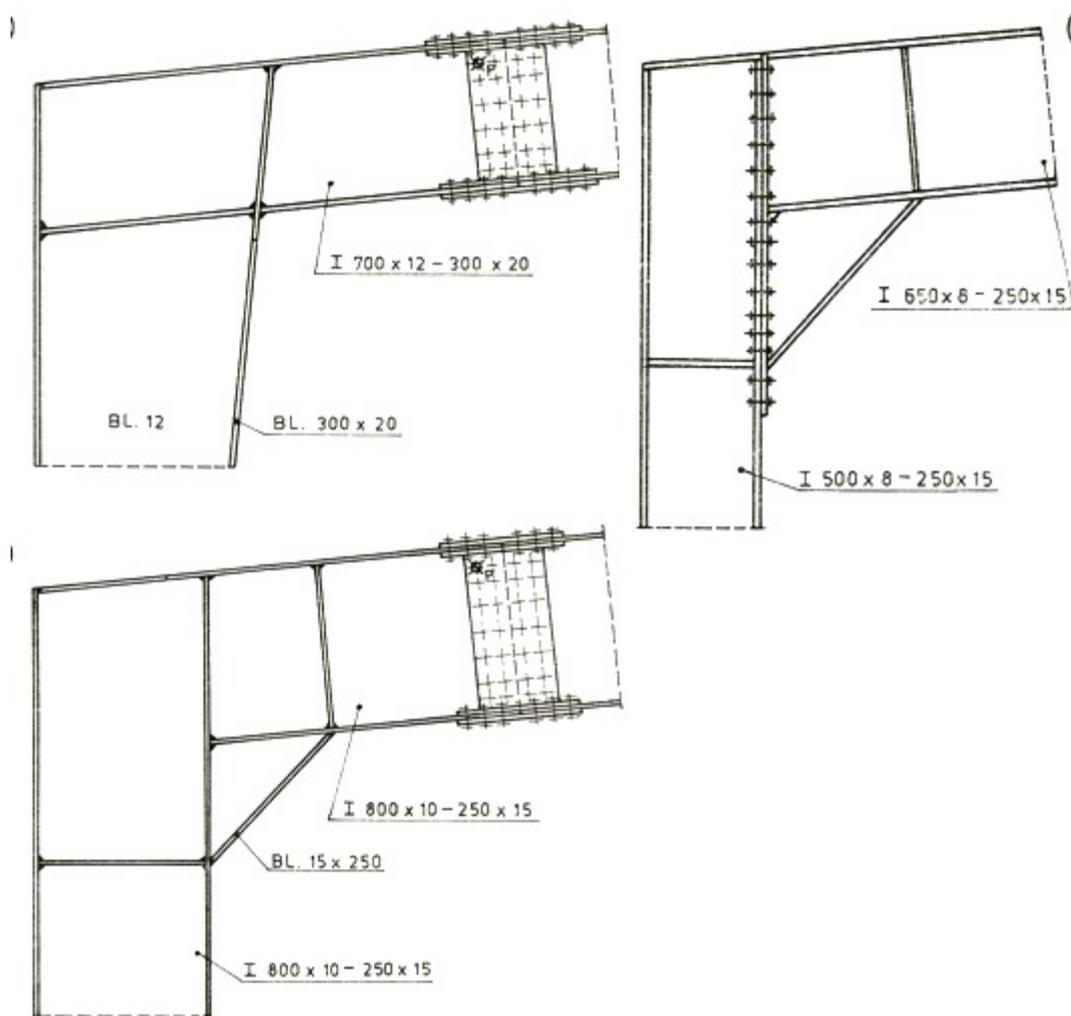
Rohranschlüsse



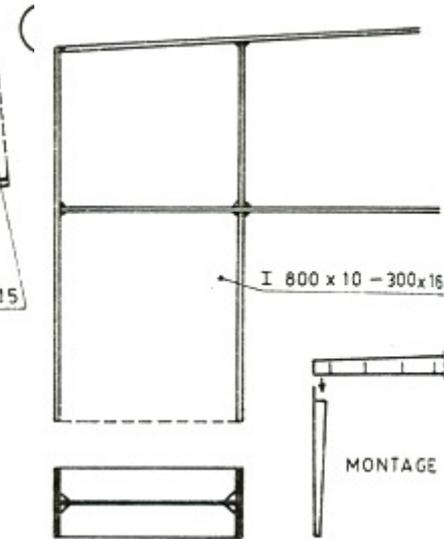


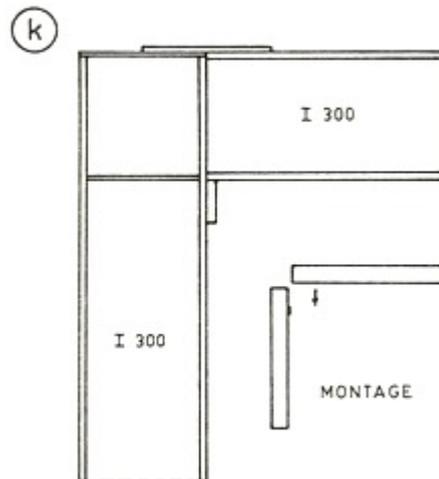
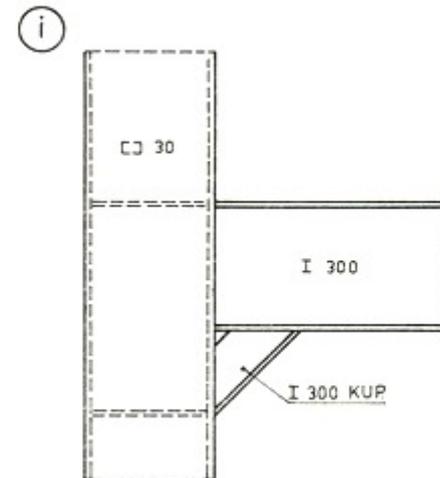
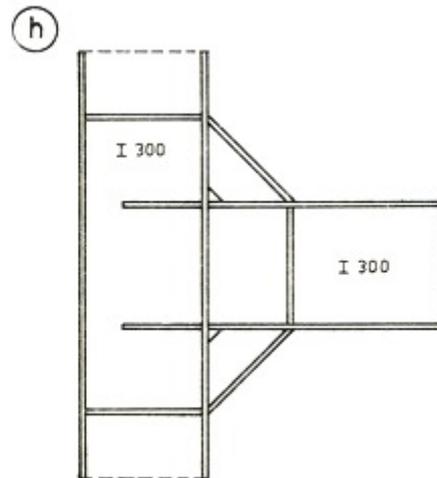
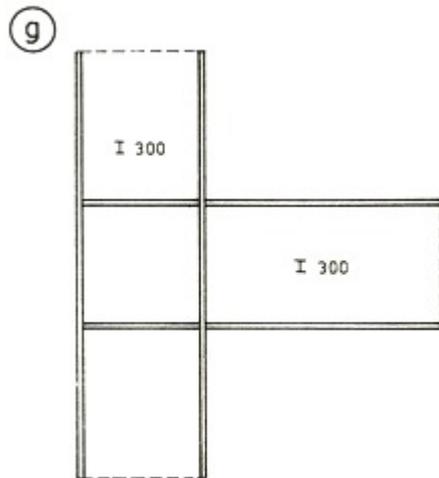


Fügung im Stahlbau

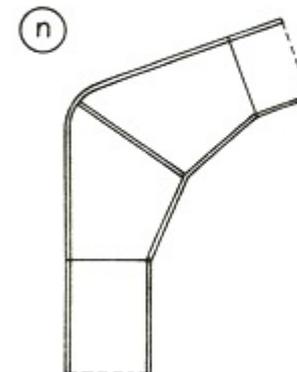
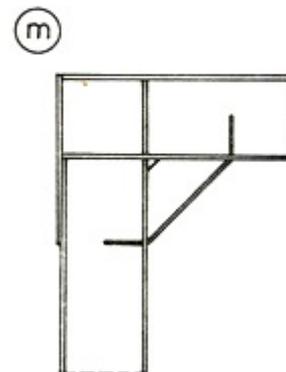


Rahmenecken



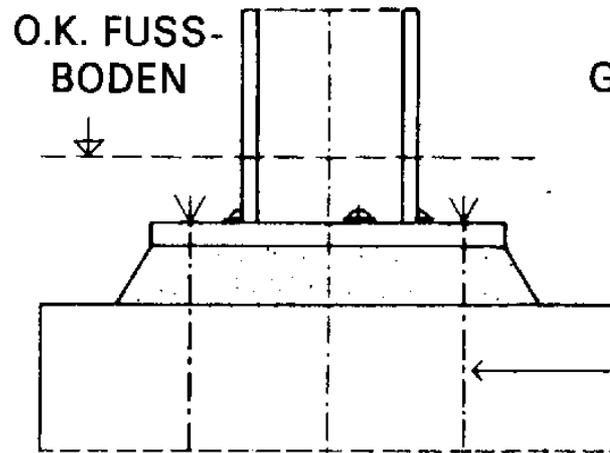


EINIGE MÖGLICHKEITEN DER RAHMENECKENBILDUNG
BEI WALZPROFILIEN

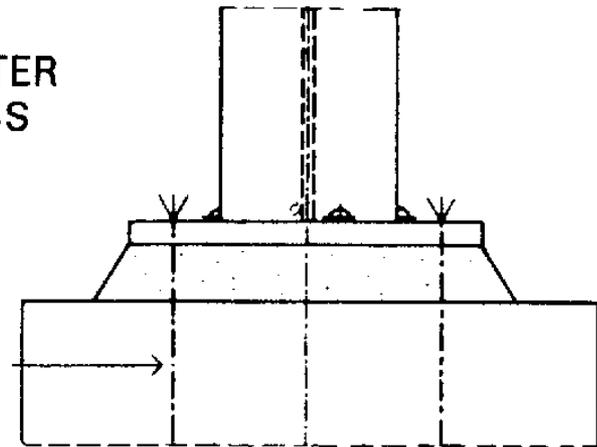


Fügung im Stahlbau

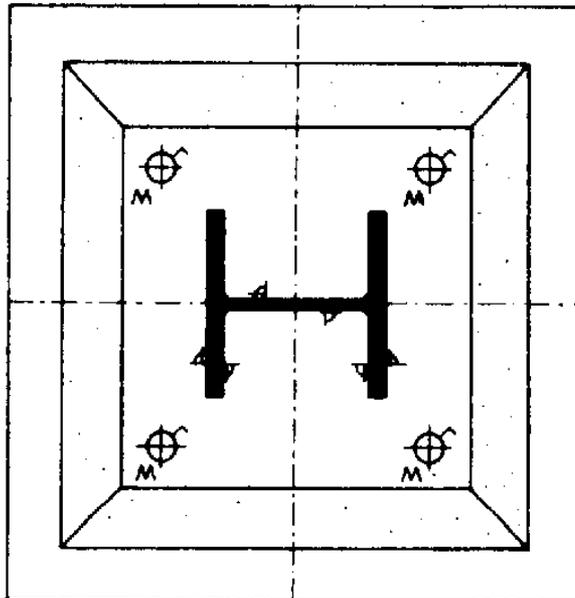
Fußpunkte - geschraubt



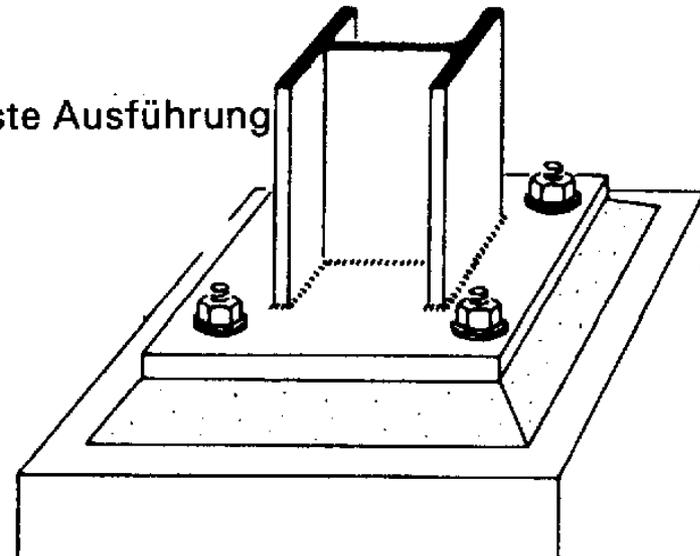
EINFACHER
GESCHWEISSTER
STÜTZENFUSS



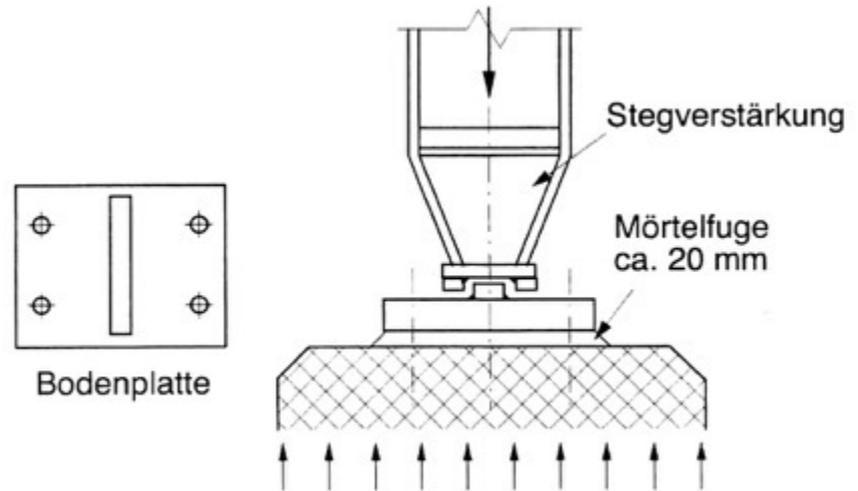
Starke Fußplatte



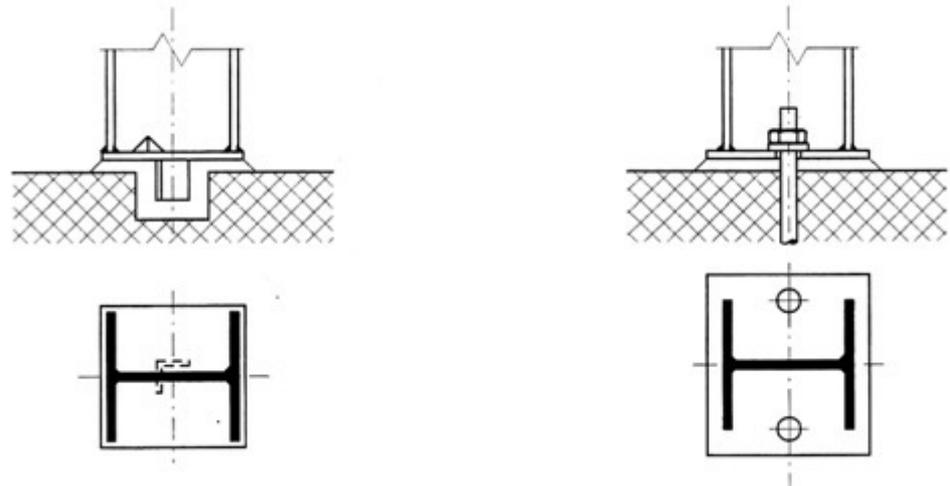
häufigste Ausführung

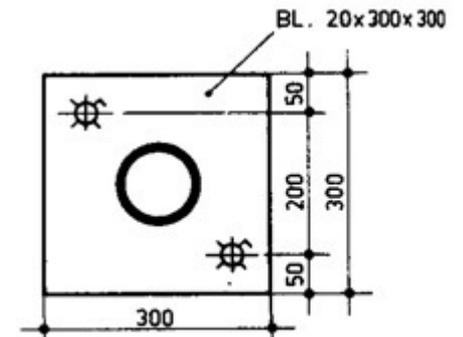
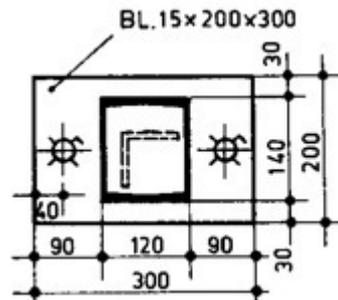
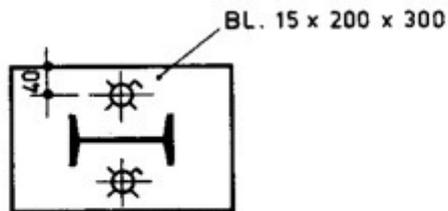
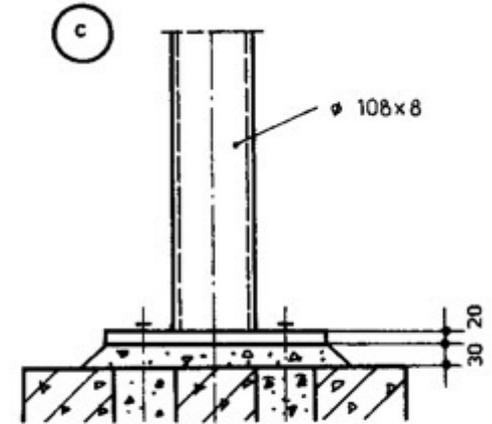
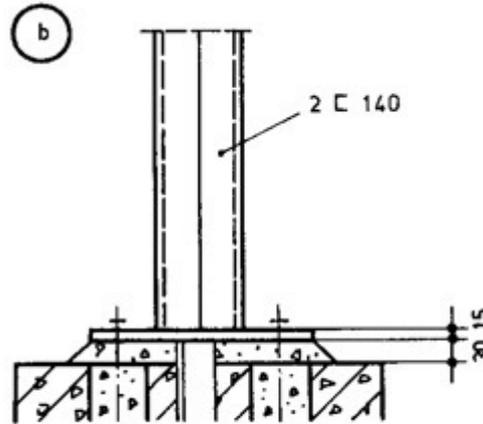
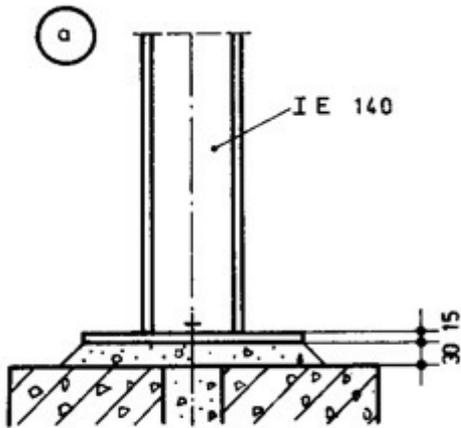


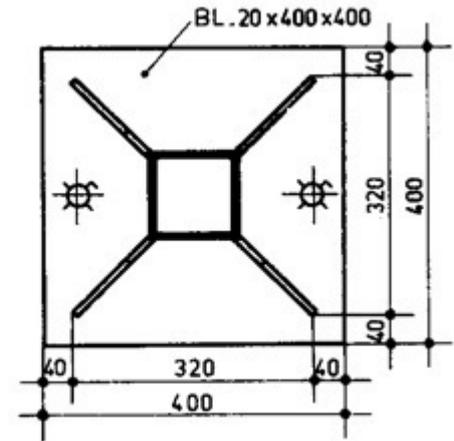
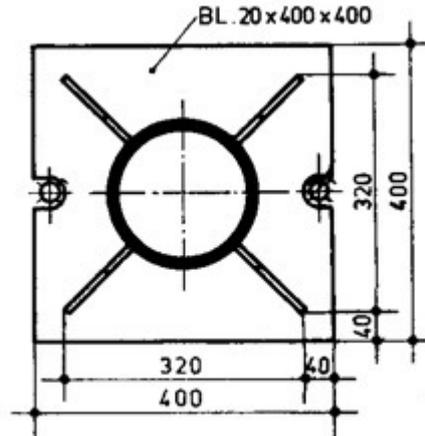
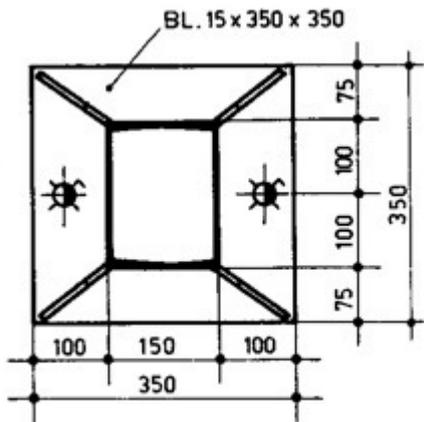
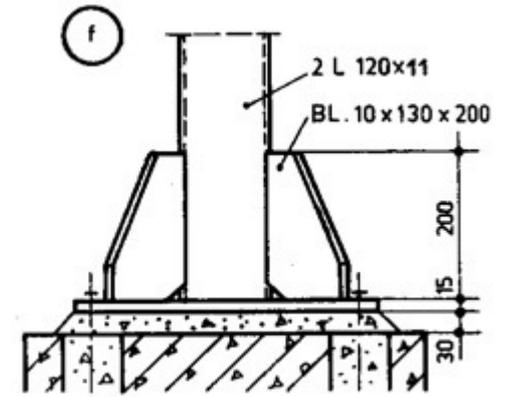
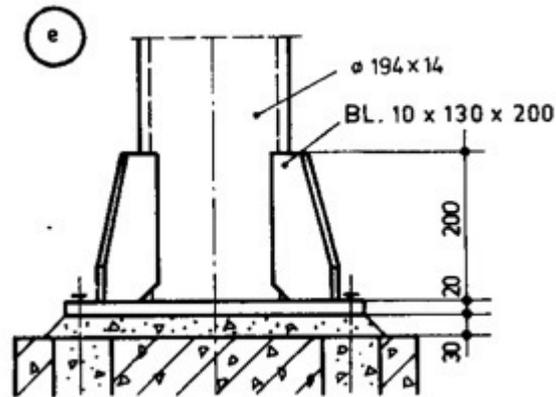
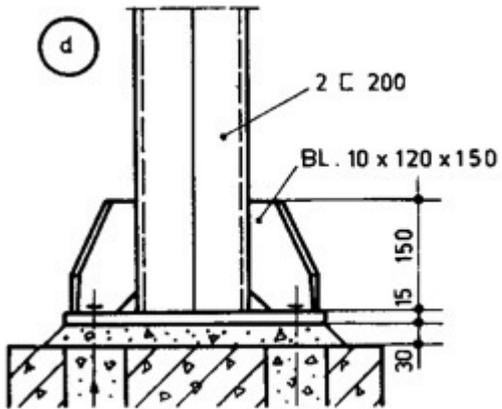
Gelenkiger Stützenfuß
über Kipplager

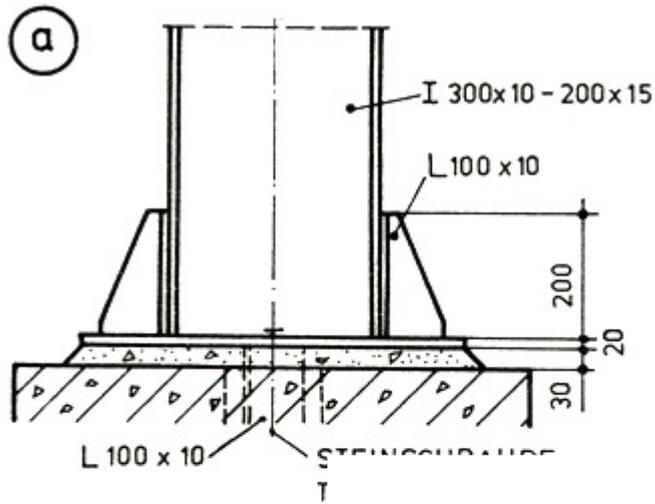


Aufnahme von
Horizontallasten

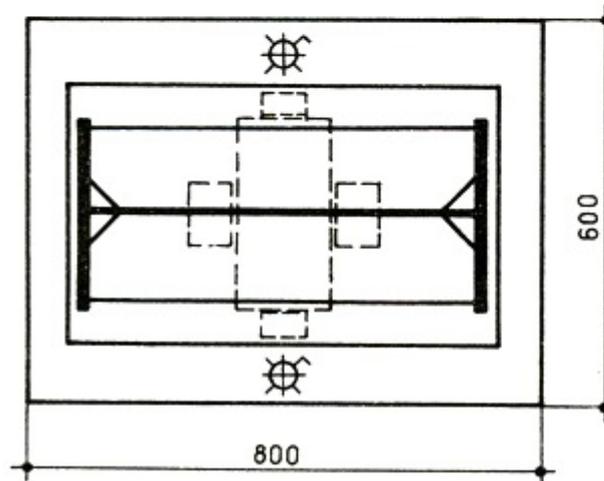
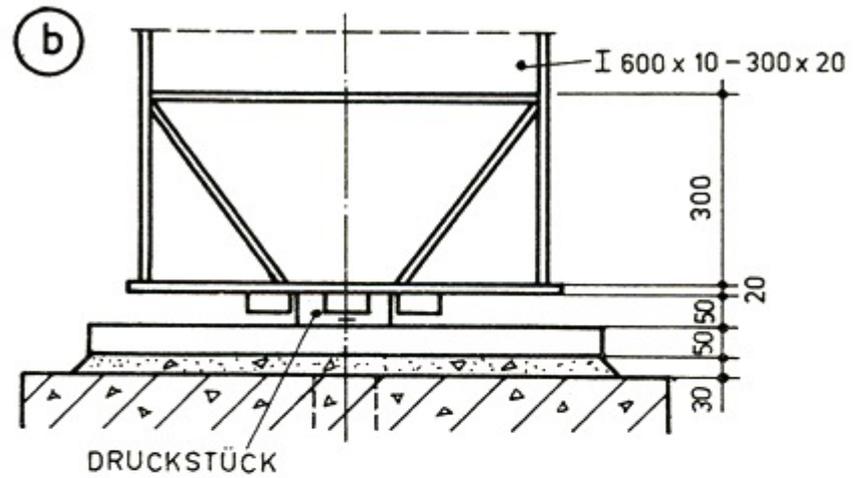
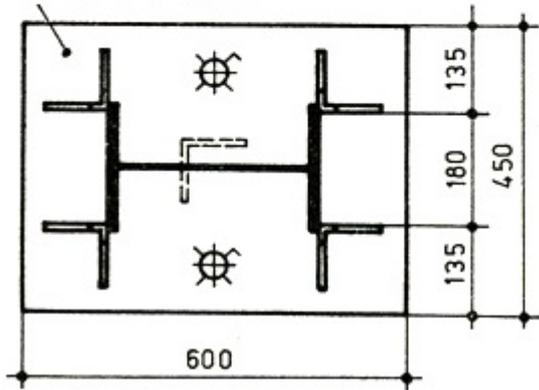






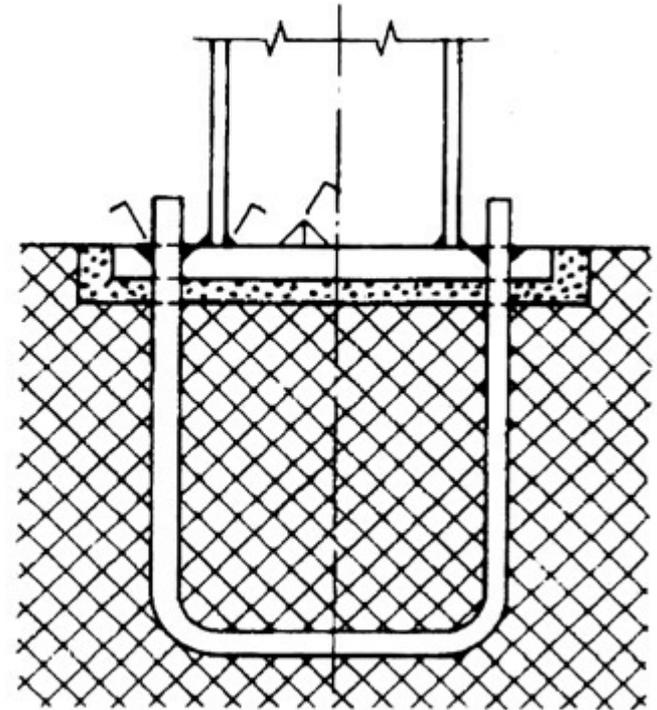
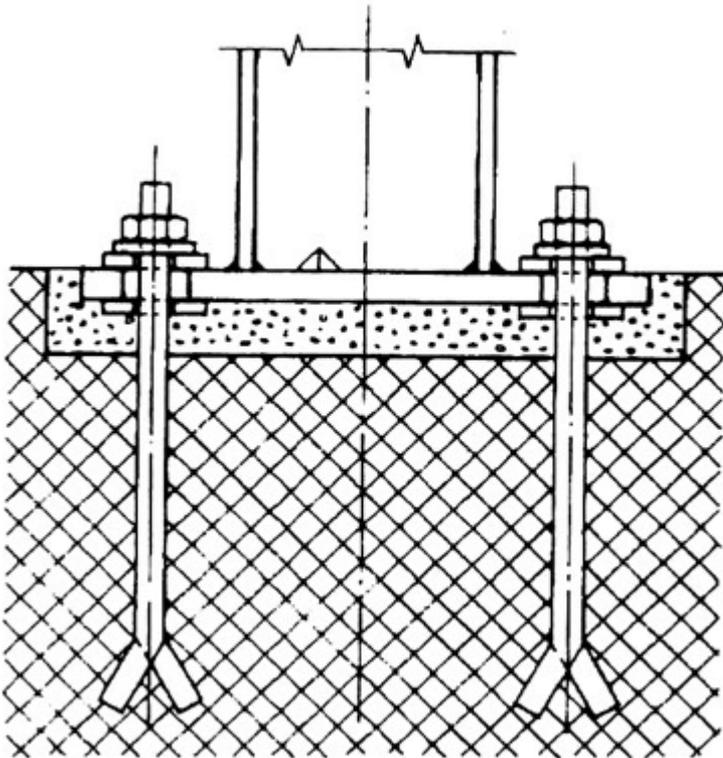


BL. 20 x 450 x 600

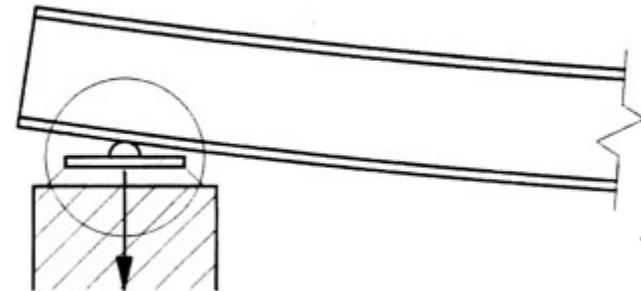
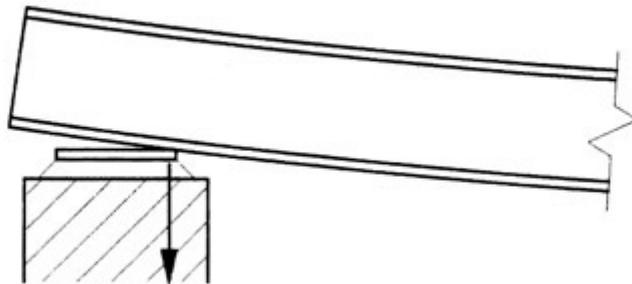
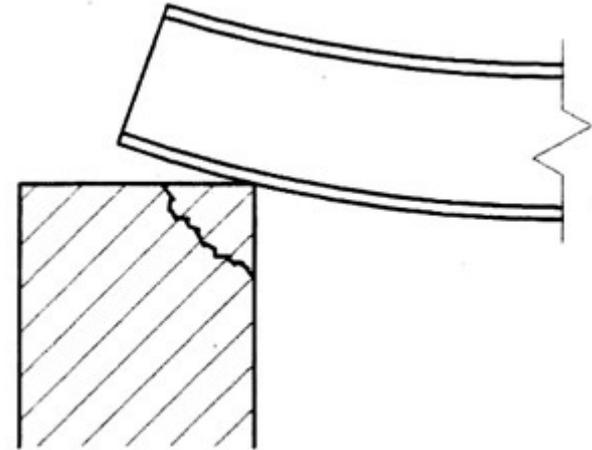
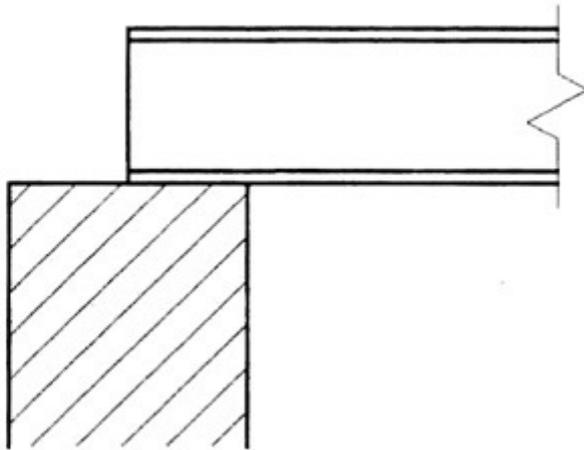


Fügung im Stahlbau

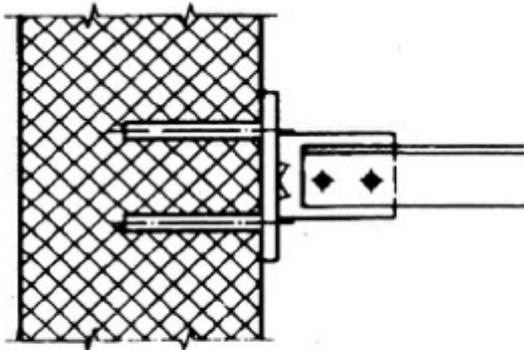
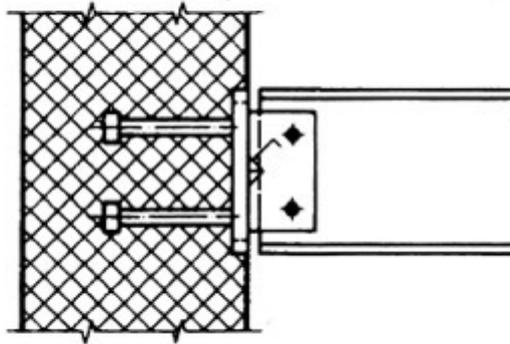
Stützenfuß - eingespannt



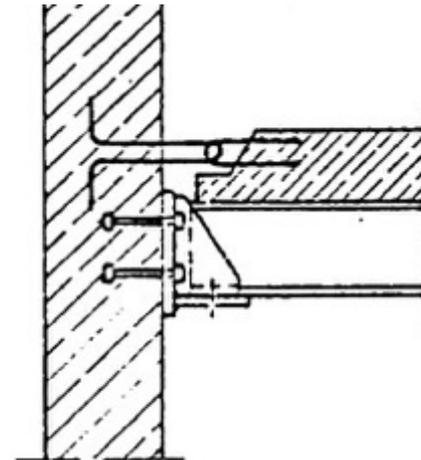
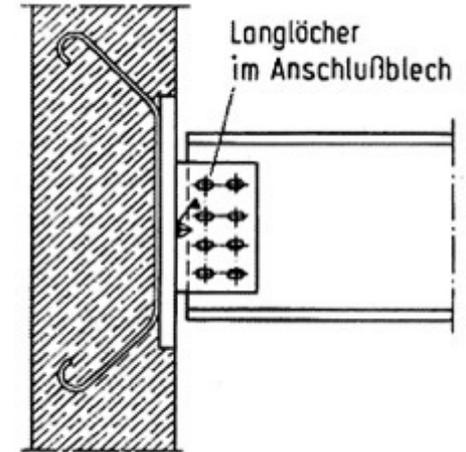
Einbetonierte Ankerschrauben / Anschlusseisen



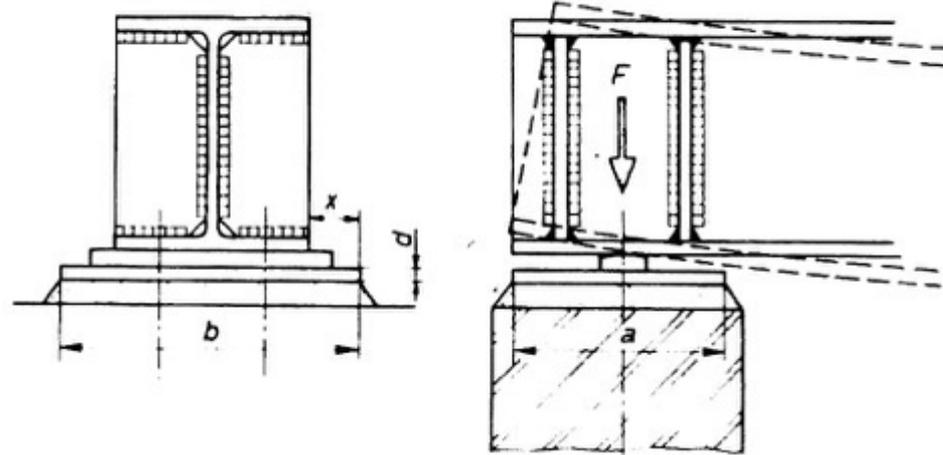
Fügung im Stahlbau



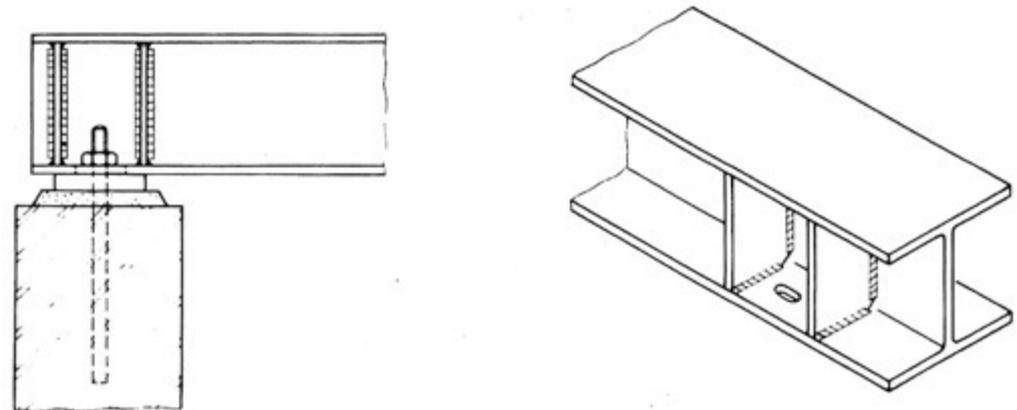
Trägeranschluss an Betonwänden



Kipplager



verschiebliches Lager



Fügung im Stahlbau

Trägerauflager in Mauerwerk und Beton

