

Solarstrom in Deutschland: „Klimakiller“ Nummer 1!

Die Vertreter der Solarbranche sowie vieler Nichtregierungsorganisationen wie z.B. WWF oder Greenpeace vertreten die Meinung, dass Kohle der Klimakiller Nr. 1 sei. Kohle deckt rund 40 % des Weltenergiebedarfs; in China beträgt der Anteil der Kohle sogar 70 %. Kohle wird noch für viele Jahrhunderte die wichtigste Energiequelle für die ganze Welt bleiben, da sie nicht nur billig, sondern auch in grossen Mengen vorhanden ist.

Aber stimmt denn diese Aussage der Solarbranche und der Nichtregierungsorganisationen? Unbestritten ist, dass bei der Verbrennung von Kohle Kohlendioxid entsteht. Aber auch Photovoltaik(PV)-Anlagen führen zur Emission von klimawirksamen Treibhausgasen – nicht beim Betrieb, sondern bei der Herstellung.

Beim Errechnen der Auswirkungen der PV-Anlagen aufs Klima pro Einheit Nutzenergie (kWh elektrisch ab Klemme) sind vor allem massgebend: die Herstellung der Solarmodule in China, speziell die Raffination von Solar-Silizium unter Einsatz erheblicher Mengen von Chemikalien und Rohstoffen, die Herstellung der Nebenanlagen, der Transport der Materialien nach Europa und demgegenüber die erfahrungsgemäss bescheidene Stromausbeute unter den klimatischen Verhältnissen in Deutschland.

Wie viel CO₂ emittiert ein modernes Kohlekraftwerk ?

Moderne Dampfkraftwerke mit Kohlenstaubfeuerung und überkritischen Frischdampfparametern (sog. Clean Coal Technology) erreichen einen thermischen Wirkungsgrad von 52%. Das bedeutet, dass sie 846 Gramm CO₂ pro kWh Strom emittieren, wenn sie mit Steinkohle (Heizwert: 30 MJ/kg) betrieben werden. Ferner sind moderne Kohlekraftwerke mit hocheffizienten

Filtern versehen, so dass die Emission von Staubpartikeln minim ist.

Hinzuzufügen ist, dass Kohlekraftwerke bedarfsgerecht Strom produzieren und deswegen weder Speichieranlagen noch Reservekapazitäten benötigen. Die Letzteren sind aber bei Solarstrom unabdingbar und verursachen Umwandlungsverluste.

**Herstellung der
Solarmodule in
China und
Herstellung der
Nebenanlagen**

**Heute werden rund
80 % der in Europa**

**eingesetzten
Solarmodule in
China hergestellt
(siehe EU anti-
dumping
investigation on
solar panel imports
from China). Die
Herstellung von
ultrareinem
Silizium für die
Modulzellen ist**

**extrem
energieintensiv.
Nach Prof. Jian
Shuisheng von der
Pekinger Jiatong-
Universität sind in
der chinesischen
Industrie pro
Quadratmeter Modul
mehr als 300 kg
Kohle notwendig.
Daraus entstehen**

**mehr als 1'100 kg
CO₂, das in die
Atmosphäre
gelangt.**

**Auch die Fertigung
der Nebenanlagen
eine PV-Anlage wie
z.B.**

**Wechselrichter,
Batterien,
Kupferkabel,
Schalter,**

**Instrumente,
Abstützungen und
Beton braucht
fossile
Brennstoffe. Der
Energiebedarf für
Nebenanlagen wird
in der
Fachliteratur auf
zusätzliche 13%
geschätzt. Also
summieren sich die**

**Gesamtemissionen
pro Quadratmeter
Solarpanel auf
1'243 kg CO₂.**

**Gasförmig
e**

**Chemikali
en für
die
Herstellu**

ng von

Solarsili

zium

Als

Reinigung

**sgase
werden
unter
anderen
Stickstoff
trifluor**

id (NF3)

und

Schwefel

hexafluor

id (SF6)

eingesetz

**t. Beide
gelangen
als
Leckage
in die
Atmosphär**

**e; sie
sind aber
auch
hochwirks
ame
Treibhaus**

gase, das

heisst:

Sie haben

ein sehr

grosses

globales

**Erwärmung
spotenzia**

l. NF3

hat den

Faktor

16 ' 600 ,

das

heißt: 1

Gramm NF3

hat in

der

Atmosphäre

e

dasselbe

Erwärmung

spotenzia

l wie

16 ' 600

Gramm

CO₂.

Schwefel

hexafluorid

hat den

Faktor

23 ' 900 .

Diese

Auswirkungen

gen

wurden

bis jetzt

**zu wenig
beachtet,
obschon
beispiels
weise die
NF3 -**

**Konzentra
tion in
der
Atmosphä
re messbar
angestieg**

en ist.

Das

Gesamt -

Erwärmung

spotenzia

**1 dieser
Gase ist
in der
Studie
“Nitrogen
trifluori**

**de global
emissions
estimated
from
upgraded
atmospher**

ic

measurements

(Ref. 1)

anhand

von

**Messungen
in der
Atmosphäre
ermittelt
worden :**

**Alle
Reinigung
sgase,
die im
Jahr 2010
weltweit**

**bei der
Fertigung
von
Solarzellen
en, von
Flachbild**

schirmen

und in

der

übrigen

Halbleite

ri
ndustri

e
eingesetz
t wurden,
wirkten
sich aufs
Klima

gleich

aus wie

77

Millionen

Tonnen

CO₂. Von

der

Gesamtmen

ge

entfallen

94% auf

die

**Herstellung
von
Solarzellen
en.**

Andererseits

wurden im
Jahre
2010
Solarpane
ls mit
einer

Spitzenleistung

**von mehr
als 17.5**

GW

installiert

rt –

umgerechn

et etwa

150

Millionen

Quadratme

ter.

Somit

entsprech

en die

Emissione

n pro

Quadratmeter

Solarpane

1 513 kg

CO₂ – und

das ist

viel.

Fest

e

und

flüs

sidge

Chem

ikal

ien

für

die

Hers

tell

ung

von

Sola

rsil

iziu

m

Zude

m

w e r d

e n

bei

der

Hers

tell

ung

von

Sola

rmod

ulen

rund

20

vers

chie

dene

chem

ikal

ien

und

Stof

fe

verw

ende

t,

die

in

der

Natu

r

n i c h

t

vorh

ande

n

sind

;

dies

e

mü s s

en

in

komp

lexe

n

und

ener

givei

nten

sive

n

chem

isch

en

Proz

esse

n

küñs

tlɪc

h

herg

este

ut

werd

en.

Die

„Sil

icon

valll

ey

Toxi

C

Coal

itio

n“

(Ref

. 2)

hat

eine

Auf!

i s t u

n g

p u b l

izzie

rt.

Im

Folg

ende

n

wird

das

Erwä

rmun

gs po

t en z

ial

ausg

ewäh

lter

stof

fe

ermi

ttel

t,

die

für

die

Hers

tell

ung

der

PV -

Modu

Le

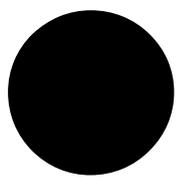
notw

endi

g

sind

:



chlo

rwas

sers

toff

(HCl

)

wird

zum

verf

Lüss

igen

von

meta

llis

chem

Silici

zium

eing

eset

zt.

Pro

Quad

ratm

eter

Mod

u

sind

5,5

kg

HCT

notw

endi

g ;

das

Erwä

rmun

gs po

t en z

ial

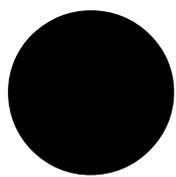
ents

pric

ht 2

kg

CO₂.



Silii

zium

karb

id

wird

eing

eset

zt,

wenn

Quad

er

aus

hoch

rein

em

silii

zium

iñ

ca.

0.2

mm

dünn

e

Silii

zium

■

Sche

iben

zers

chni

tten

werd

en .

Der

Verb

rauc

han

Silii

zi um

karb

id

wird

mit

1, 2

kg

pro

Quad

ratm

eter

Modu

1

ange

gebe

n;

dies

ents

pric

ht

eine

m

Erwä

rmun

g s p o

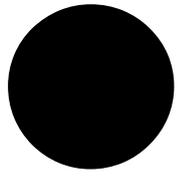
t e n z

i a l

von

9 kg

CO₂.



An

Si
tlb

er

we rd

en

10

Gram

m

pro

Quad

ratm

eter

Modu

l

verb

rauc

ht.

Die

Siub

er.

Hers

tell

ung

vert

angt

1'57

0

MJ / k

g an

grau

er

Ener

gie ;

das

Erwä

rmun

g s p o

t e n z

i a l

ents

pric

ht

1,5

kg

CO₂.

Das

gesa

mt e

Erwä

rmun

gs po

tent

ial

der

fest

en

und

flüs

sige

n

Chem

ikal

ien

wird

auf

30

kg

CO₂

pro

Quad

ratm

eter

PV -

Modu

1

g e s c

h ä t z

t .

Dazu

ist

zu

beme

rken

,

dass

die

Sola

rb ra

nc he

b i s

jetz

t

kein

e

deta

illi

erte

Zusa

mmen

stel

lung

des

Erwä

rmun

gs po

tent

ials

der

Sola

rpan

el.

Hers

tell

ung

verö

ffen

tlíc

ht

hat,

obwo

ht

das

Gefä

h r d u

n g s p

o t e n

tial

der

viel

en

verw

ende

ten

chem

ikal

ien

durc

haus

beka

nnnt

ist.

Tr

an

sp

or

七

de

r

Ma

te

ri

al

ie

n

Au

ch

di

e

T

r

an

sp

or

te

st

erl

le

n

ei

ne

er

he

bl

ic

he

Em

i's

Si

on

sq

we

U

U

e

da

r

.

Di

es

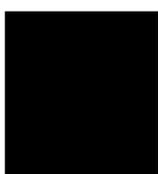
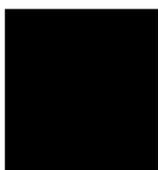
in

Z

a

ht

en



De

r

T

r

an

sp

or

七

de

r

PV



Mo

du

le

au

S

Ch

in

a

na

ch

De

ut

sc

ht

an

d

,

de

r

Tr

an

sp

or

七

de

r

Gr

un

ds

to

f

f

e

un

d

Ch

em

ik

al

ie

n

in

ne

rh rh

al

b

Ch

in

a

so

wi

e

de

r

Tr

an

sp

or

七

de

r

to

X

i

sc

he

n

Ab

fä

U

U

e

zu

De

po

ni

en

in

Ch

in

a

er

gi

bt

na

ch

un

see

re

n

Be

re

ch

nu

ng

en

23

kg

CO

2

pr

O

Qu

ad

ra

tm

et

er

Mo

du

U

me

hr

al

S

de

r

Ko

ht

et

ra

ns

po

rt

zu

eu

ro

pä

i's

ch

en

S t

ei

nk

oh

le

kr

a f

t w

er

ke

n

au

S

Sü

da

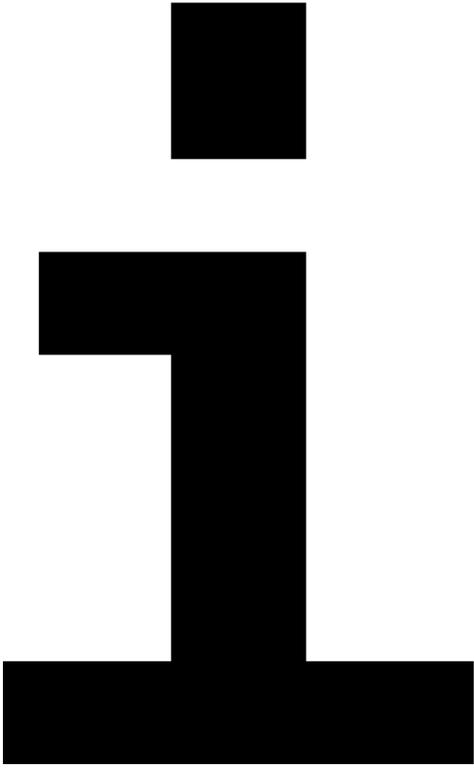
f r

ik

a.

Da

be



wi

rod

fü

r

See

et

ra

ns

po

rt

un

d

fü

r

La

nd

tr

an

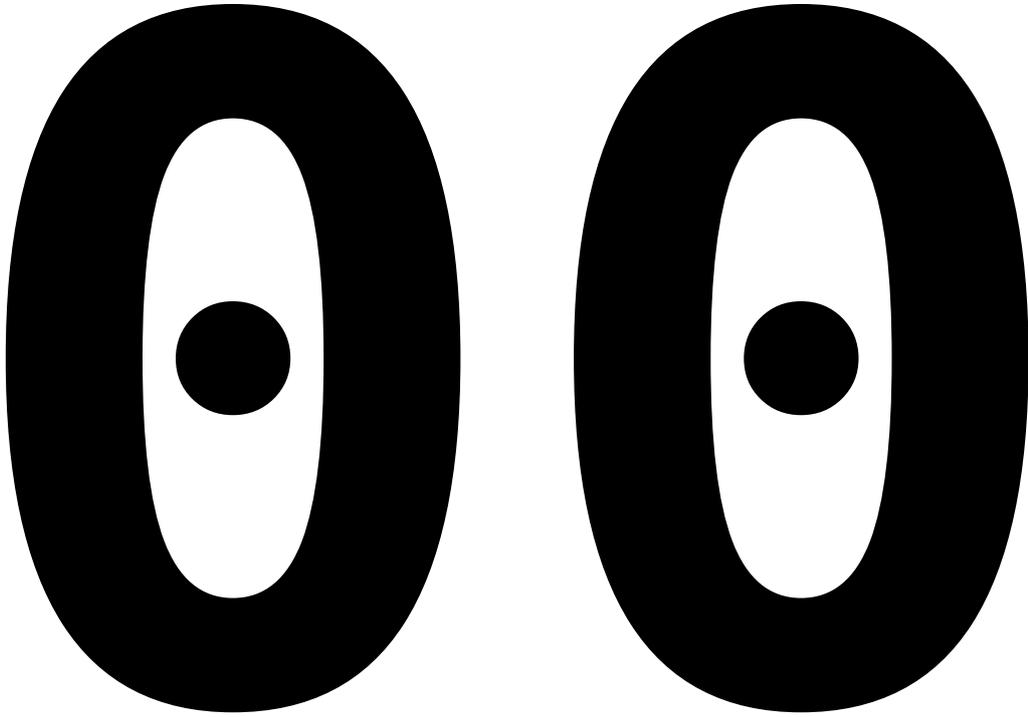
sp

or

七

0





02

b

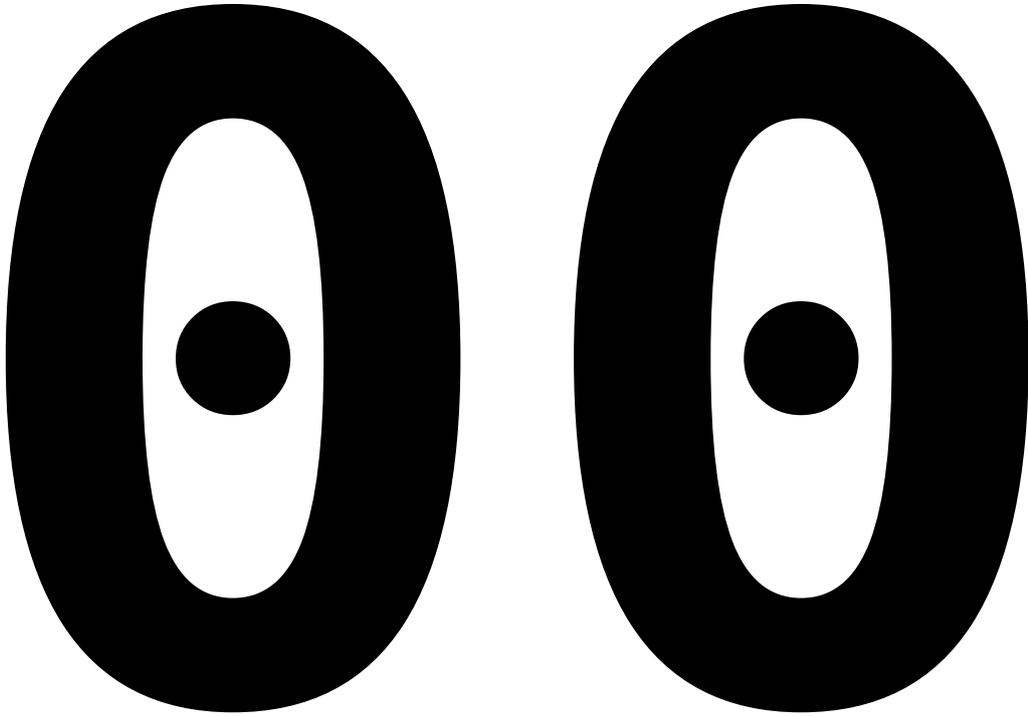
z

W



0





2

MJ

pr

O

kg

un

d

km

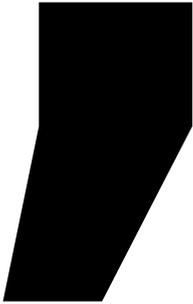
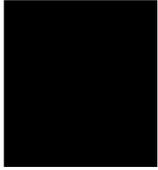
ei

ng

es

et

zt



d

ie

CO

2

—

Em

i's

Si

on

en

be

tr

ag

en

mi

nd

es

te

ns

0



1

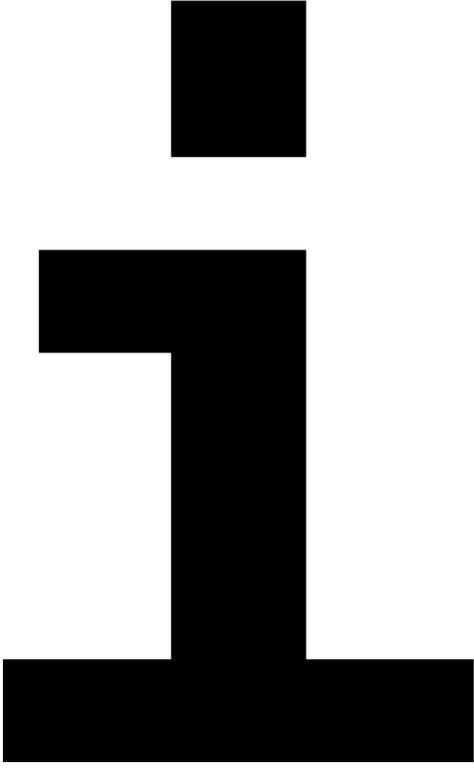
kg

M M

J

.

Be



Ko

ht

e

er

fo

lg

七

de

r

Tr

an

sp

or

七

wo

rw

ie

ge

nd

du

rc

h

S c

hi

f

f

e

;

da

he

r

er

ge

be

n

Si

ch

kl

ei

ne

re

CO

2

—

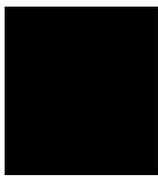
Em

i's

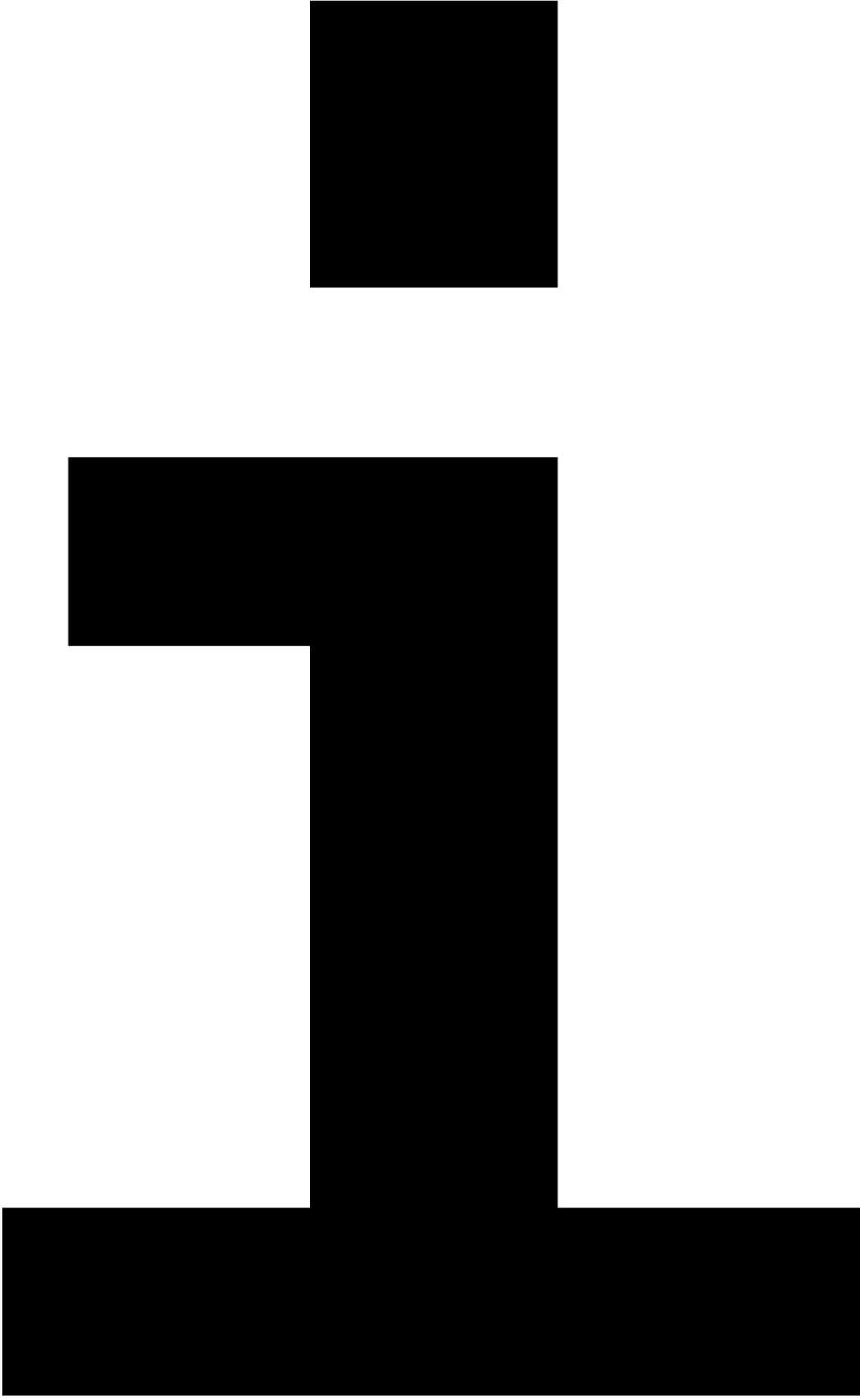
Si

on

en

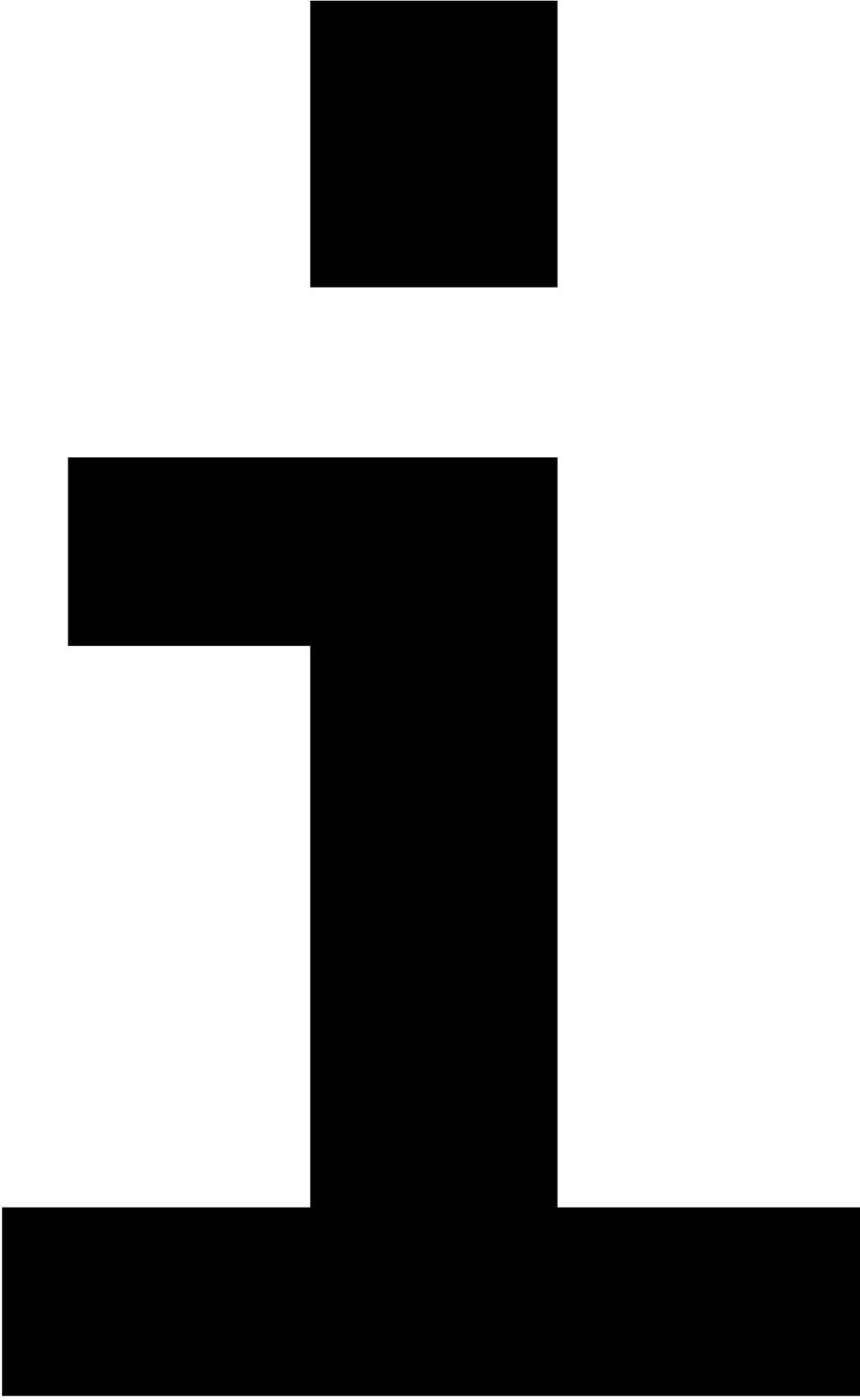


w



e

V

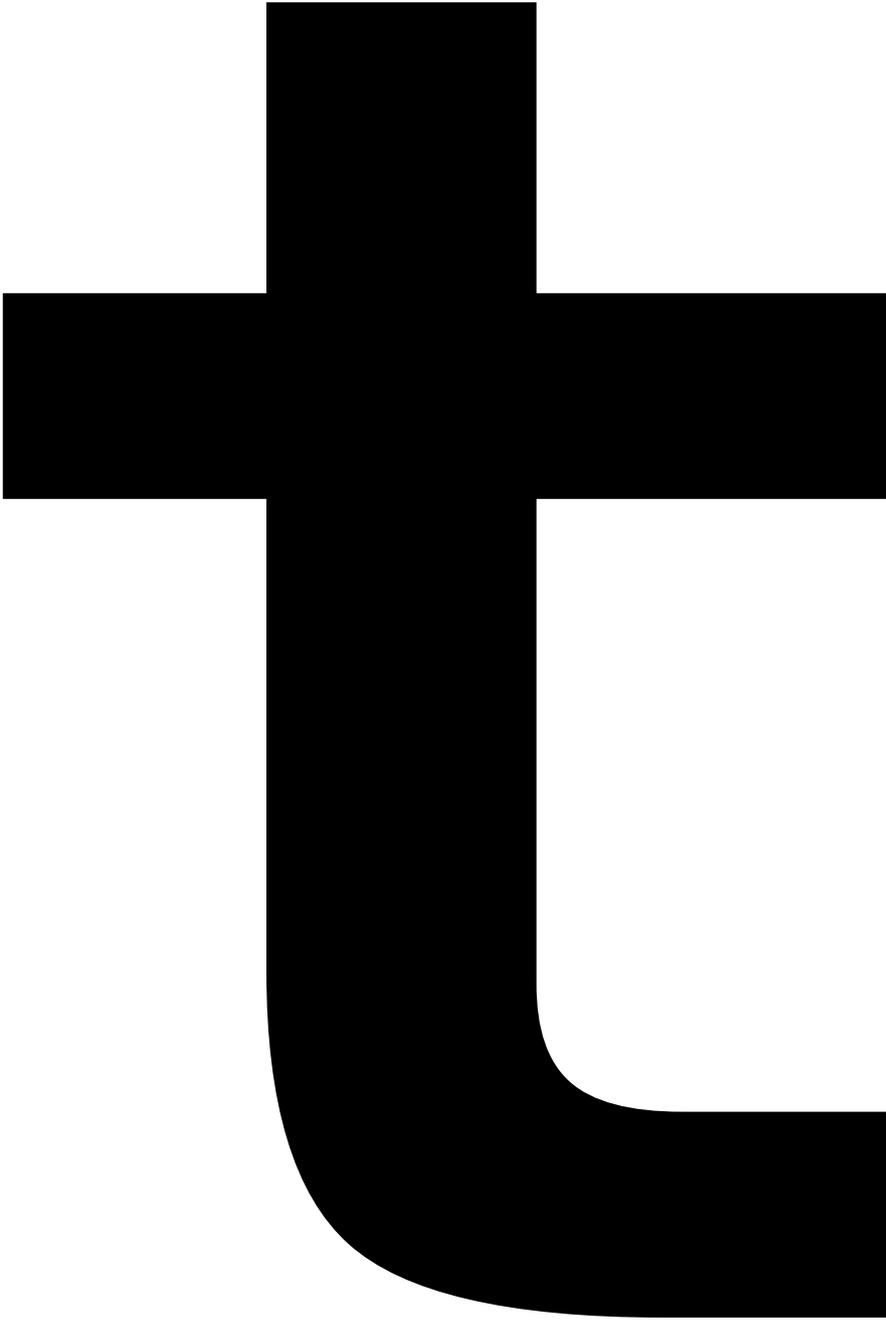


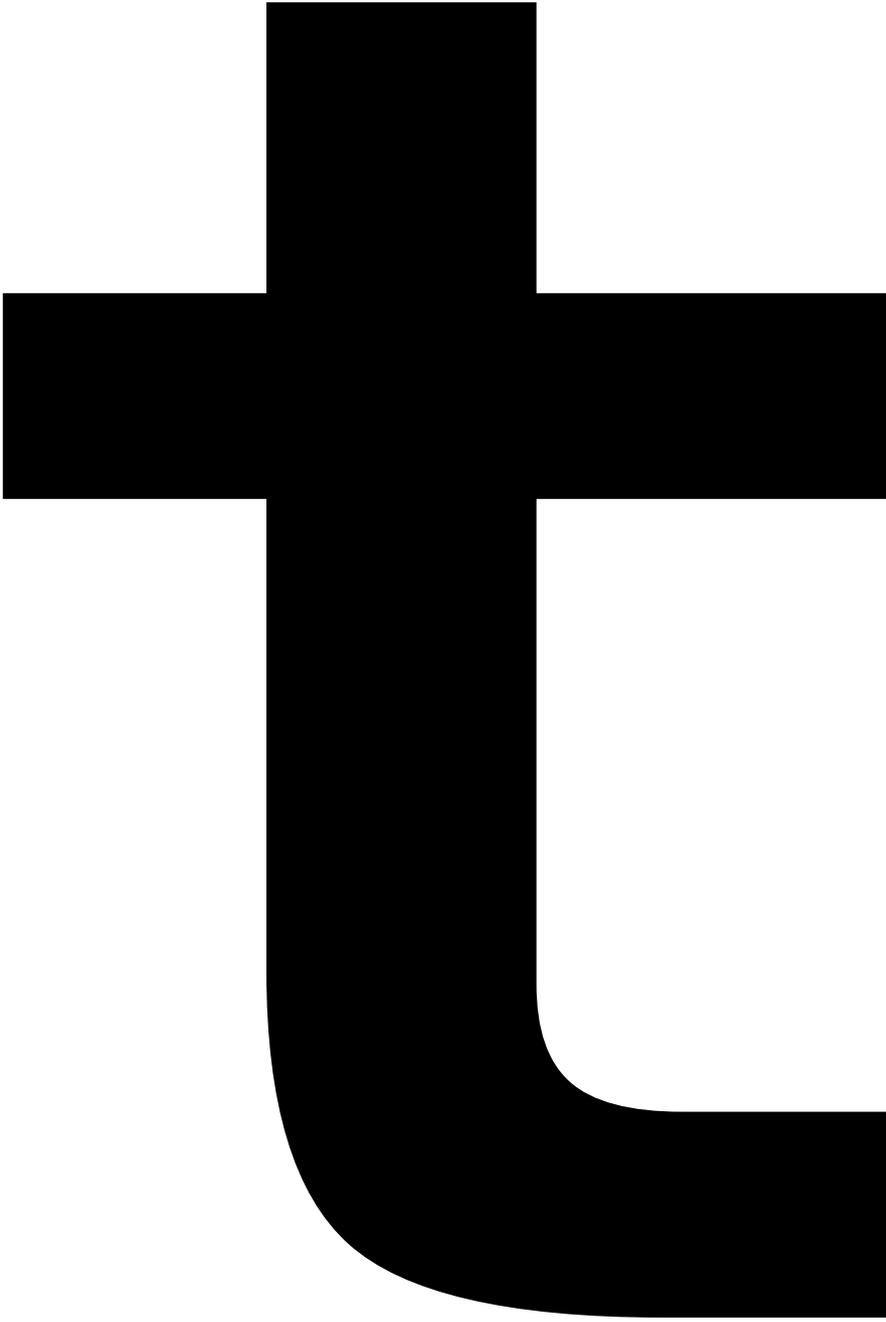
e

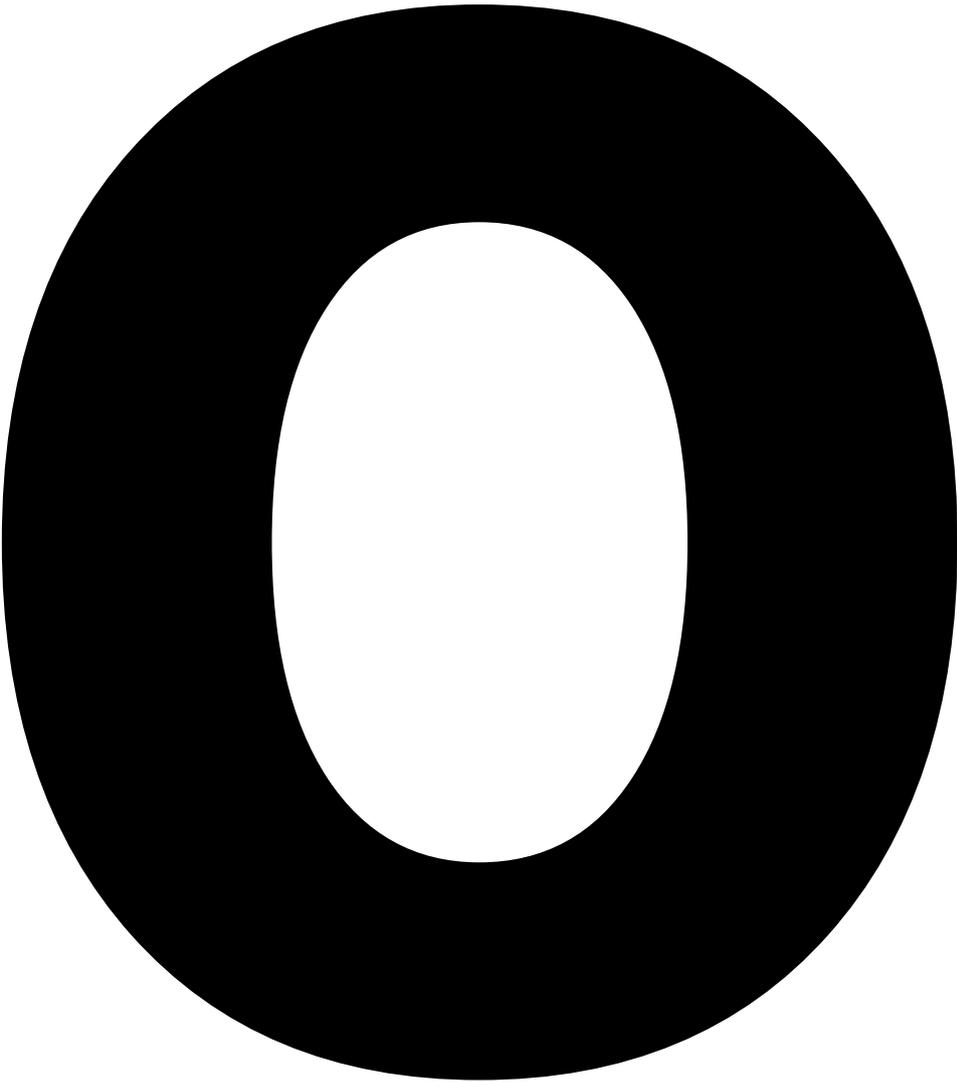
J

N

e

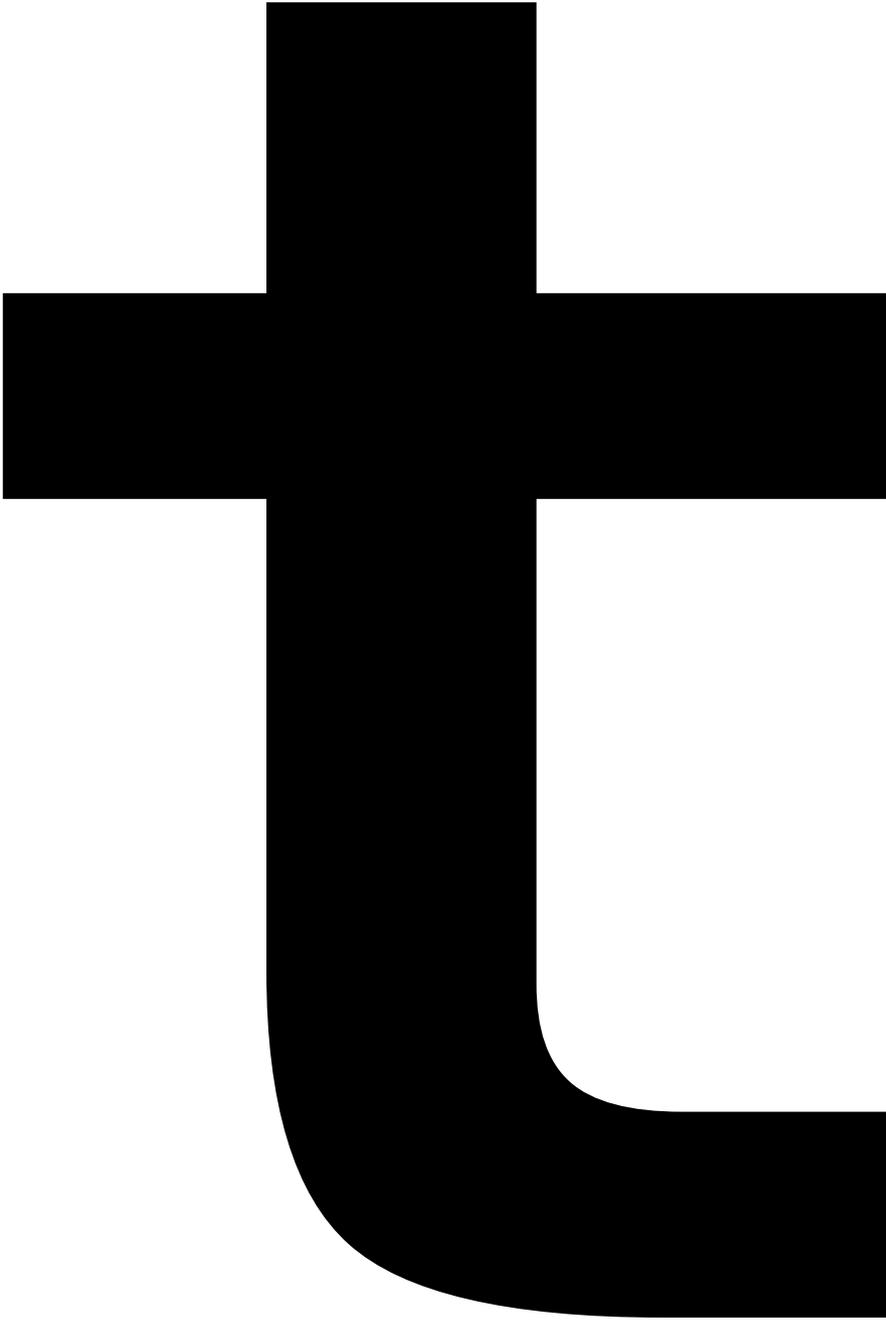




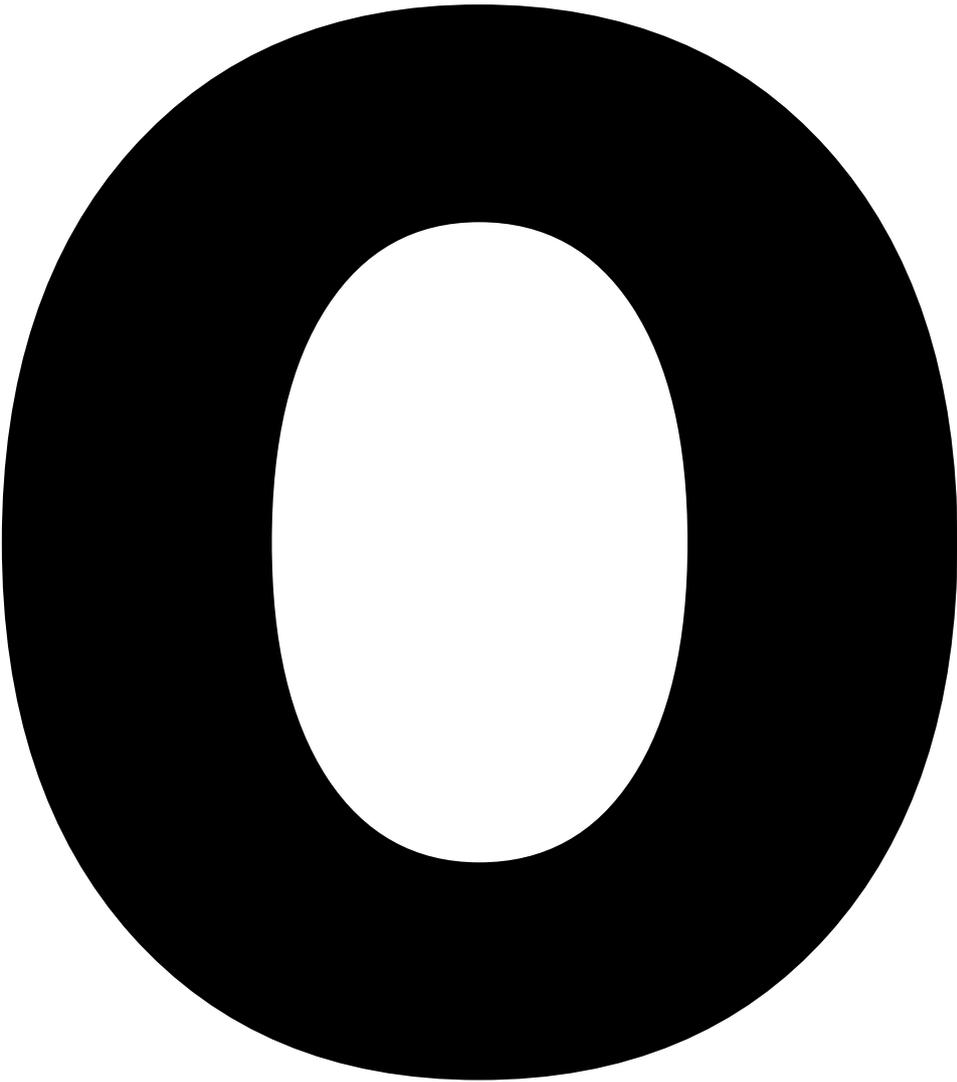




S



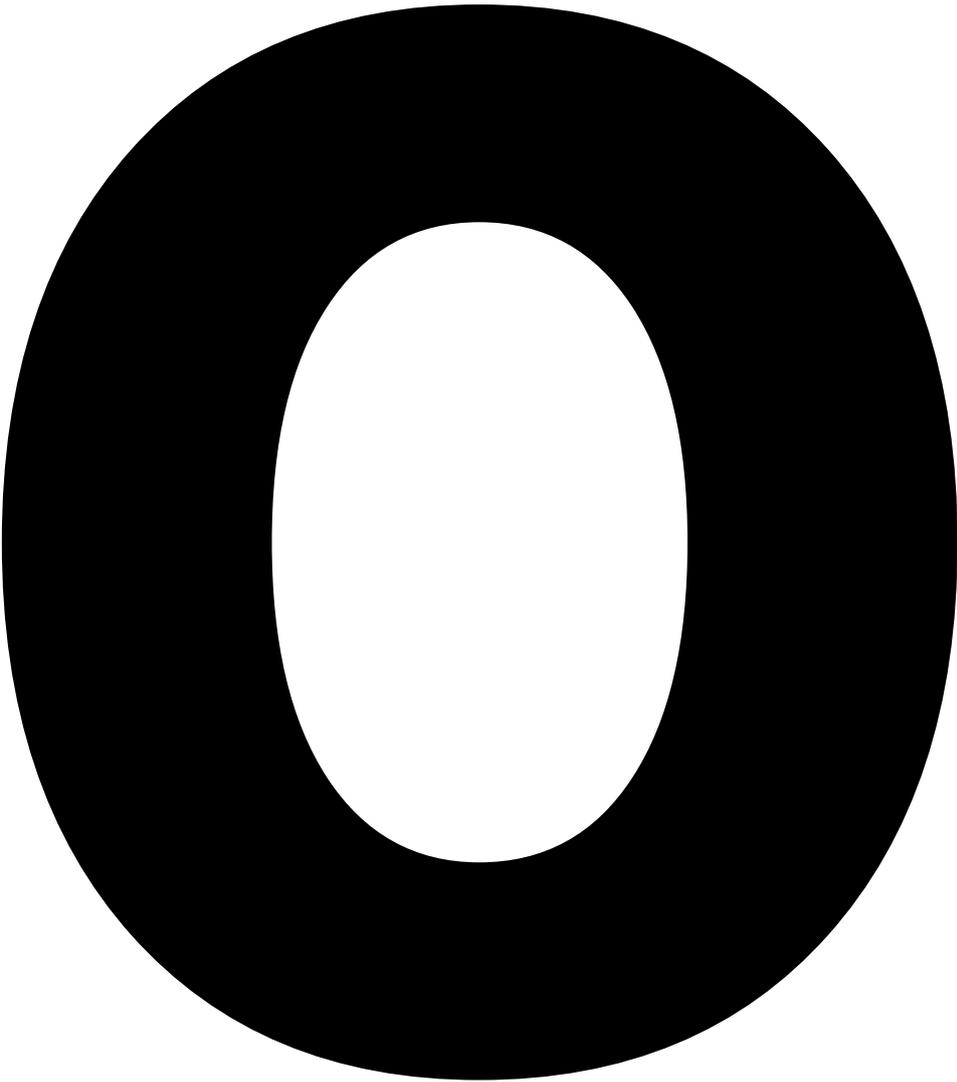
r



m

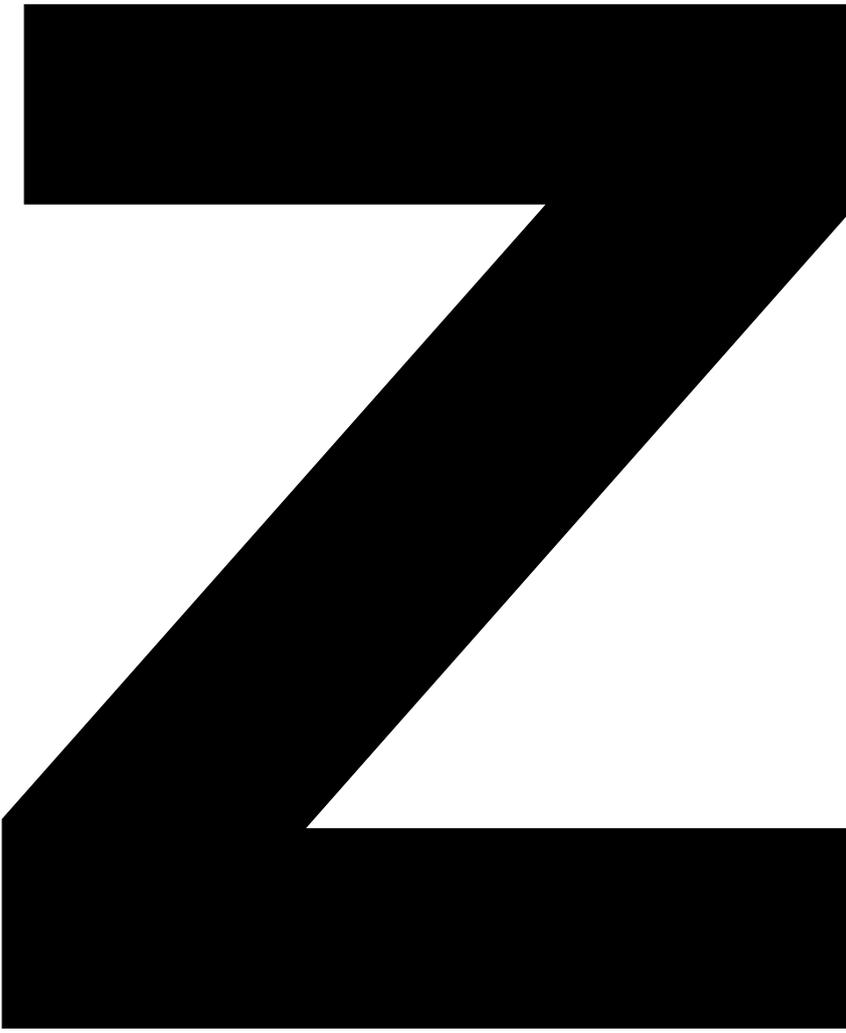
o

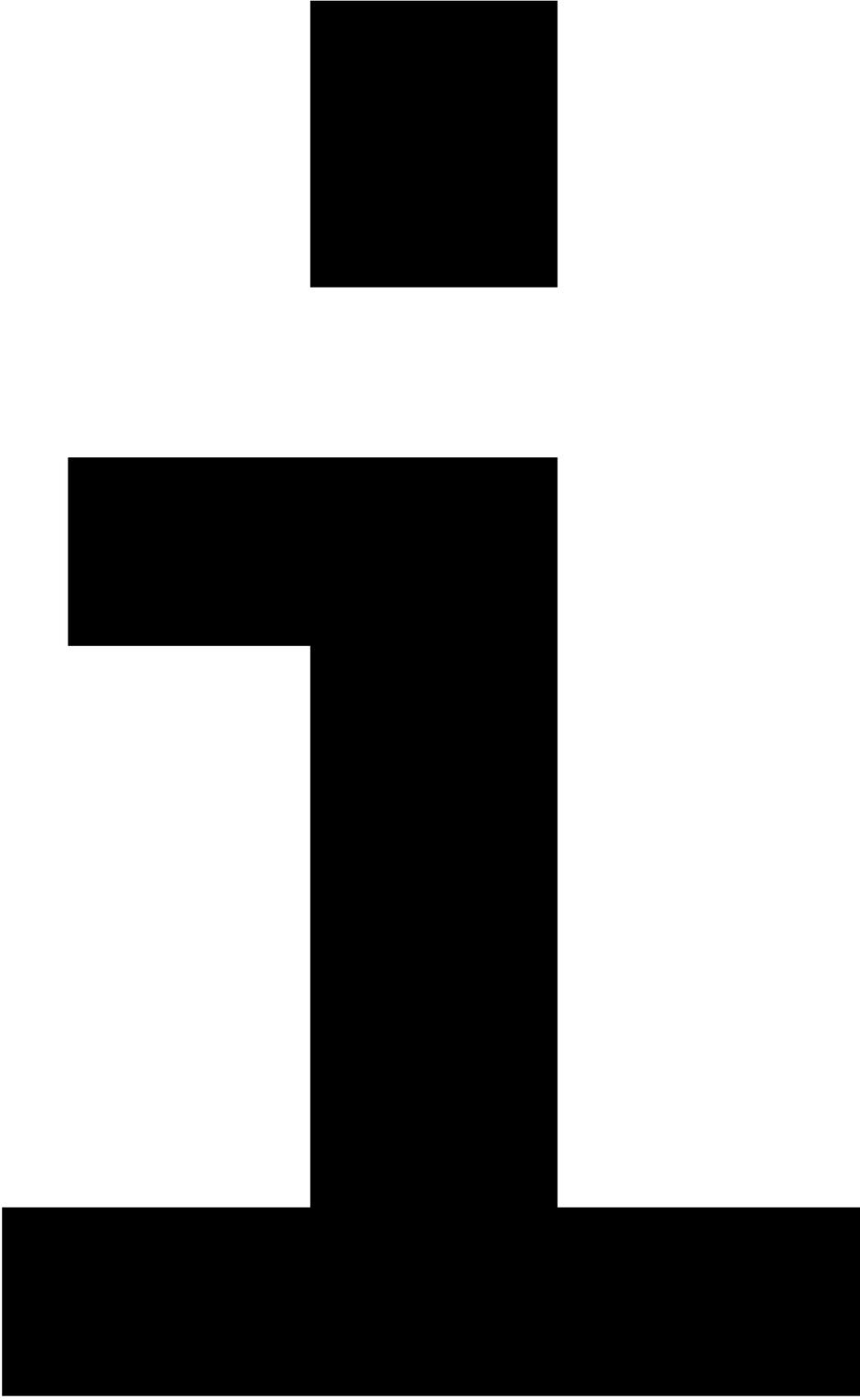
r



Q

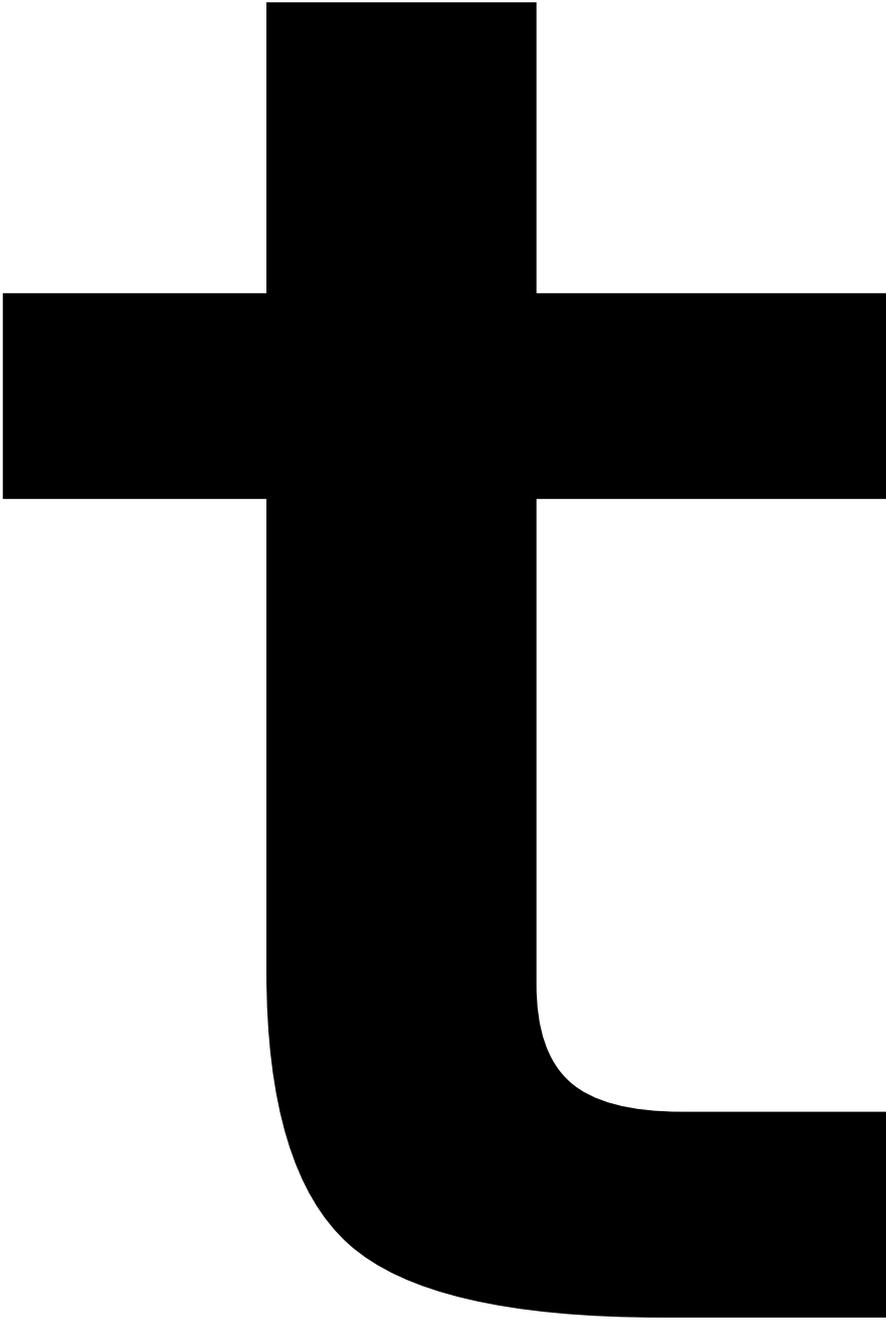
U

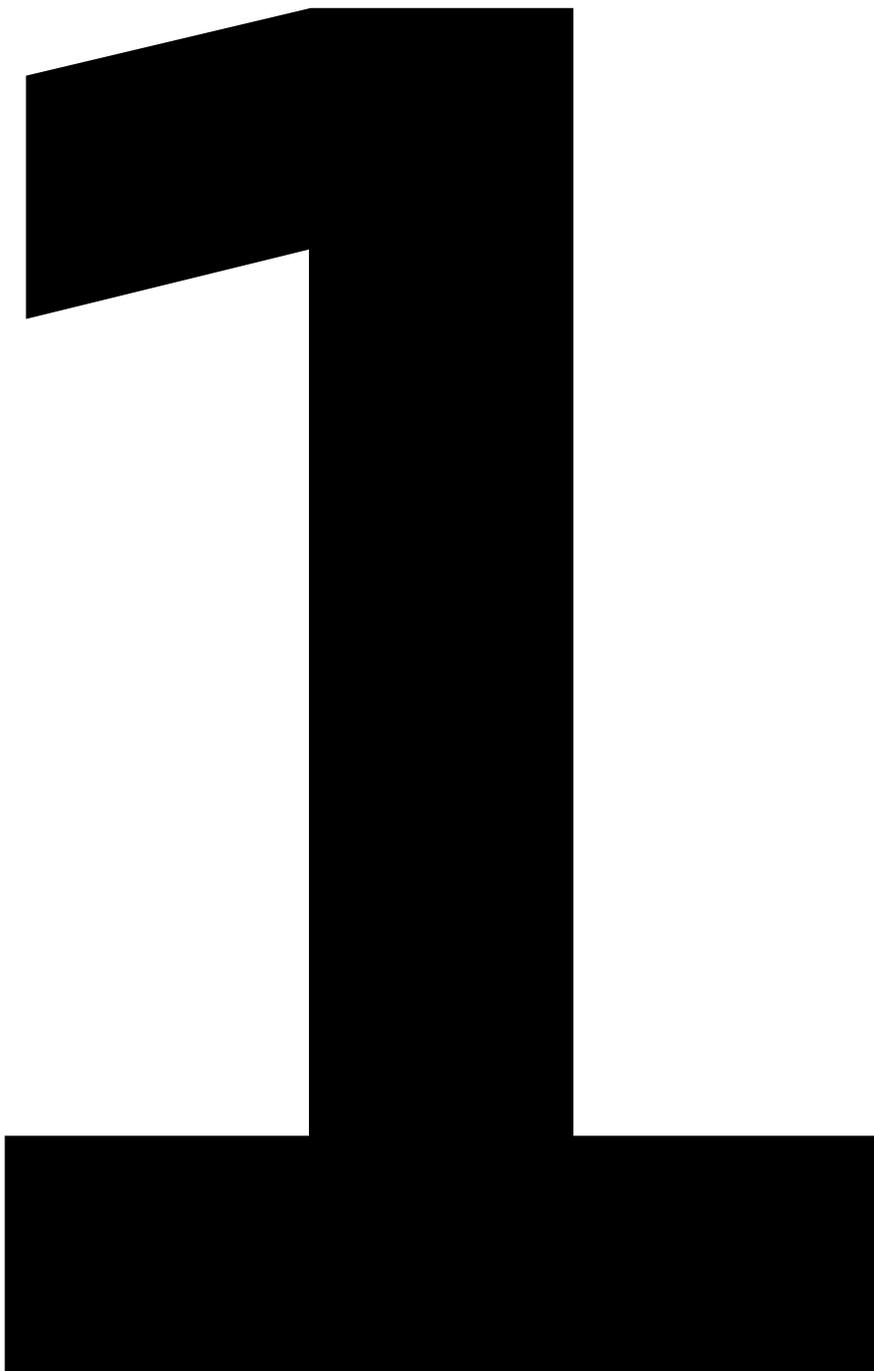




e

r





Q

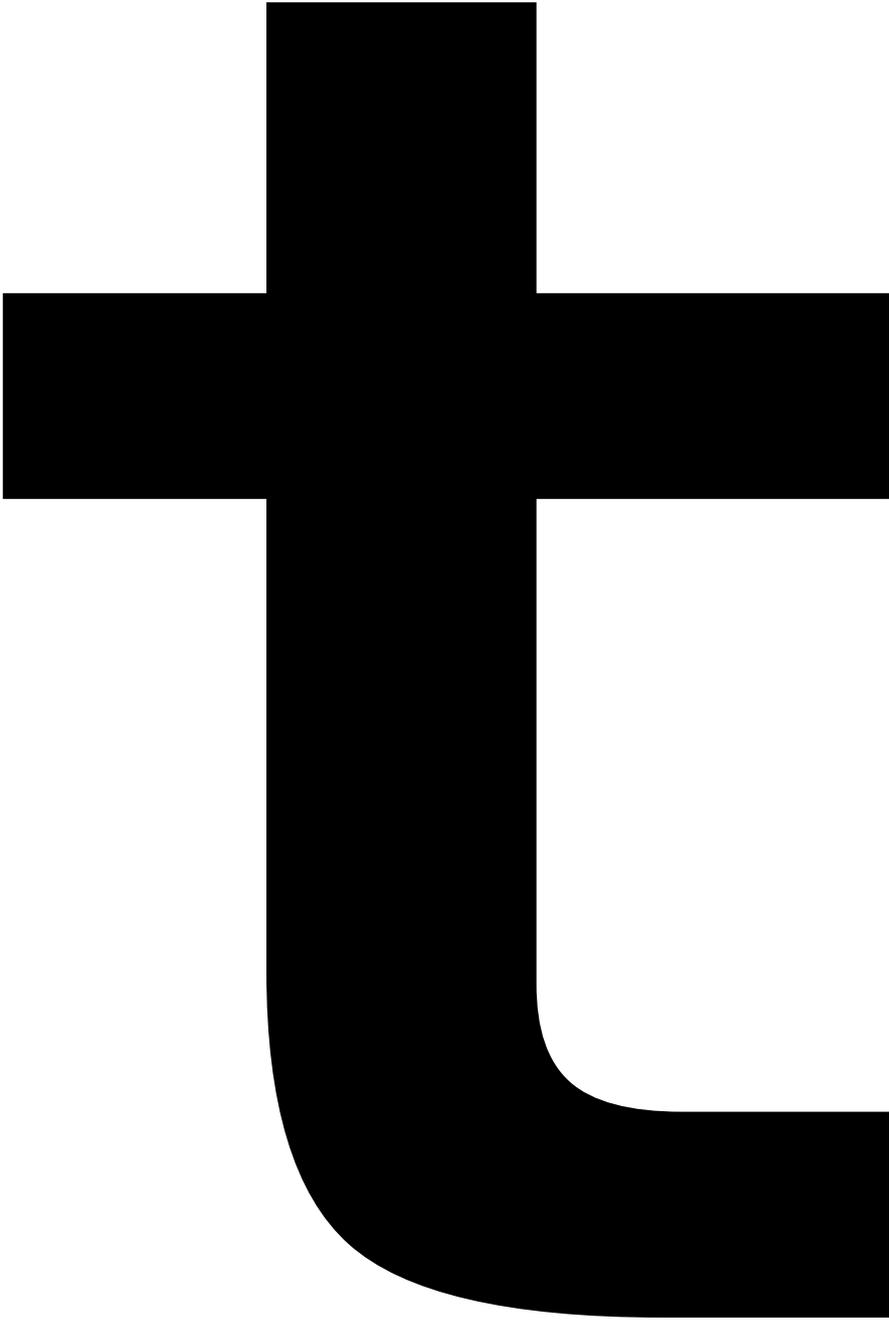
U

sa

Q

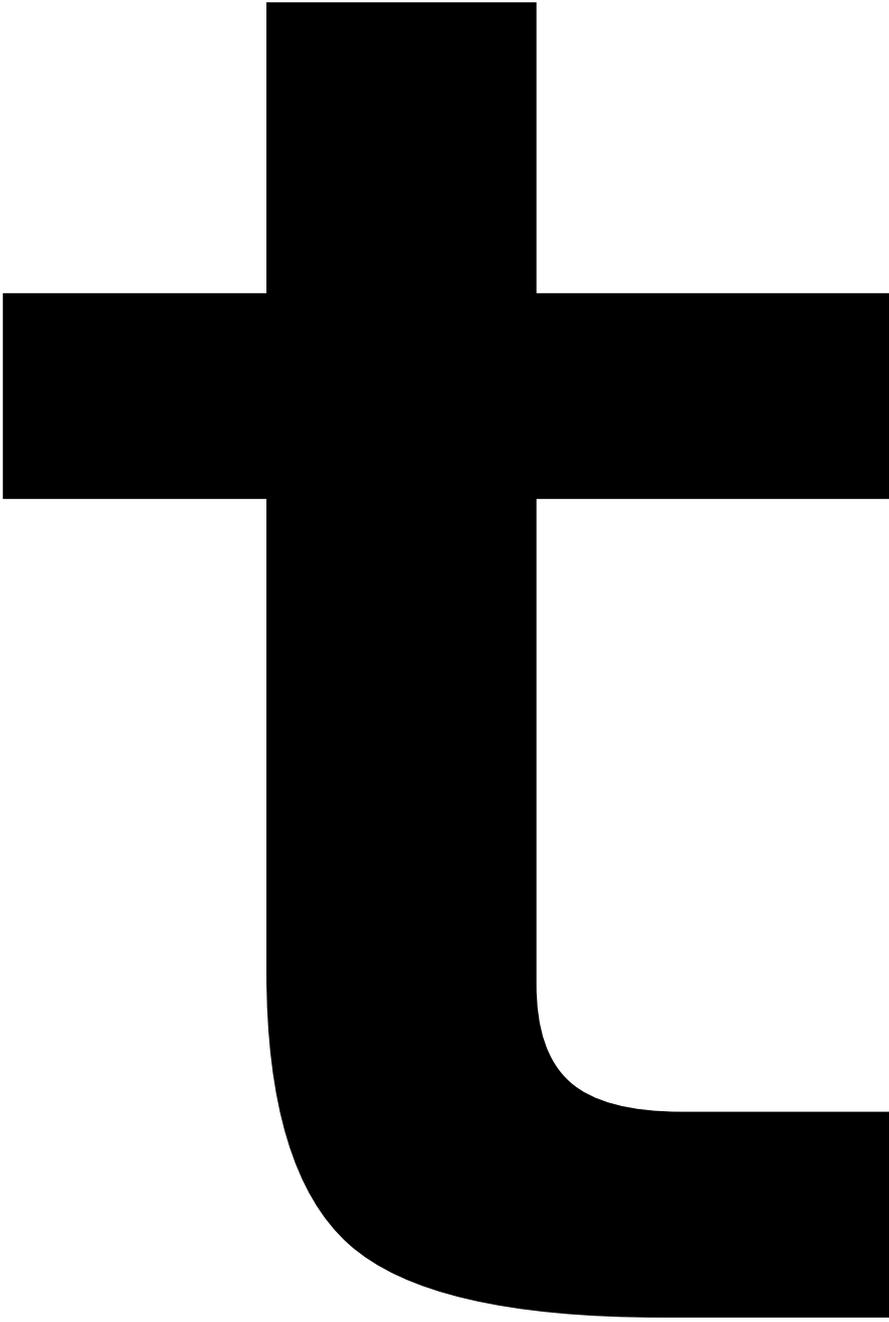
r

sa



m

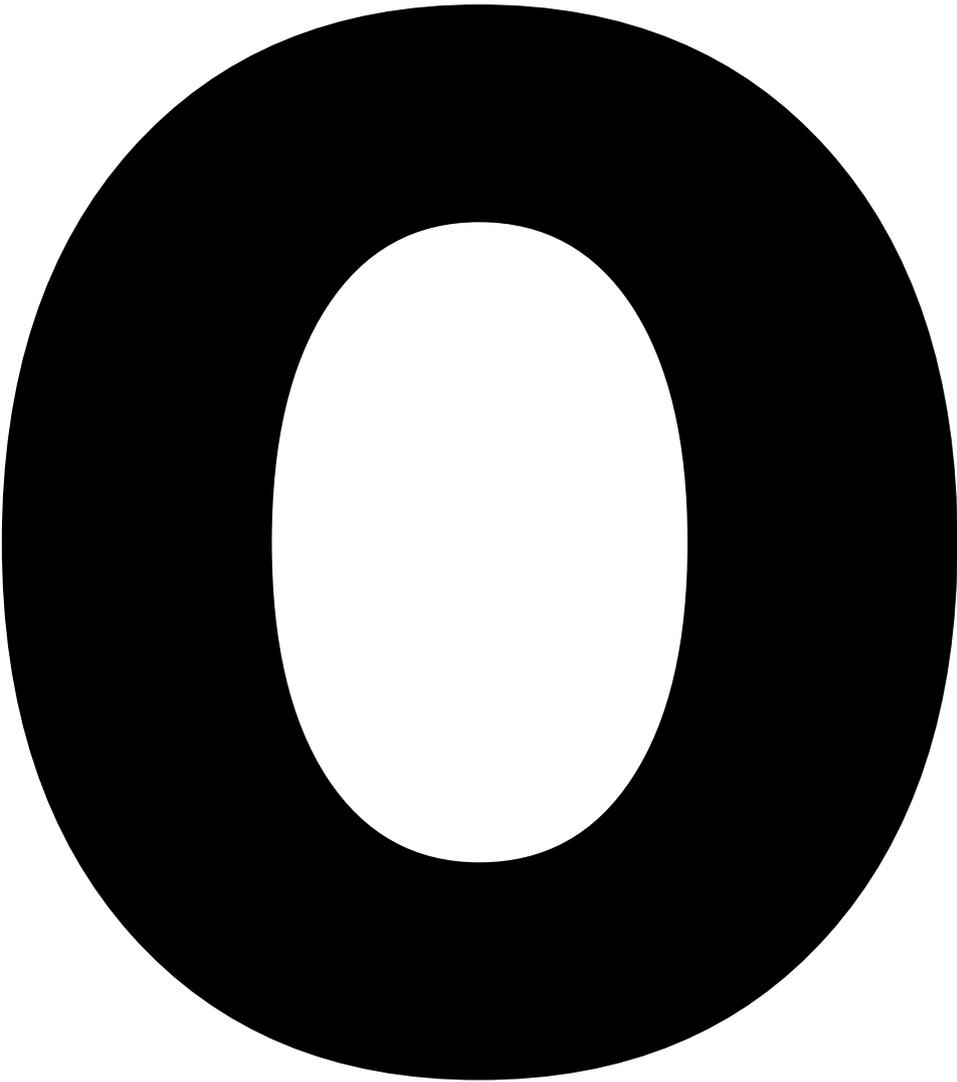
e



e

r

S



J

sa

r

o

sa

n

e

J

w



5

h

r

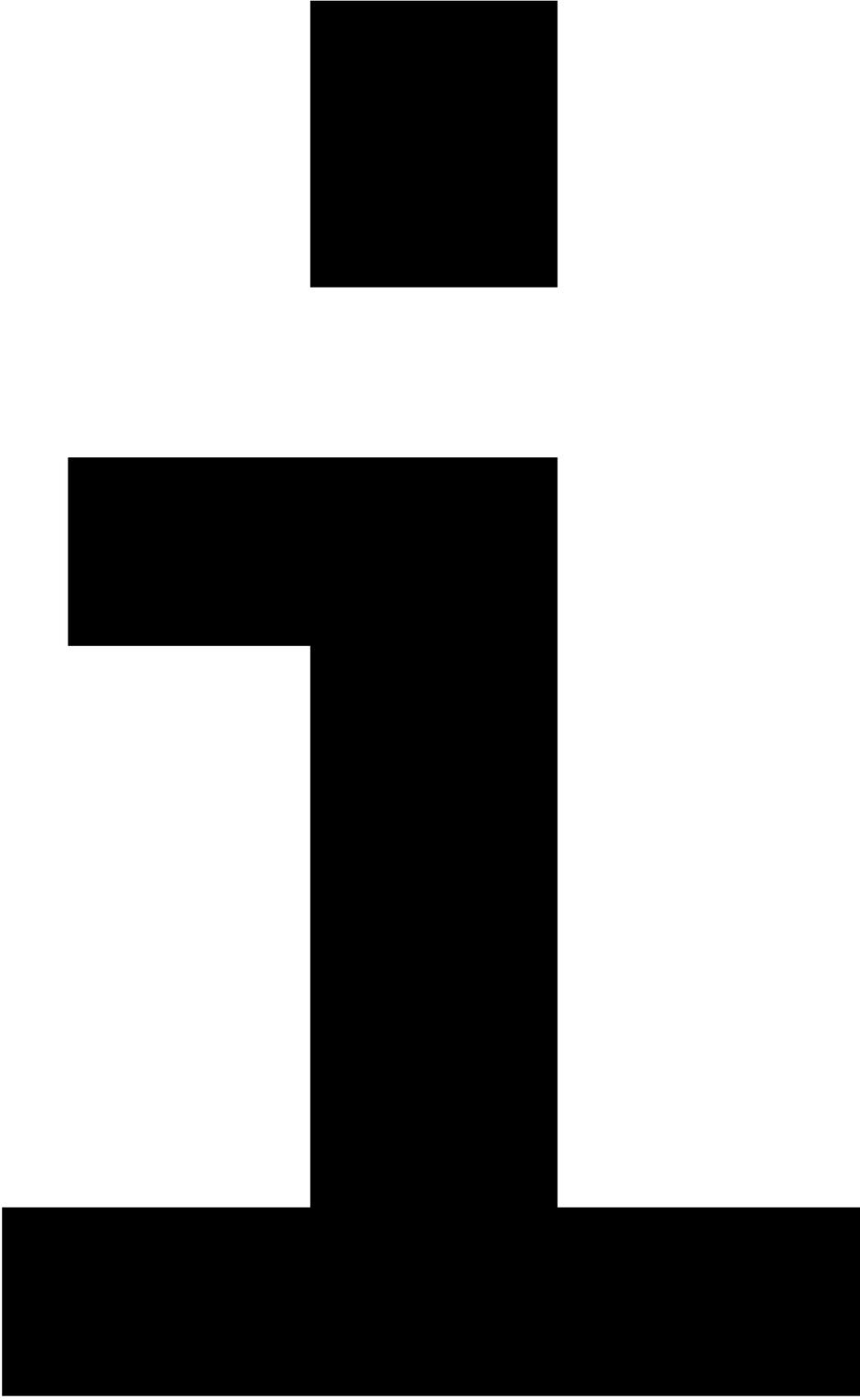
e

n

Q

S

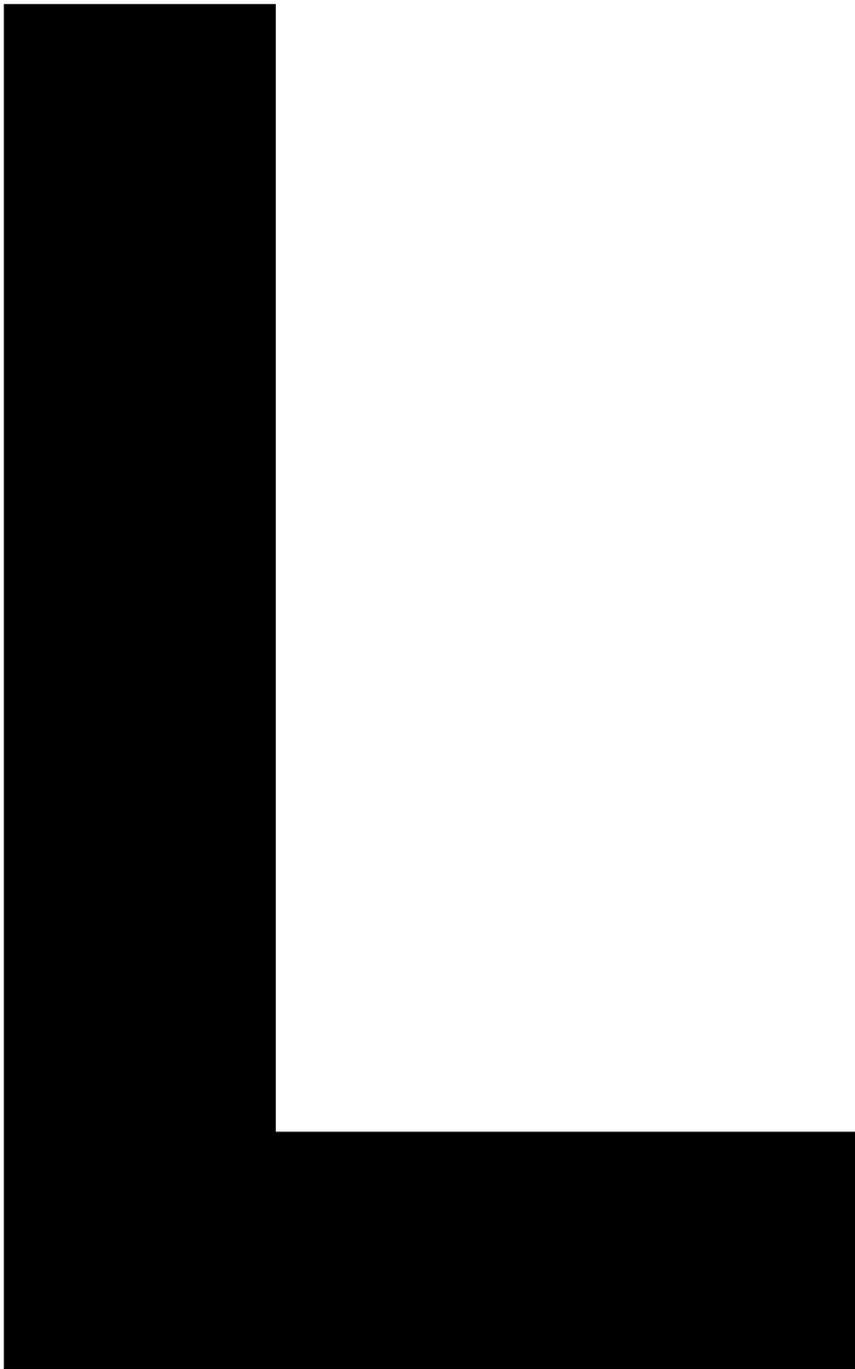
e



n

e

r



e

10

e

n

S

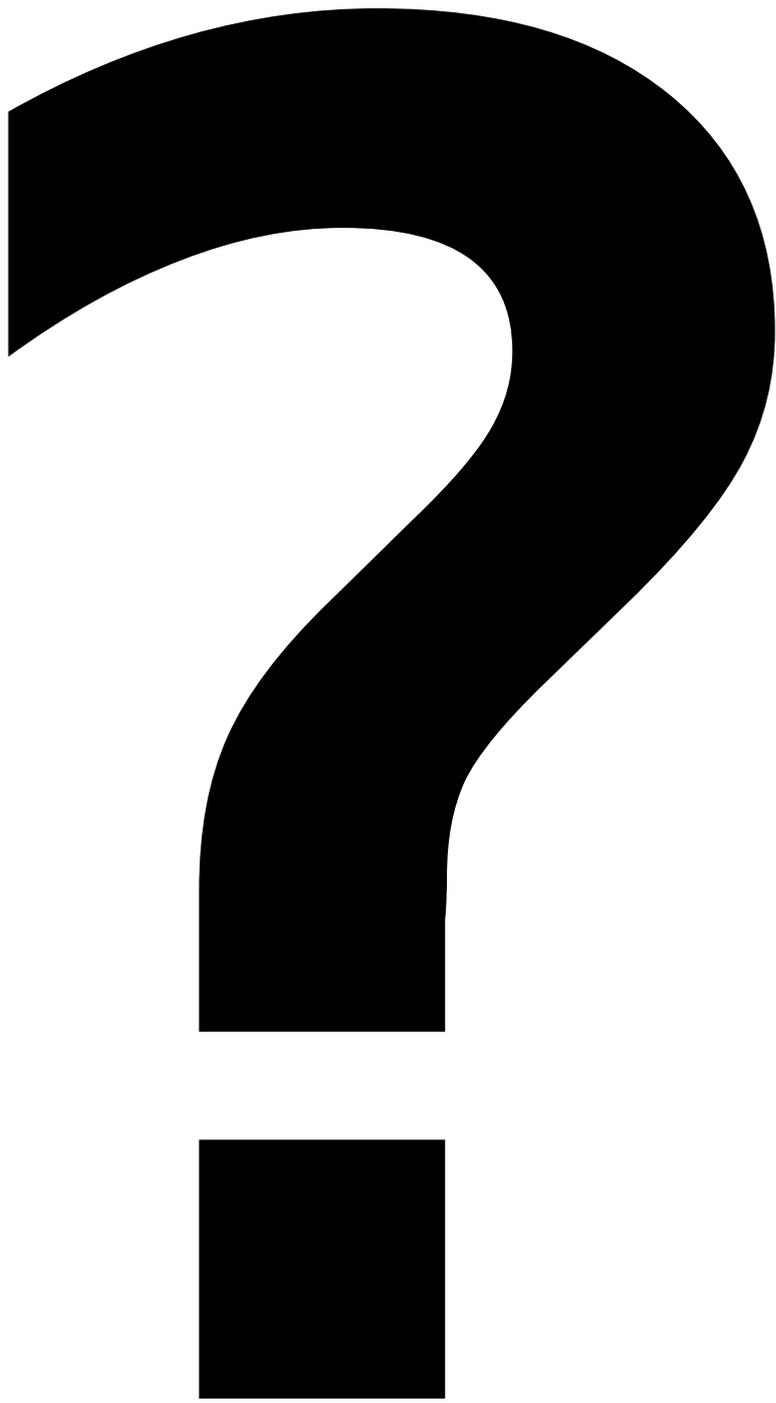
Q

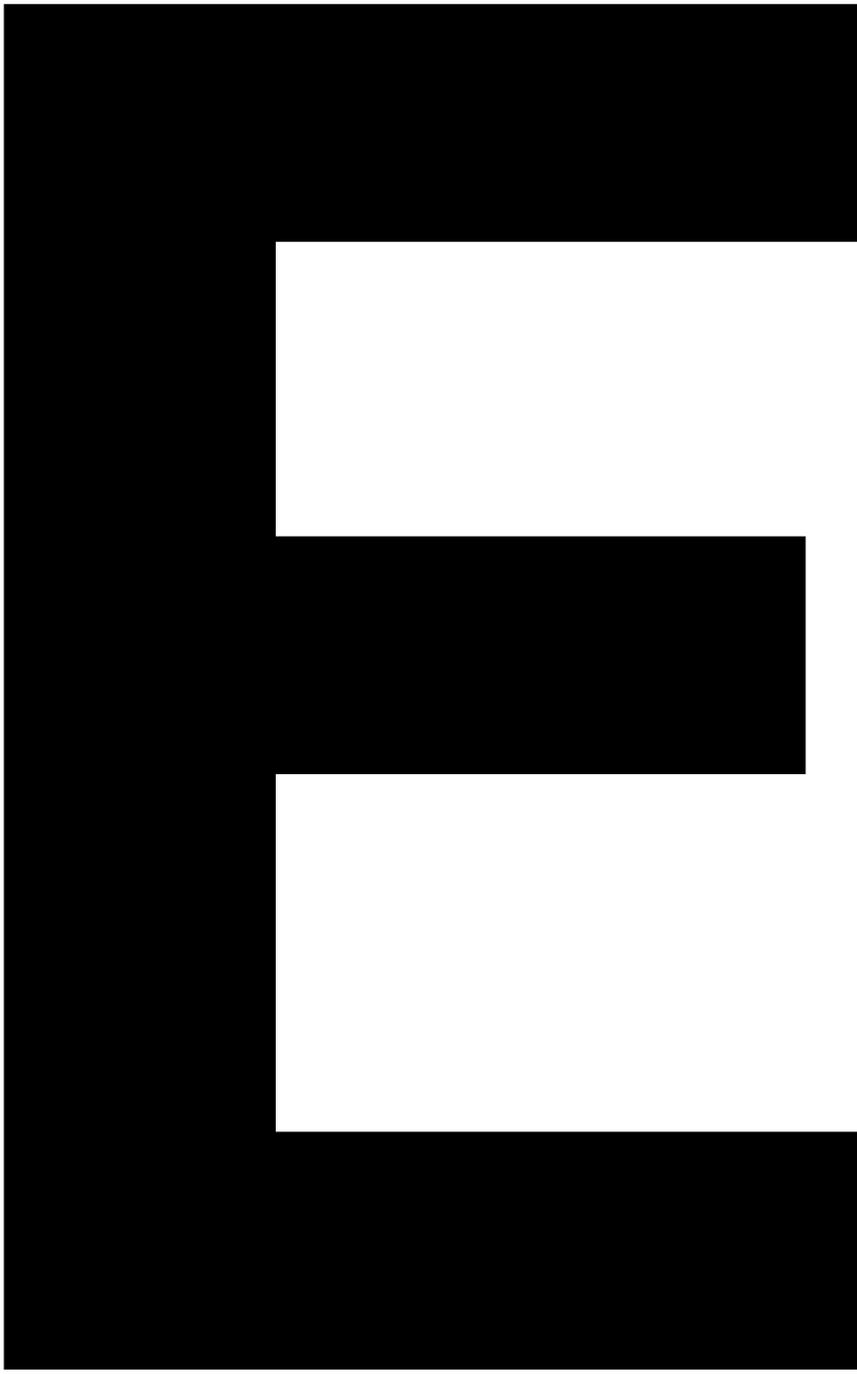
sa

U

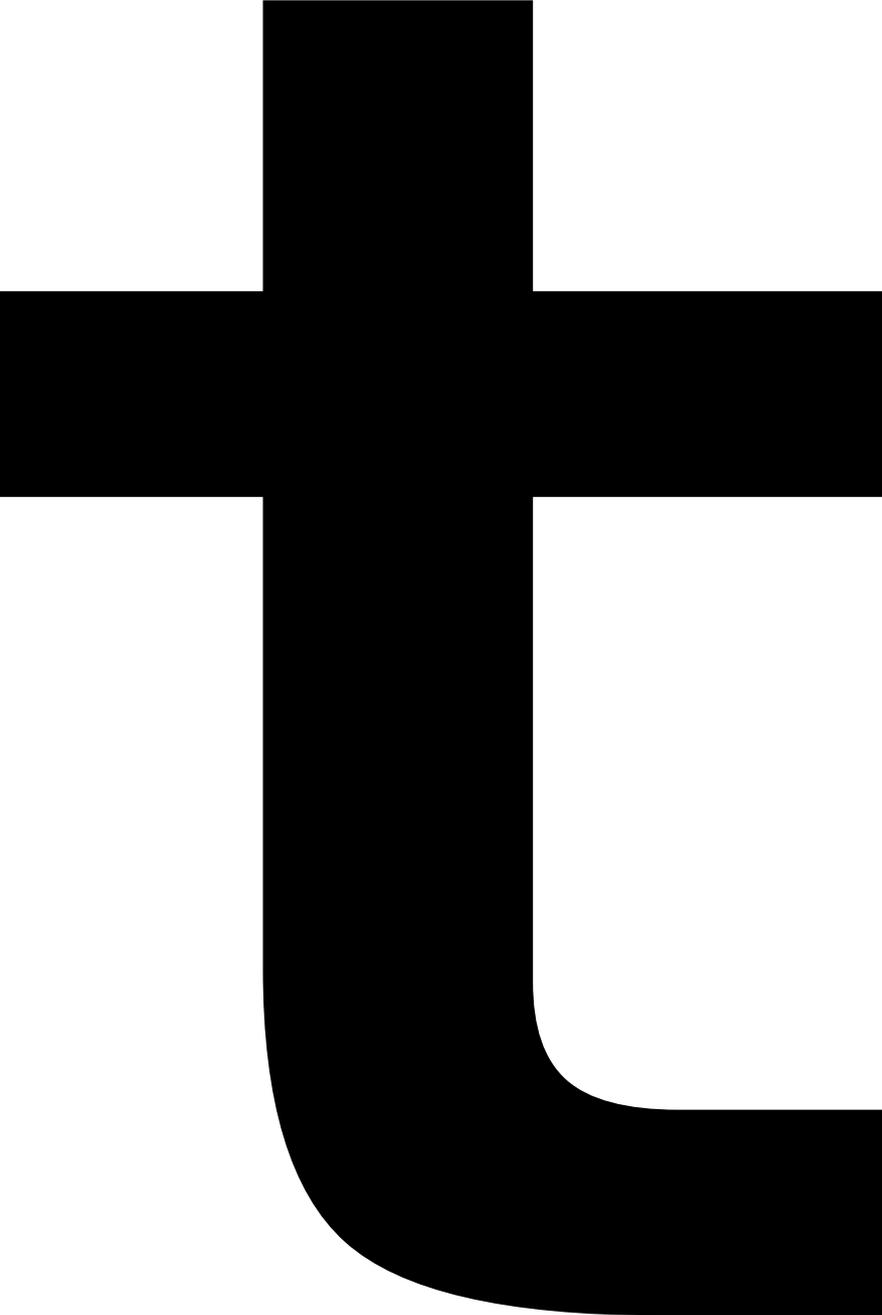
e

r





n

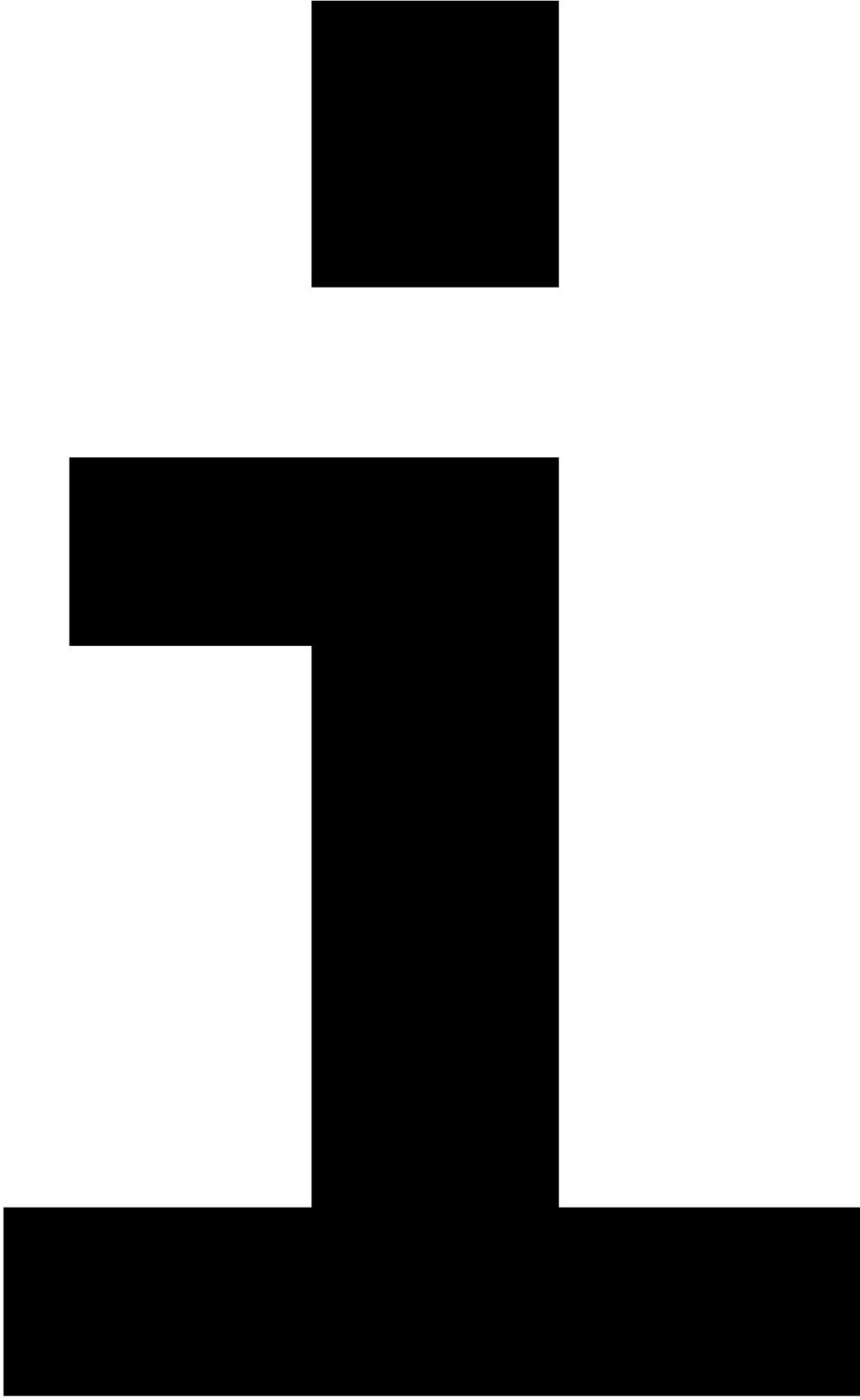


S

C

h

e

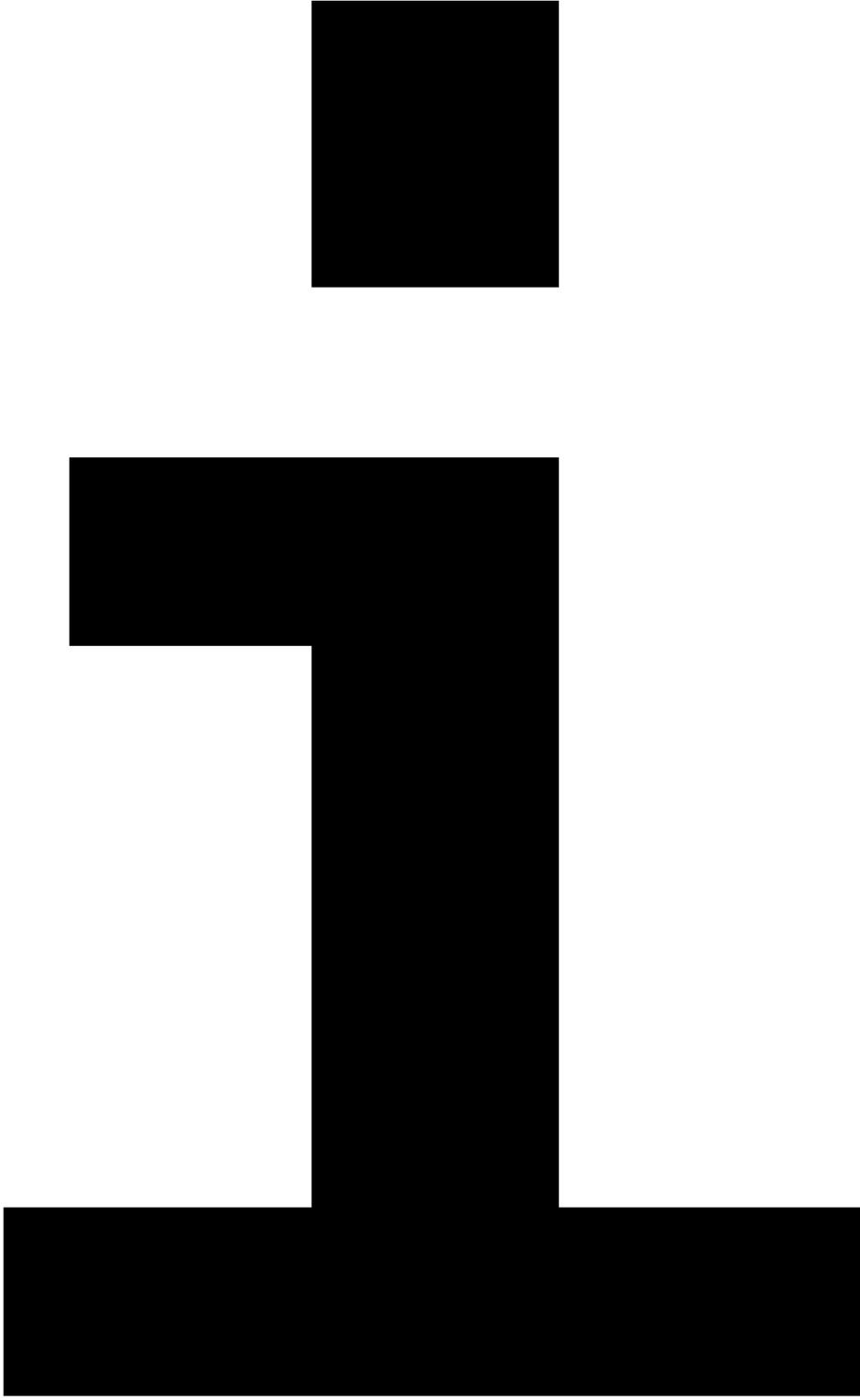


Q

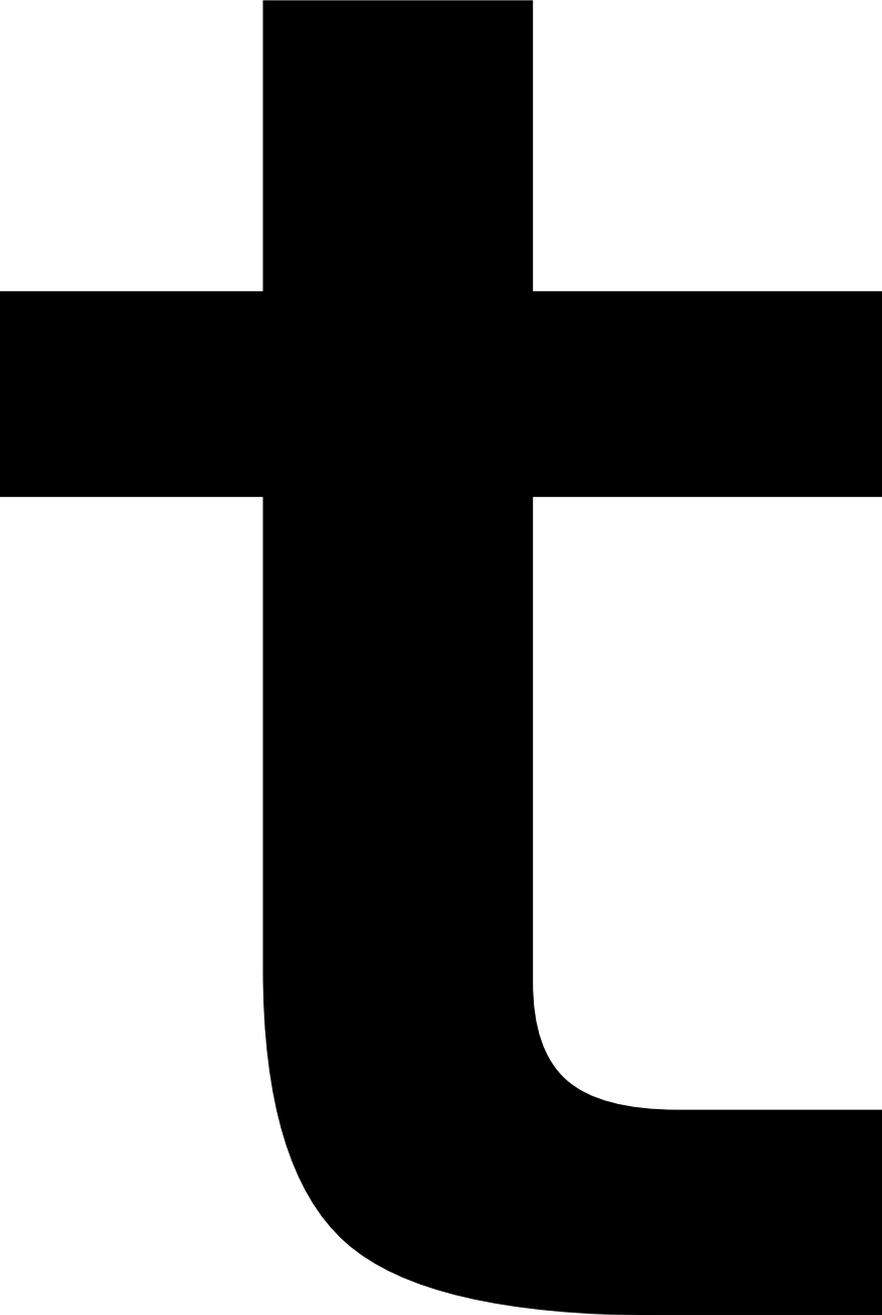
e

n

Q

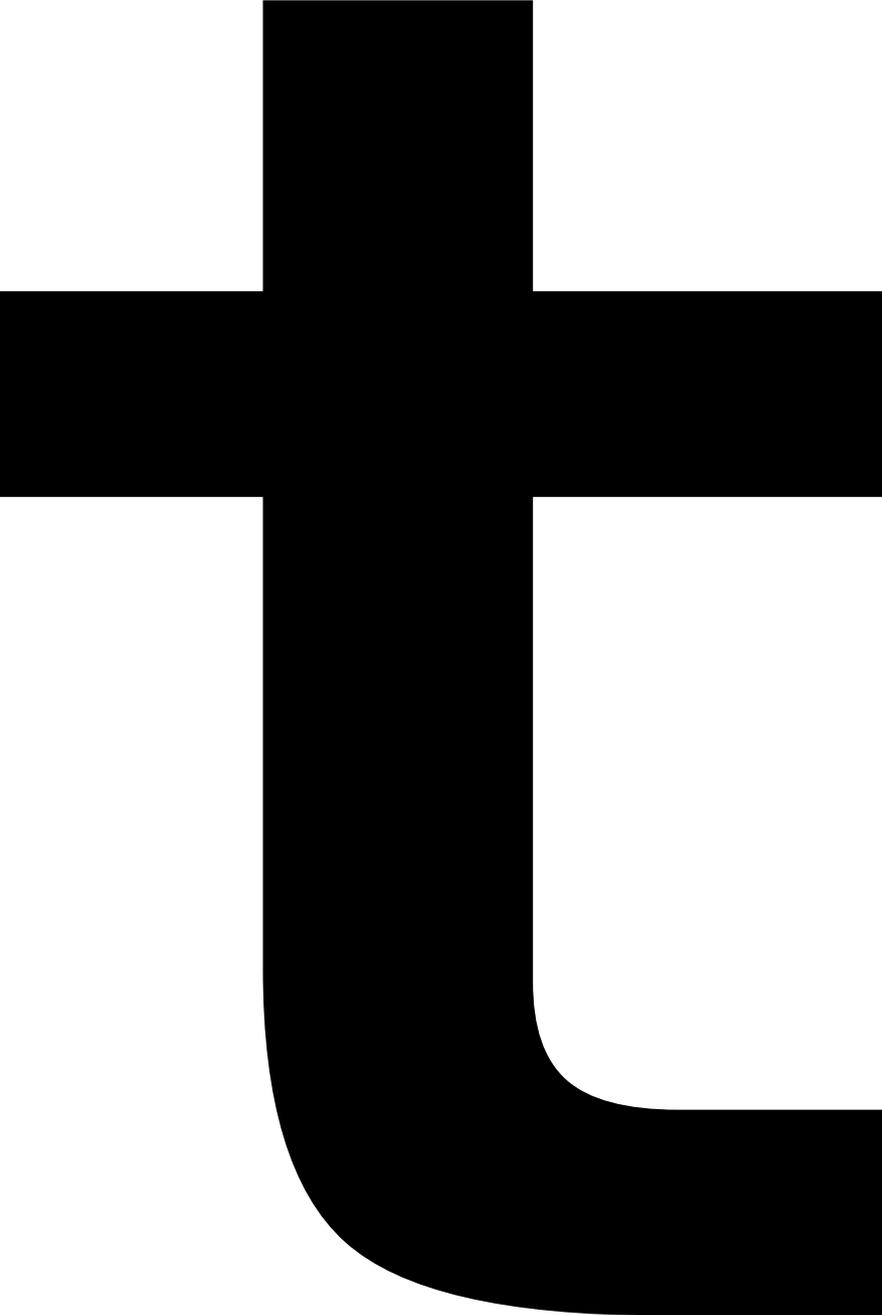


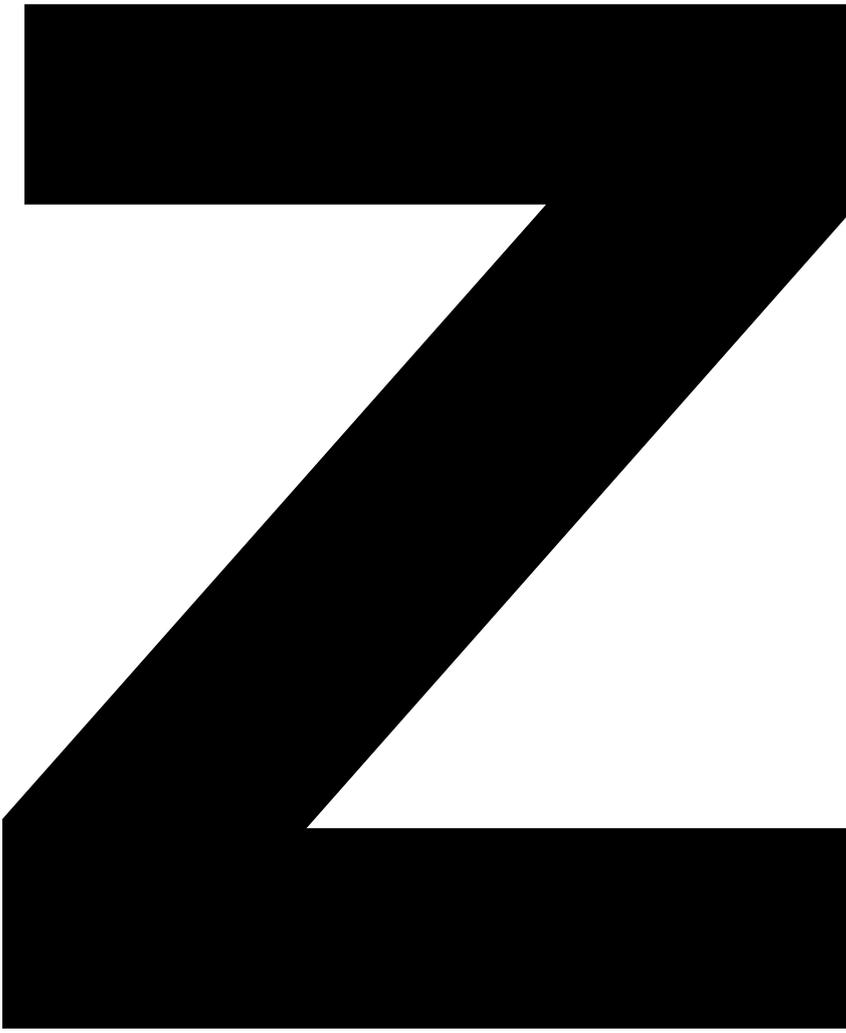
S

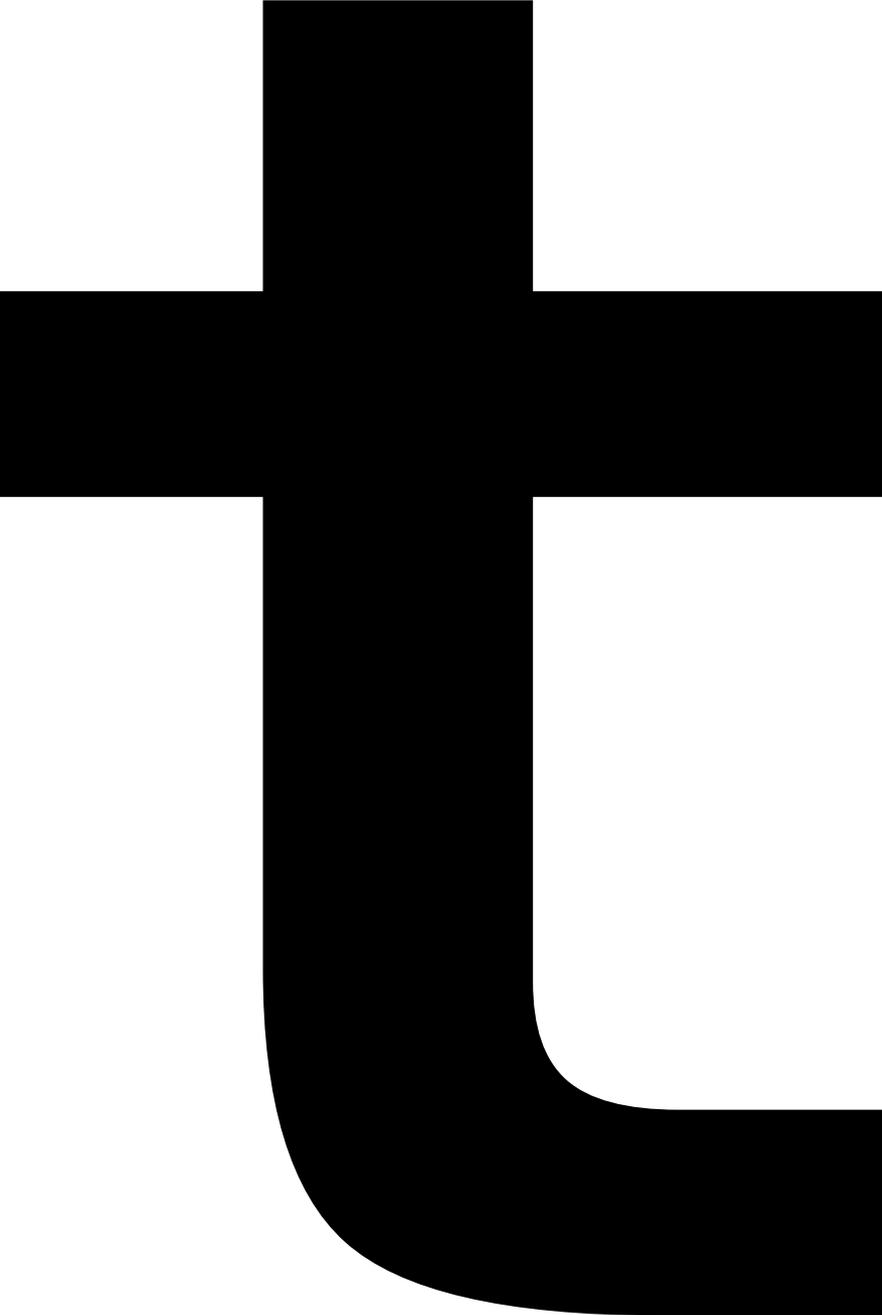


J

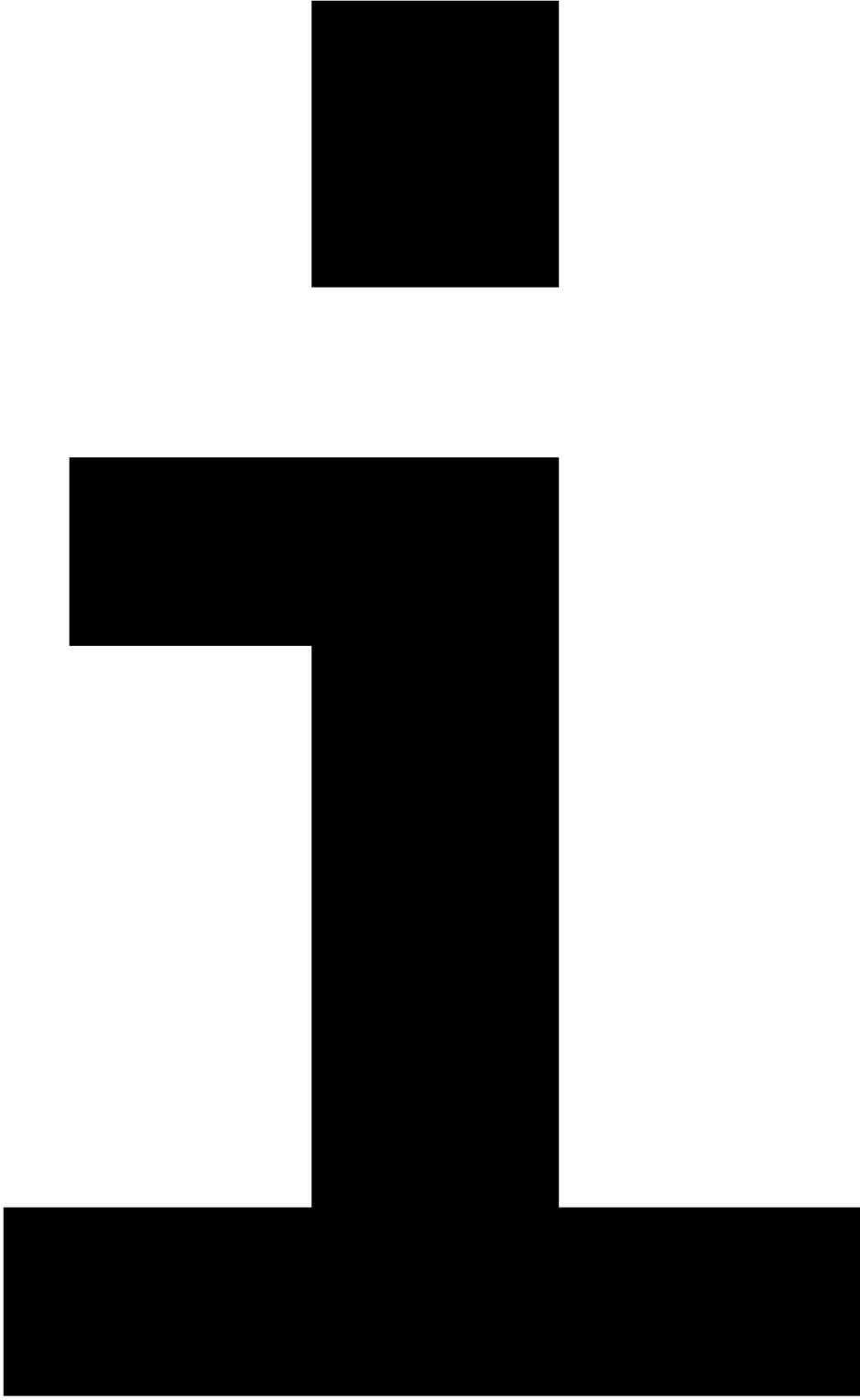
e







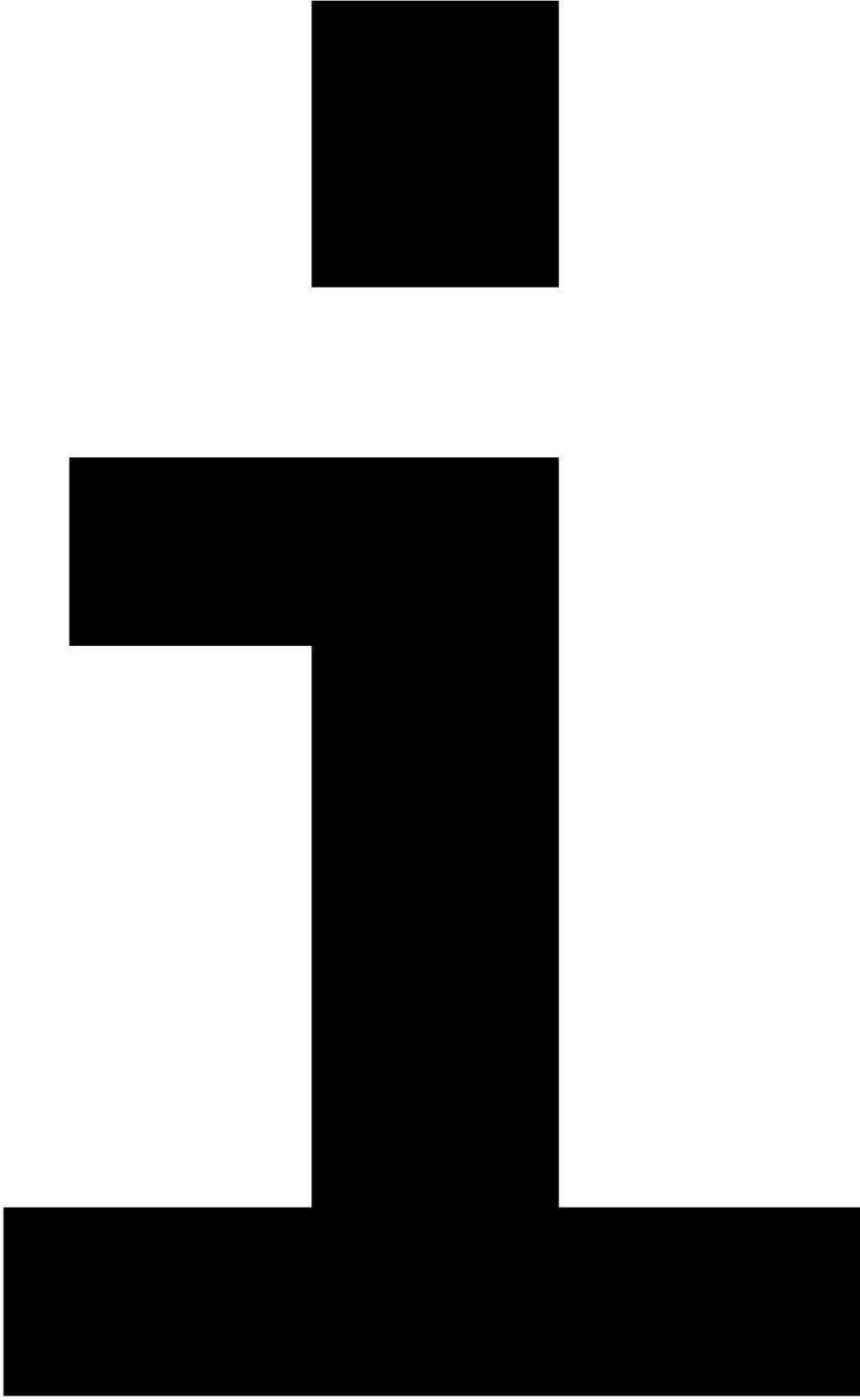
J



C

h

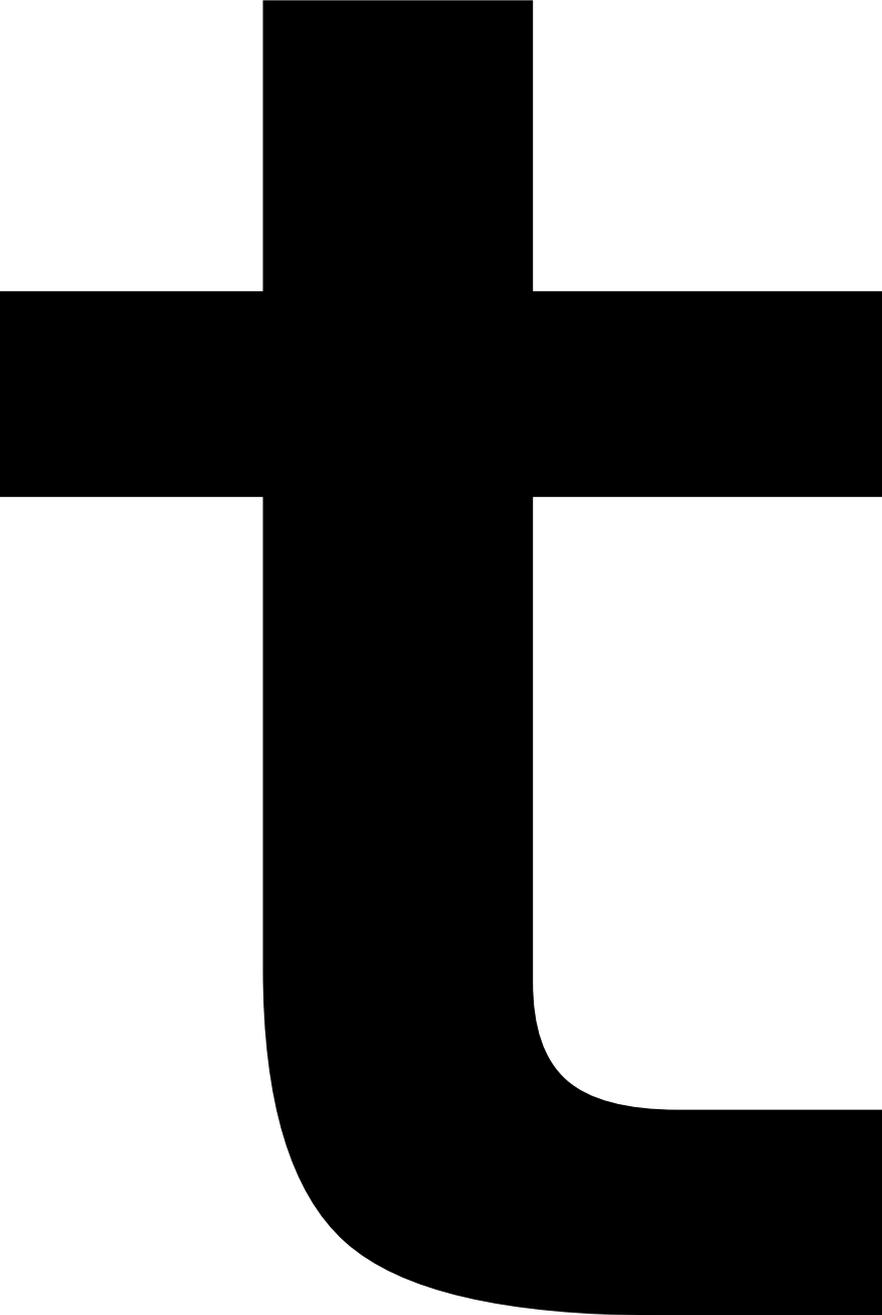
Q

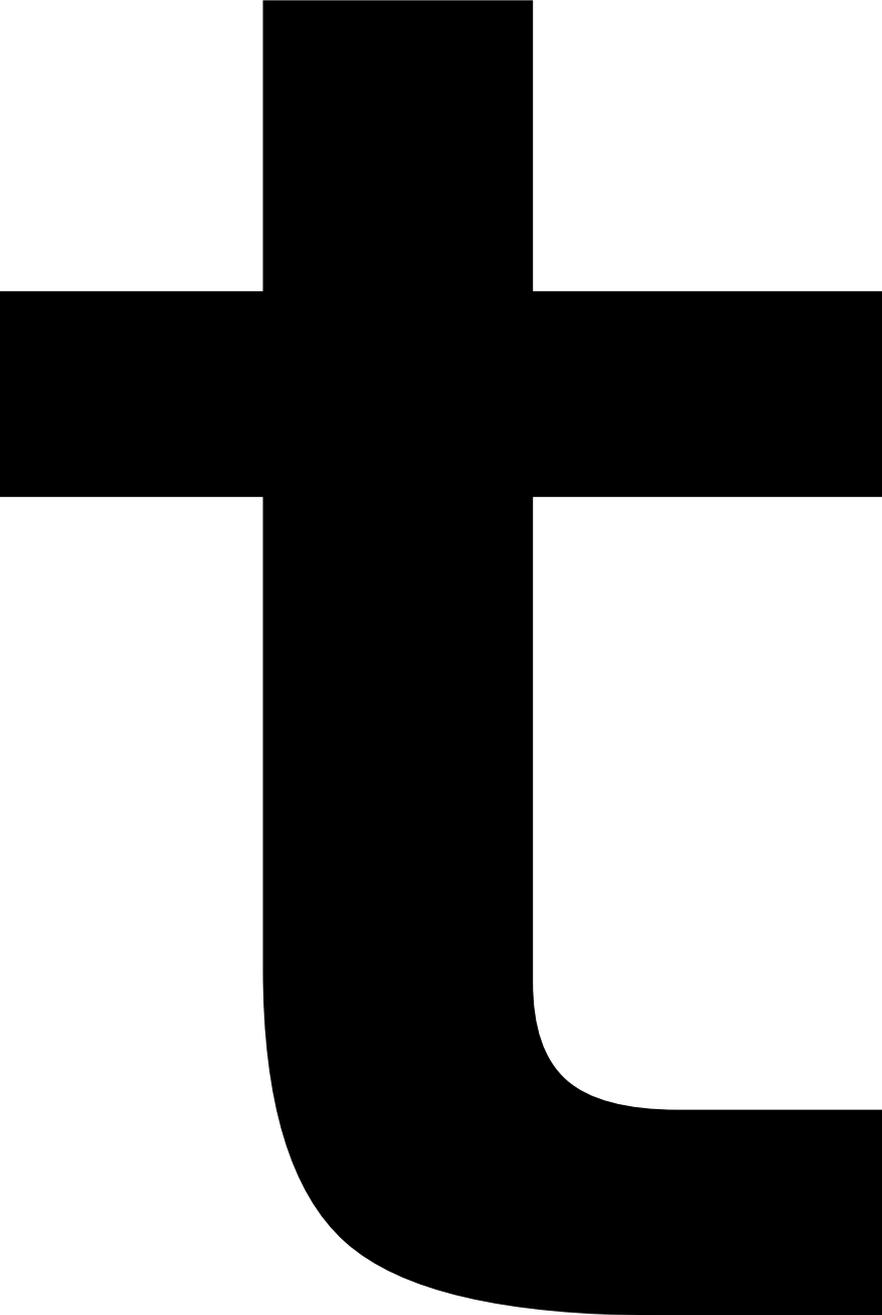


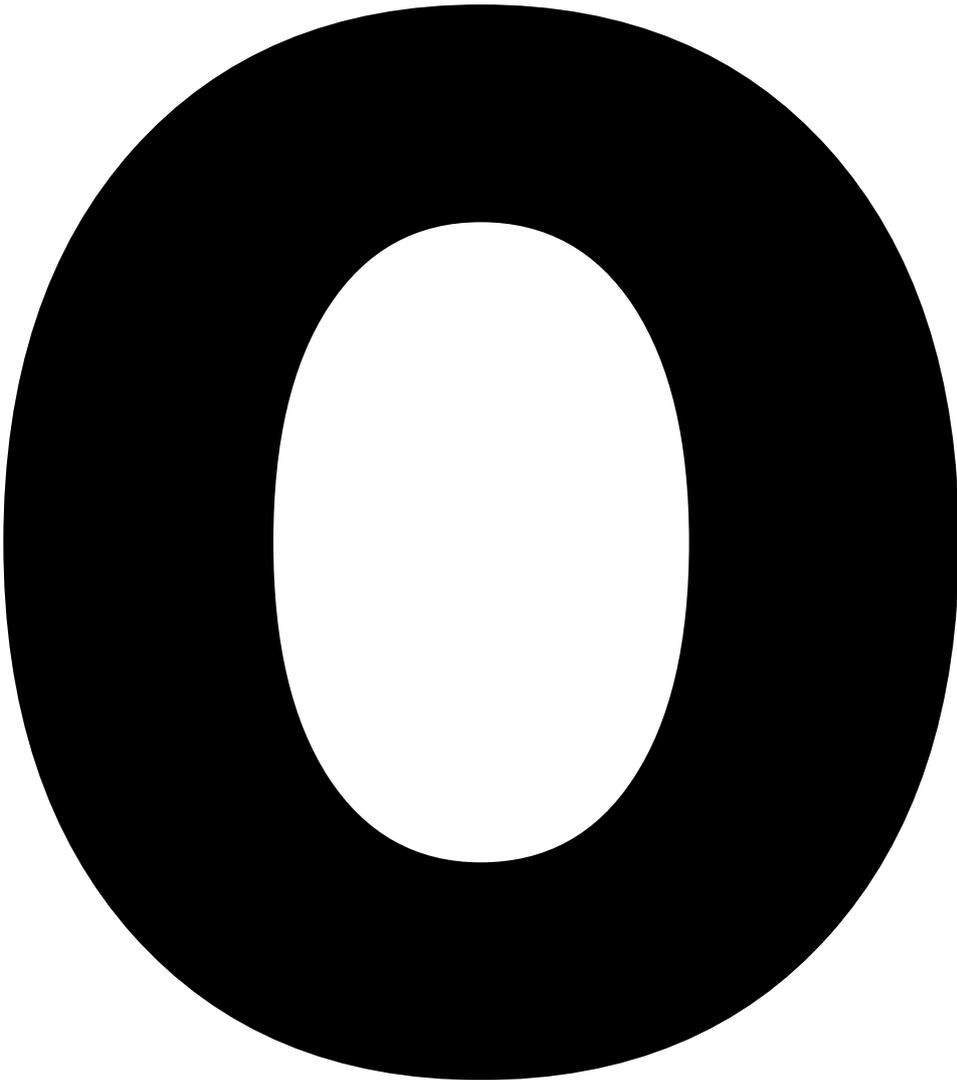
e

N

e

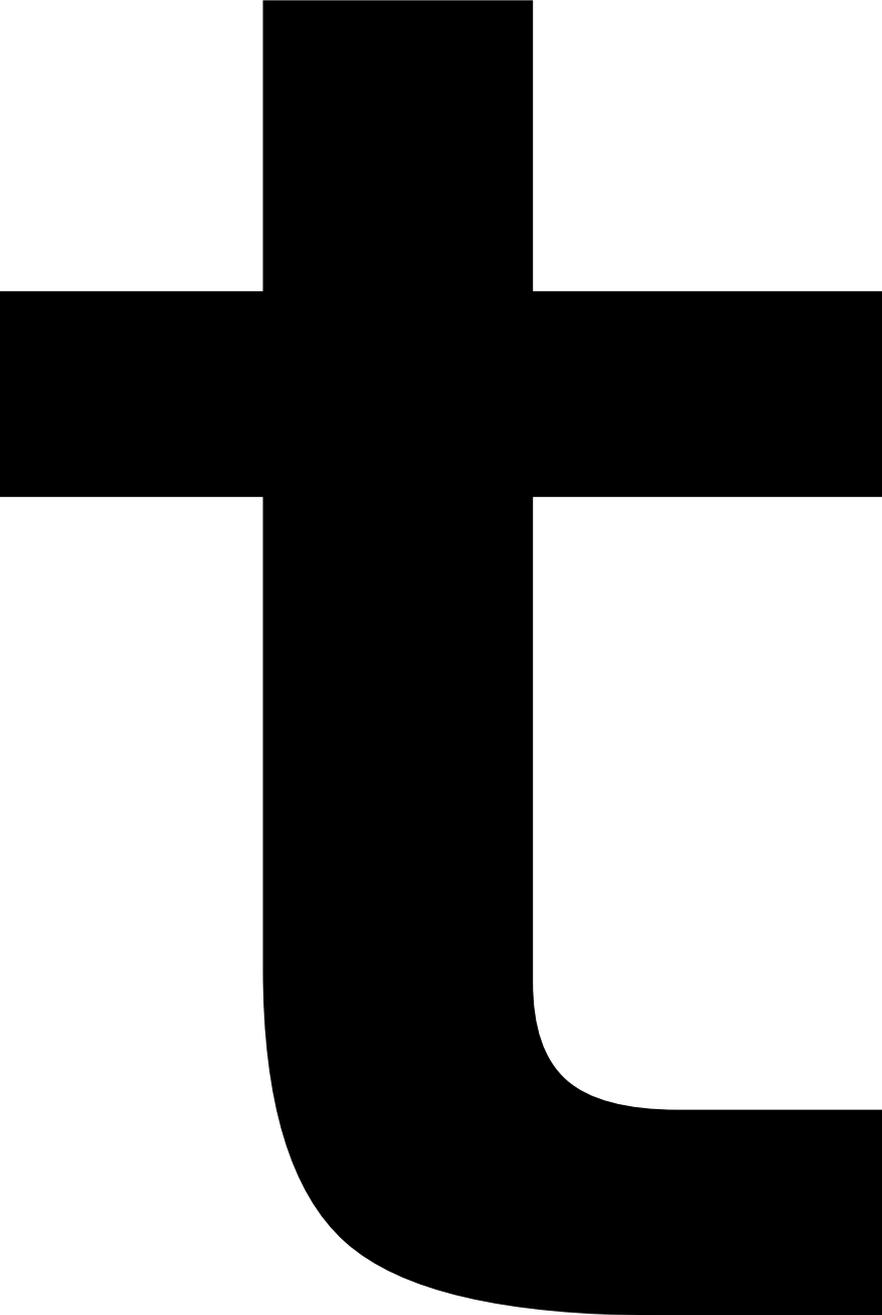


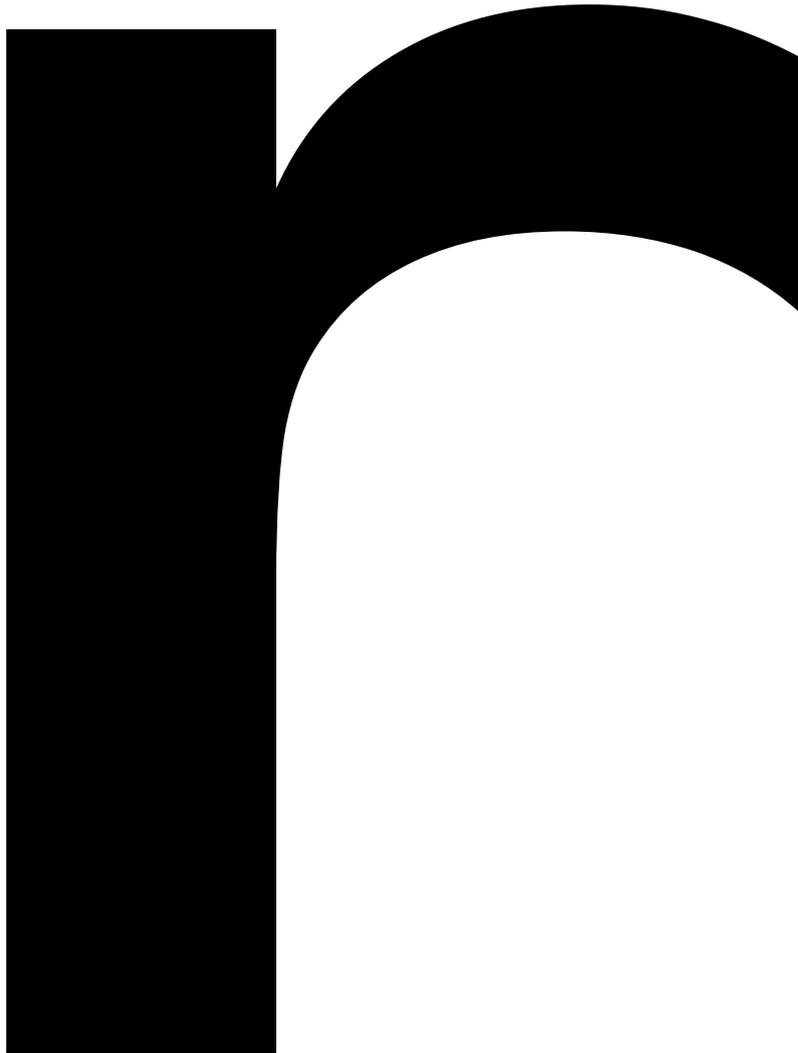


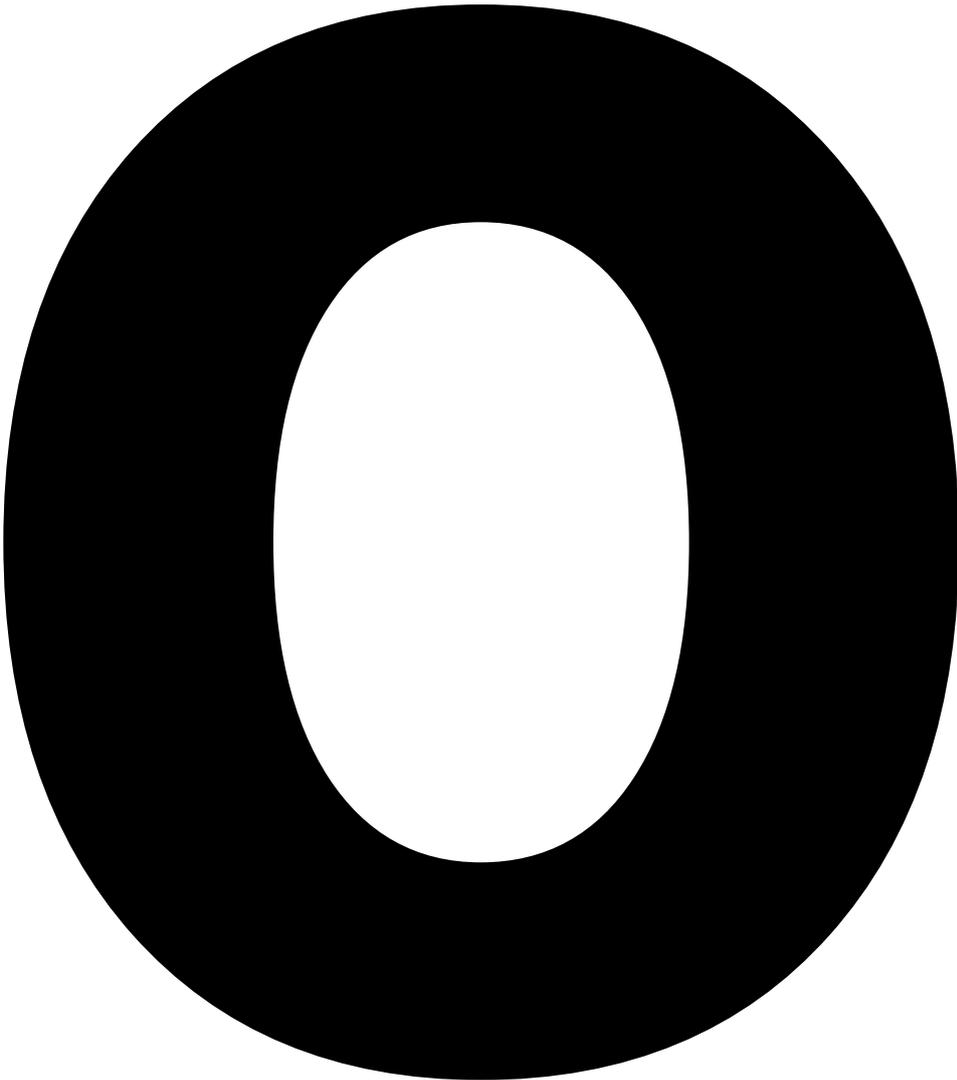




S

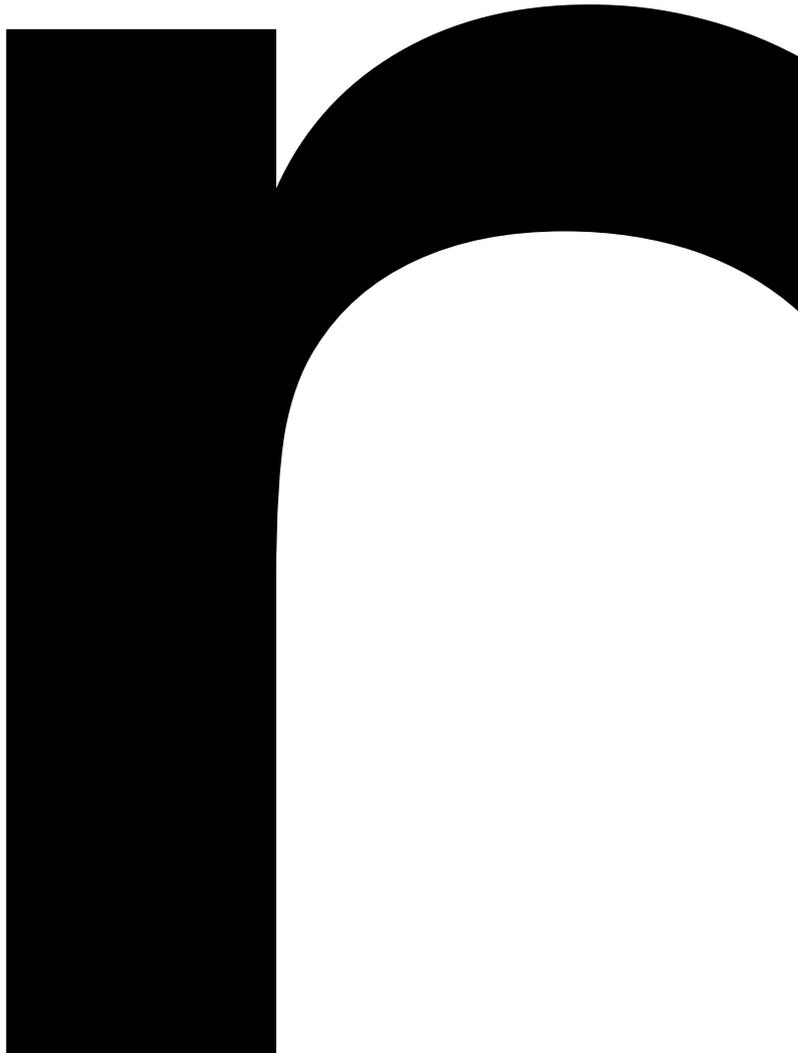


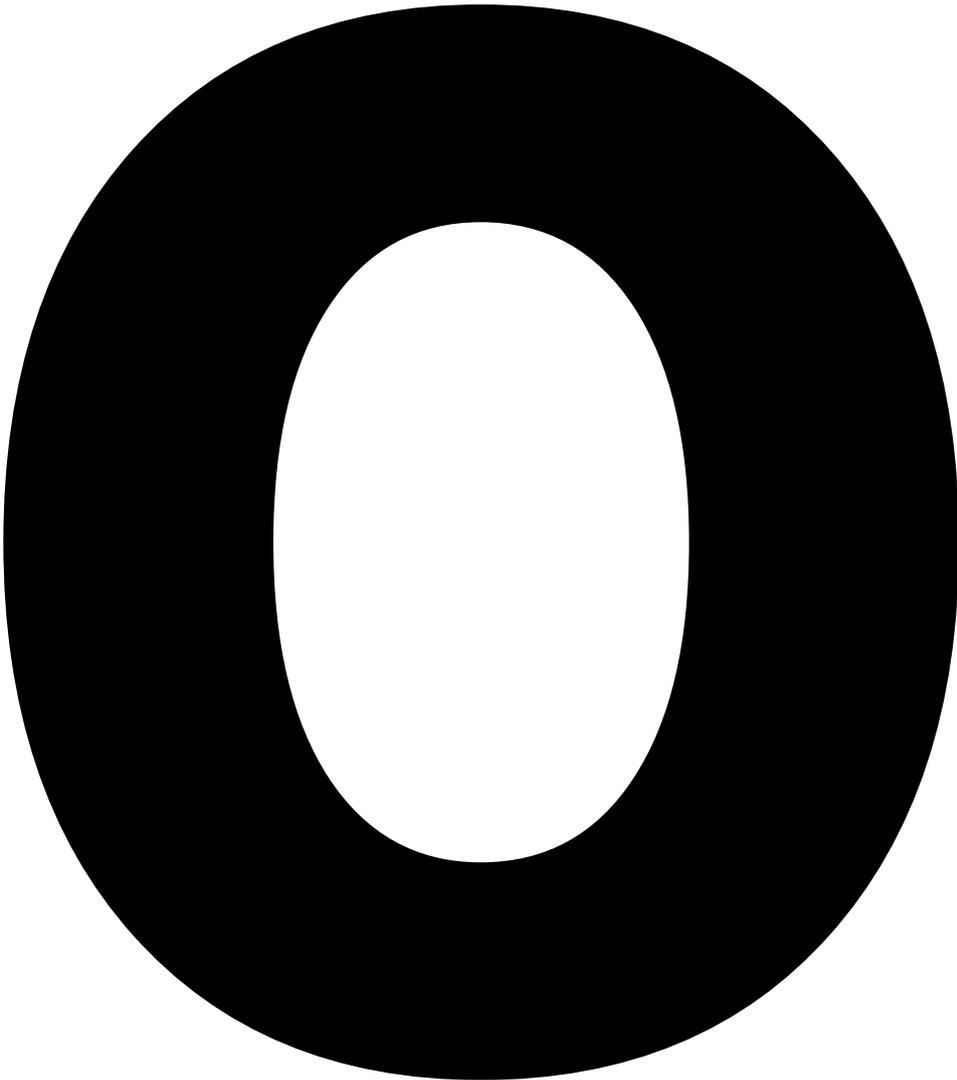




m

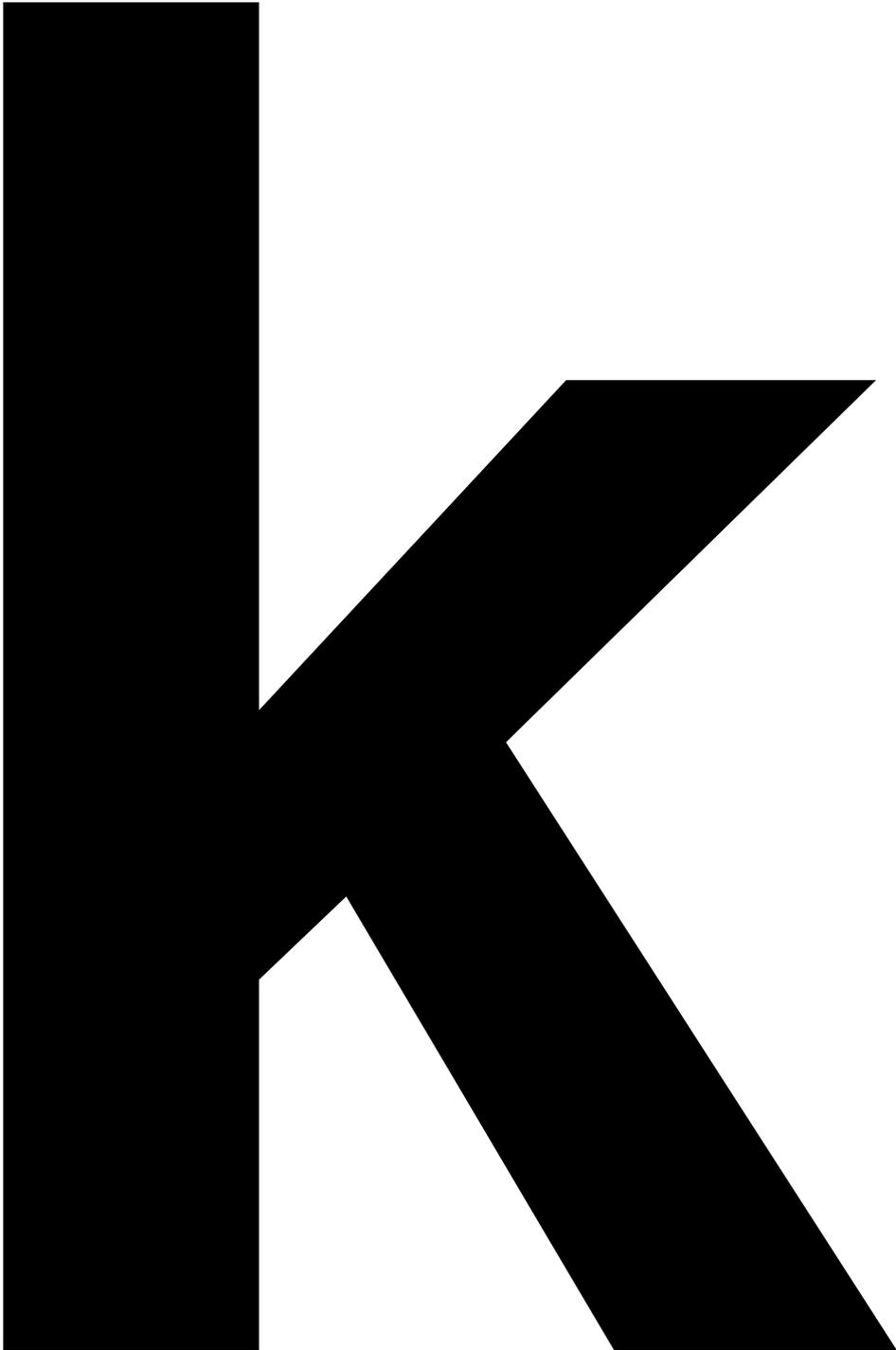
o

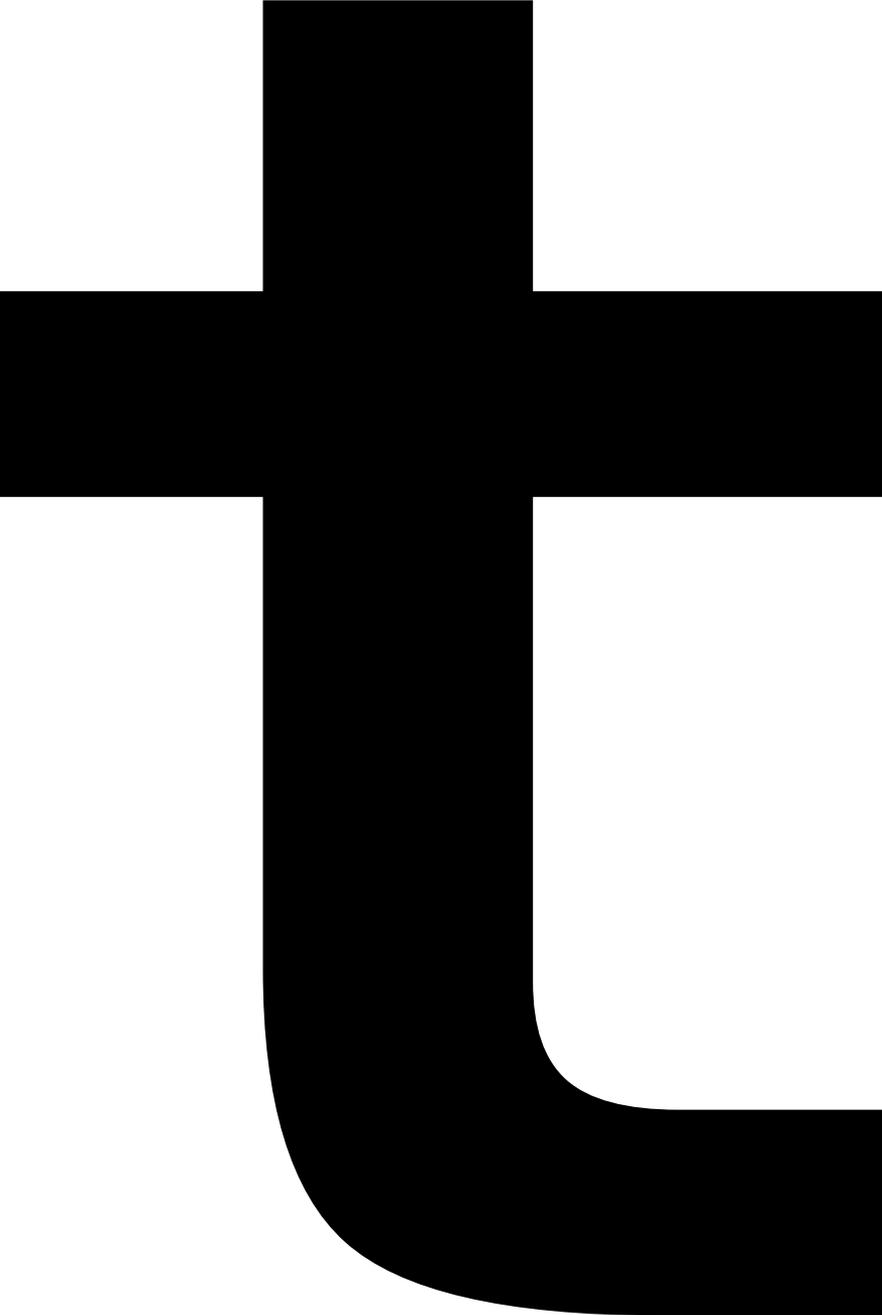


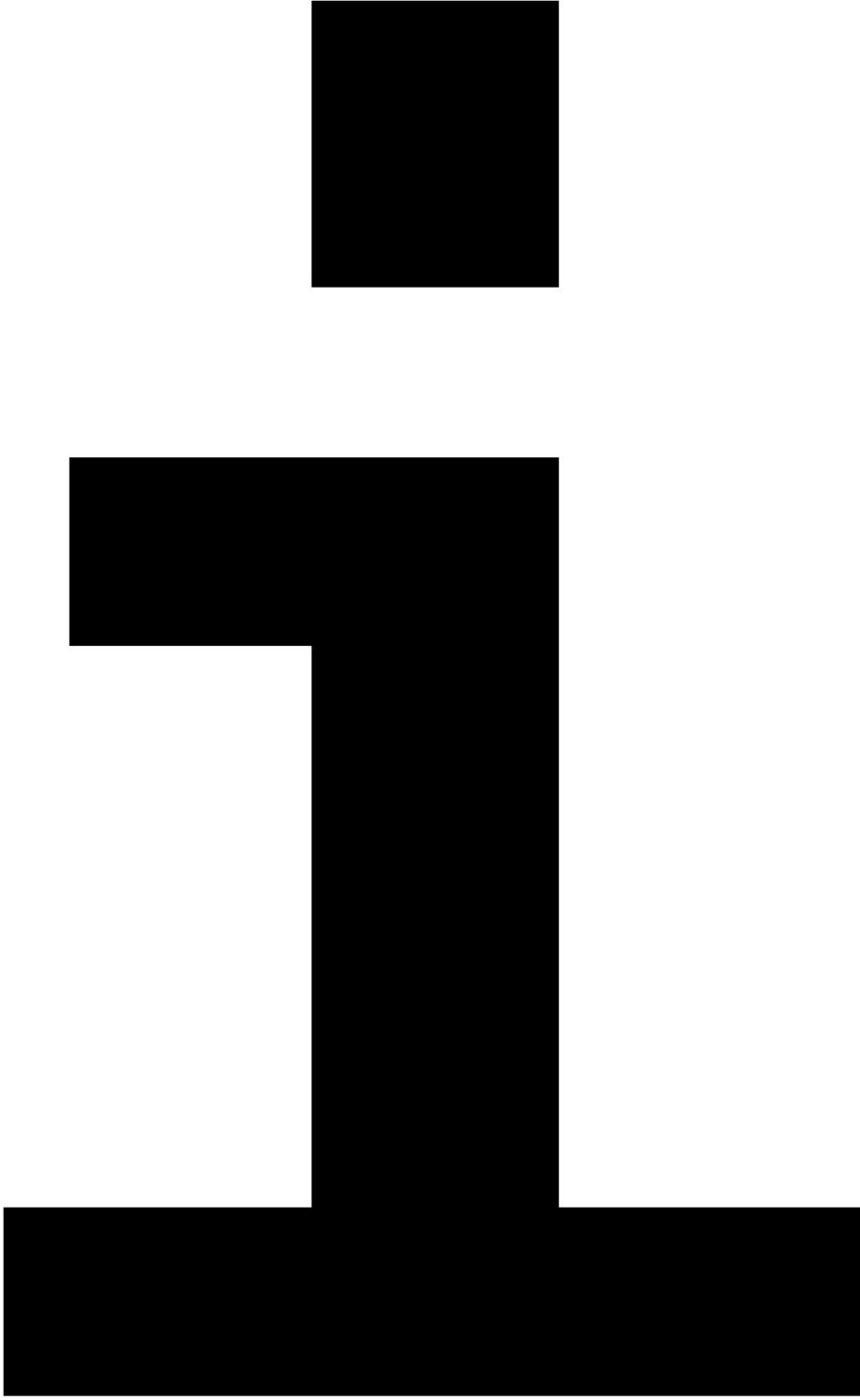


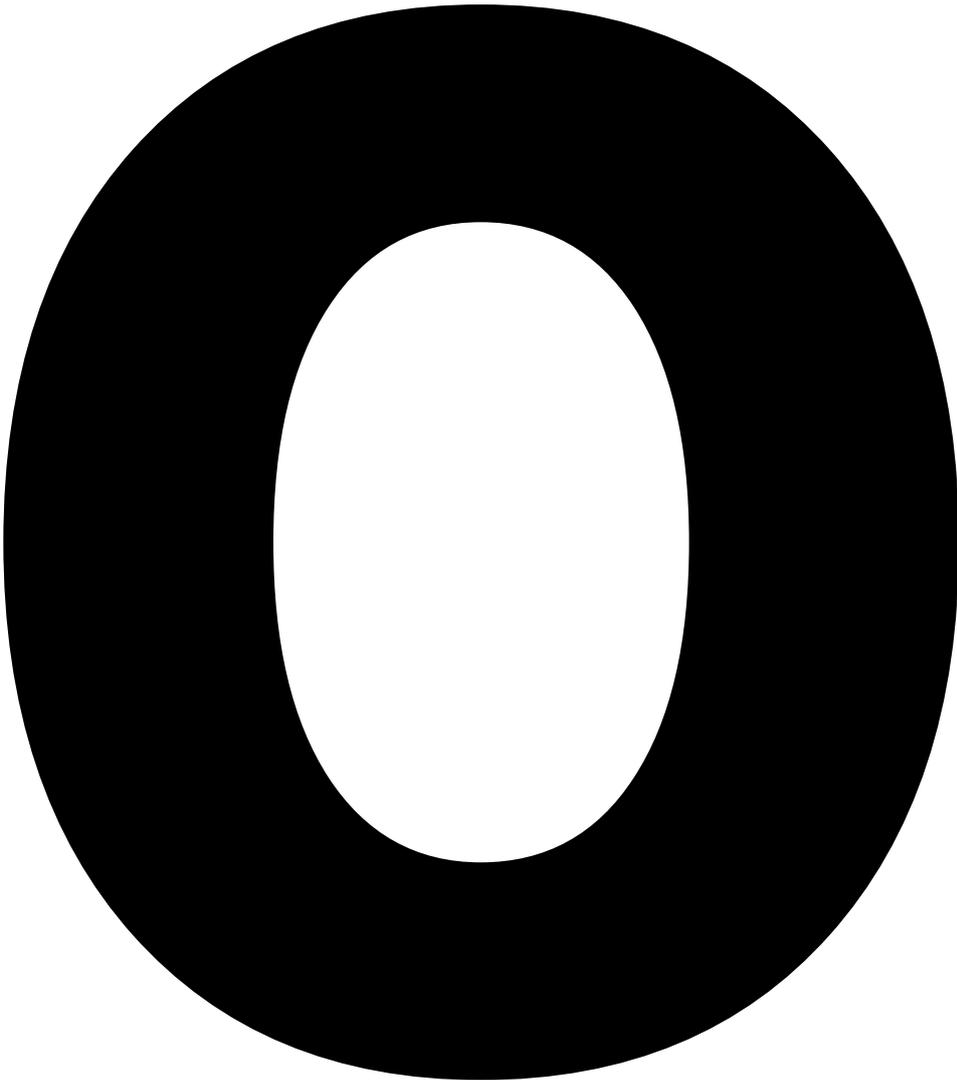
Q

u

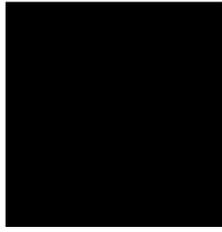
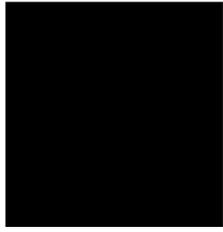








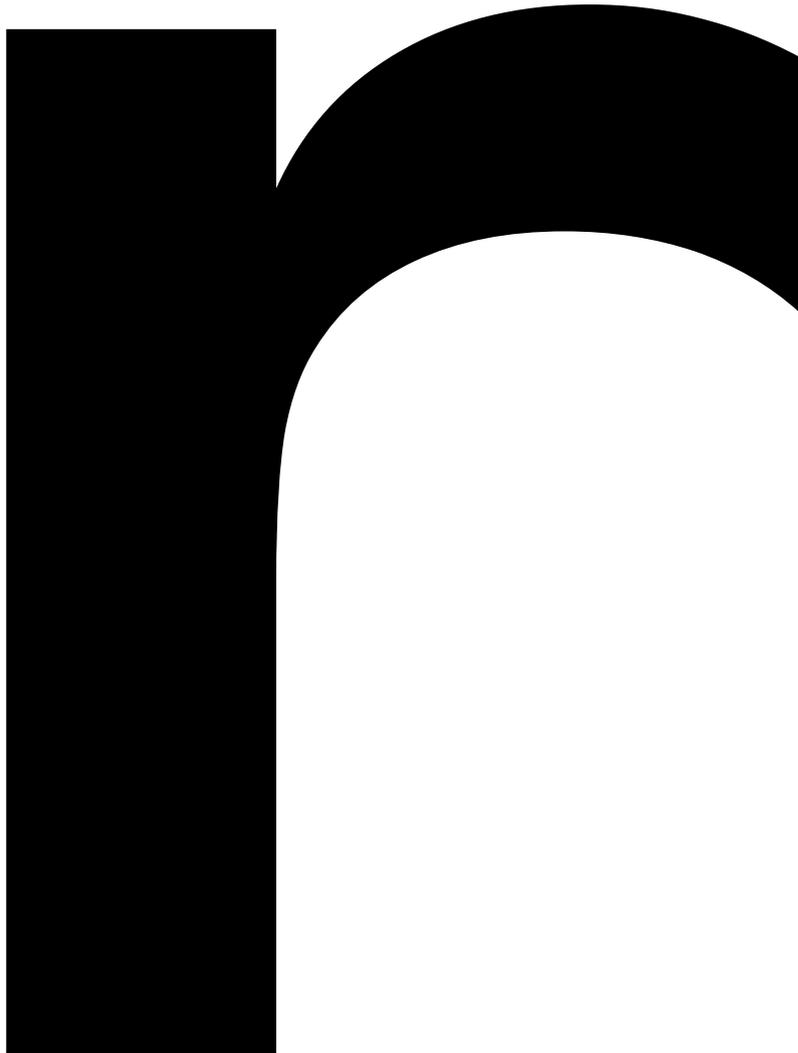
n



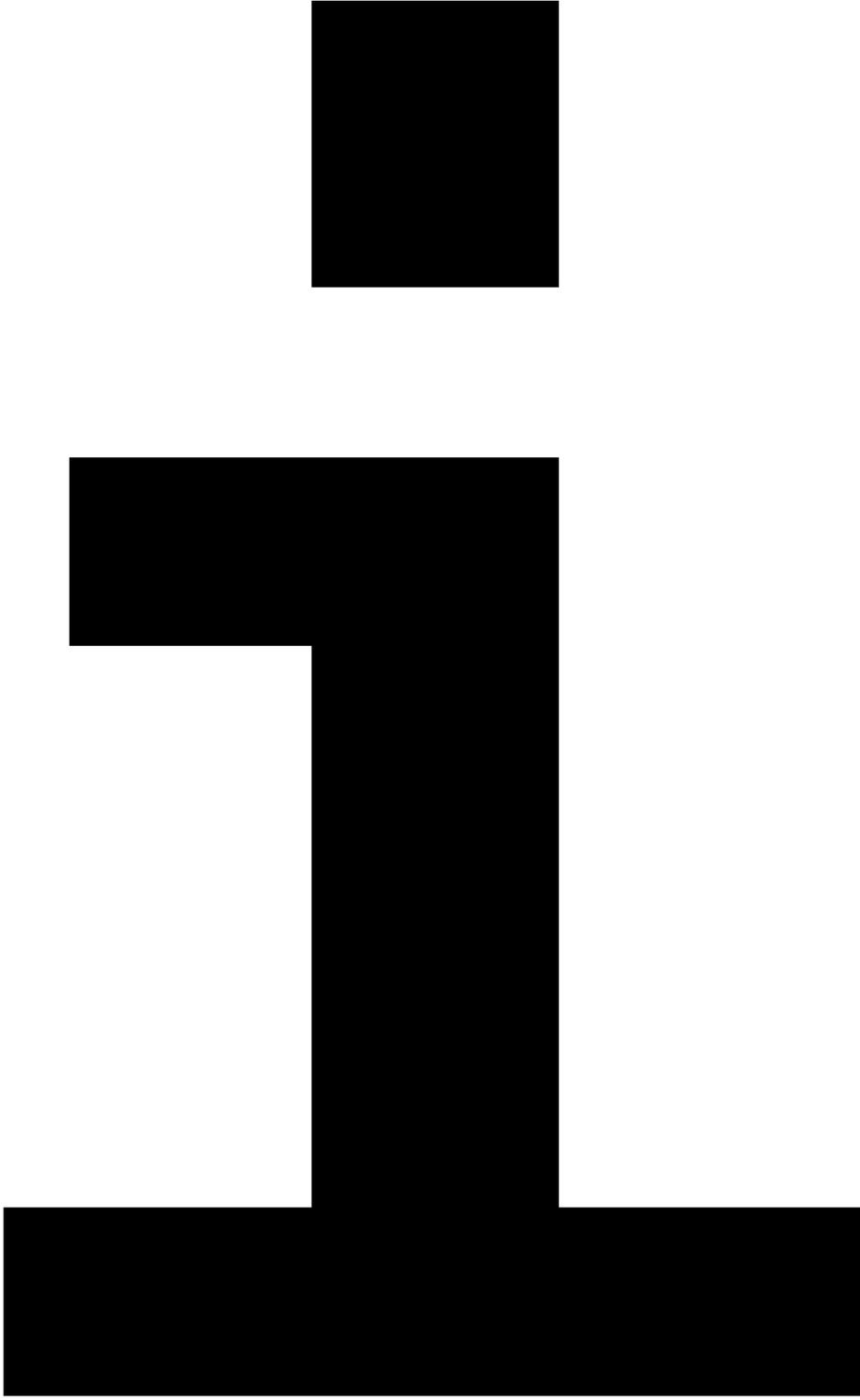
u

10

e



Q

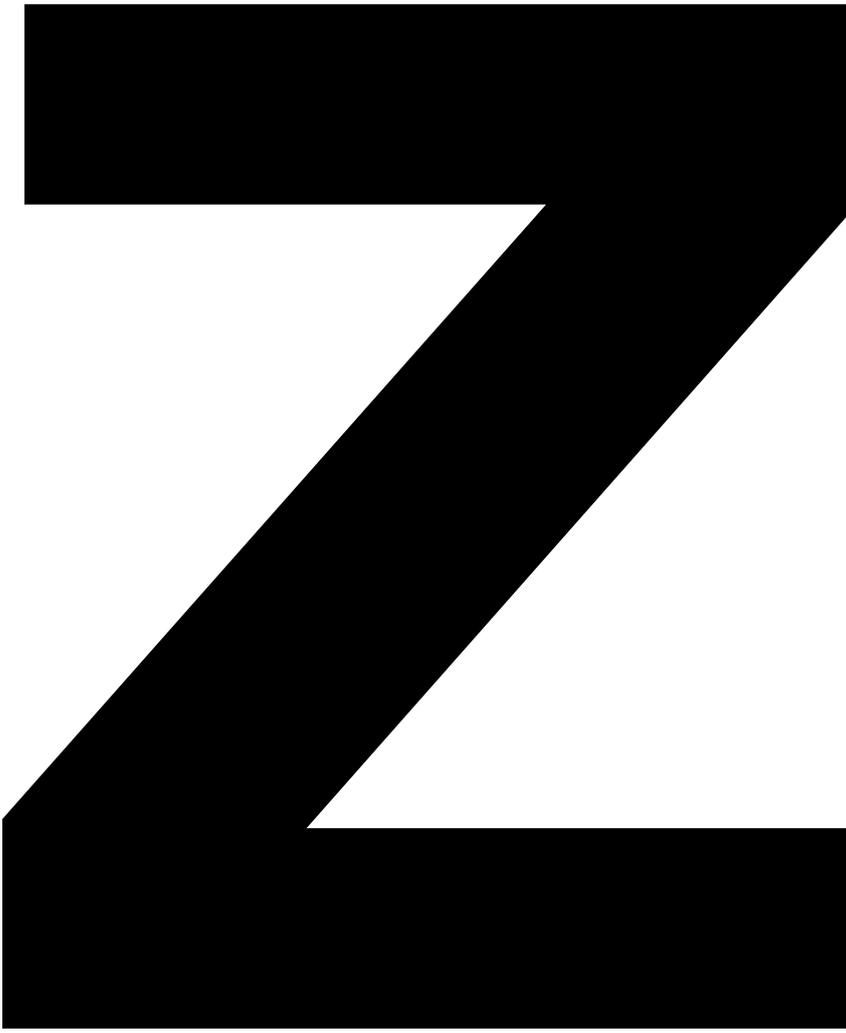


e

Q

sa

n



e



e

10

e

n

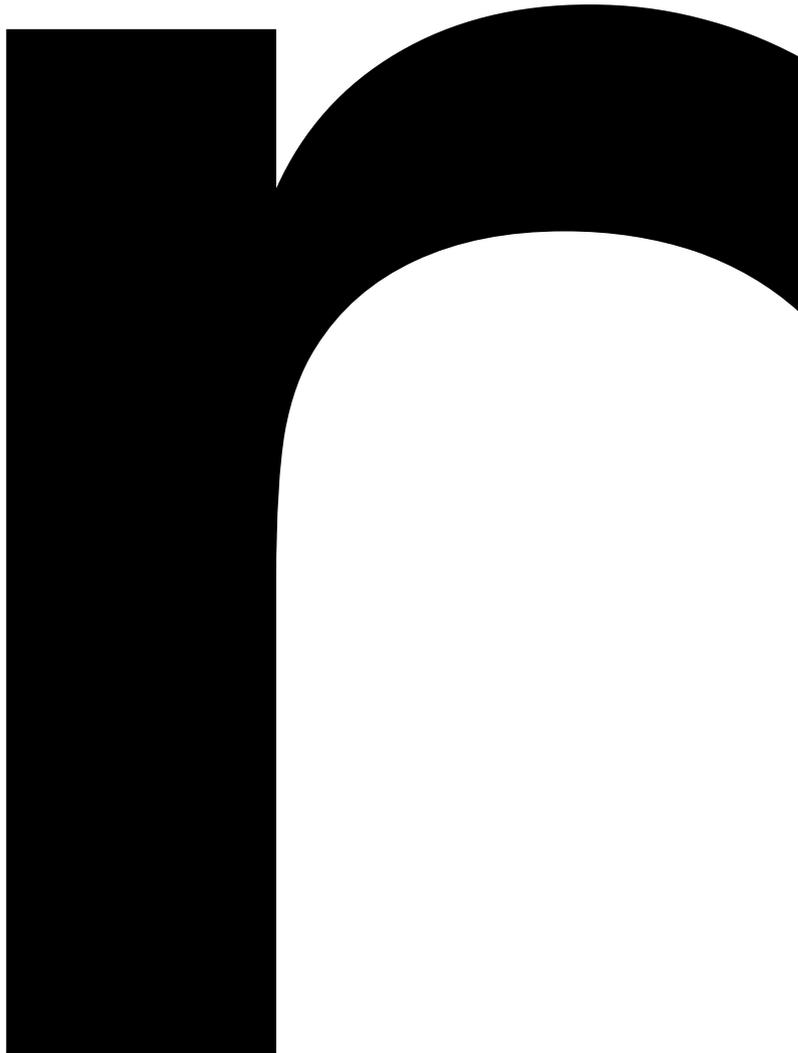
S

Q

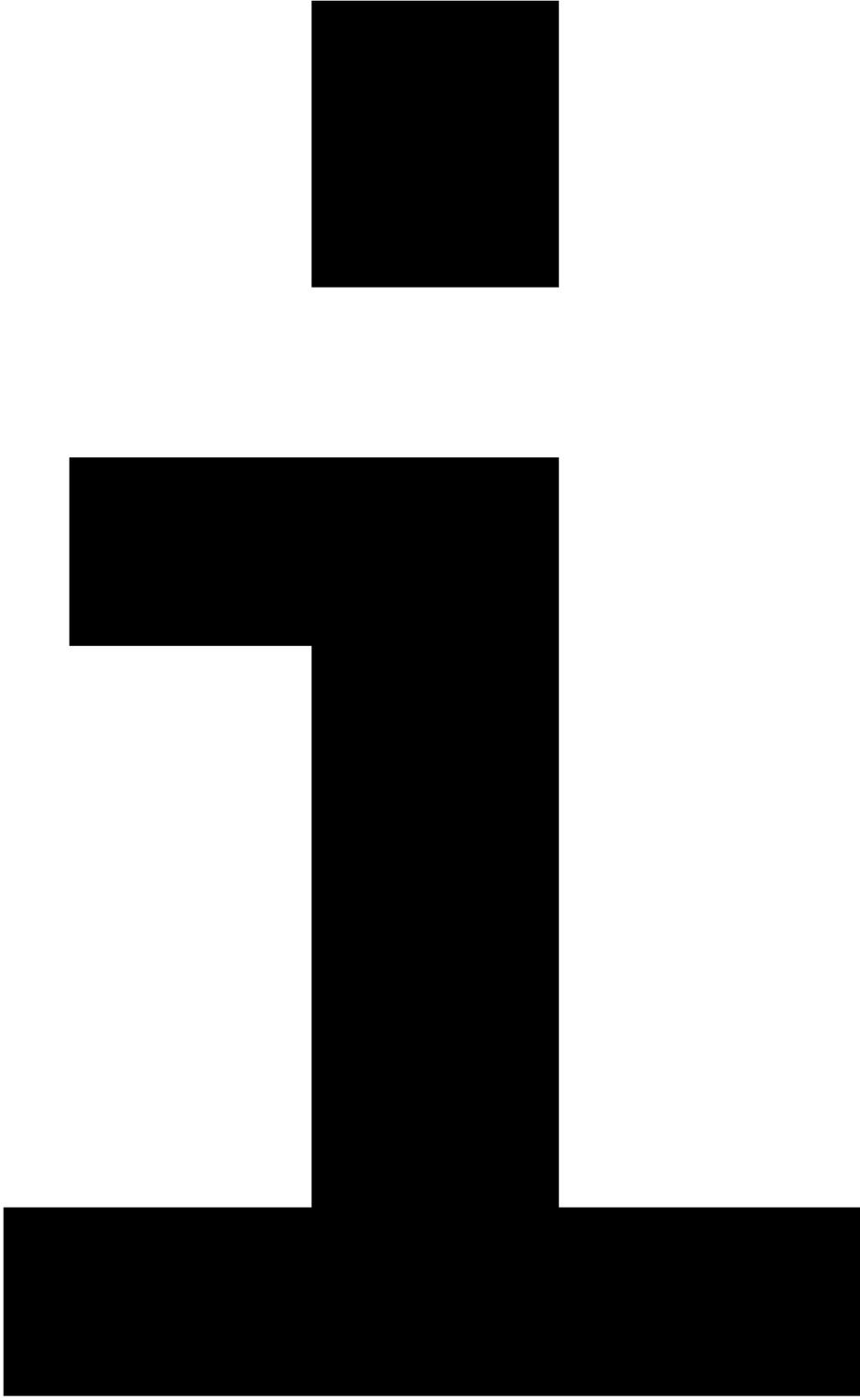
sa

u

e

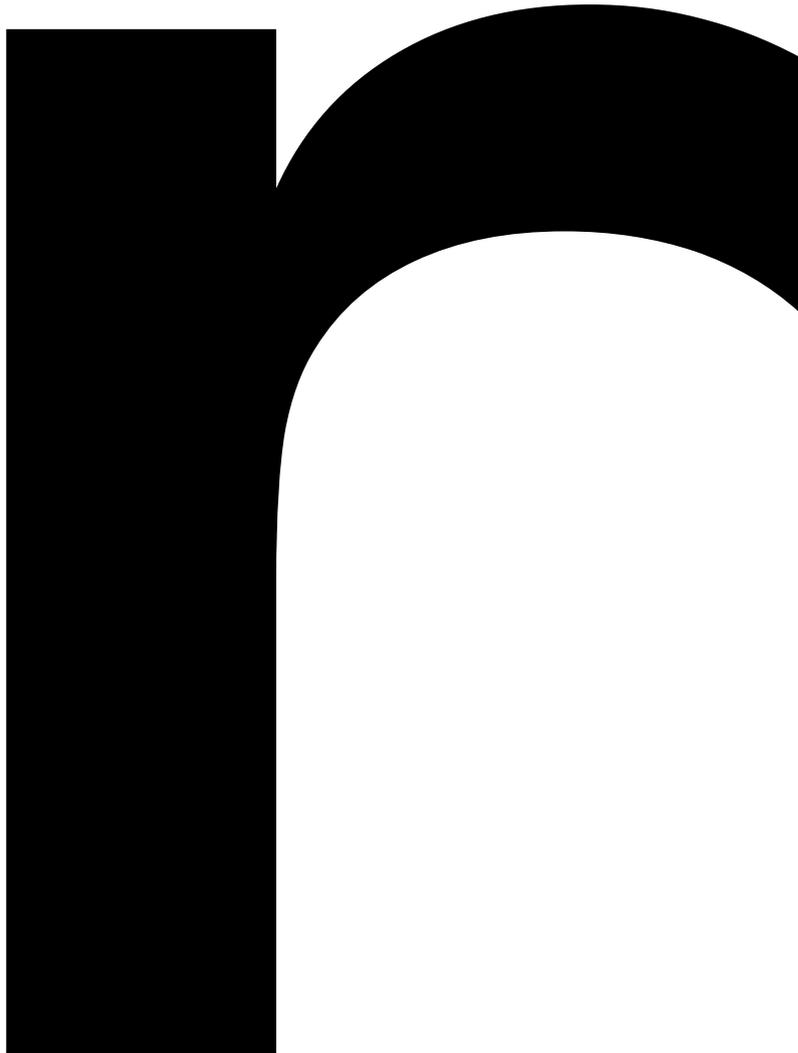


e



n

e



P

V



A

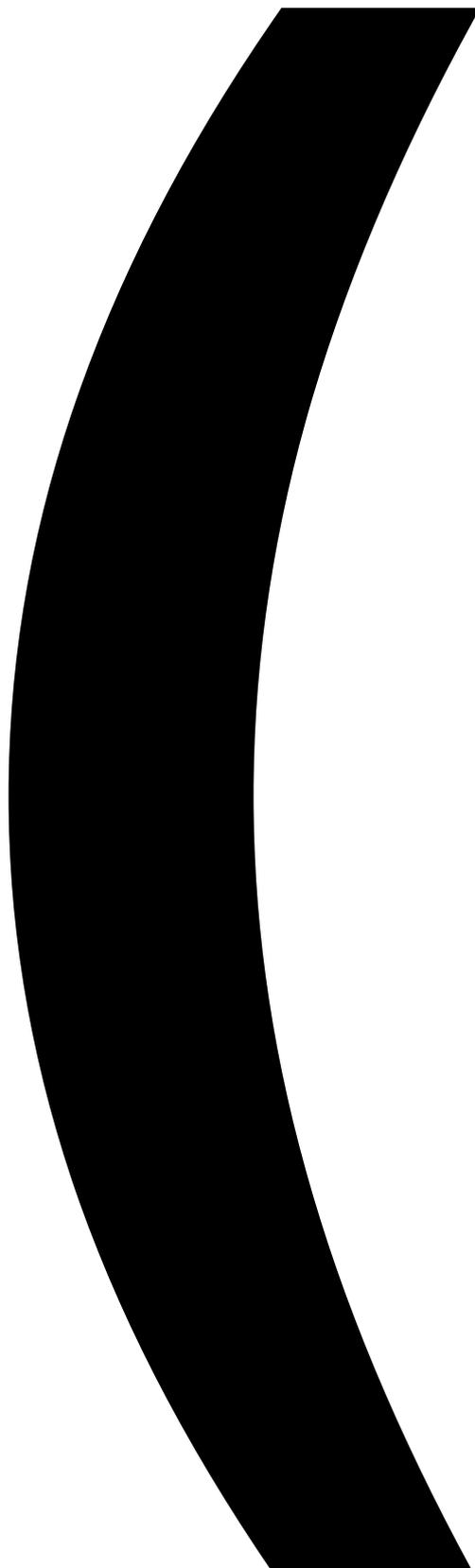
n

J

sa

Q

e



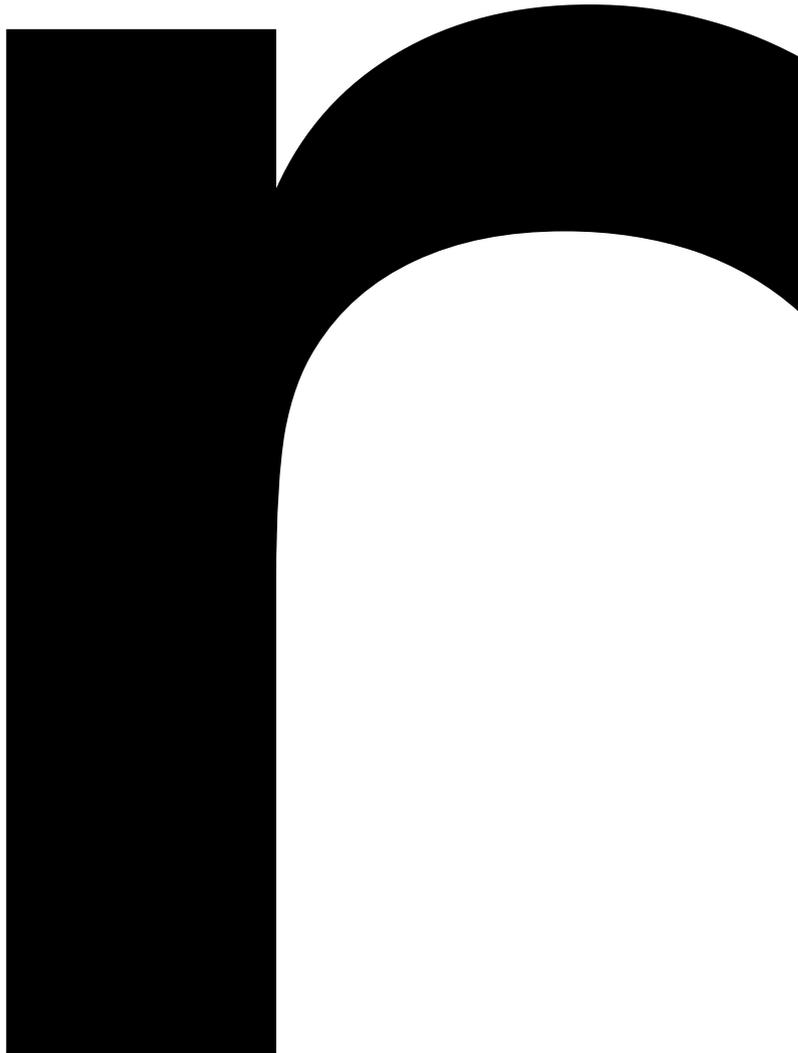
2

5

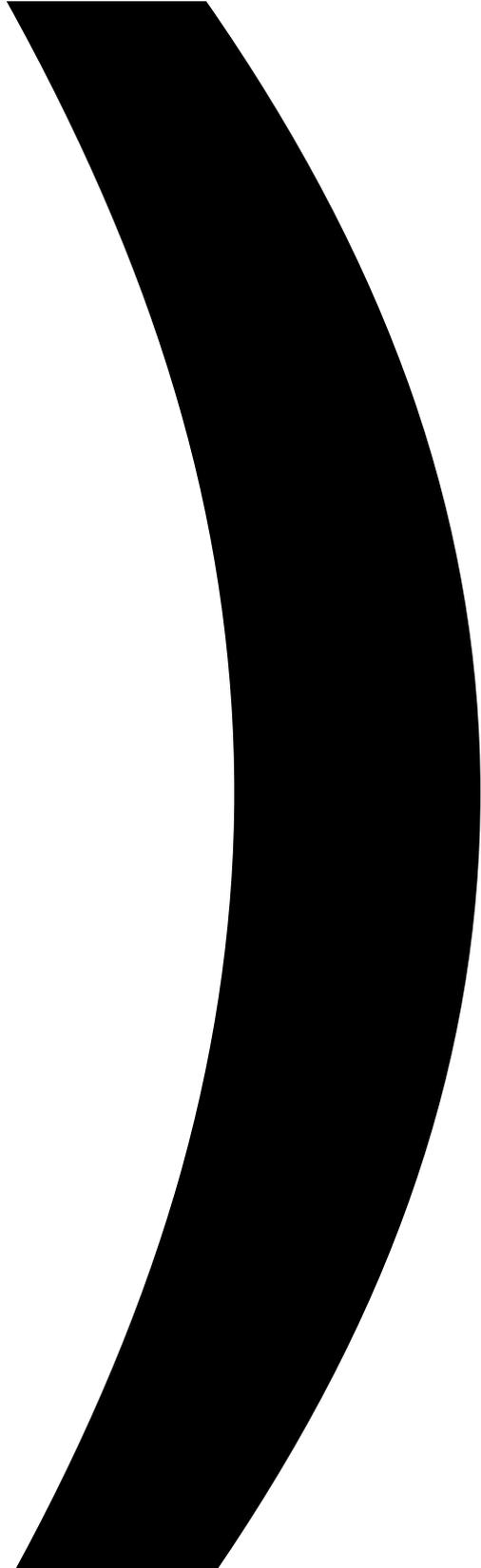
J

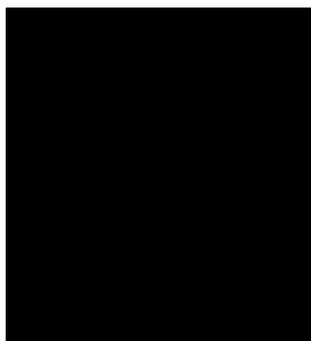
sa

h

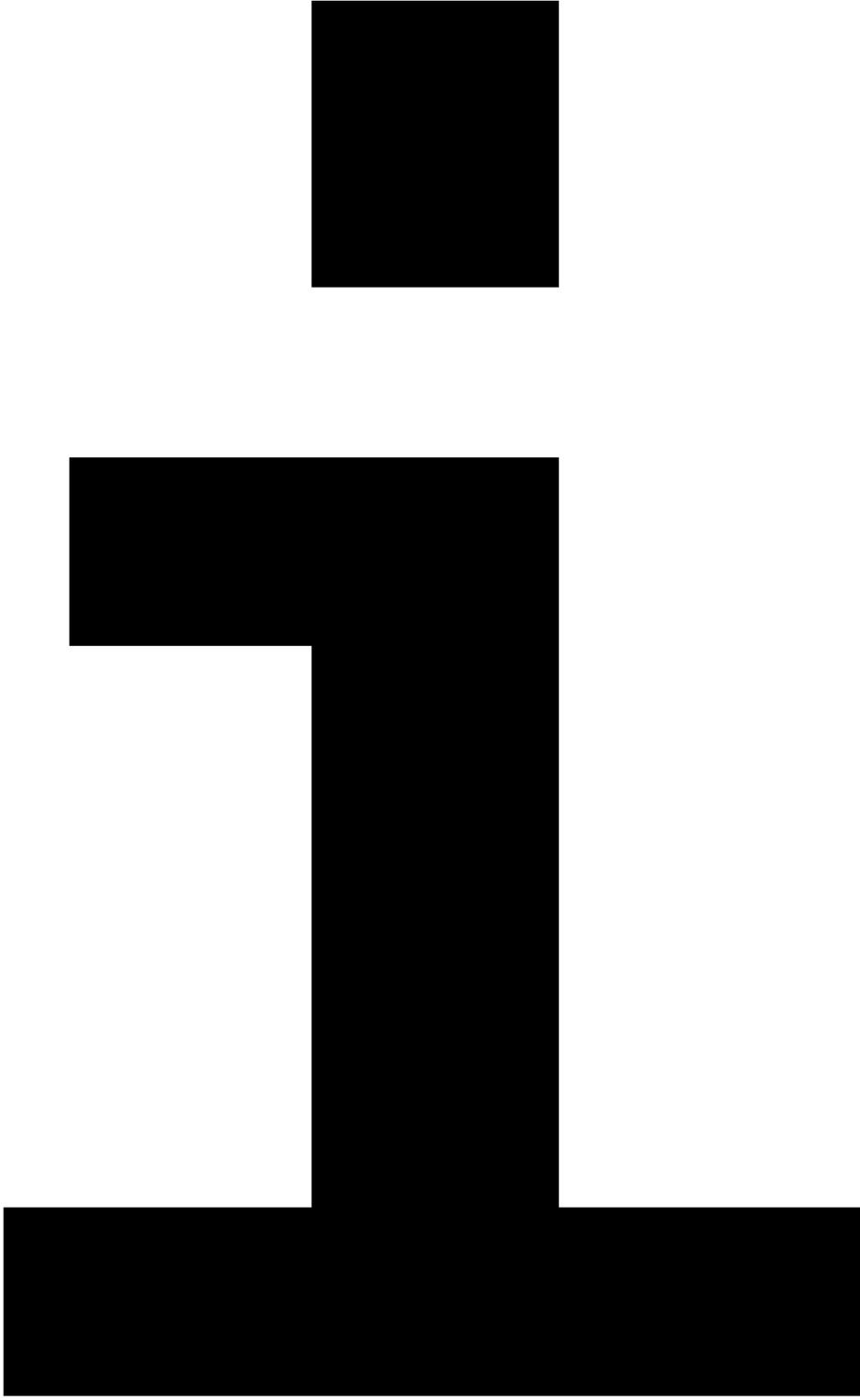


e



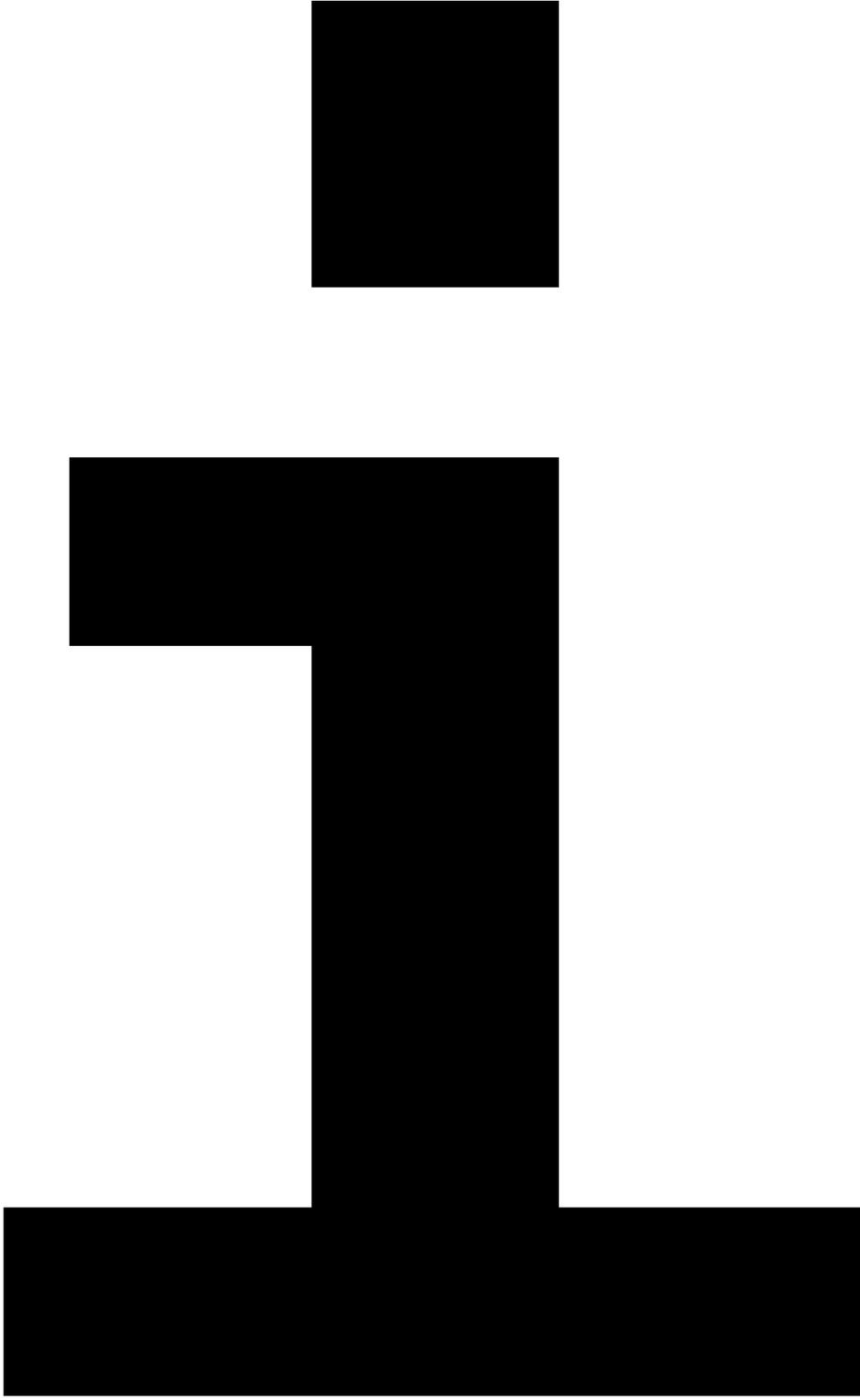


D



e

S



n



sa

h

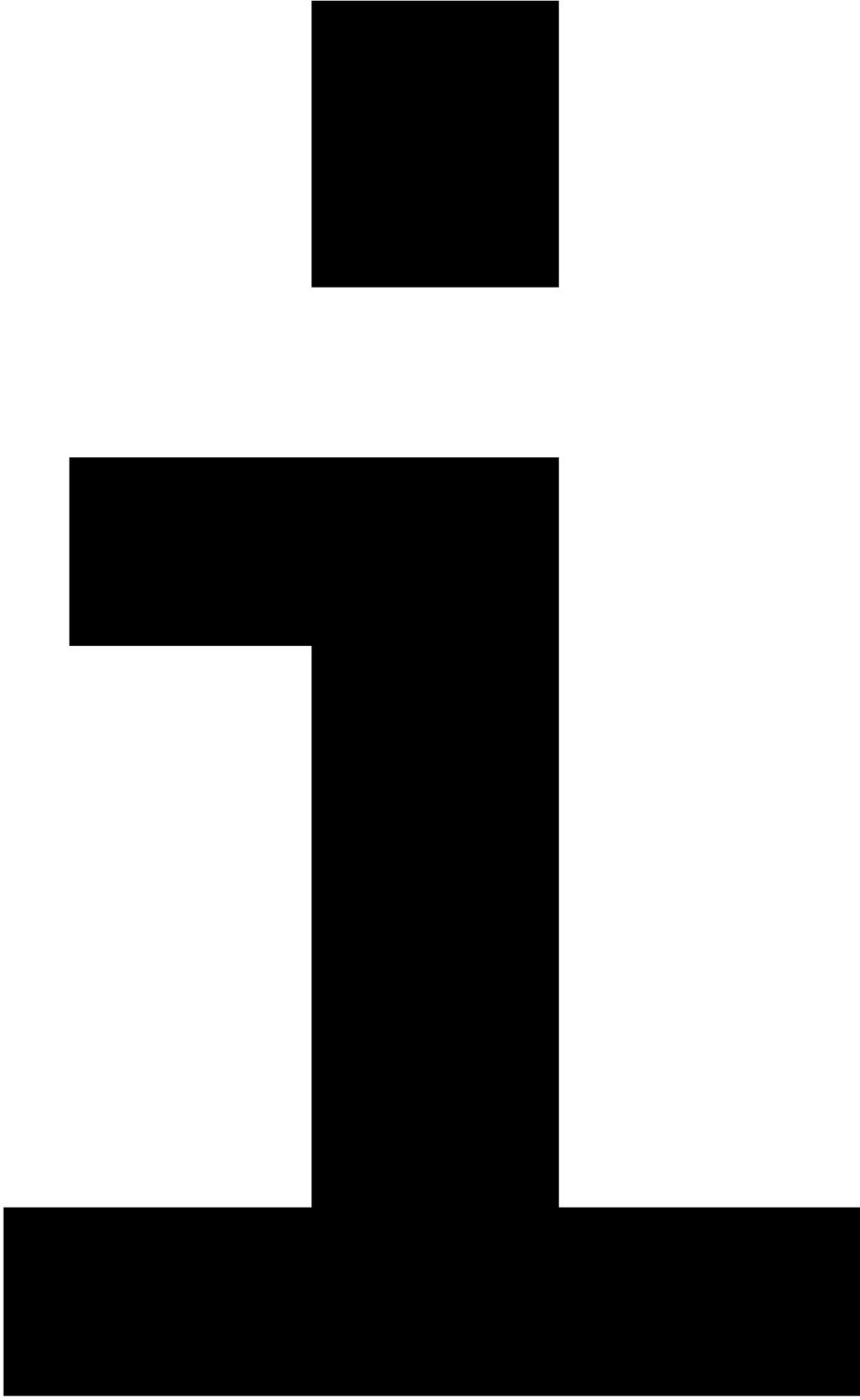
J

e

n



D

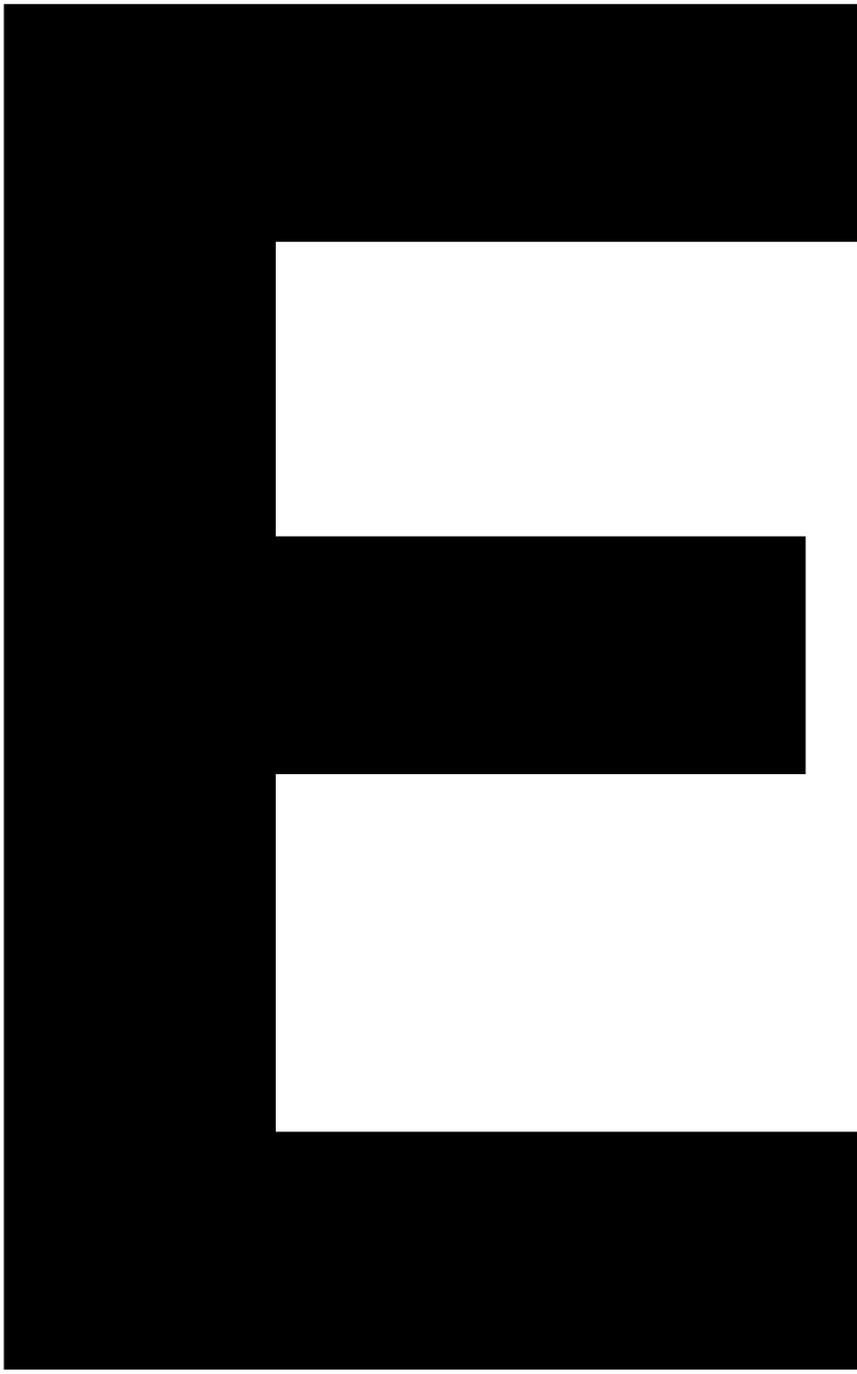


e

B

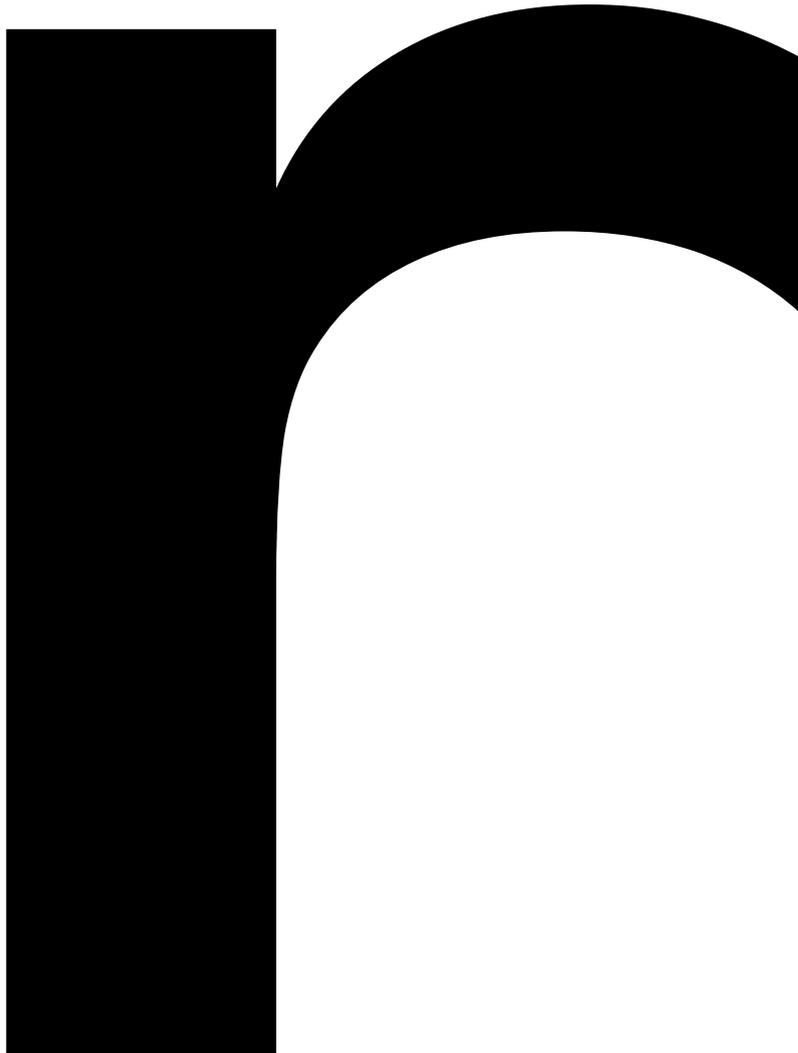
M

U

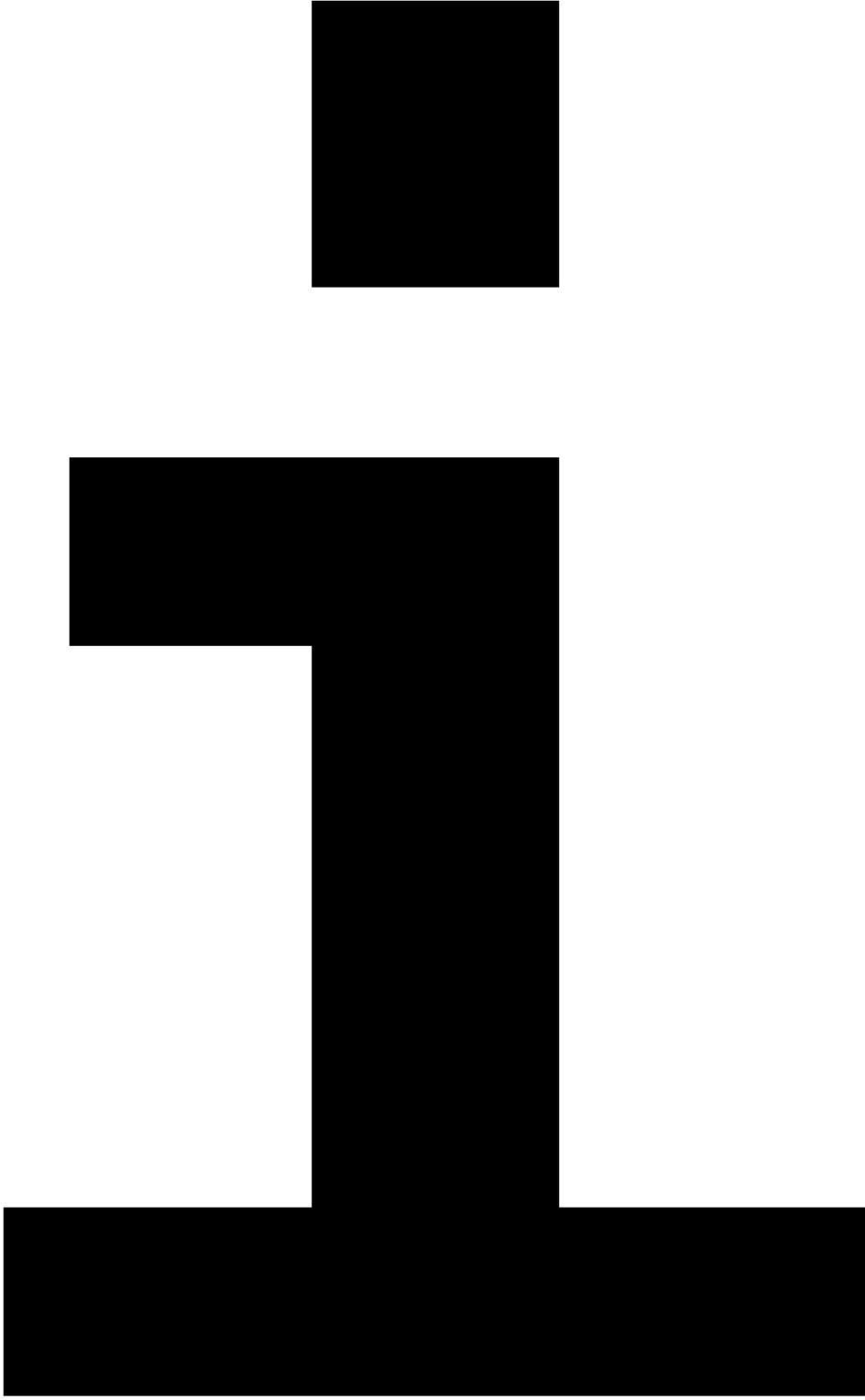


n

e

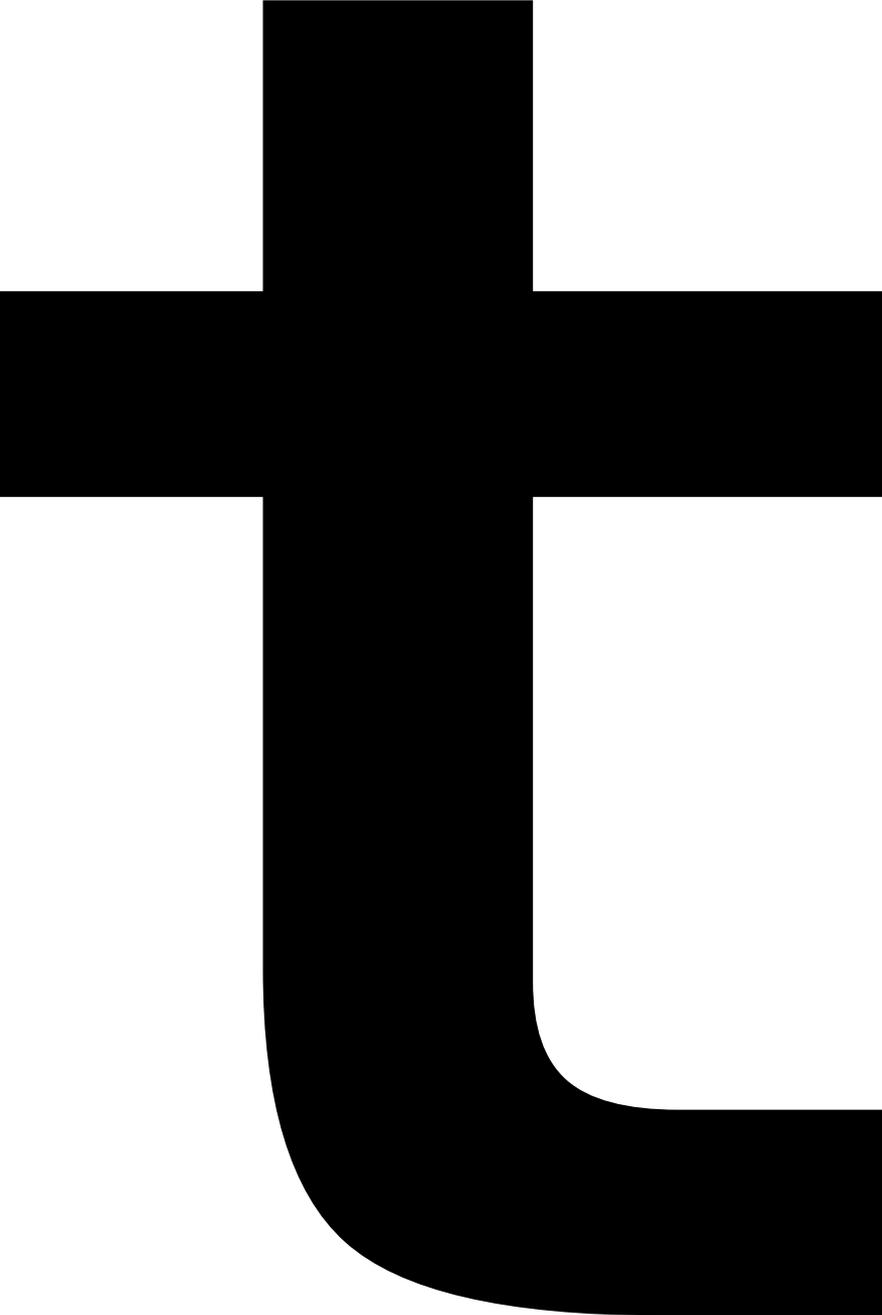


Q

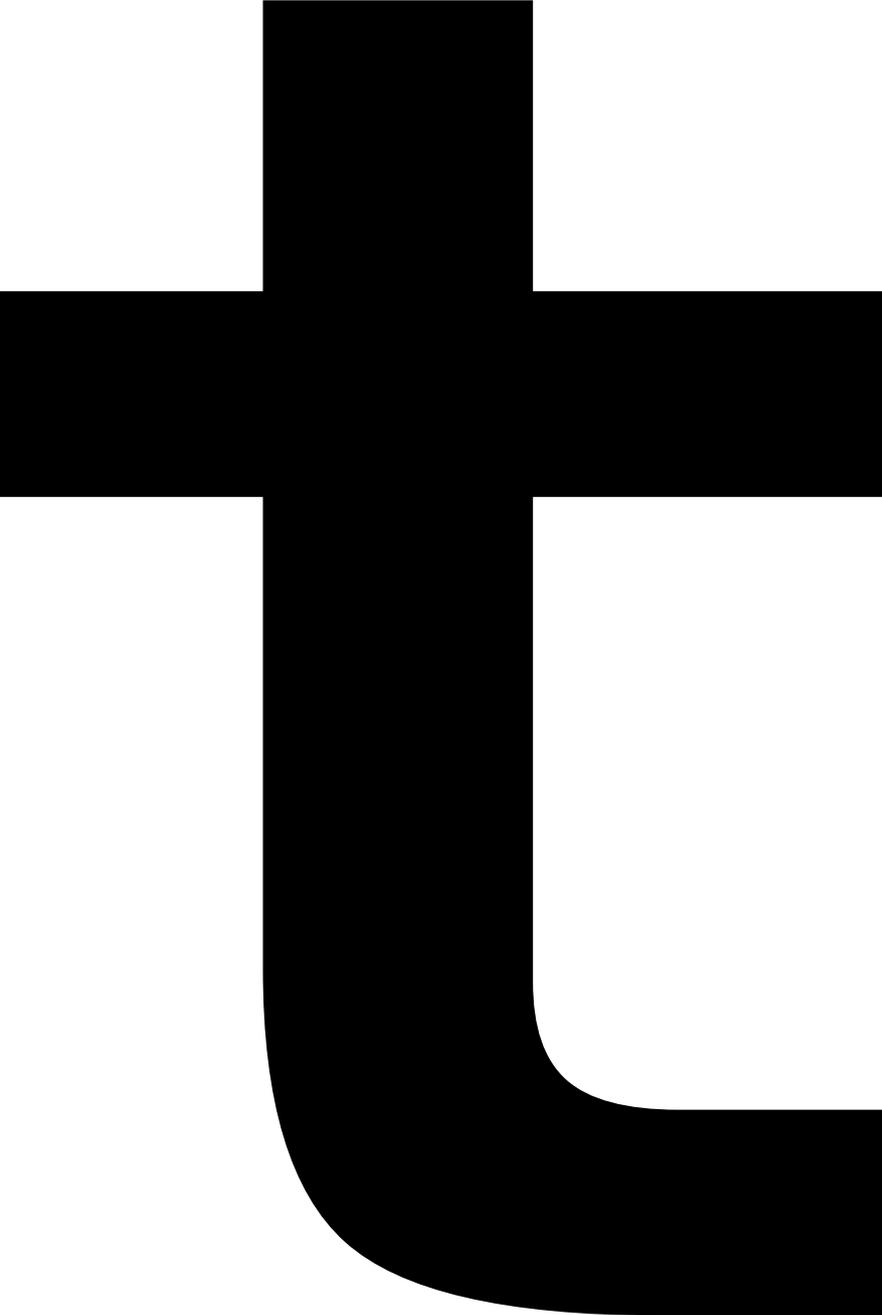


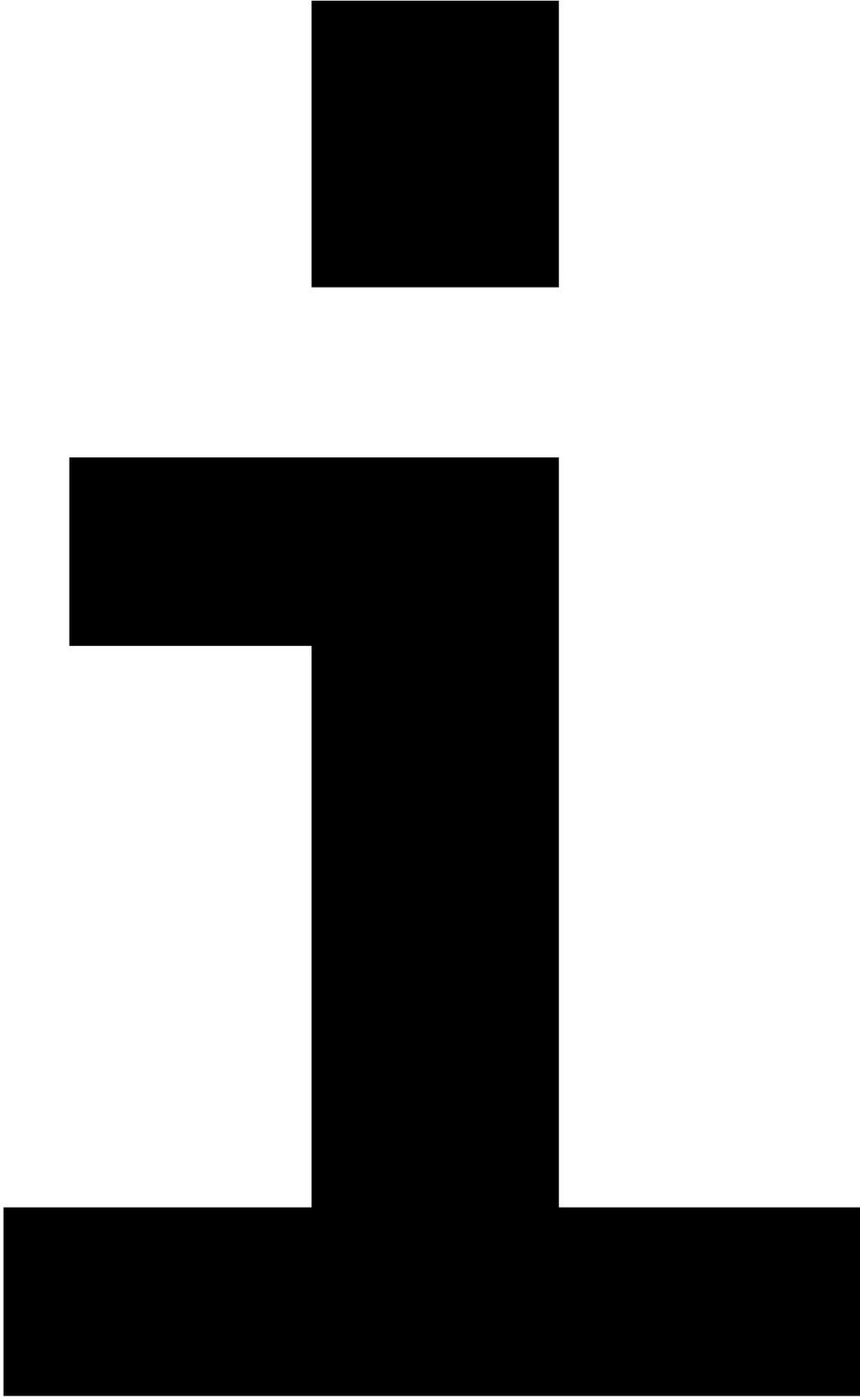
e

S

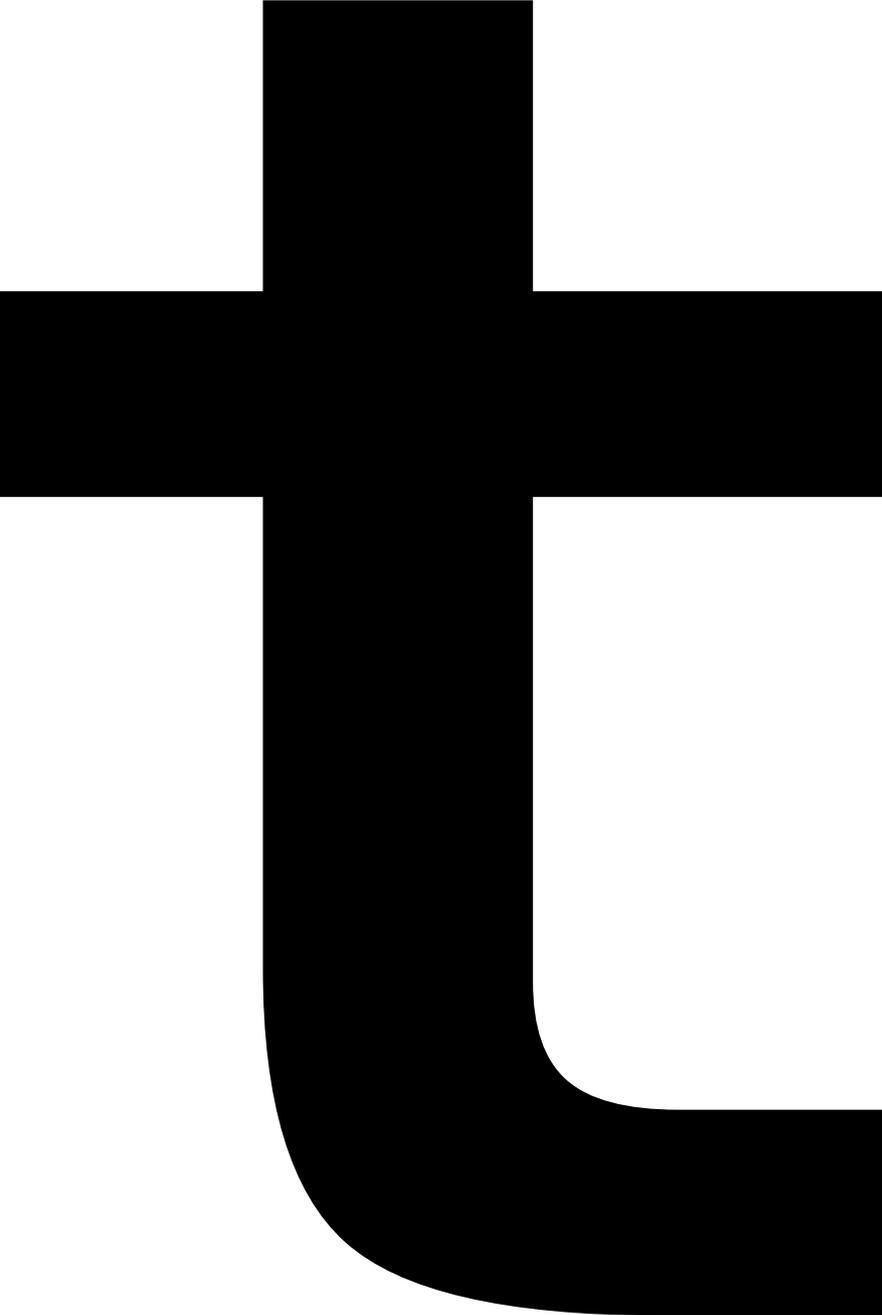


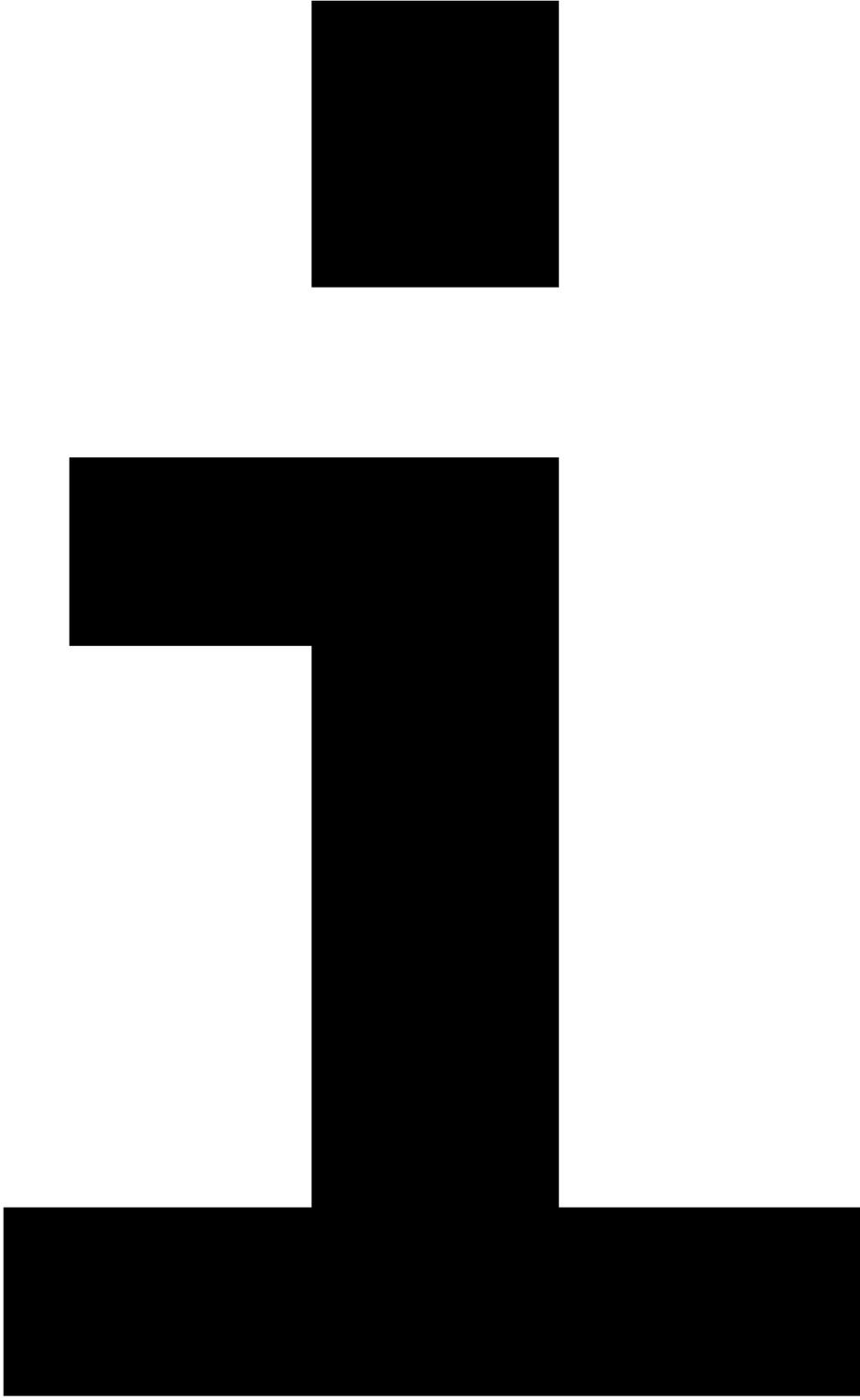
sa

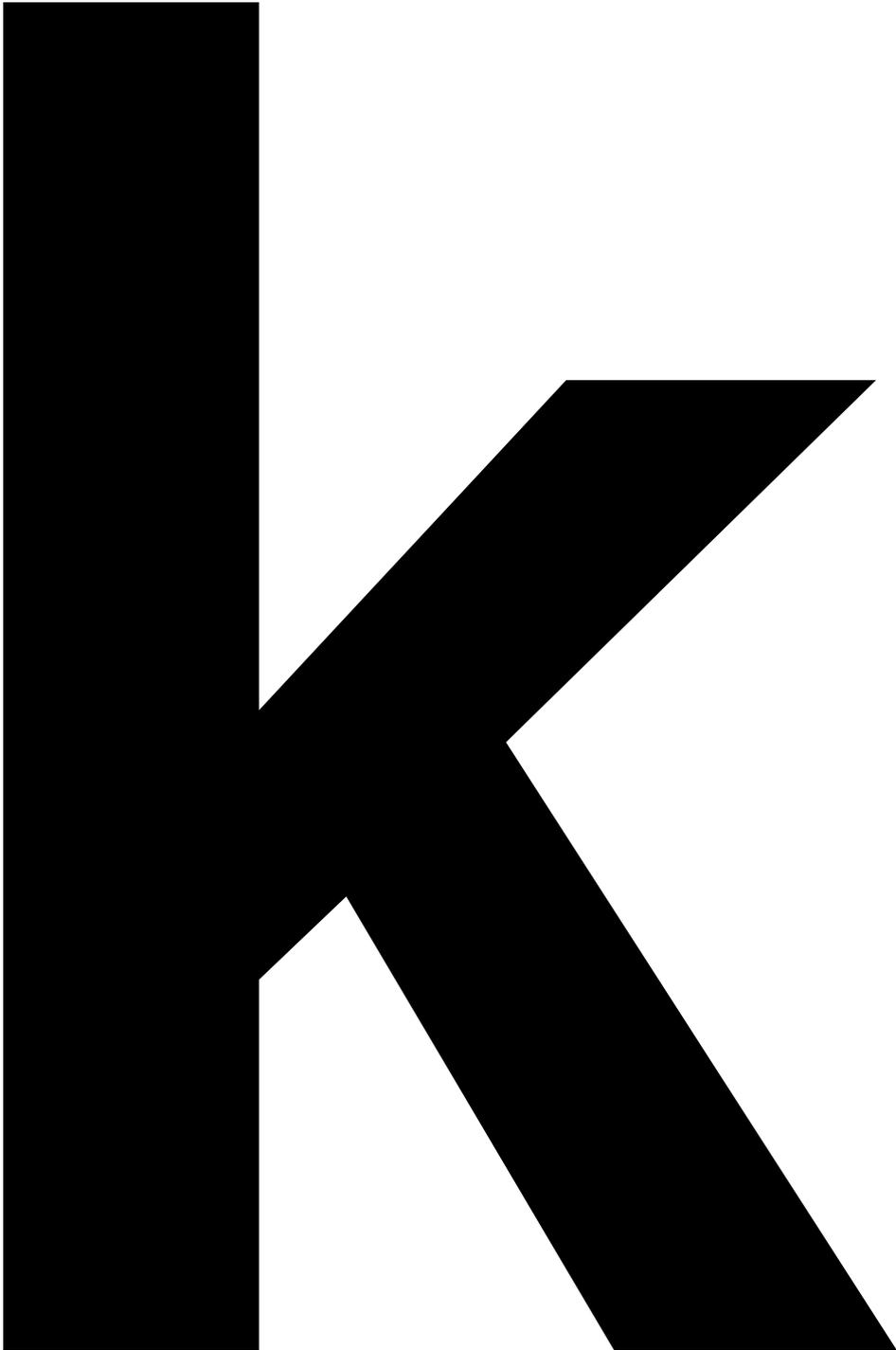




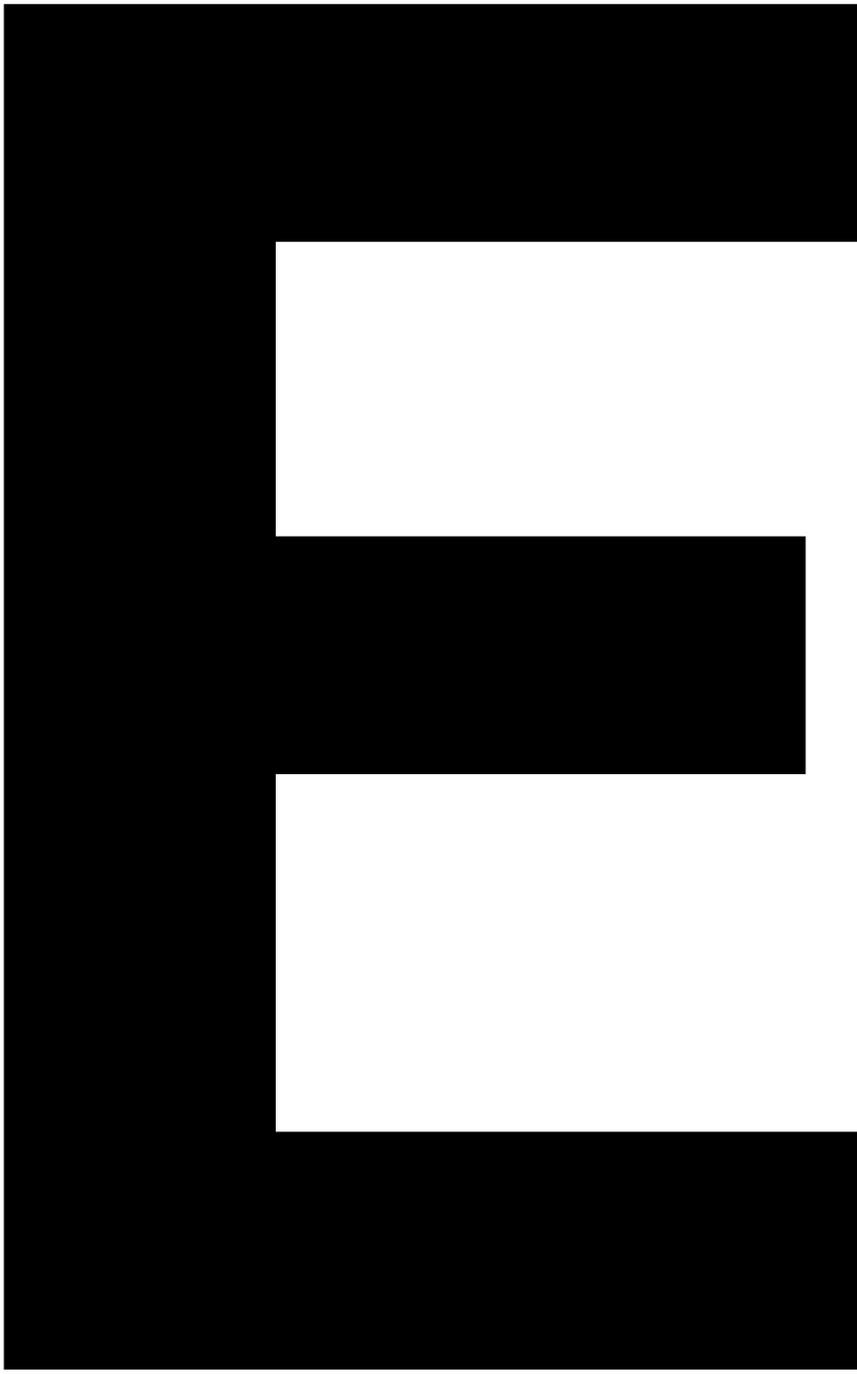
S

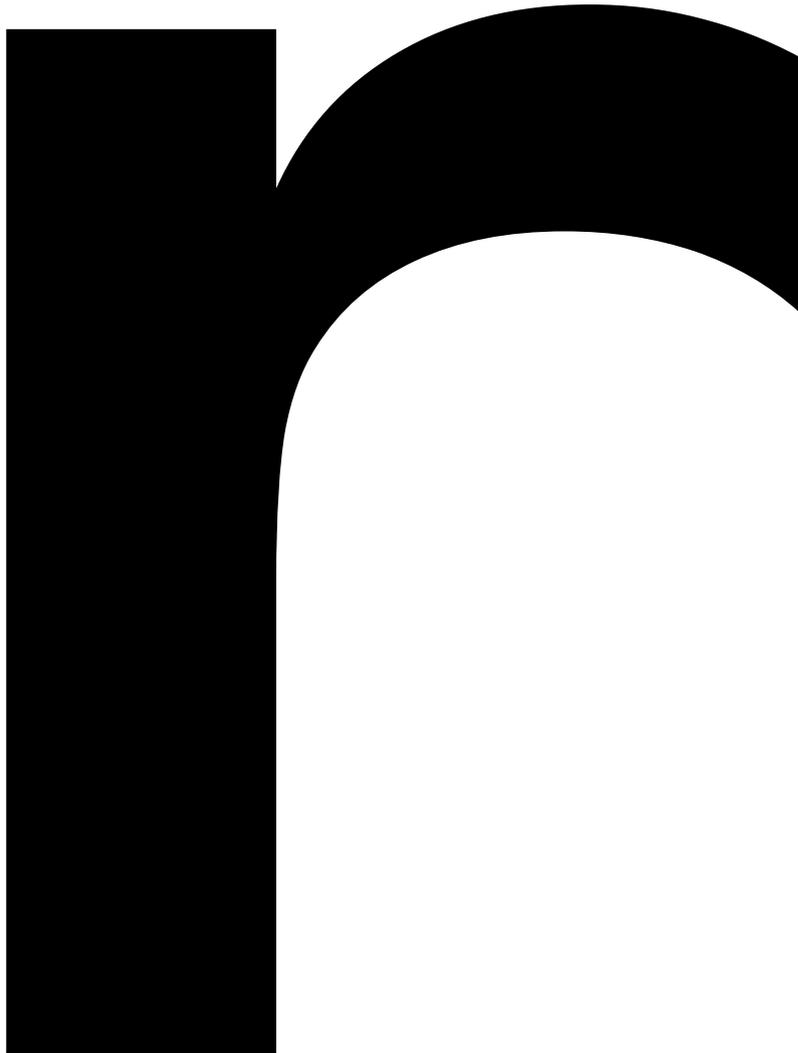










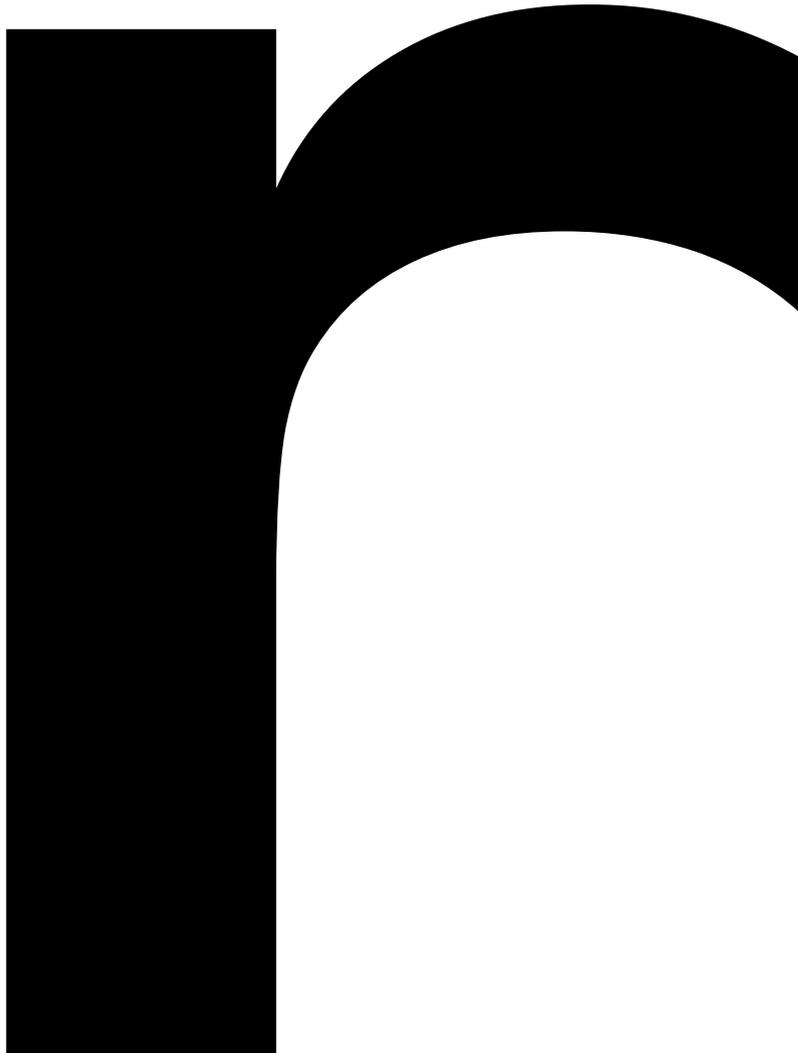


n

e

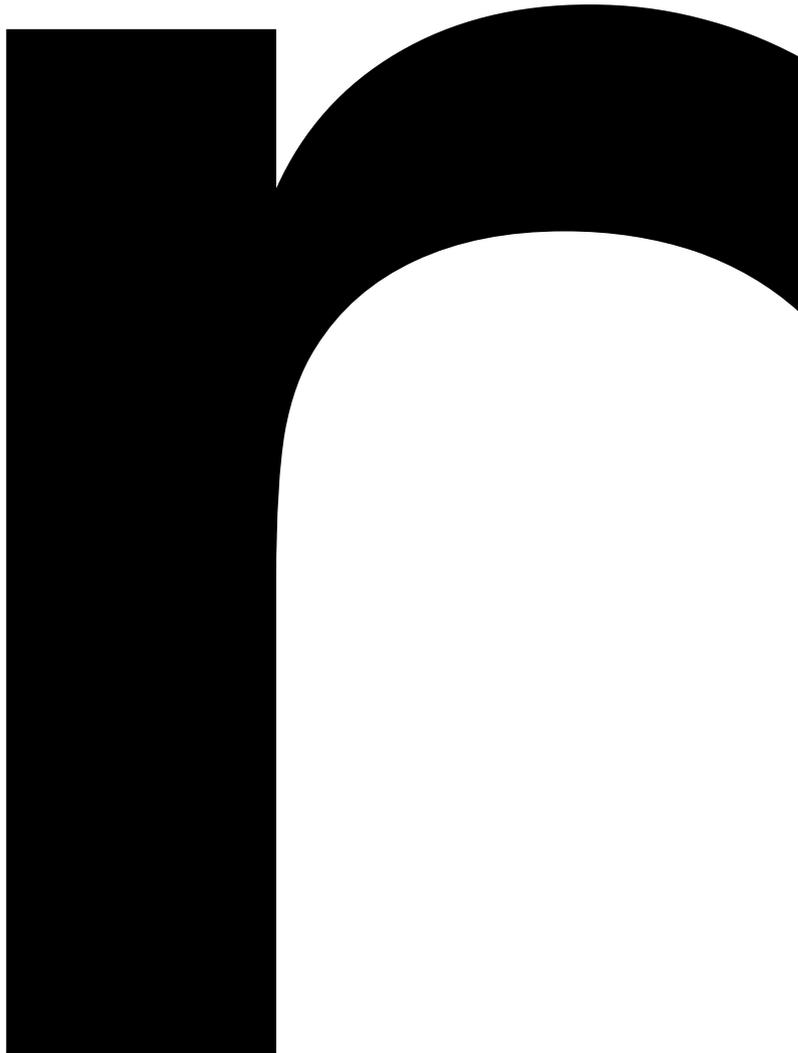
u

e

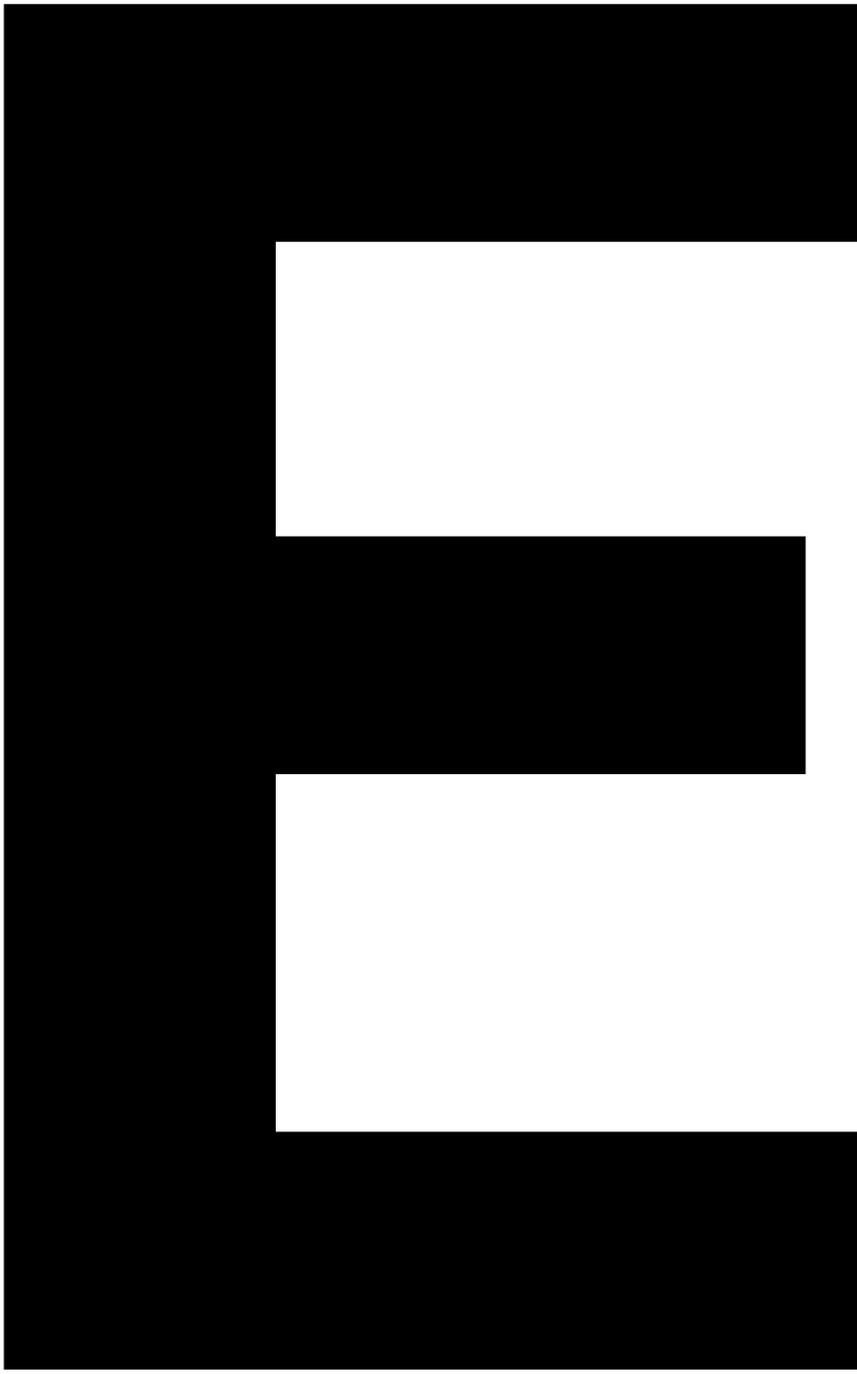


10

sa

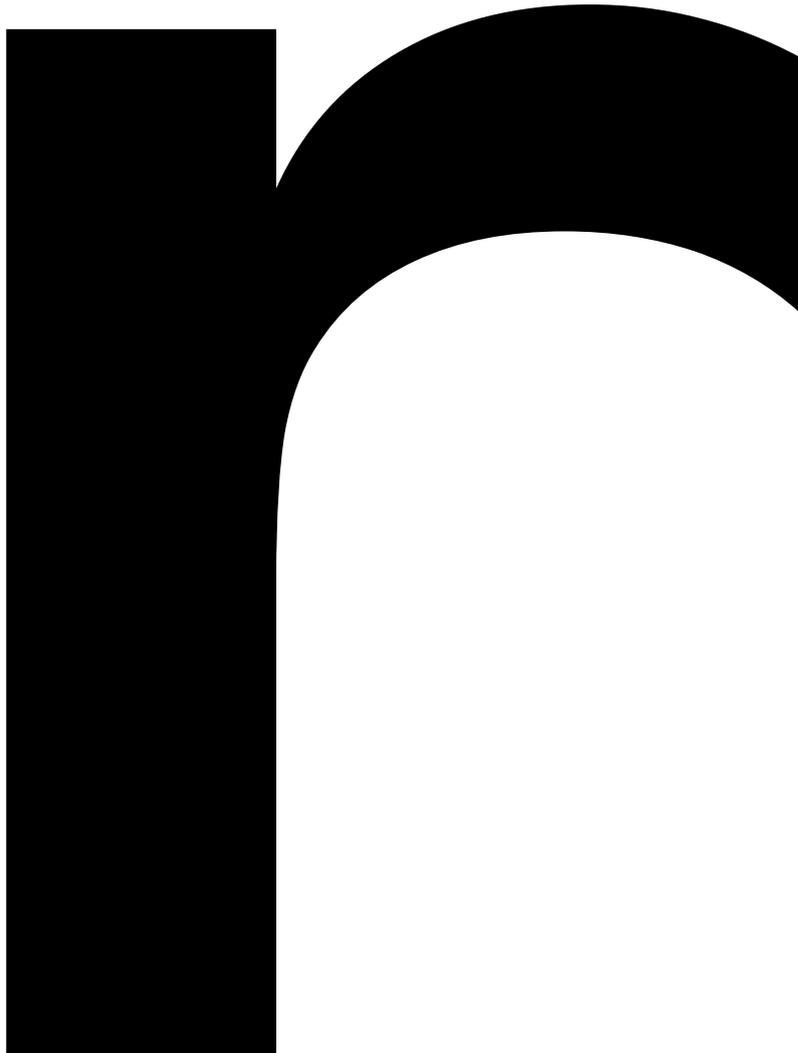


e

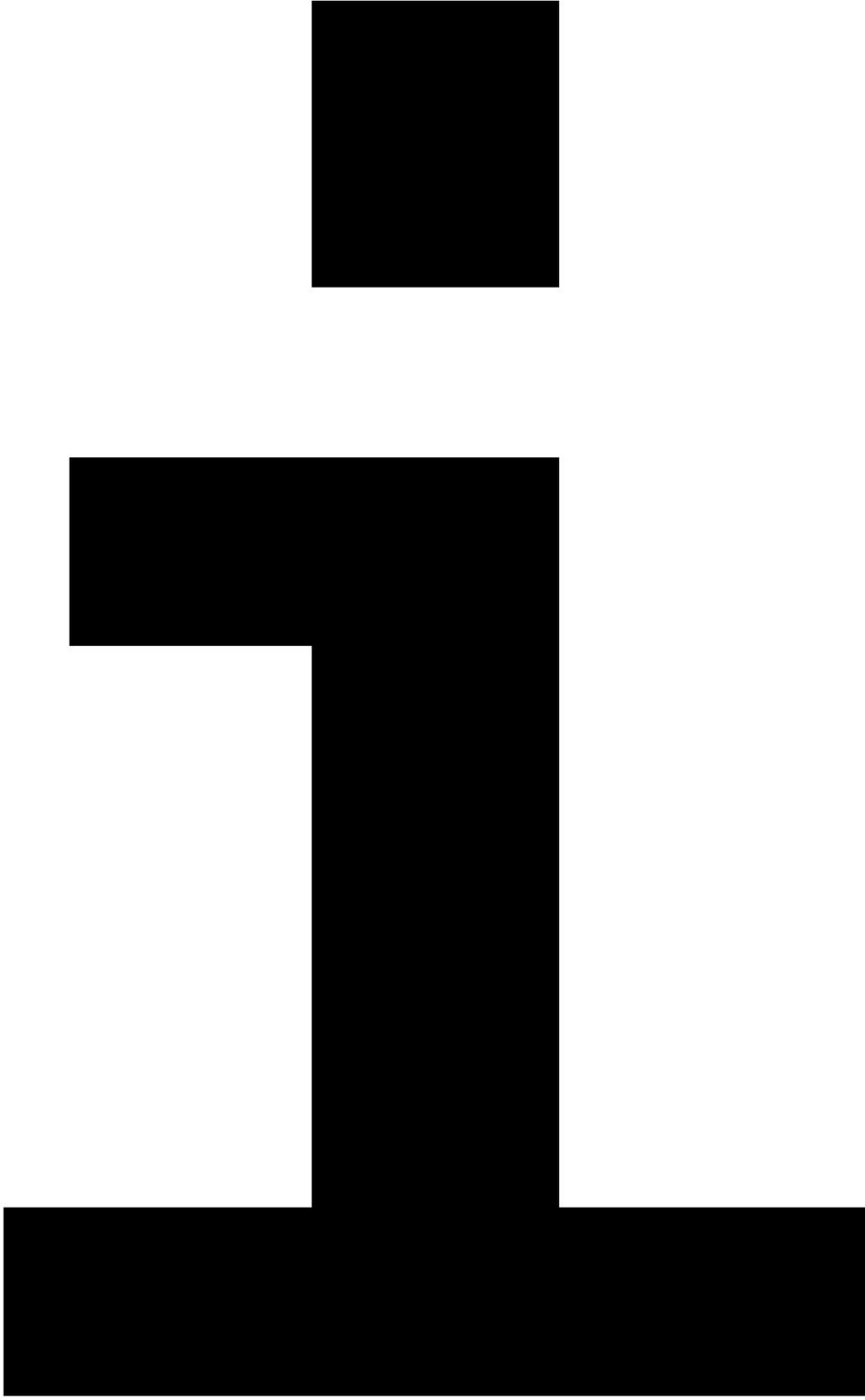


n

e

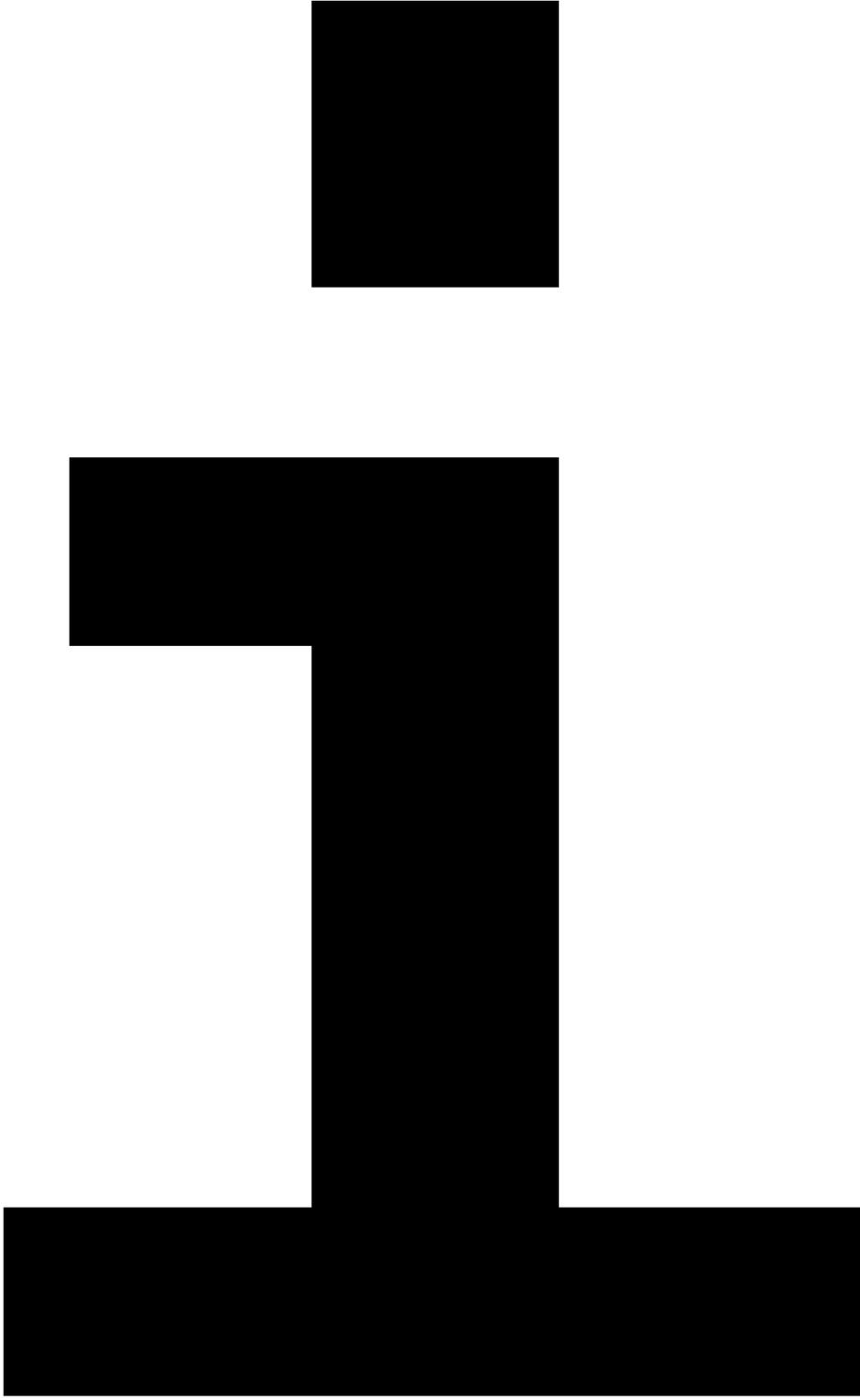


Q



e

n

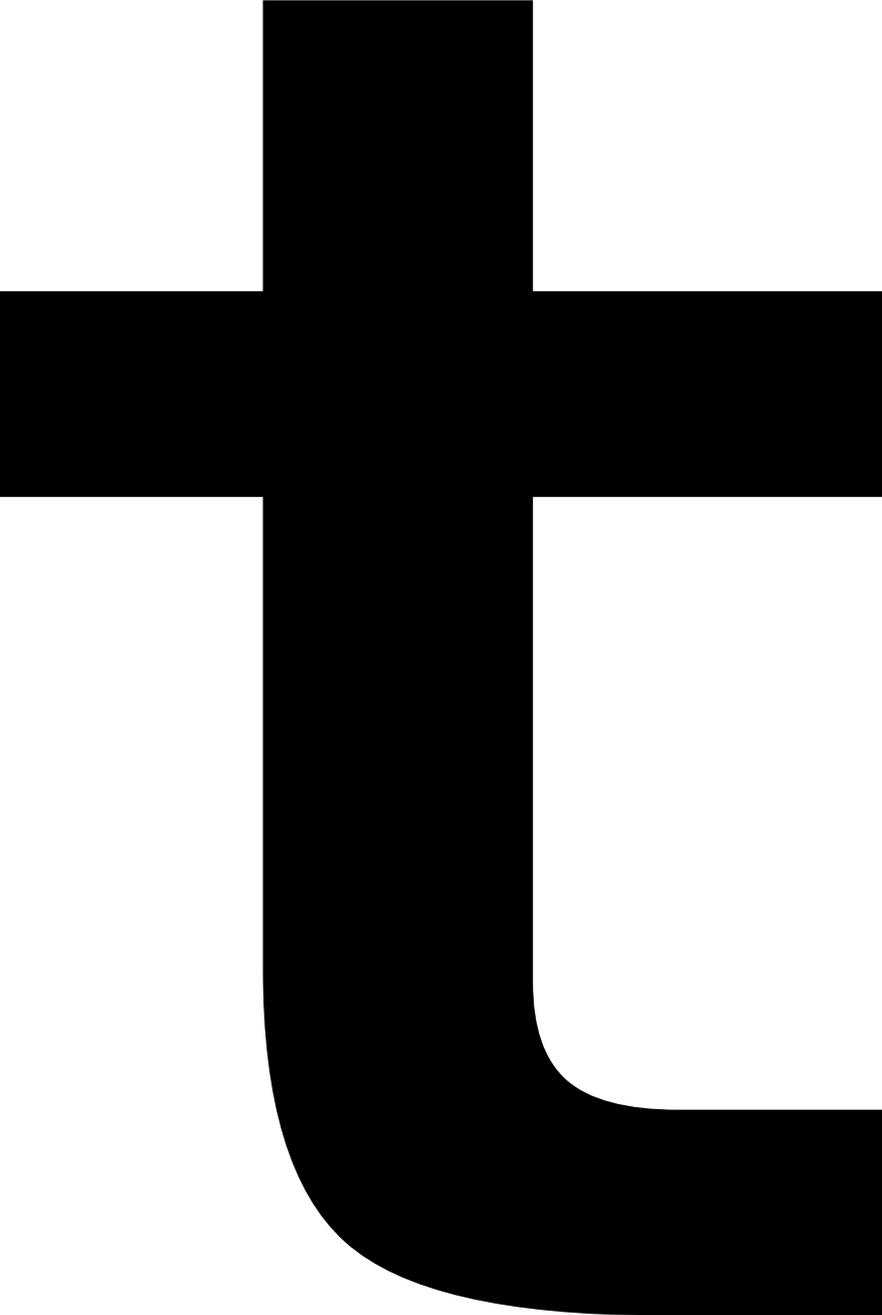


n

D

e

u



S

C

h

J

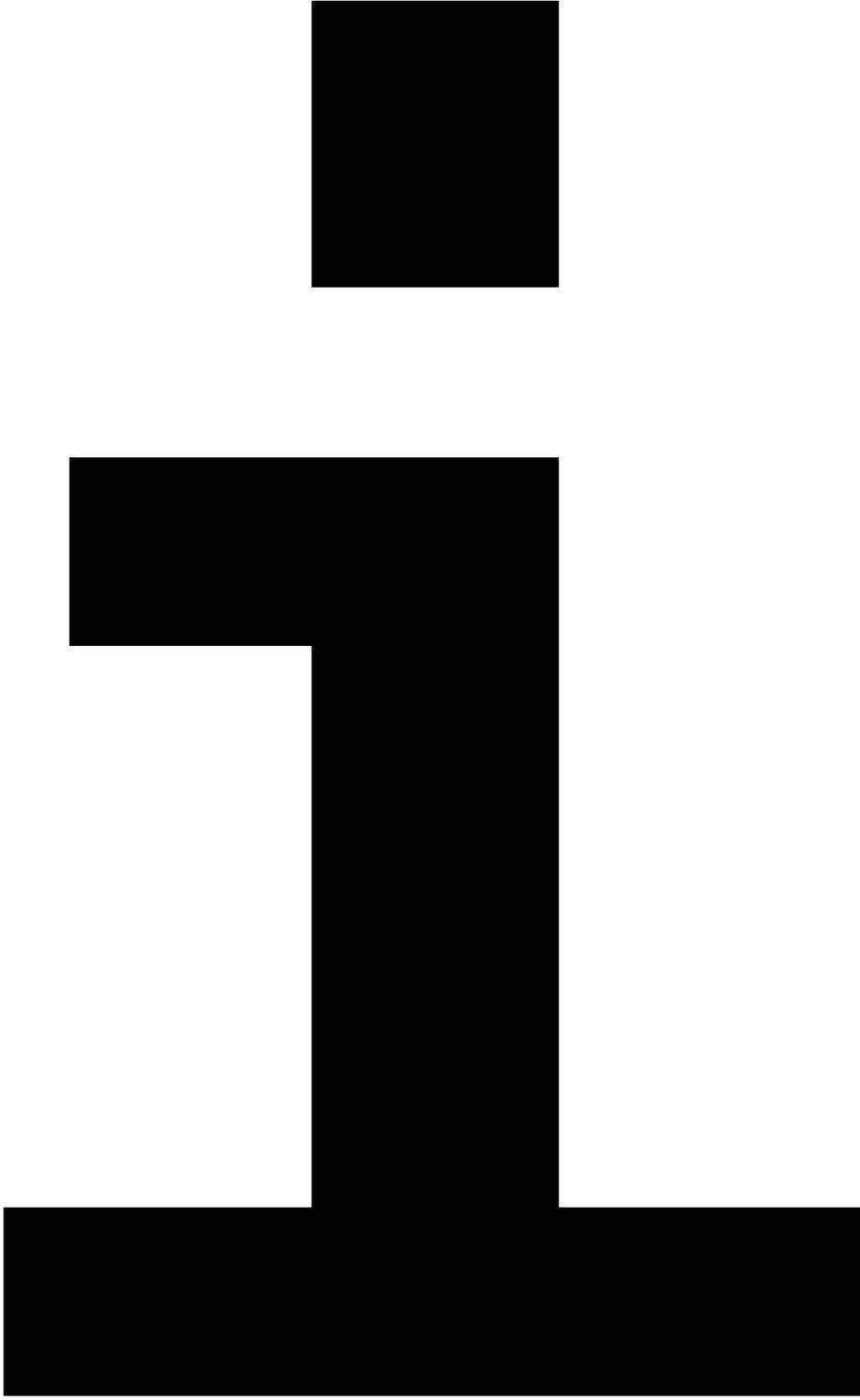
sa

n

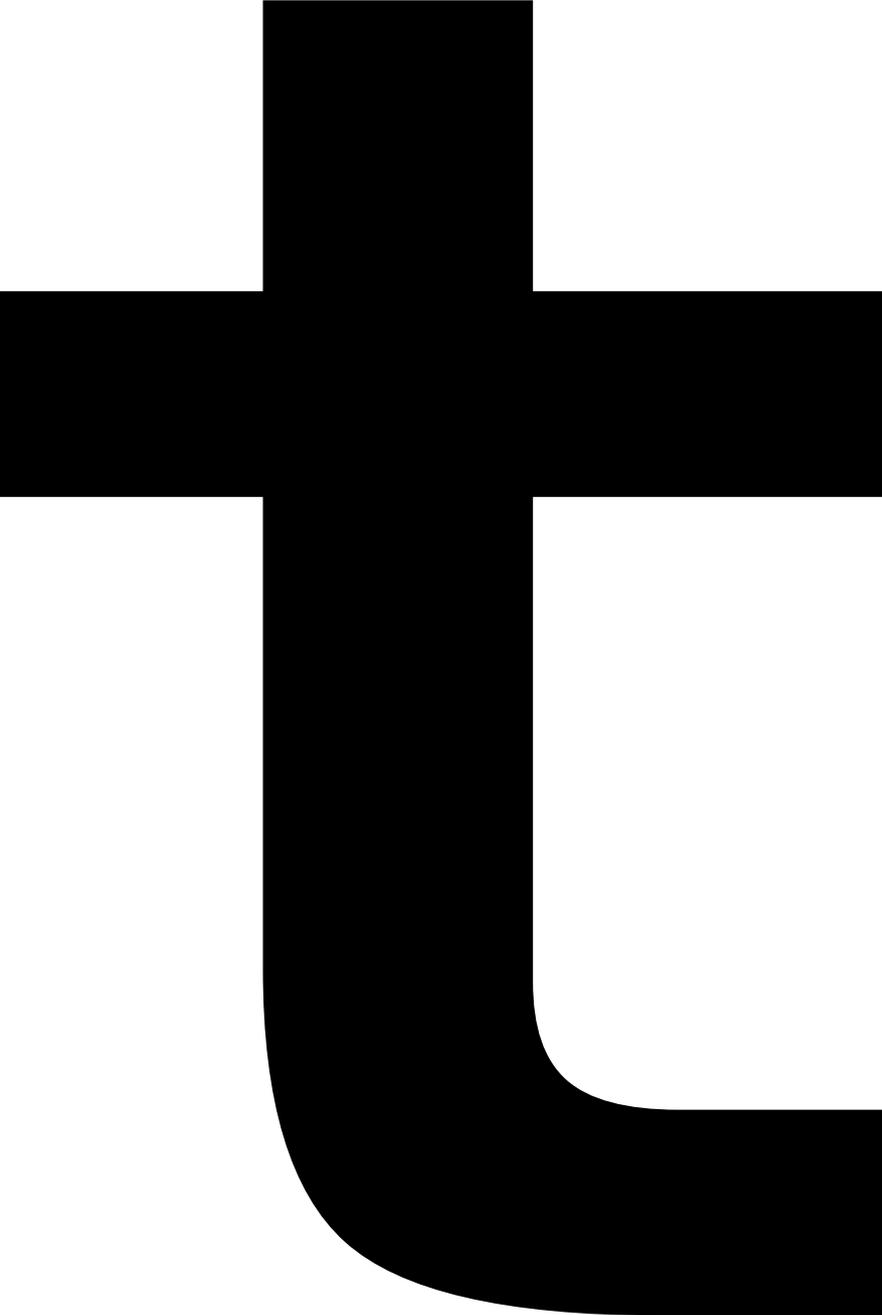
Q



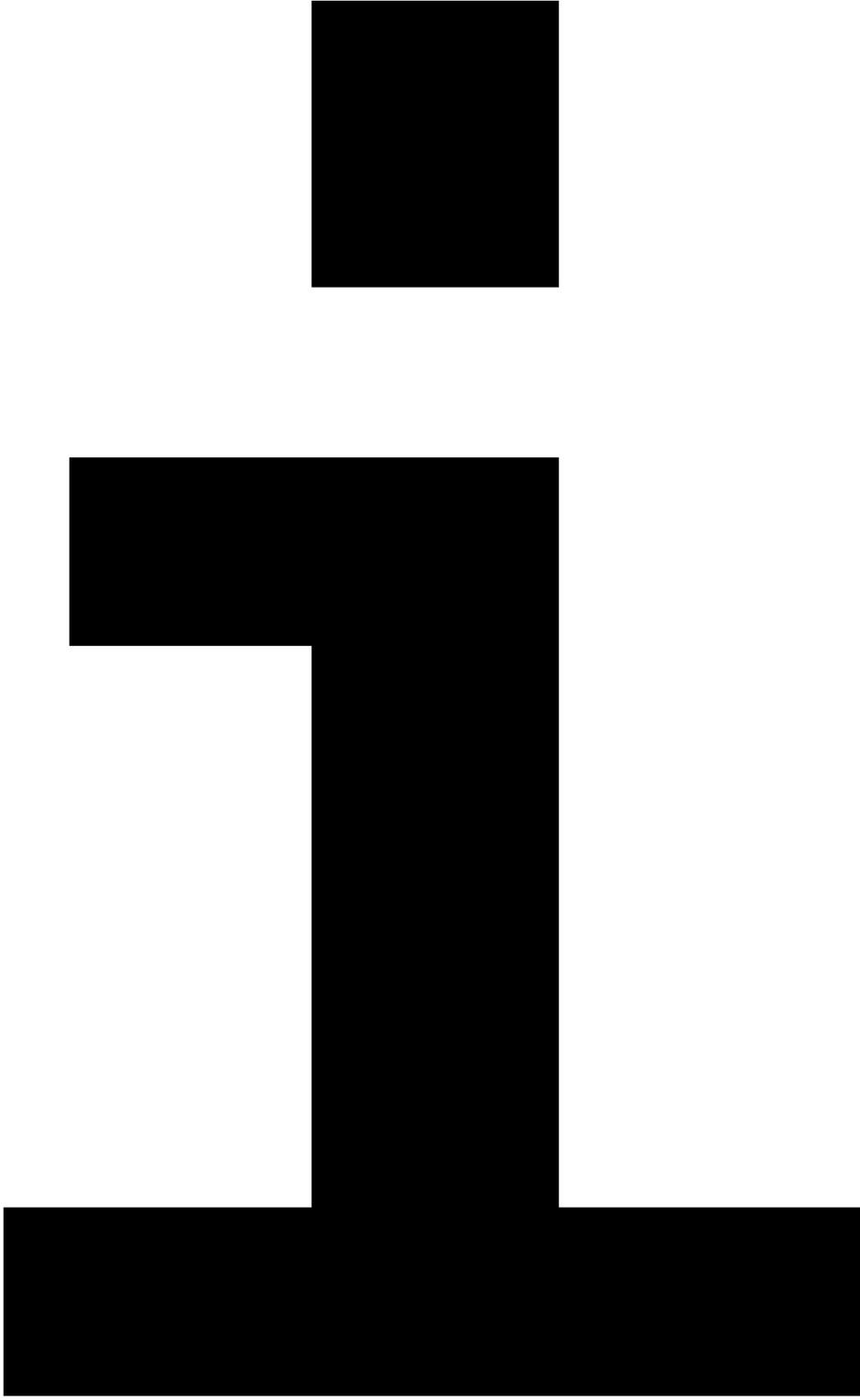
Q



10



Q



e

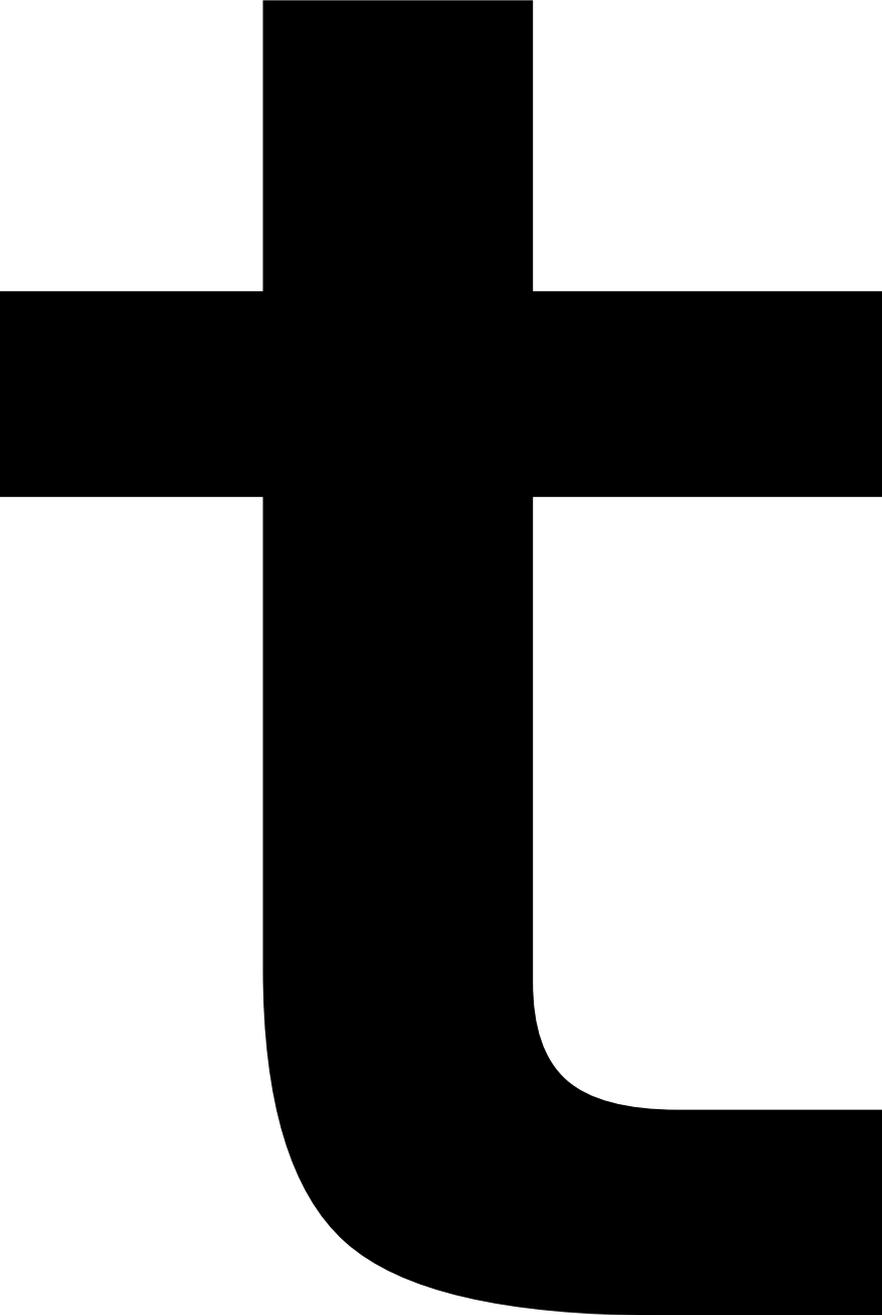
G

e

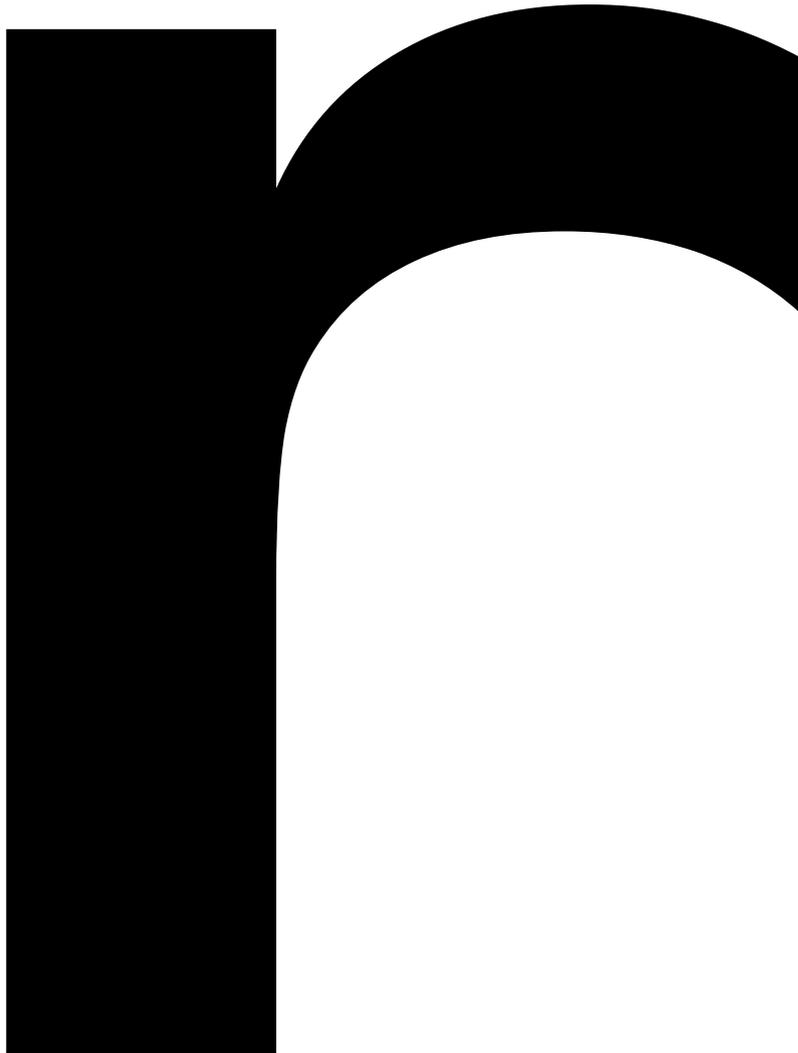
S

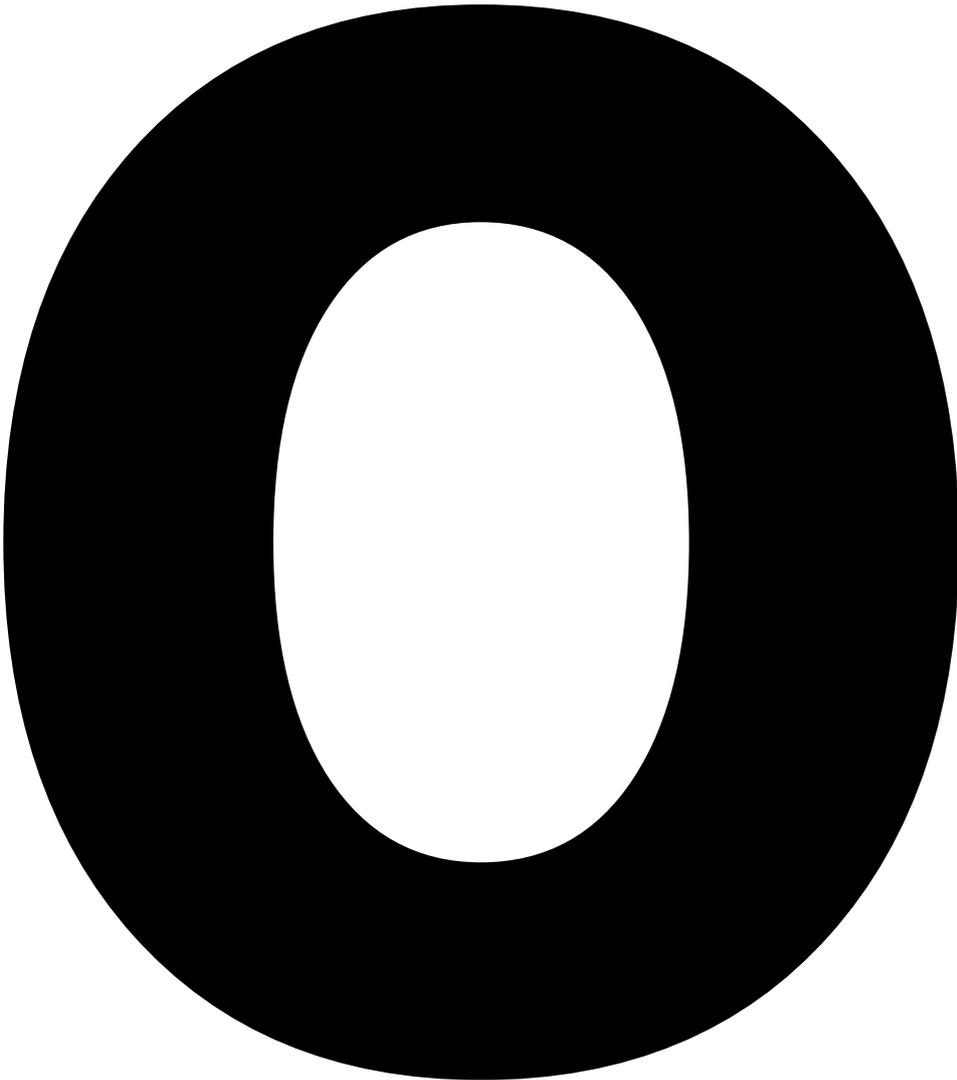
sa

m



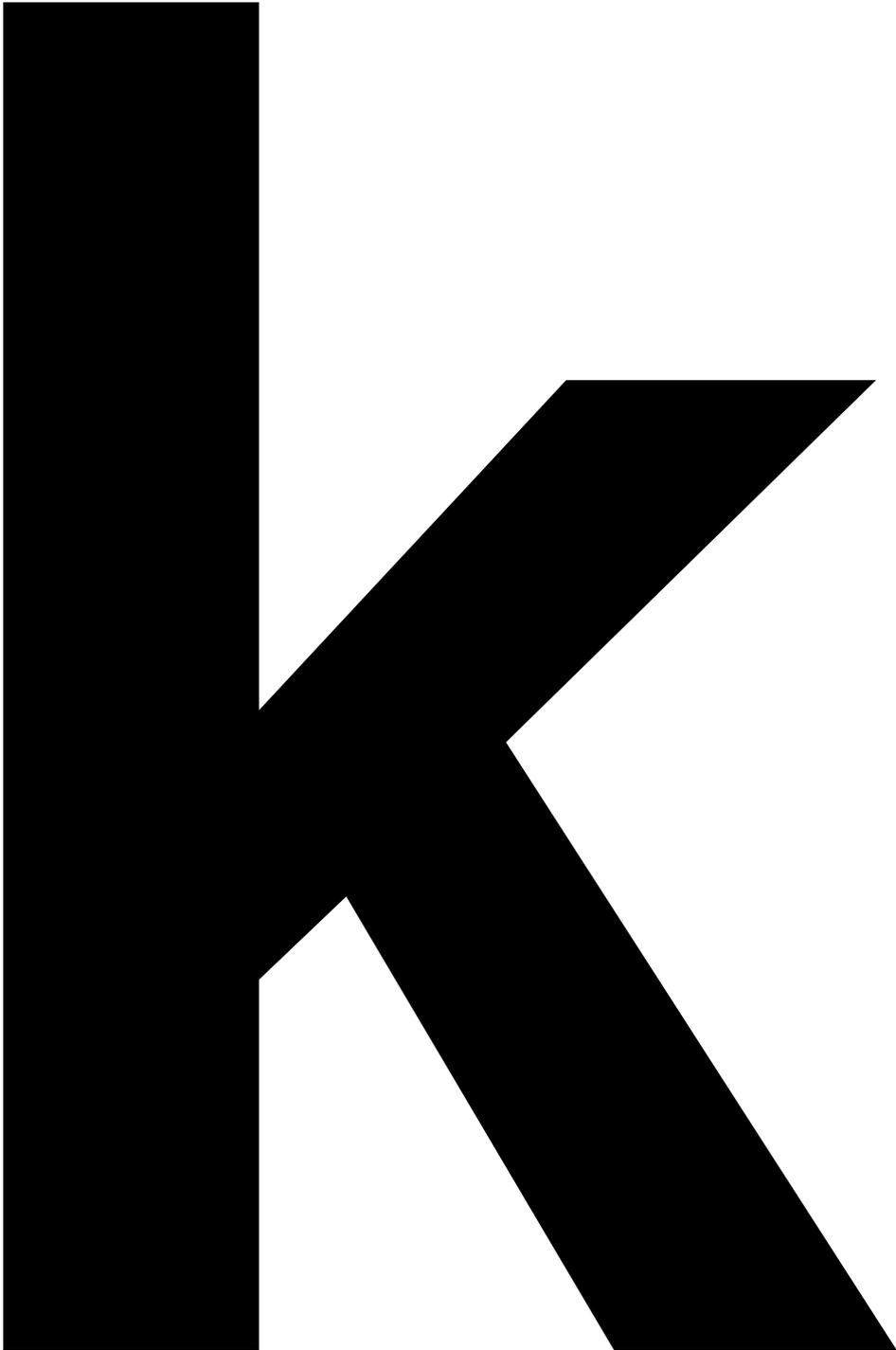
o

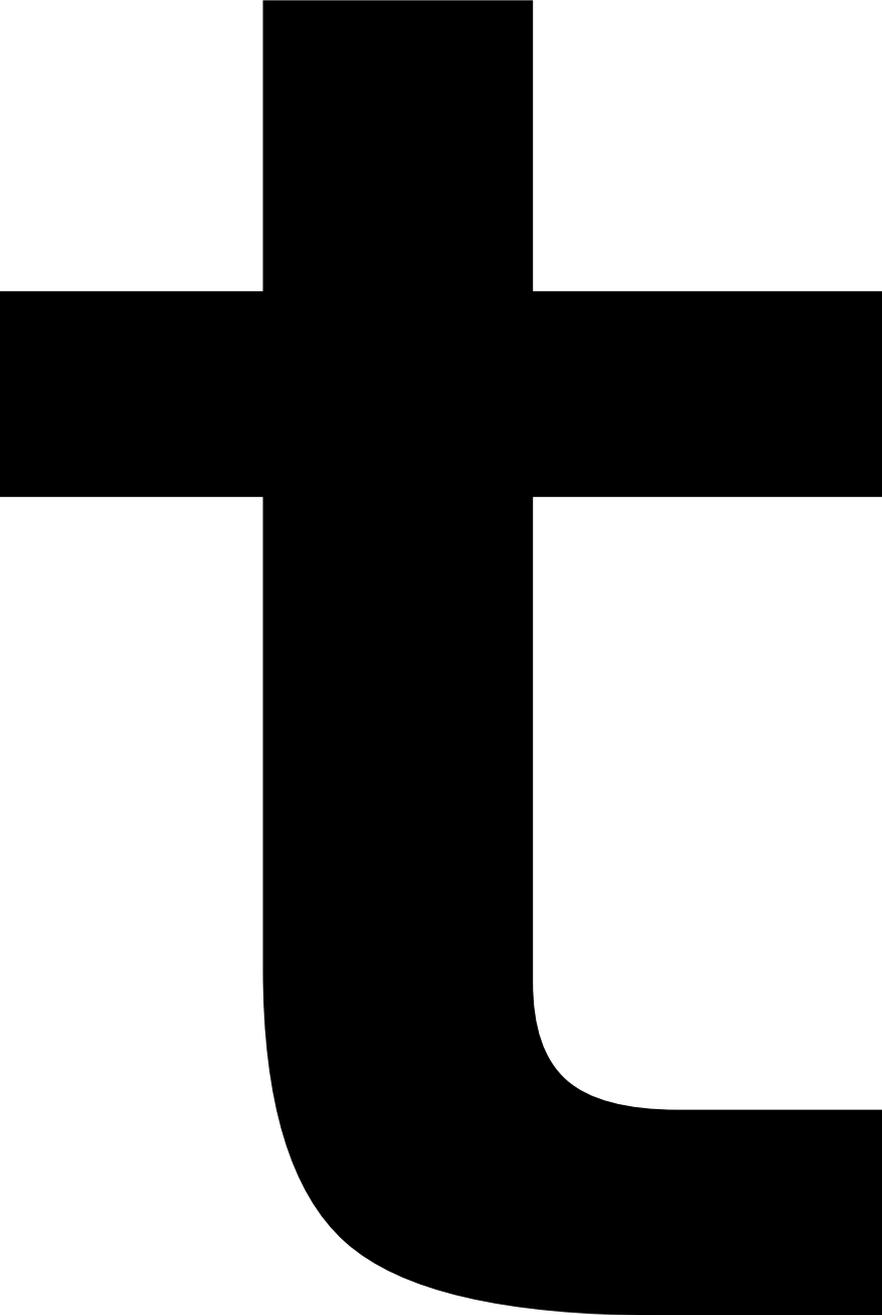


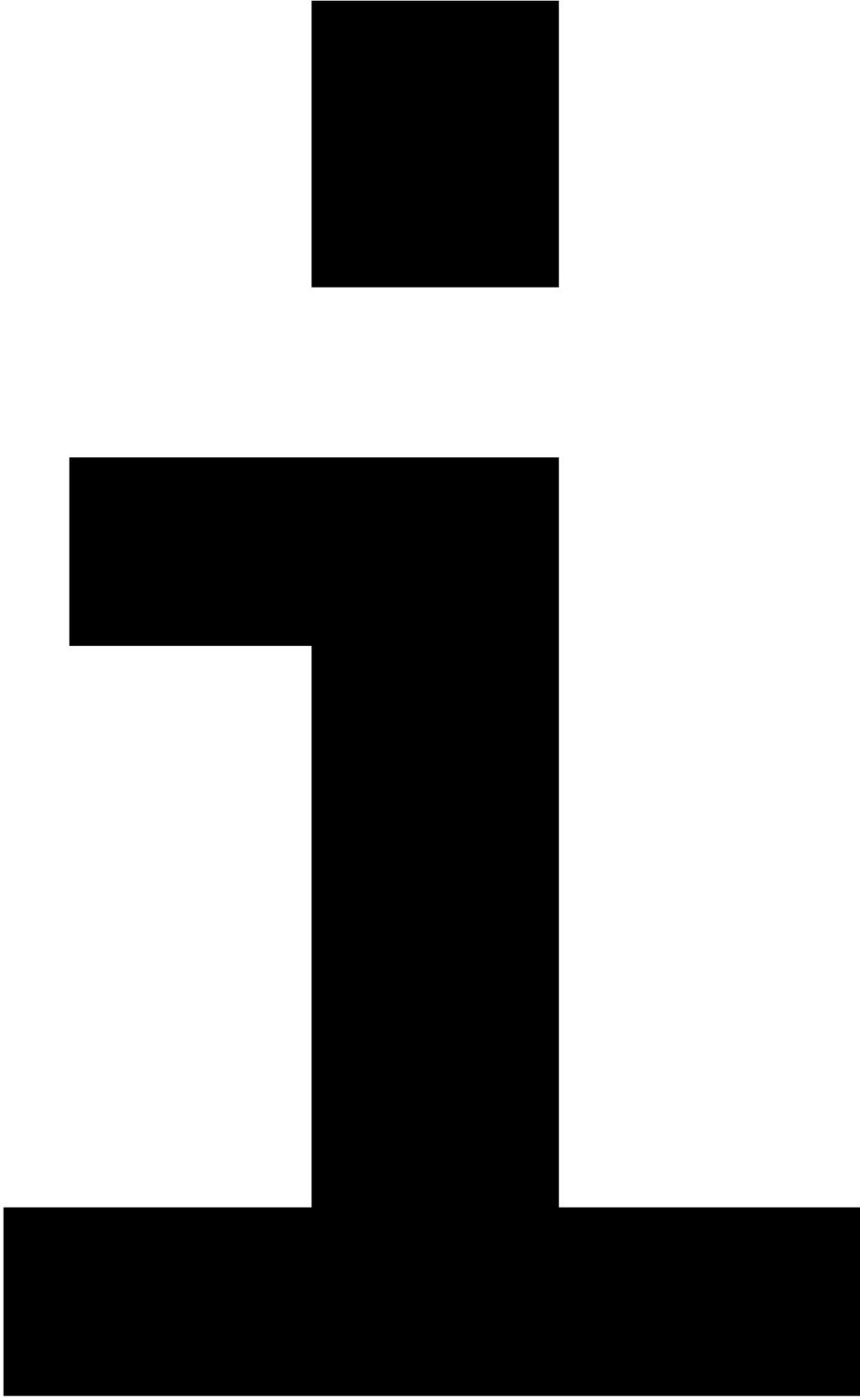


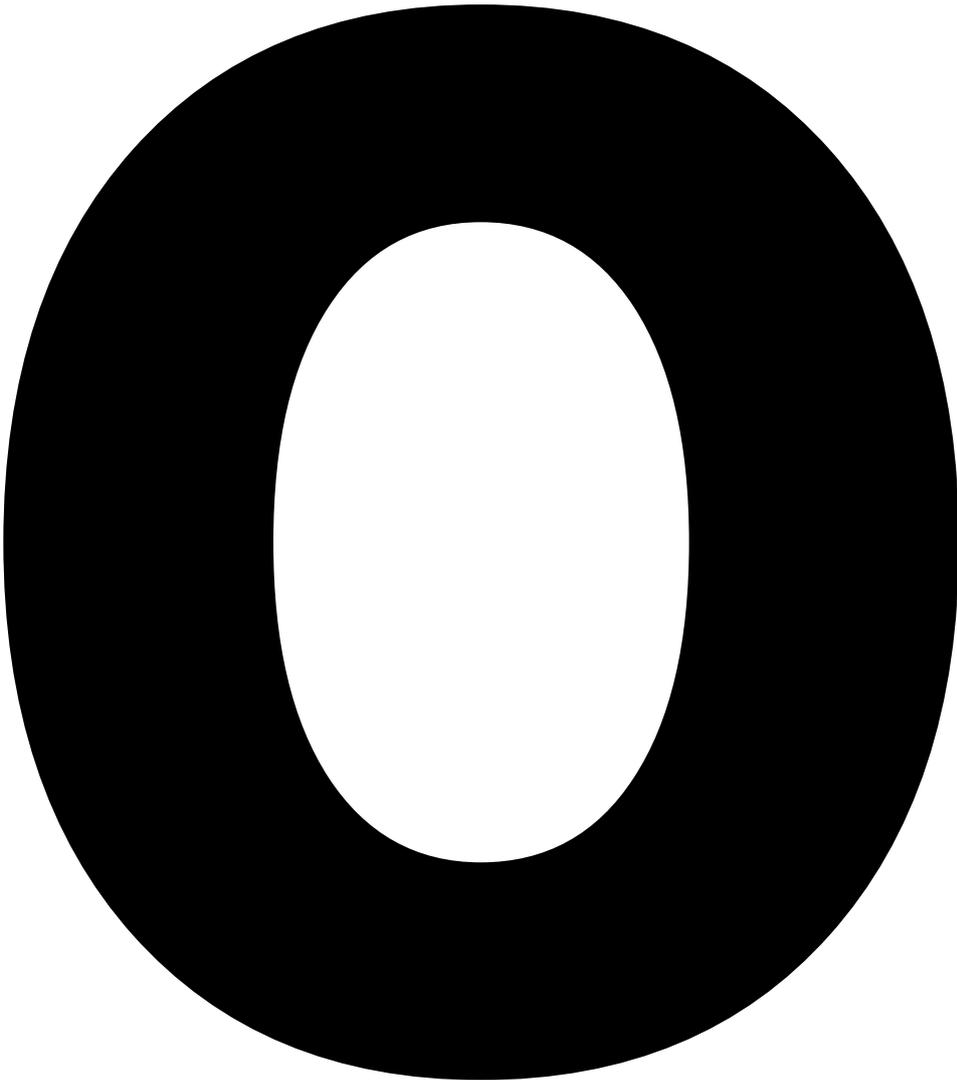
Q

u







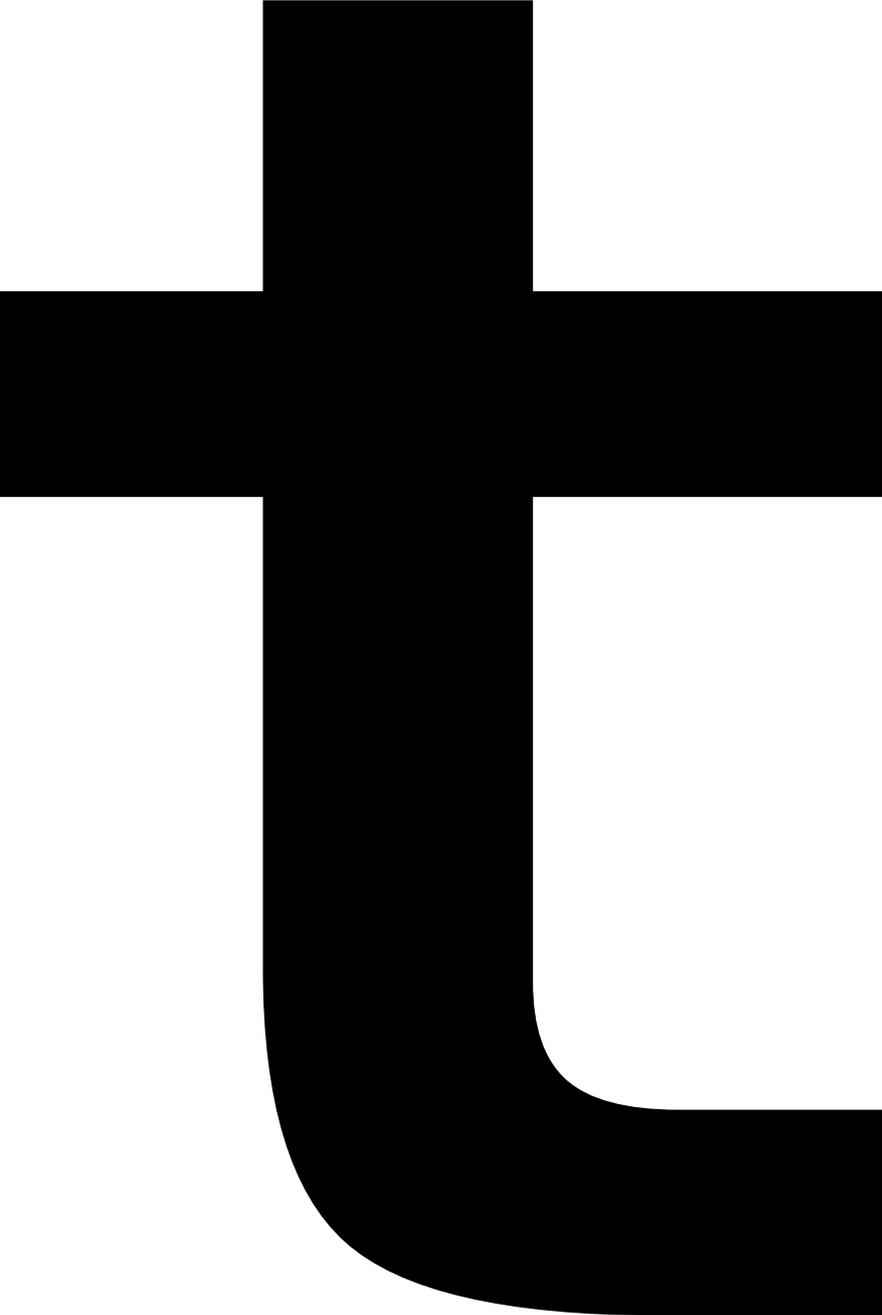


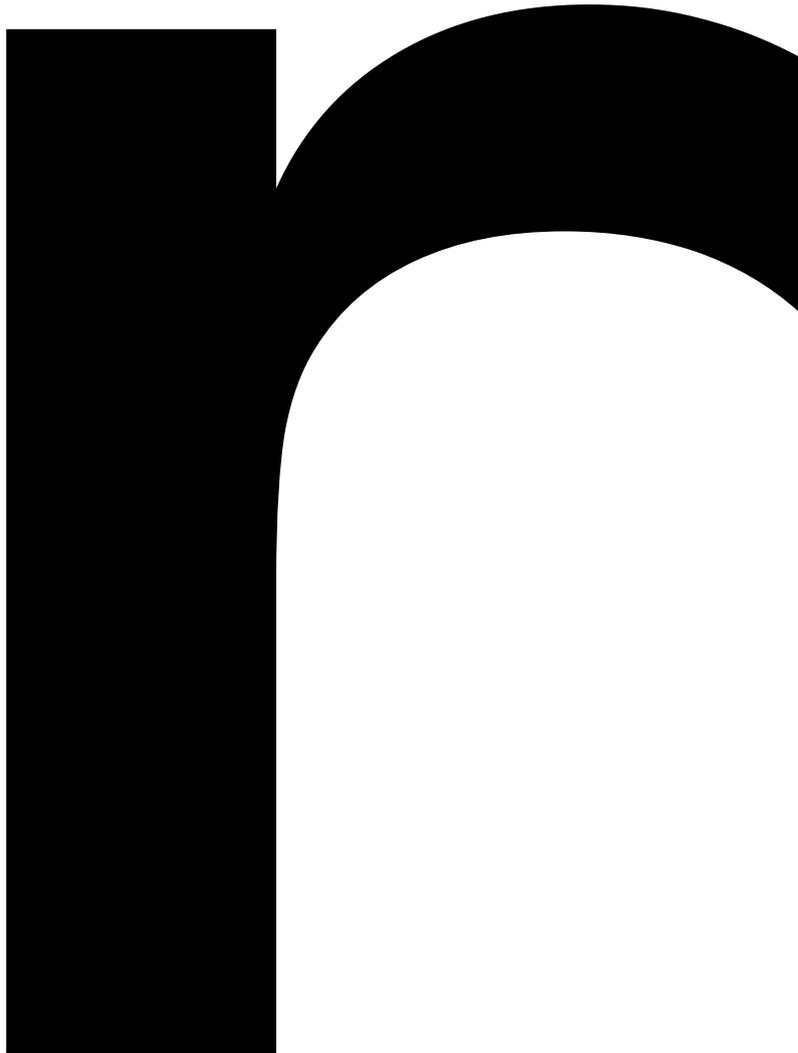
n

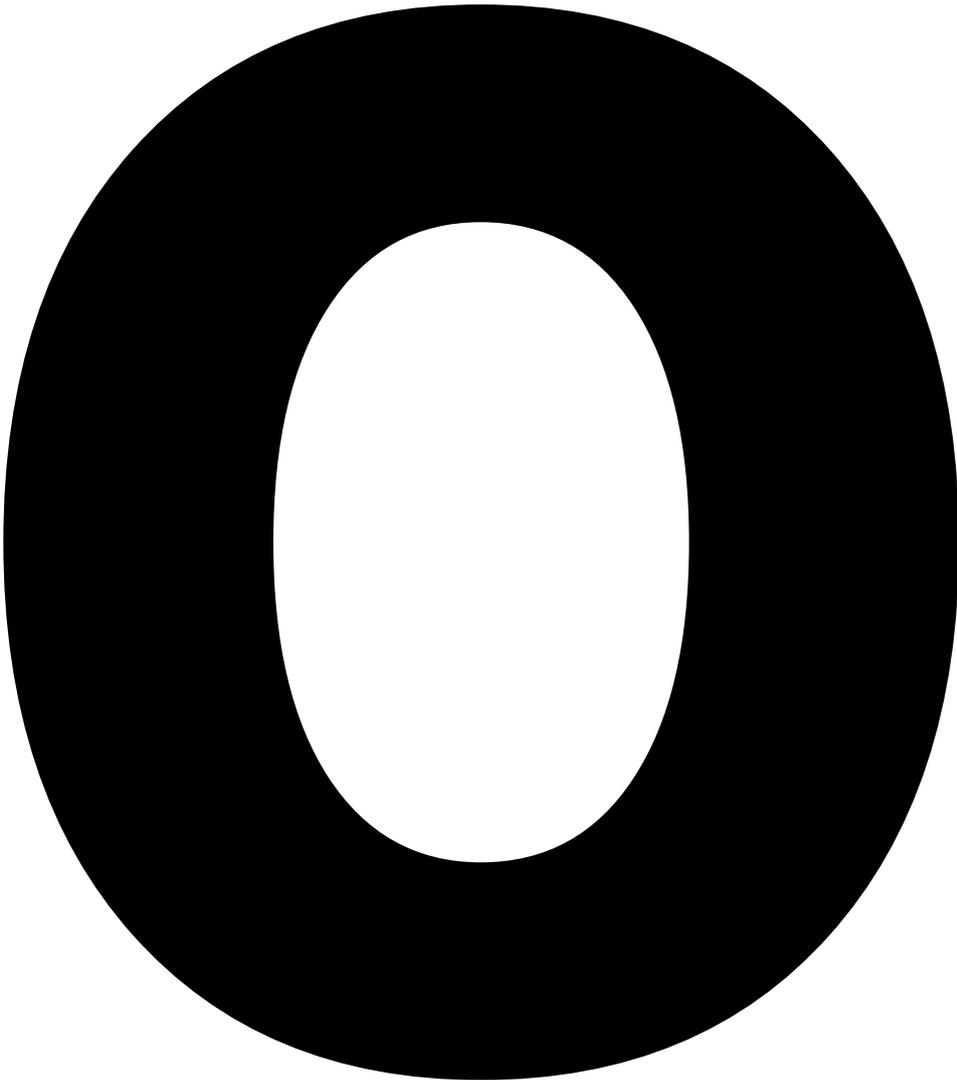
sa

n

S







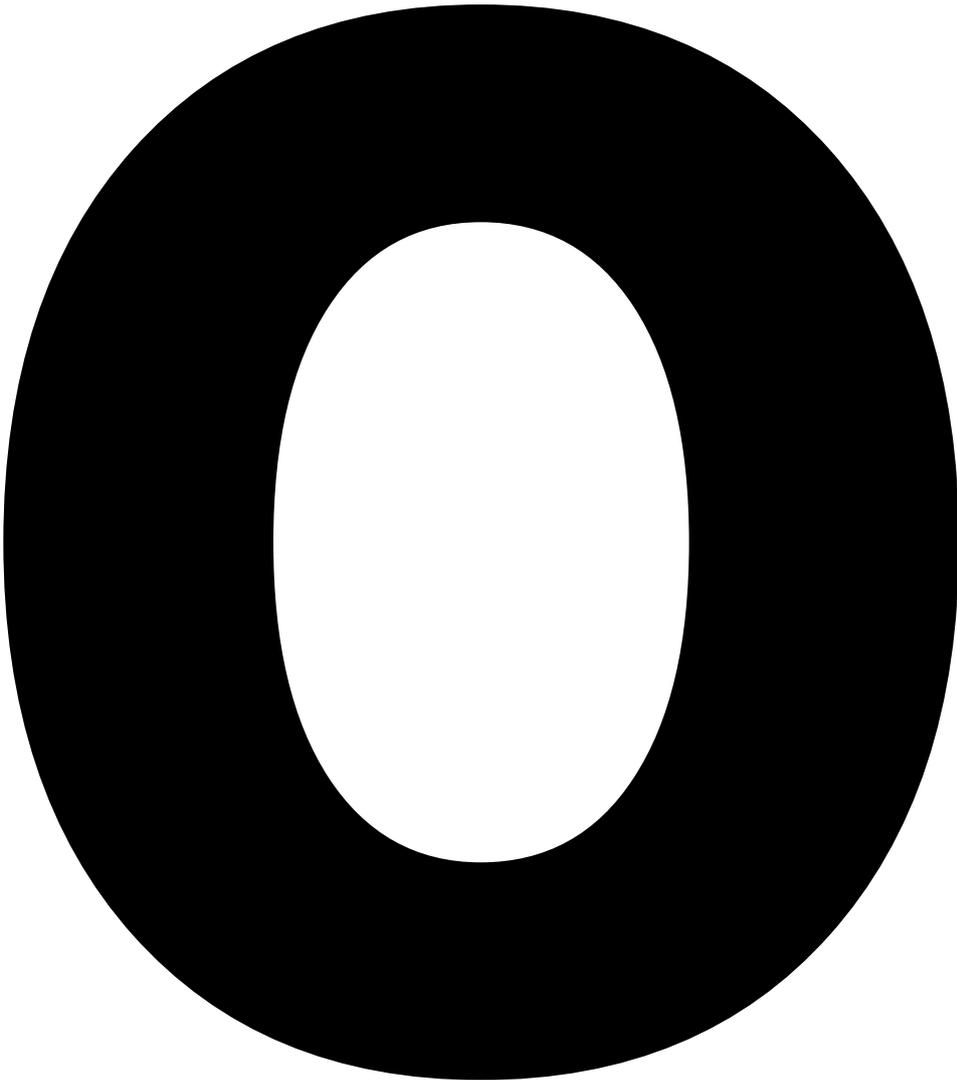
m

sa

u

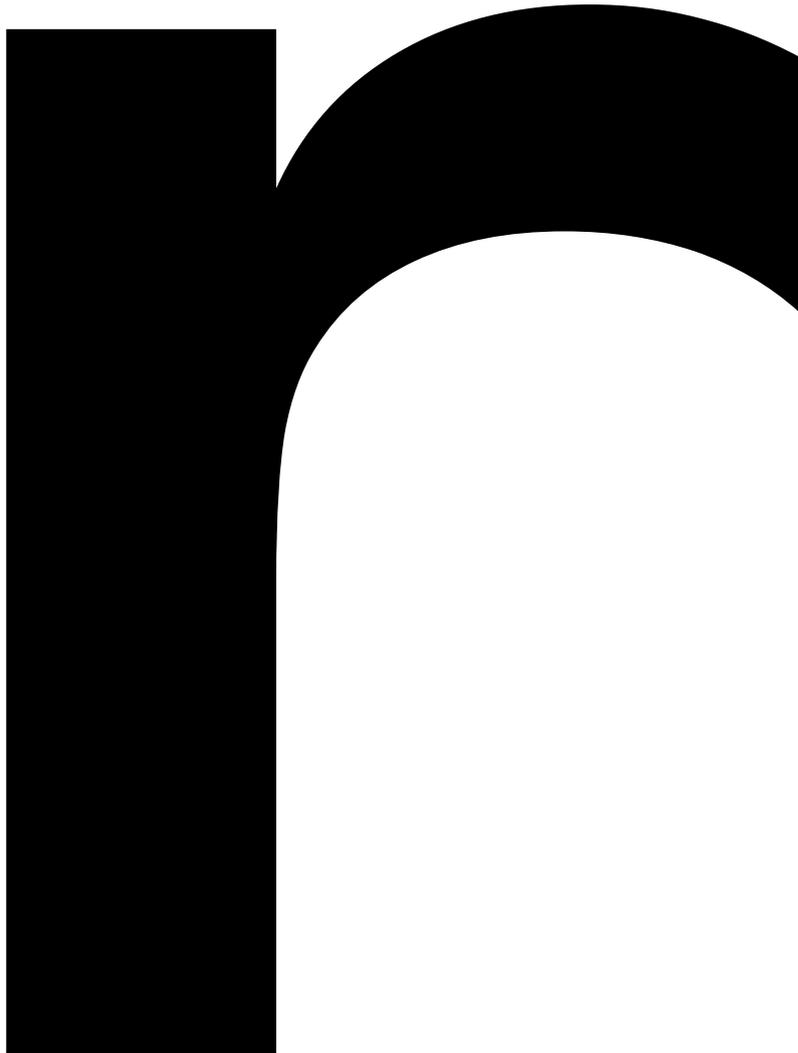
S

S



J

sa



sa

n

J

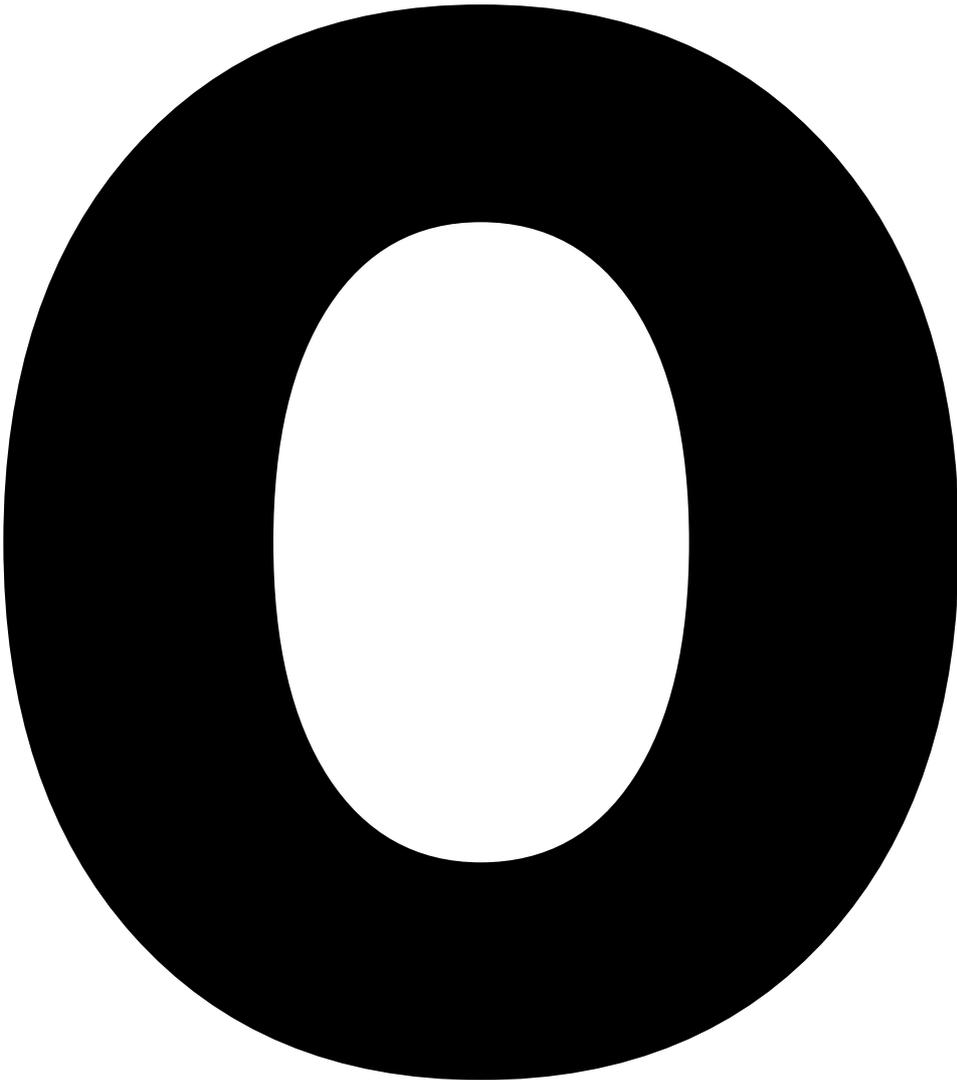
sa

Q

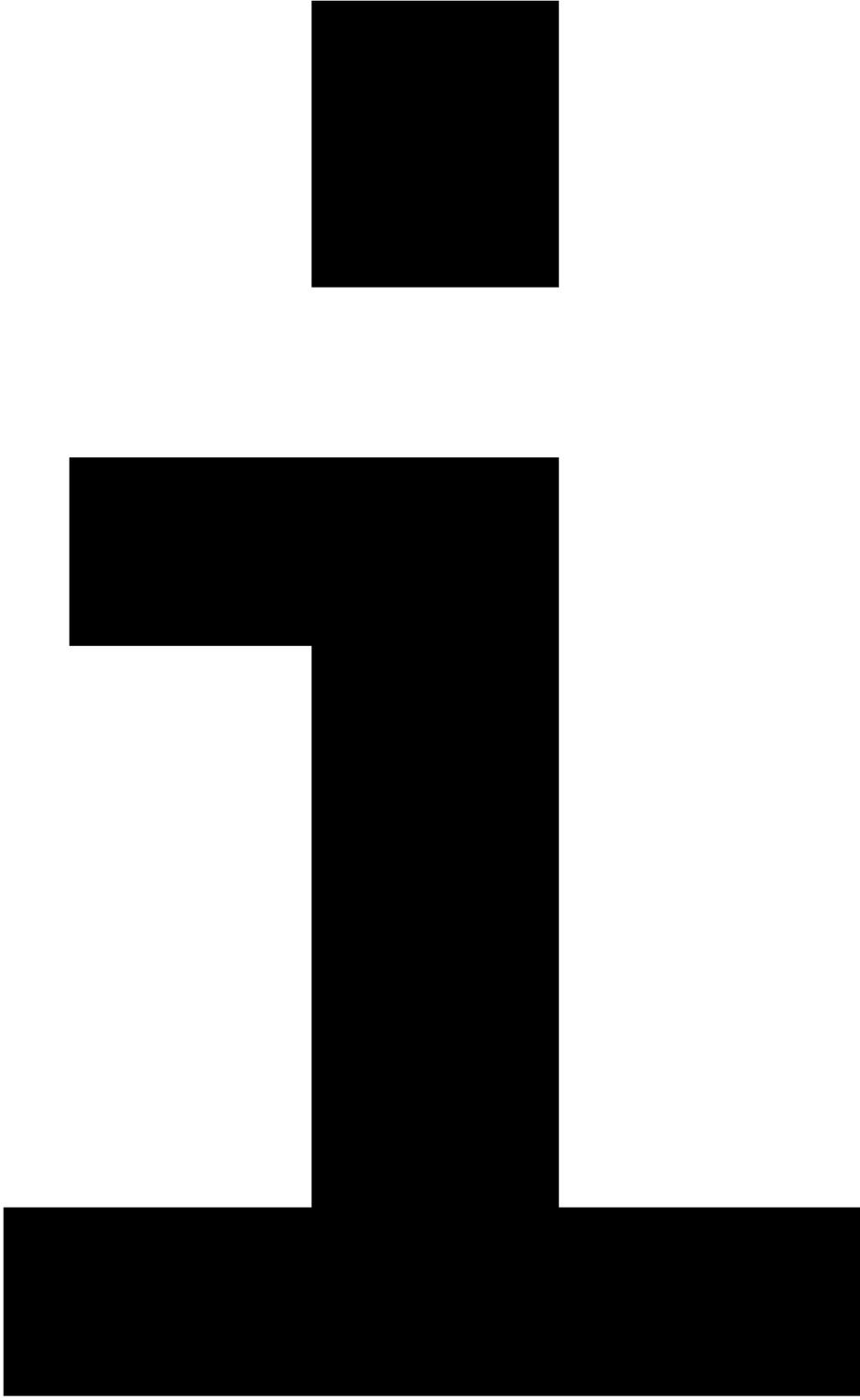
e

n

S

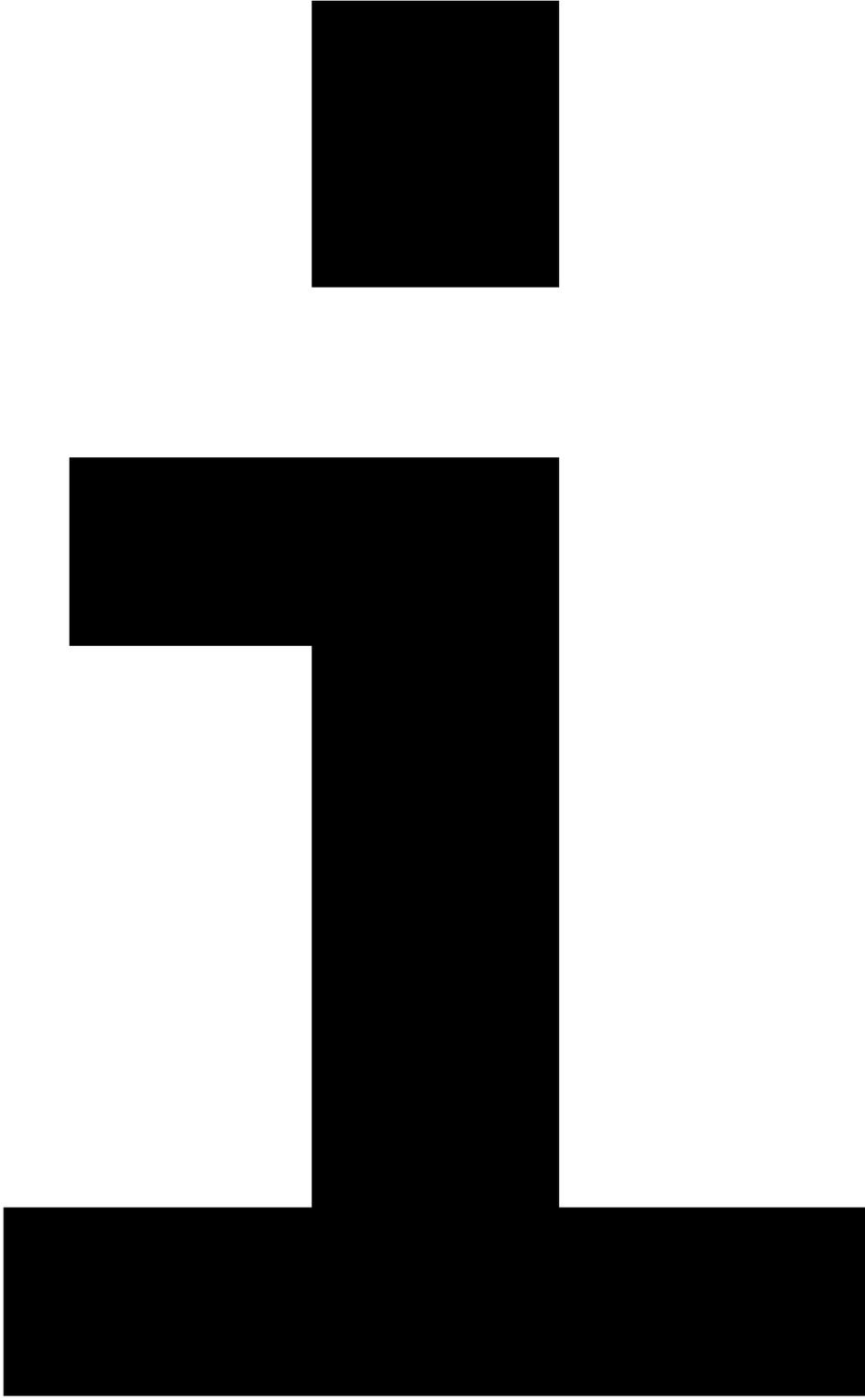


w

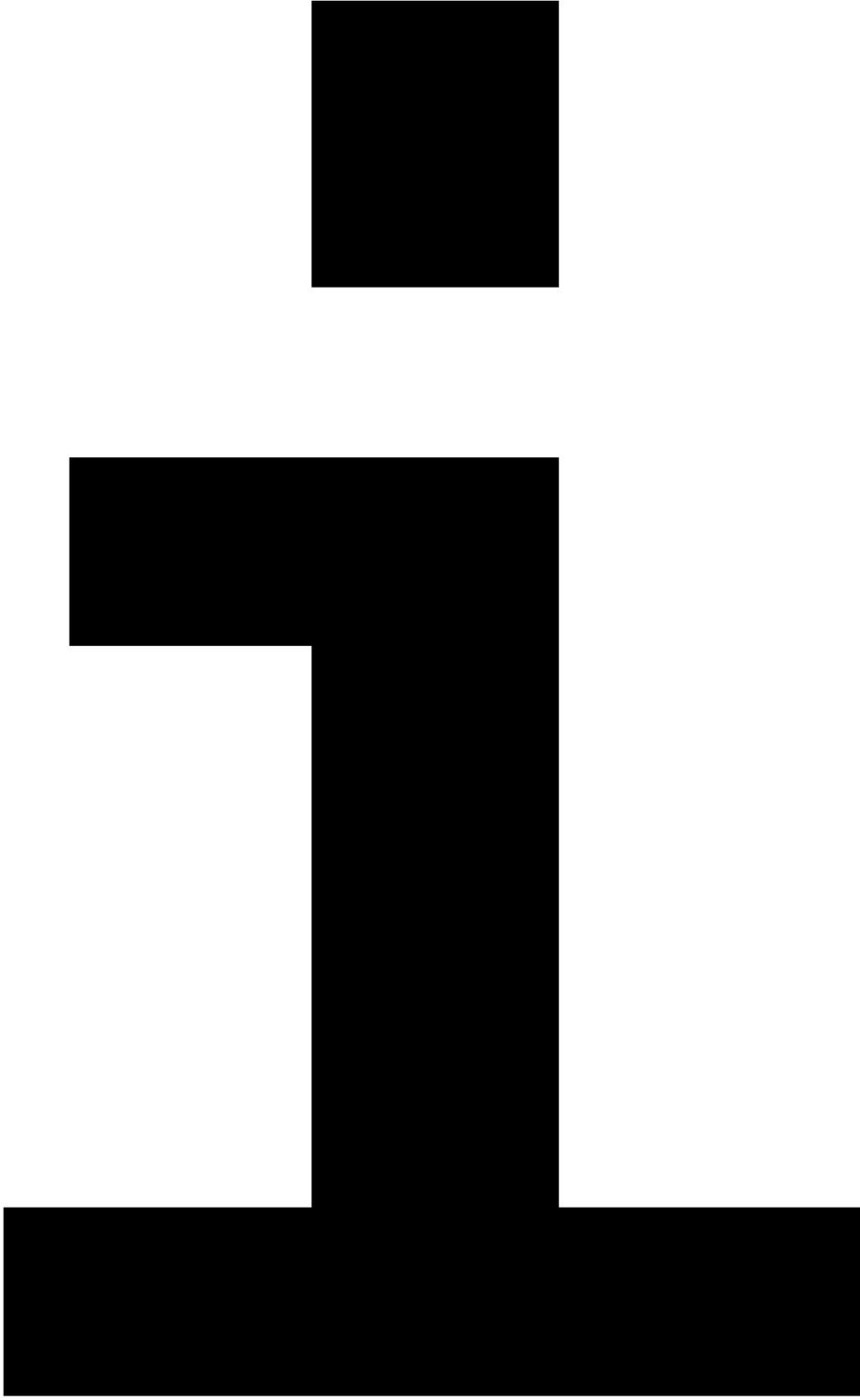


e

Q

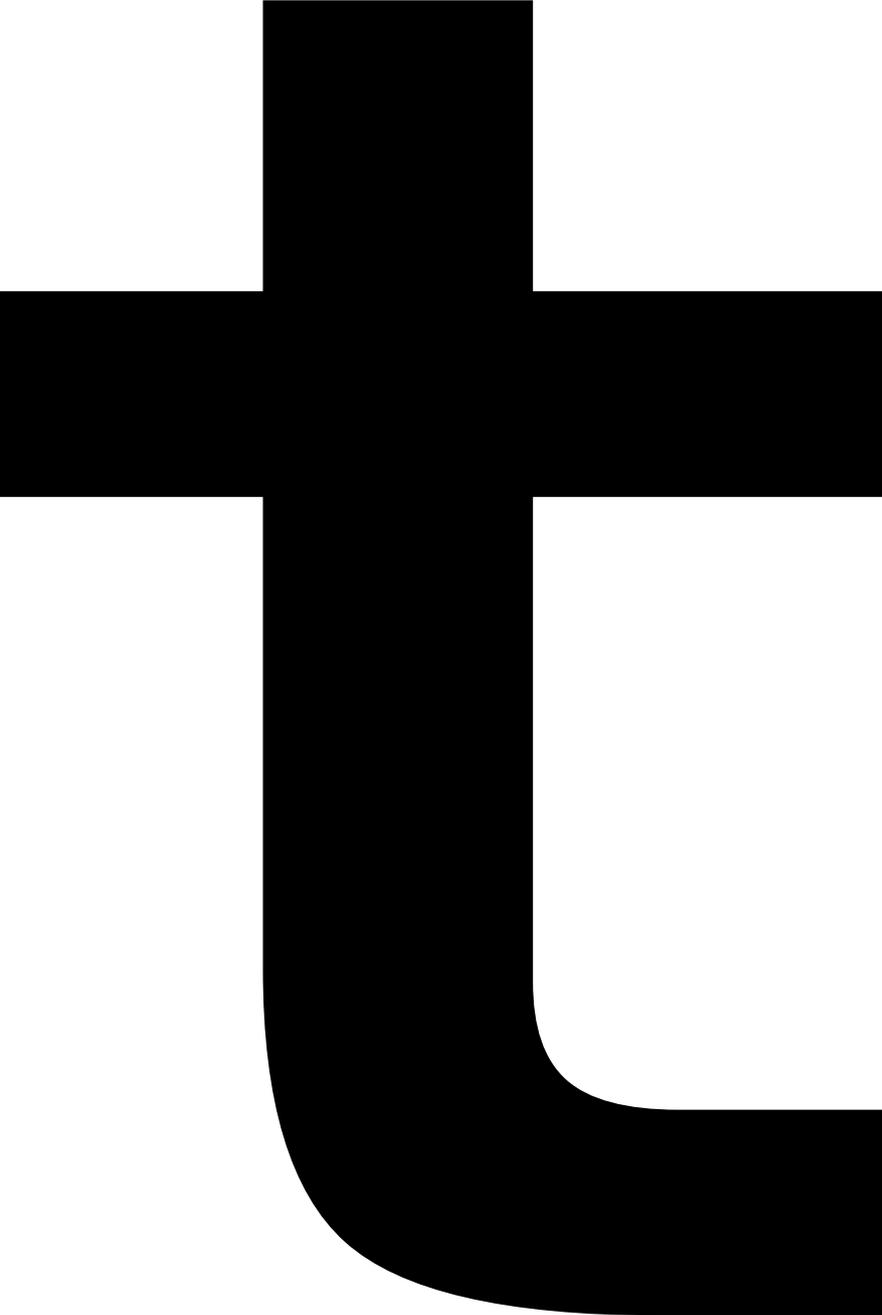


e



n

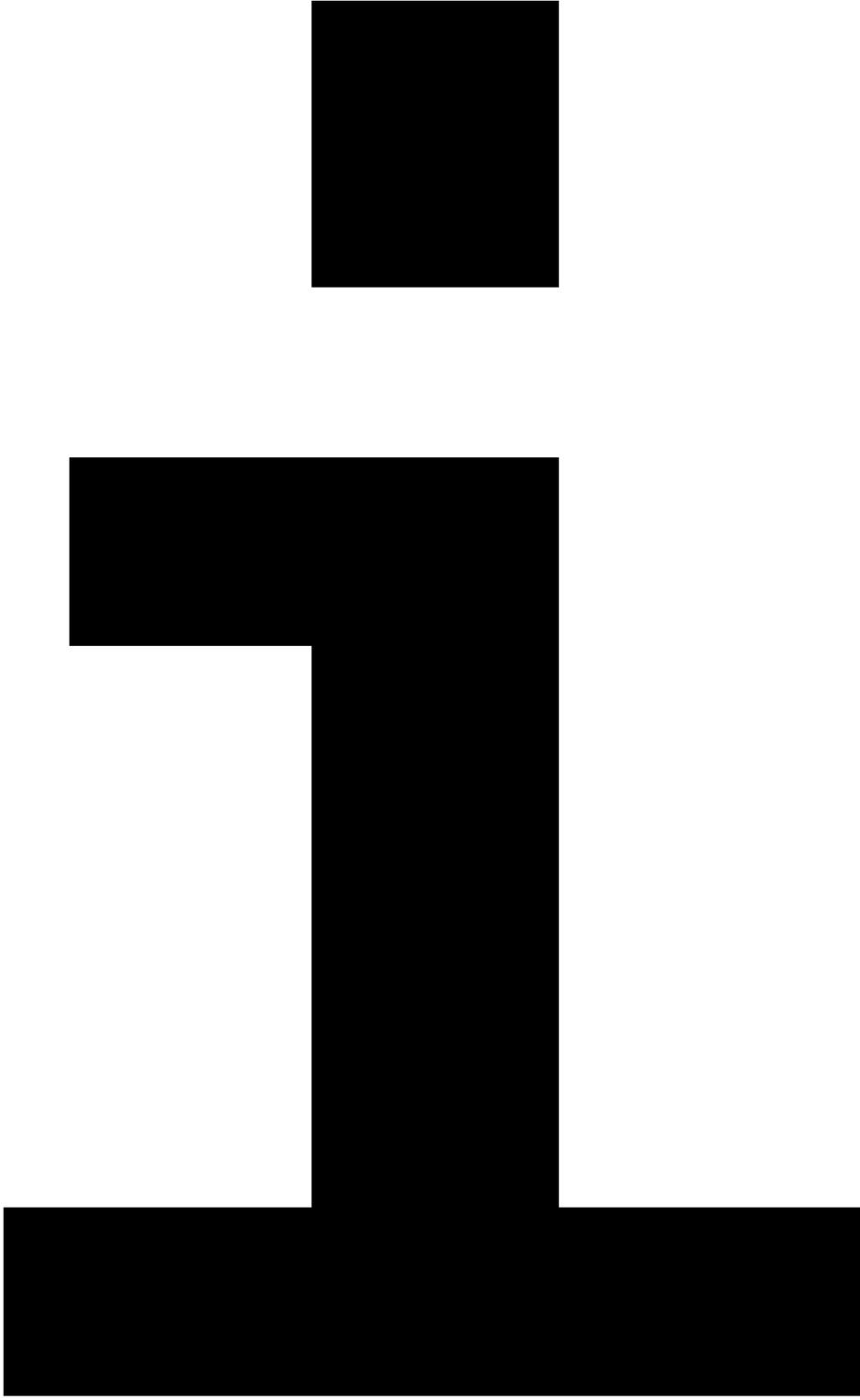
S



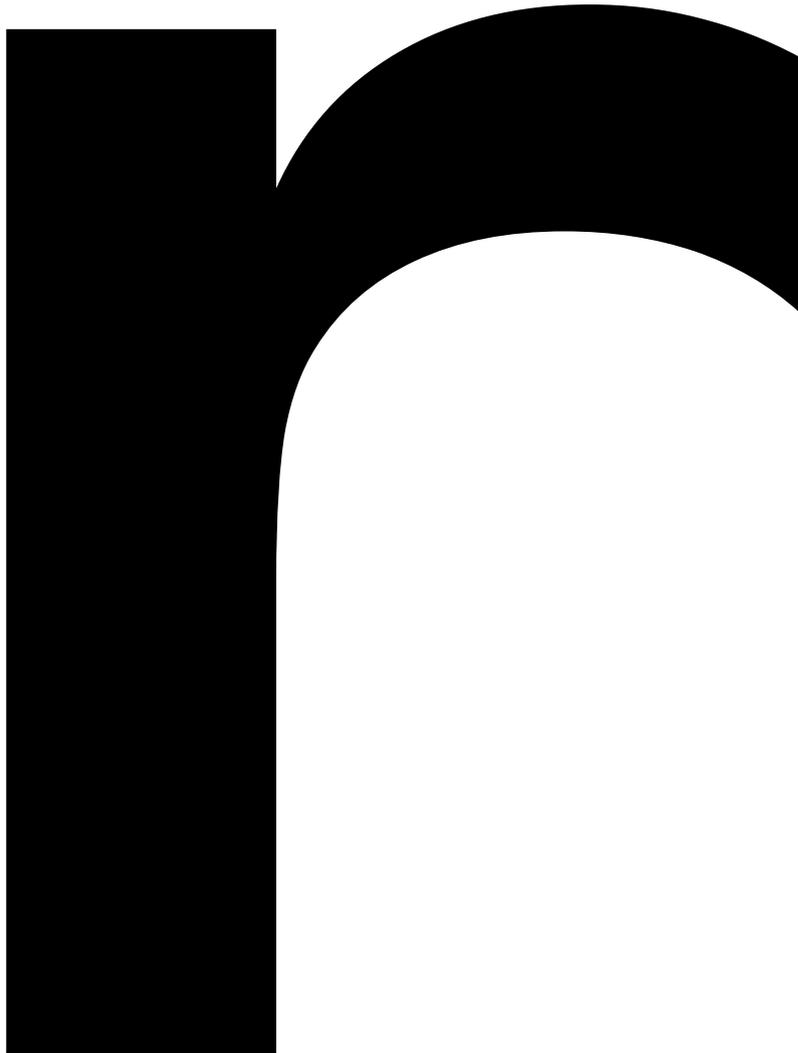
sa

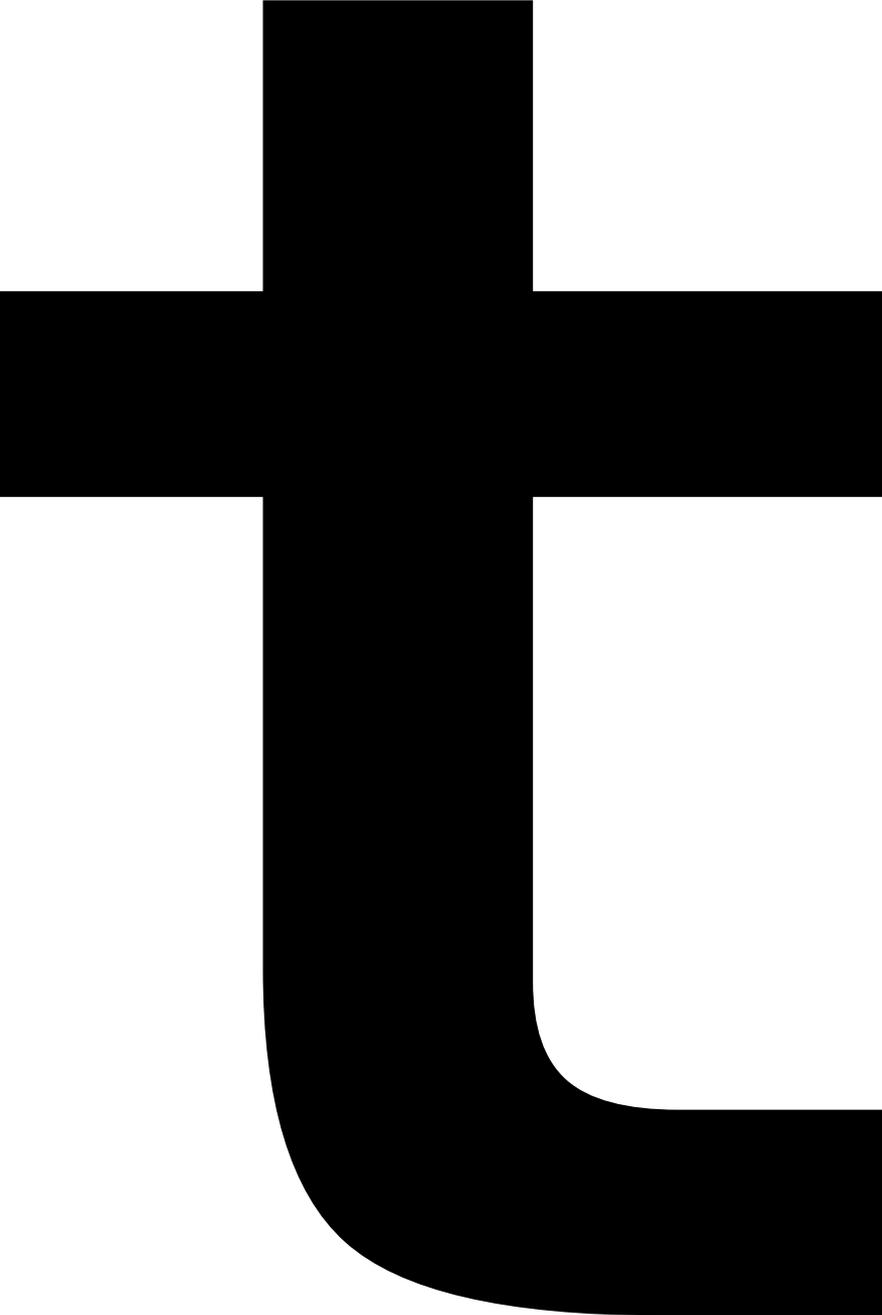
J

J



e





e

N

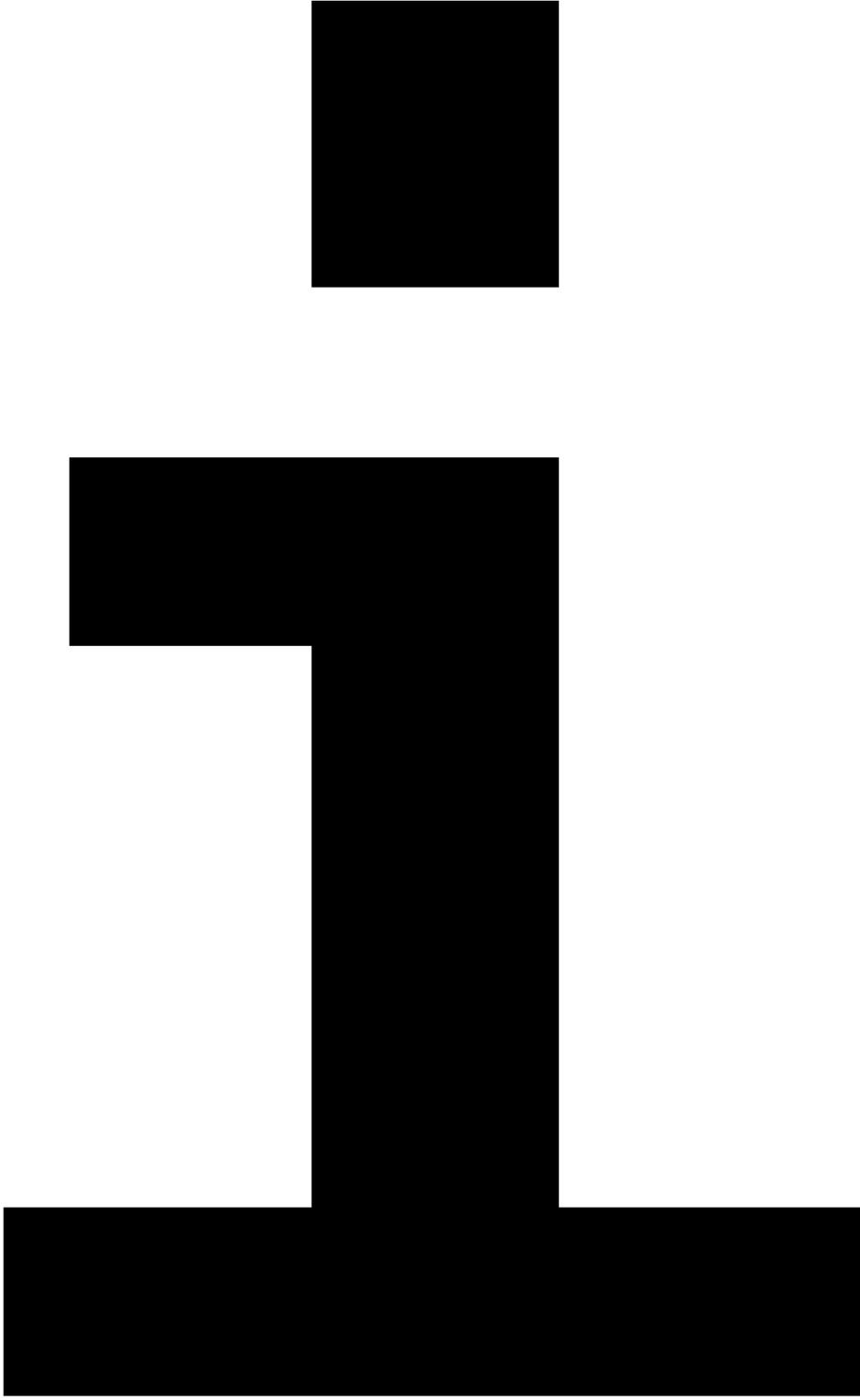
e

n

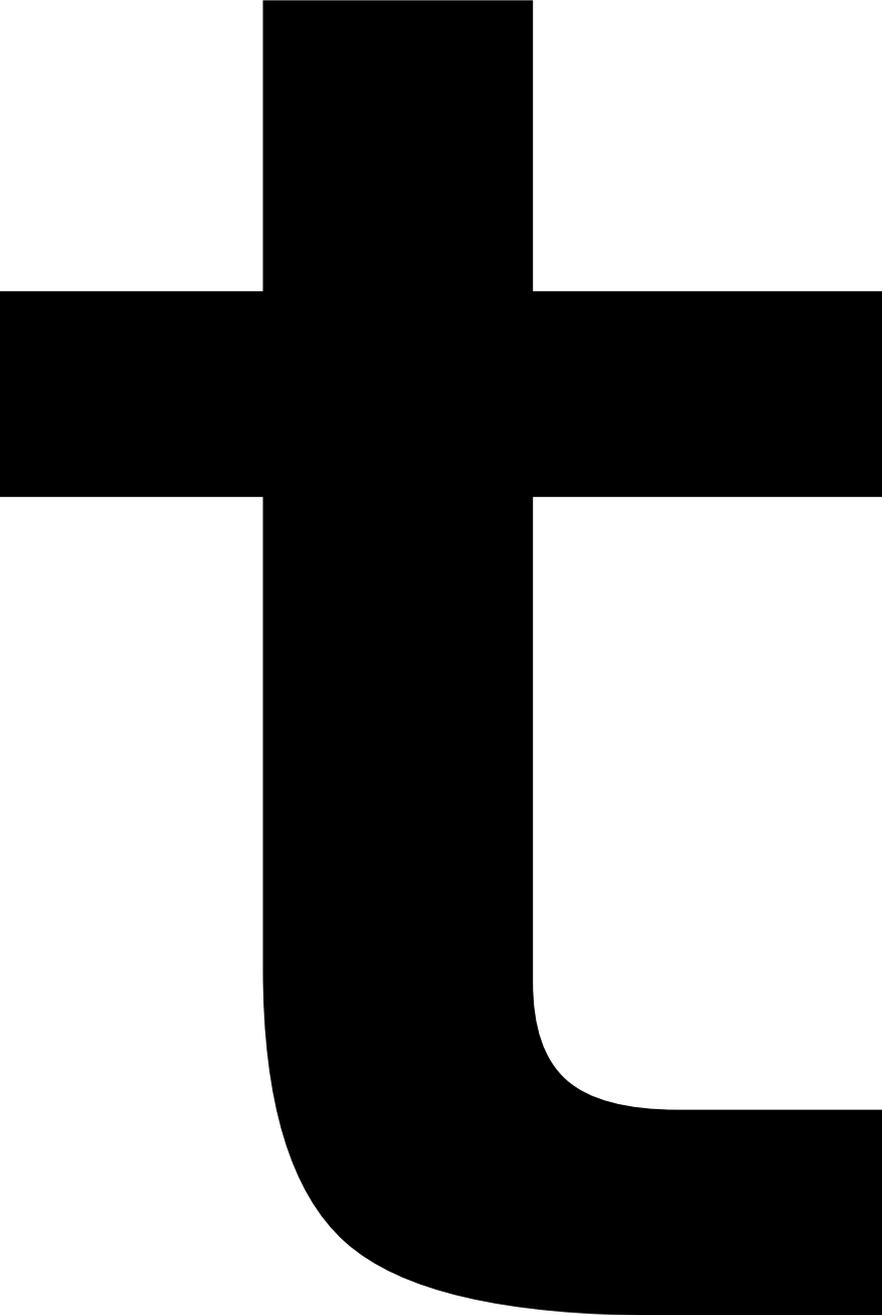
n

J

e



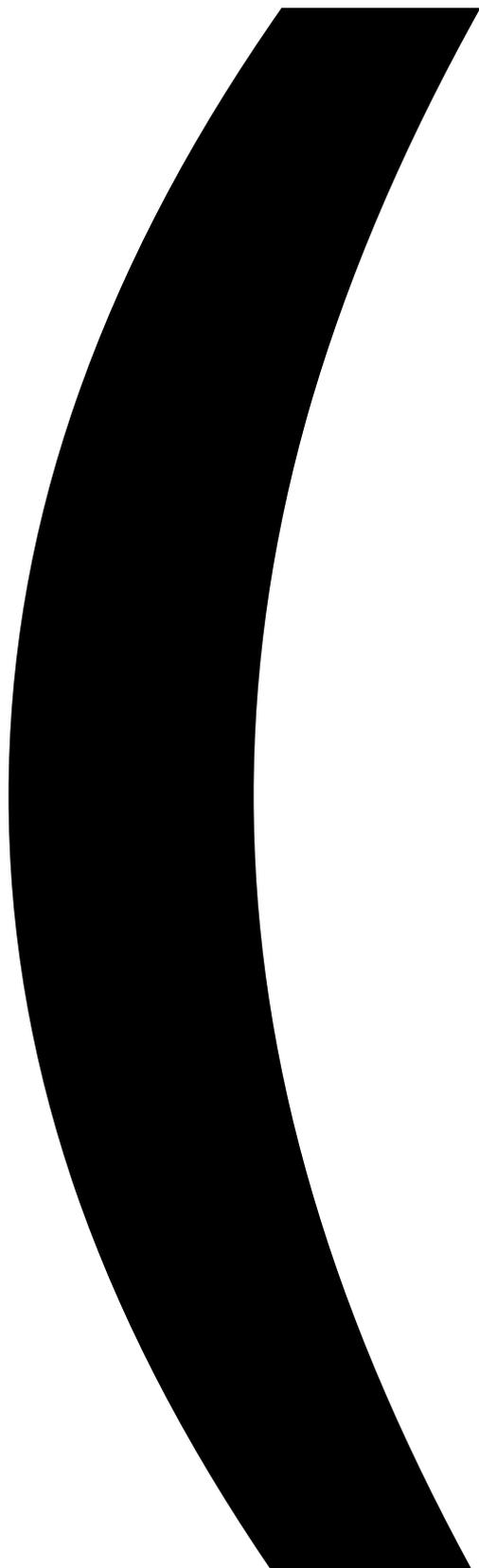
S



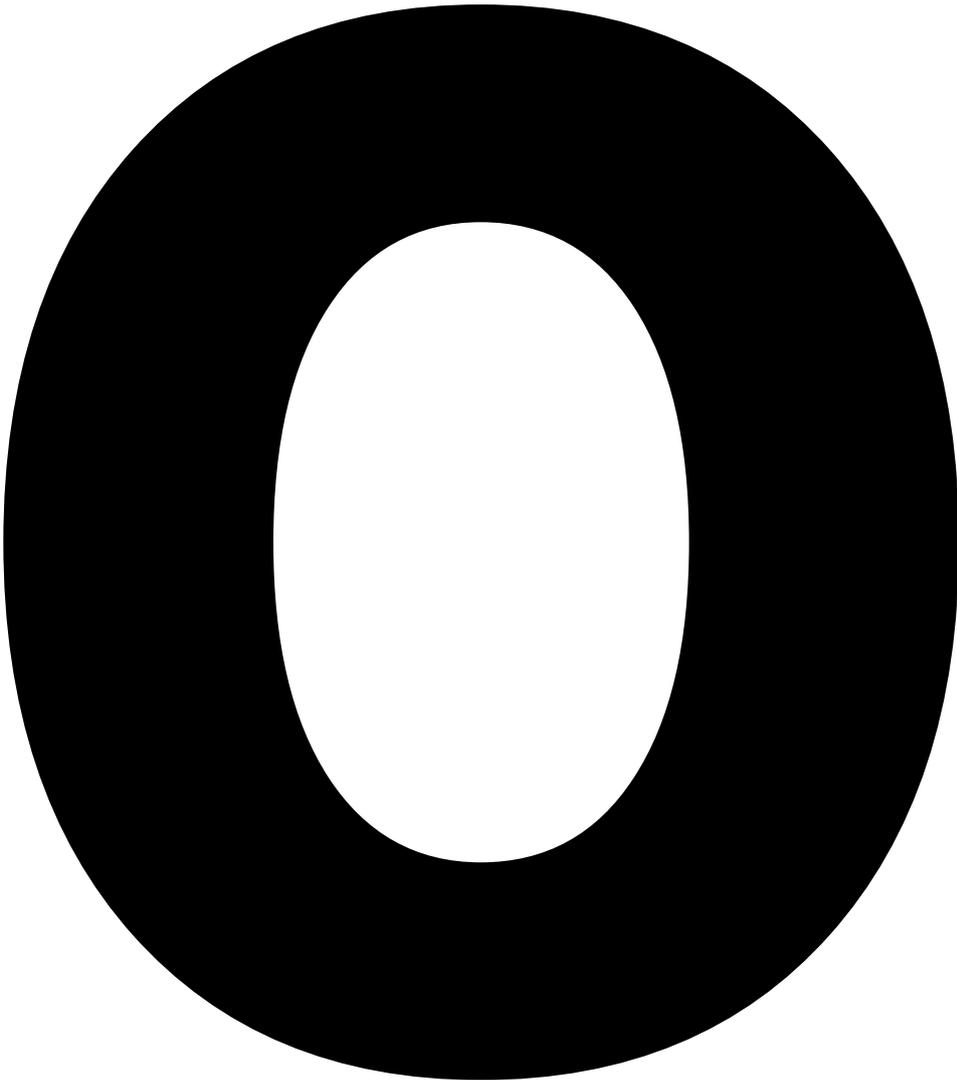
u

n

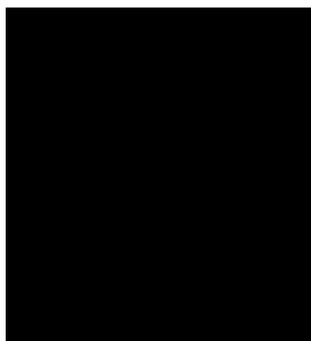
Q



S



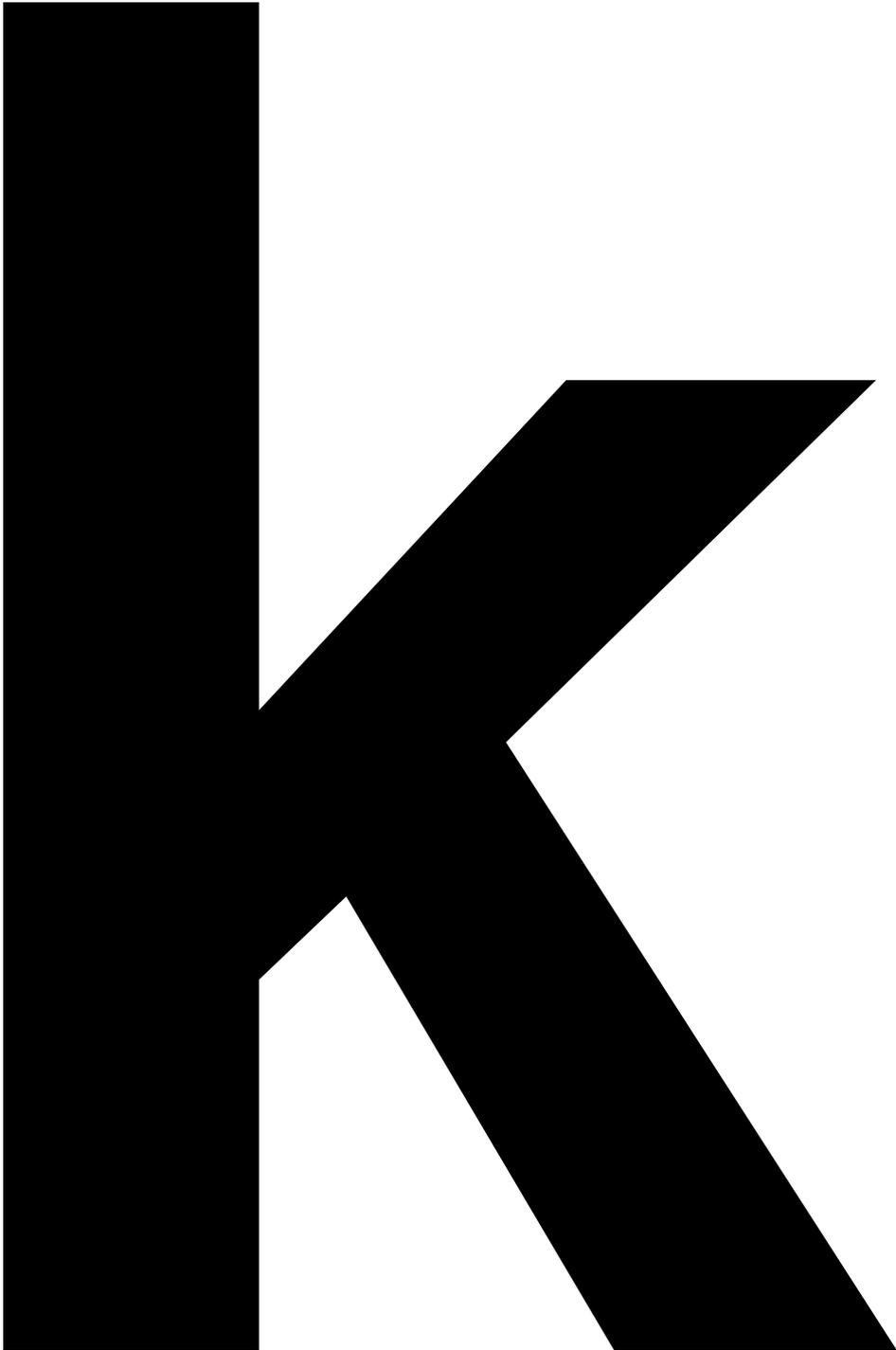
Q



P

e

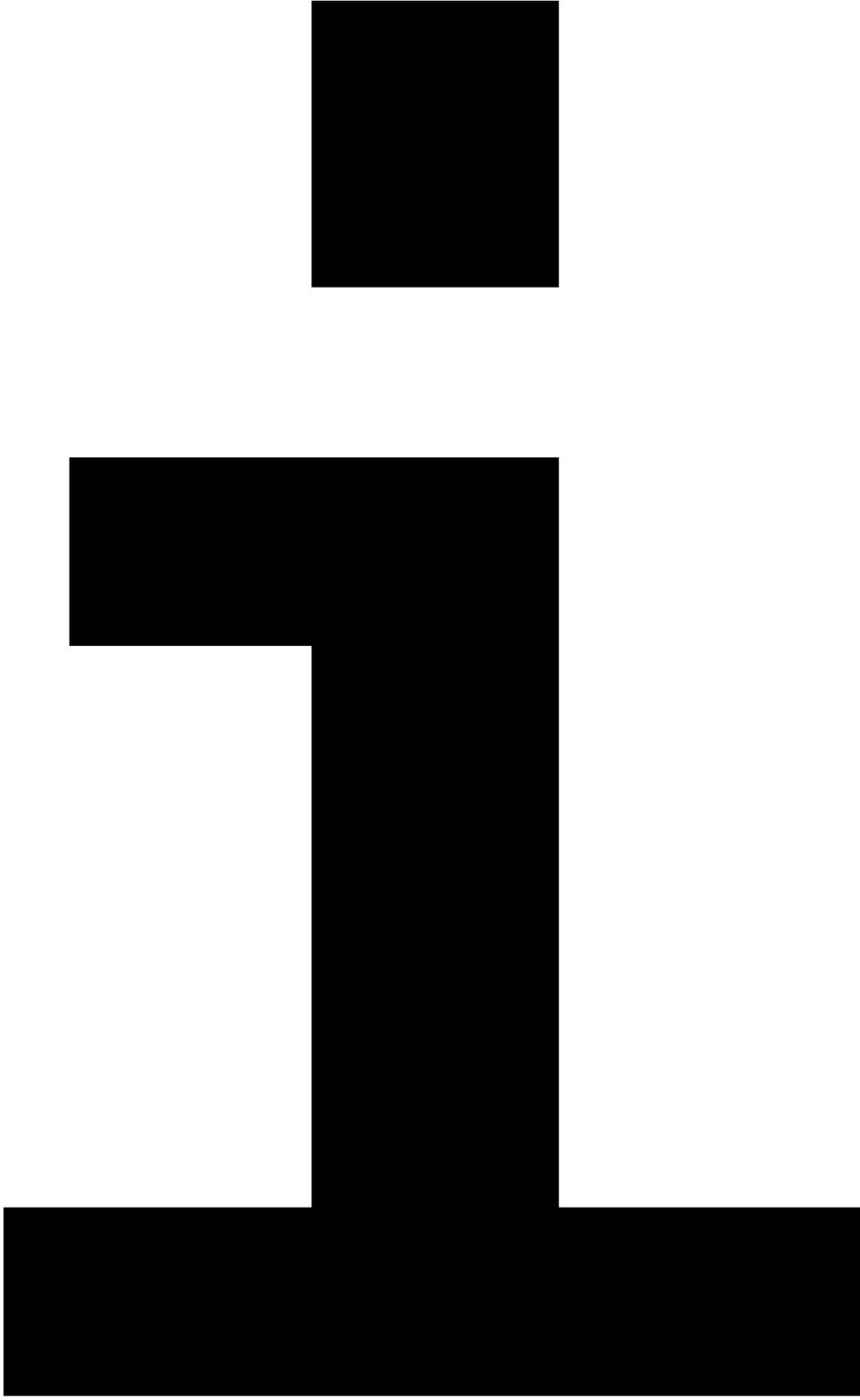
sa



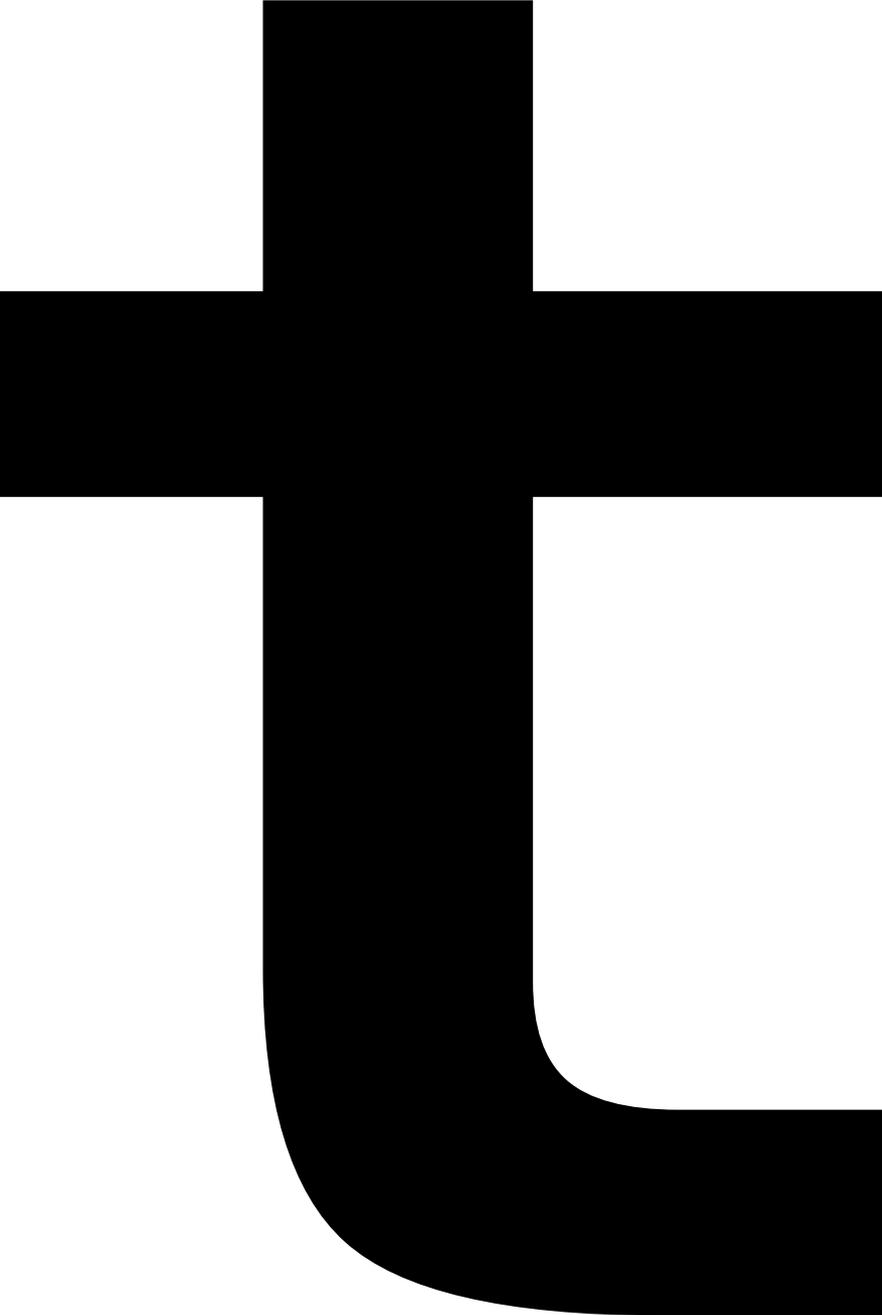




e



S



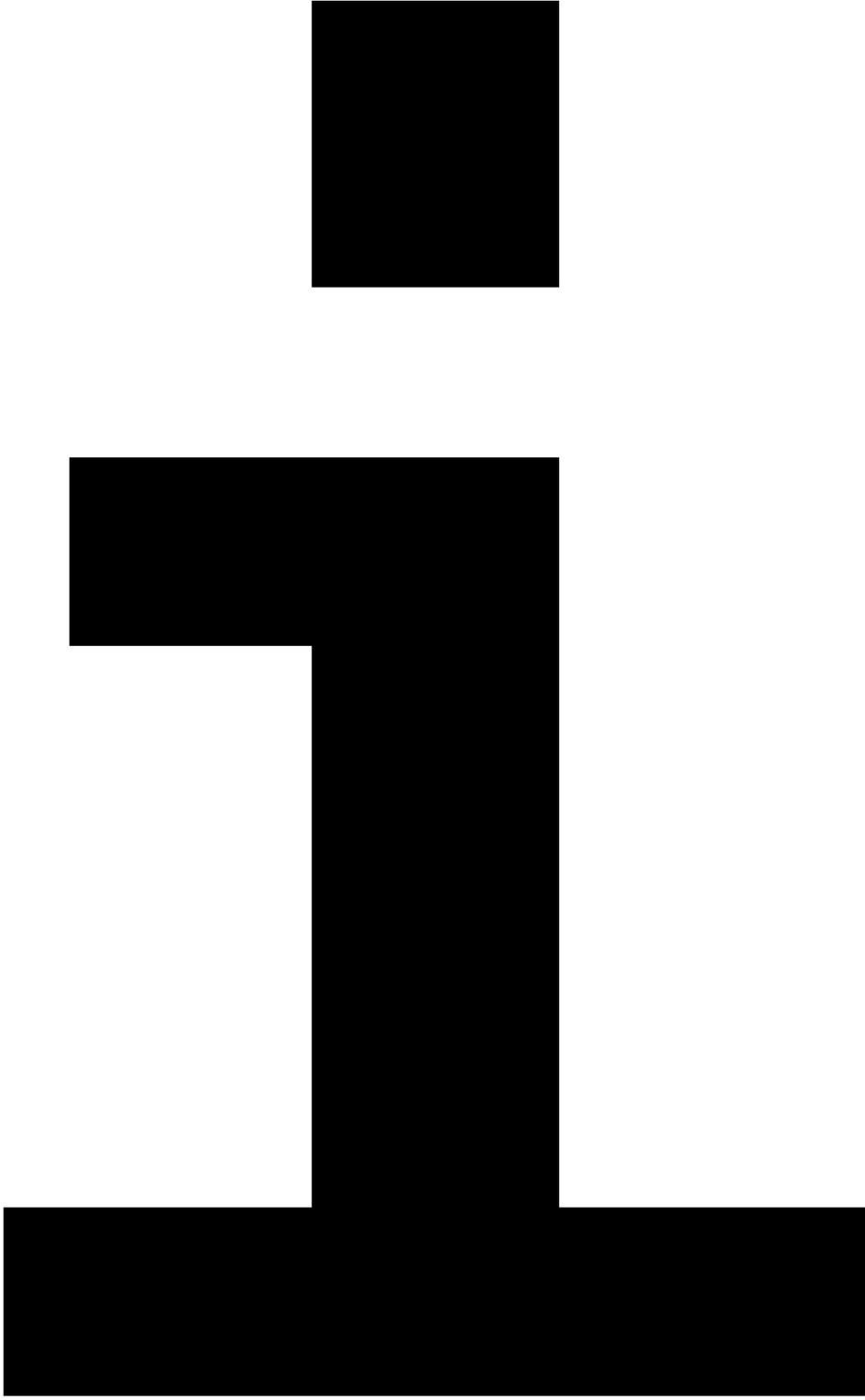
u

n

Q

10

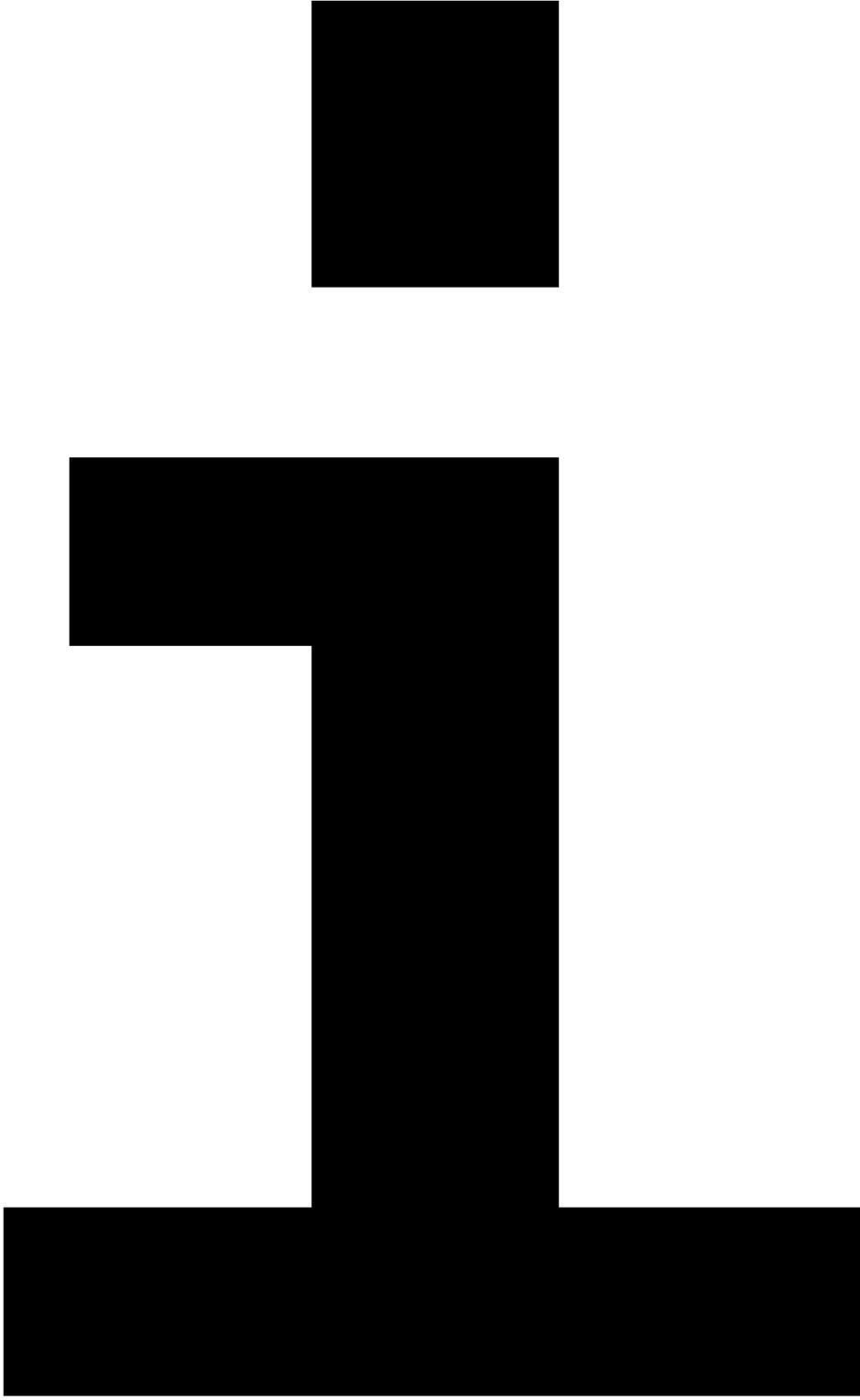
e



u

n

e



n

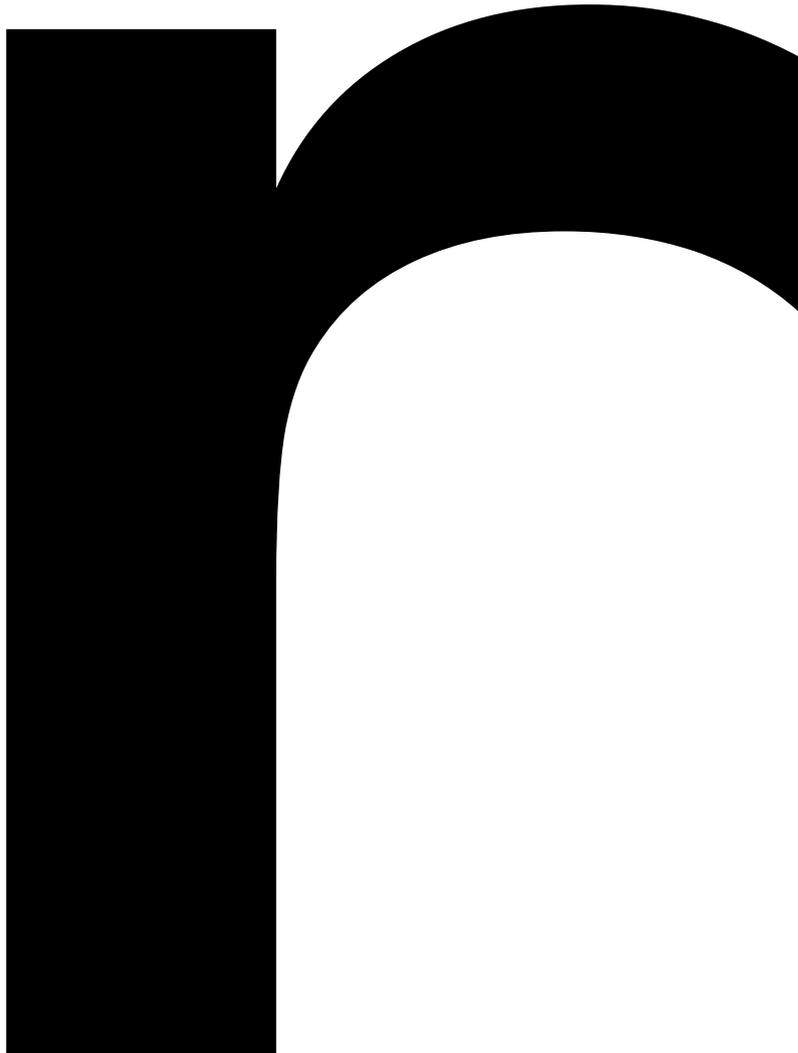
Q

e

S

C

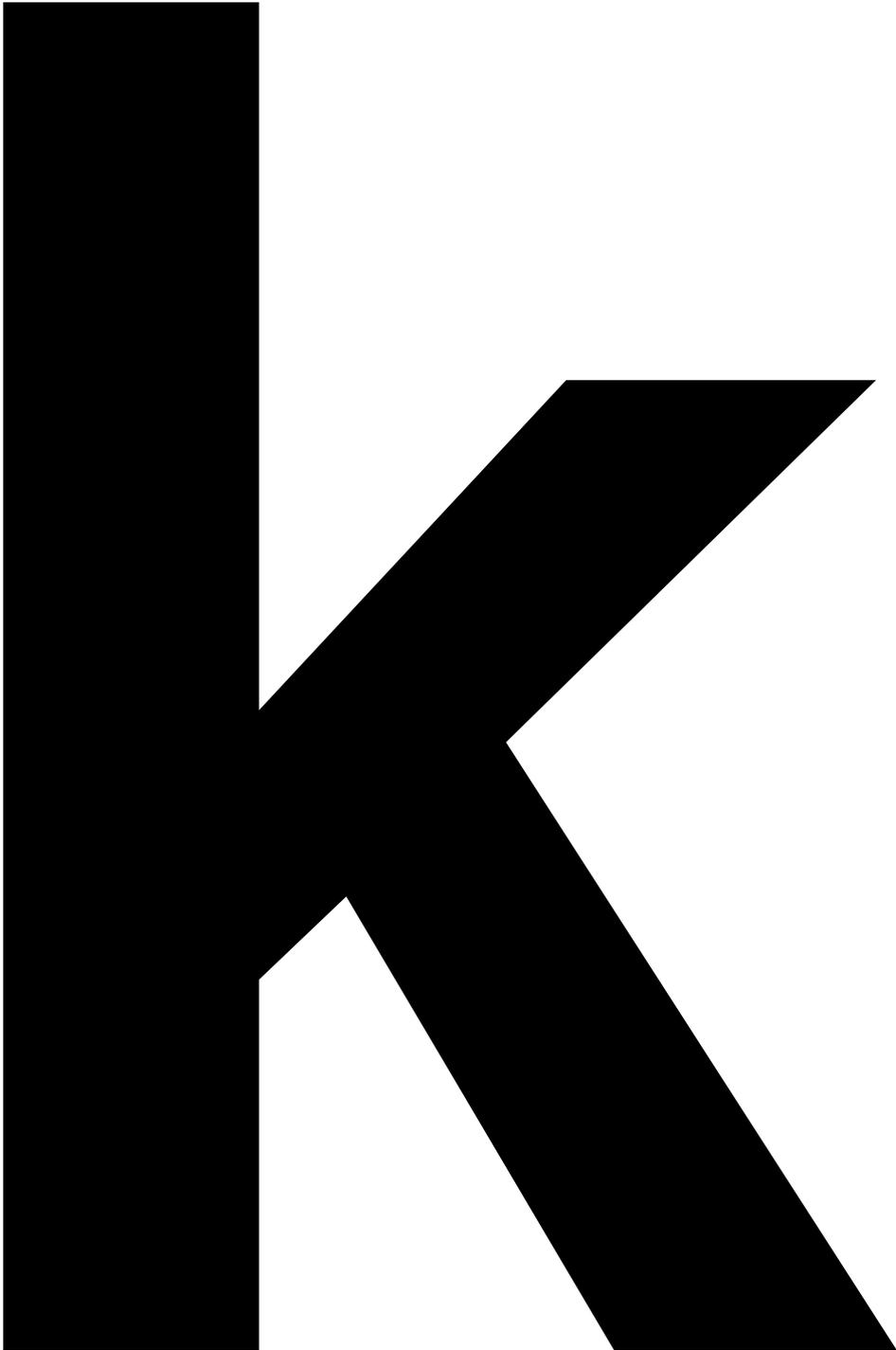
h

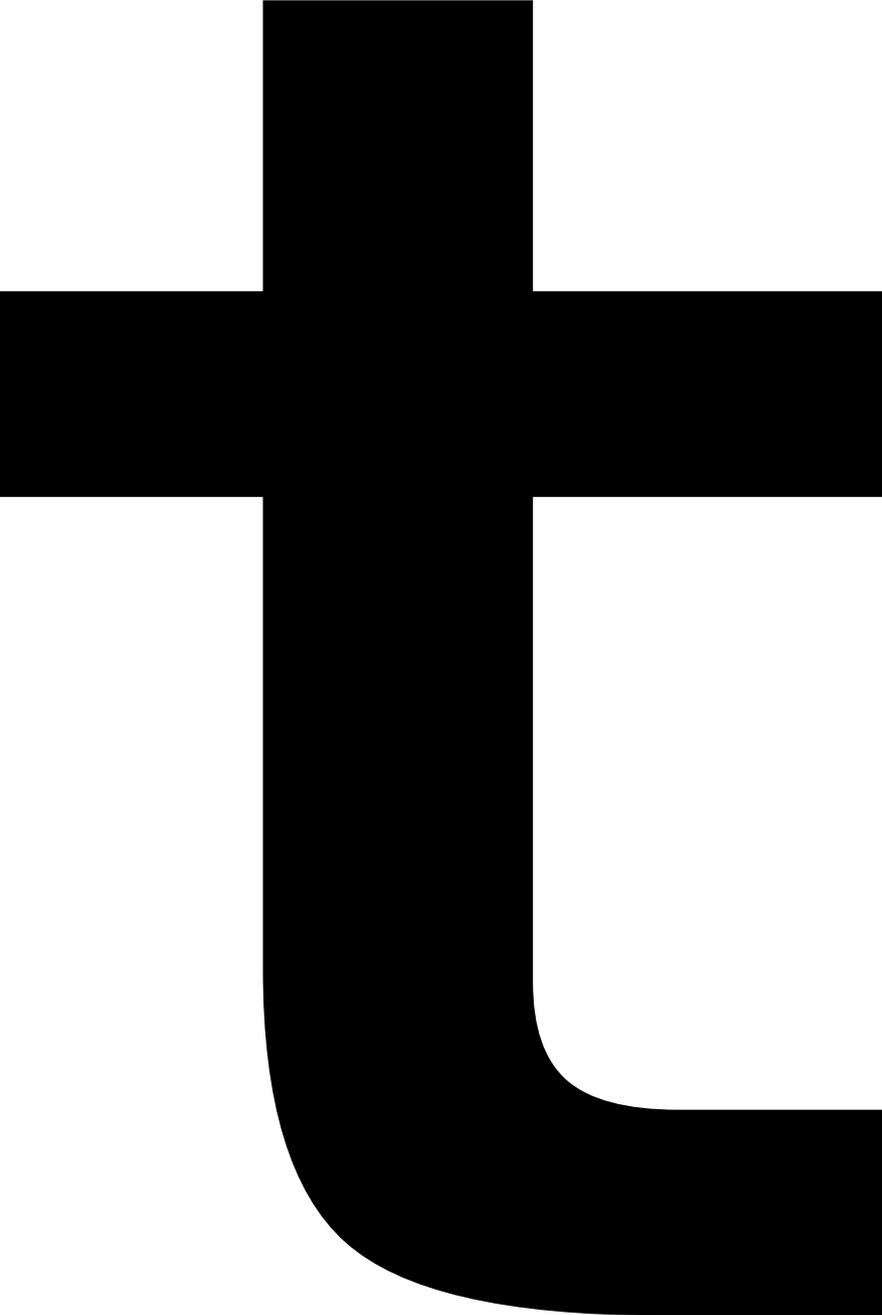




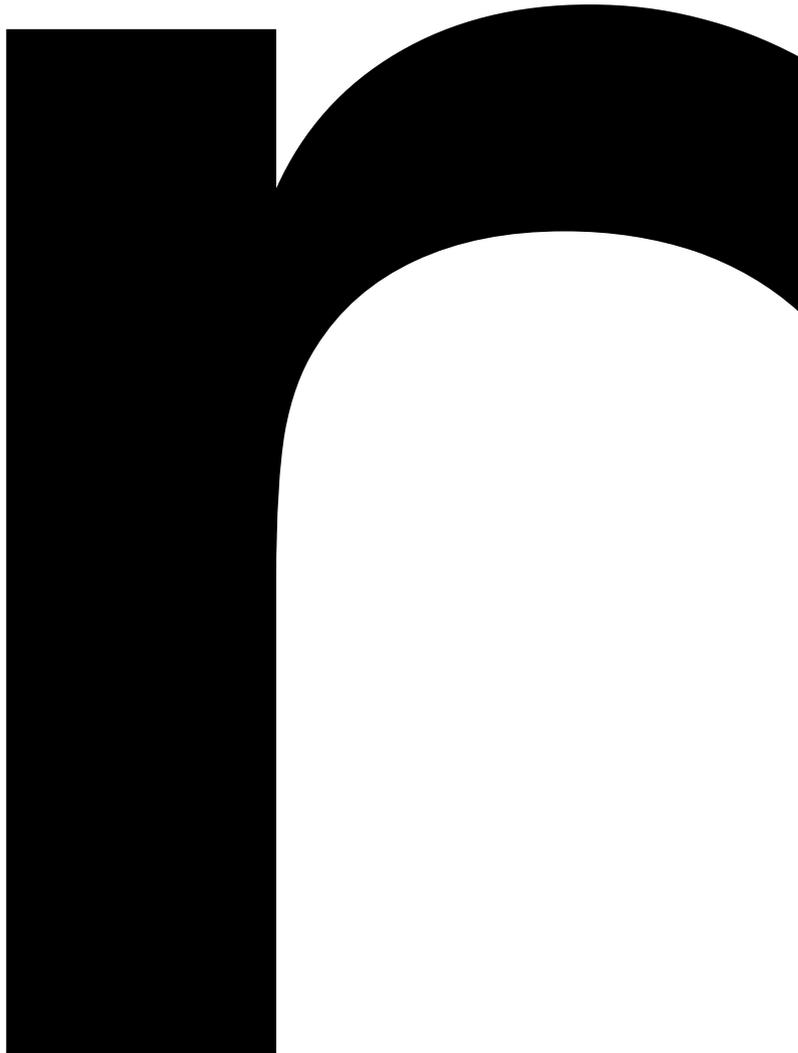
5a

n

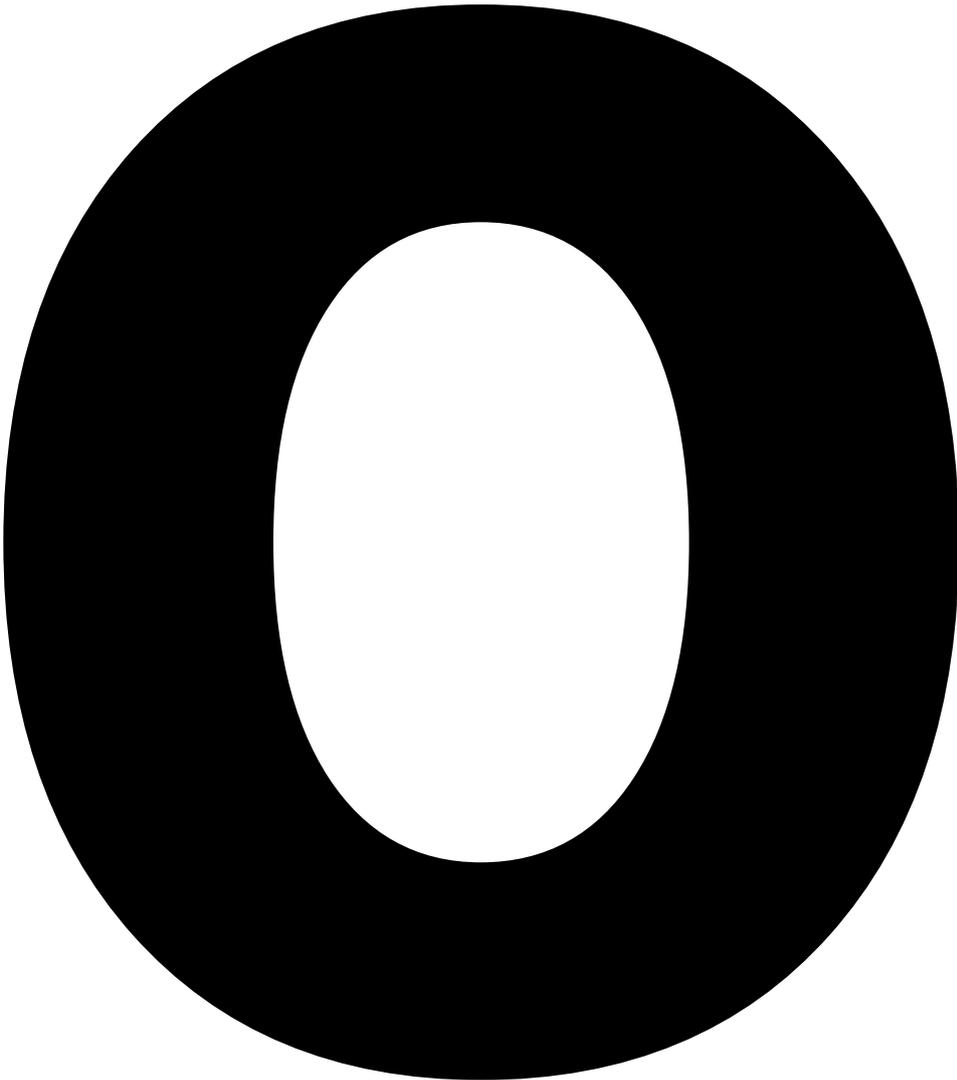




e



S



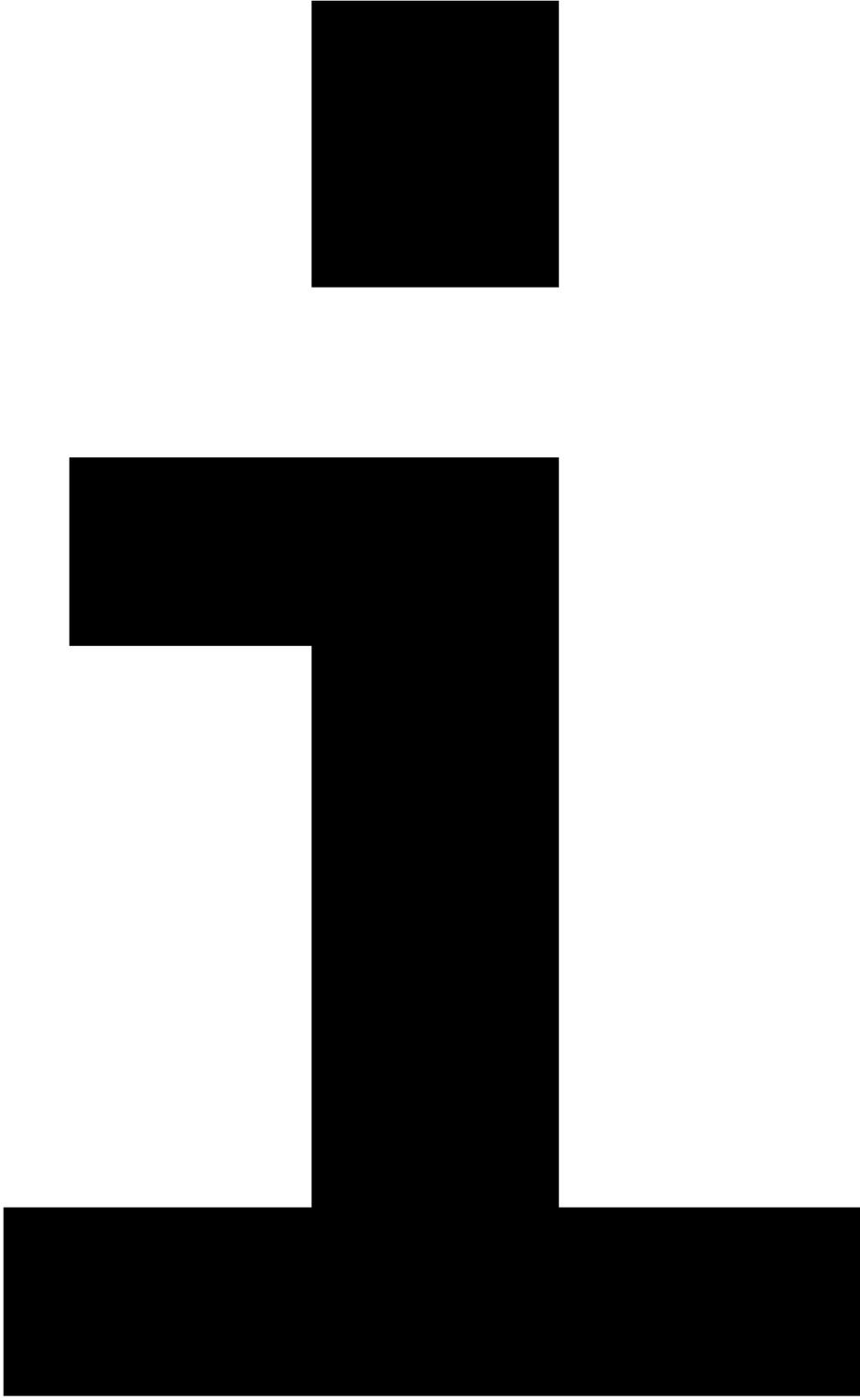
n

n

e

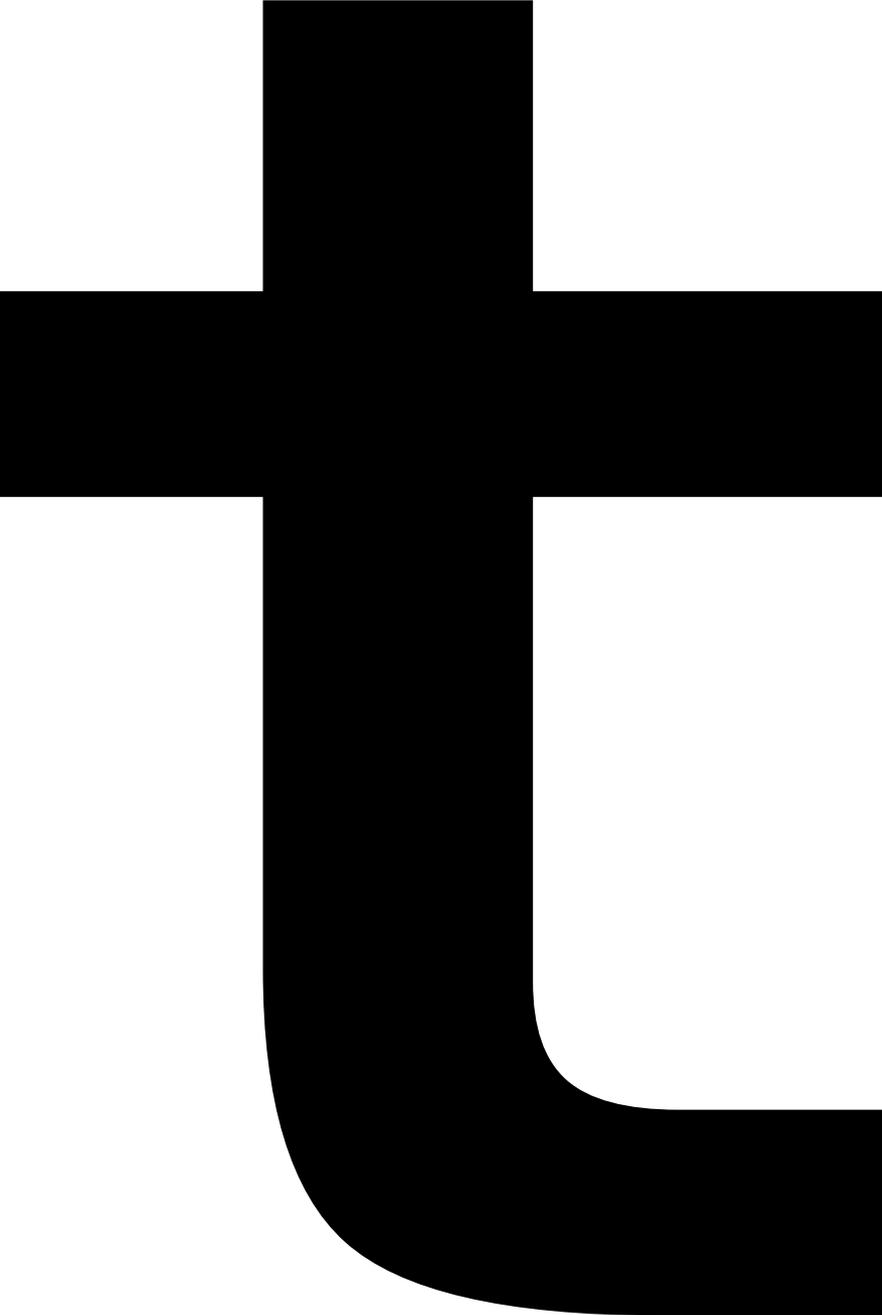
n

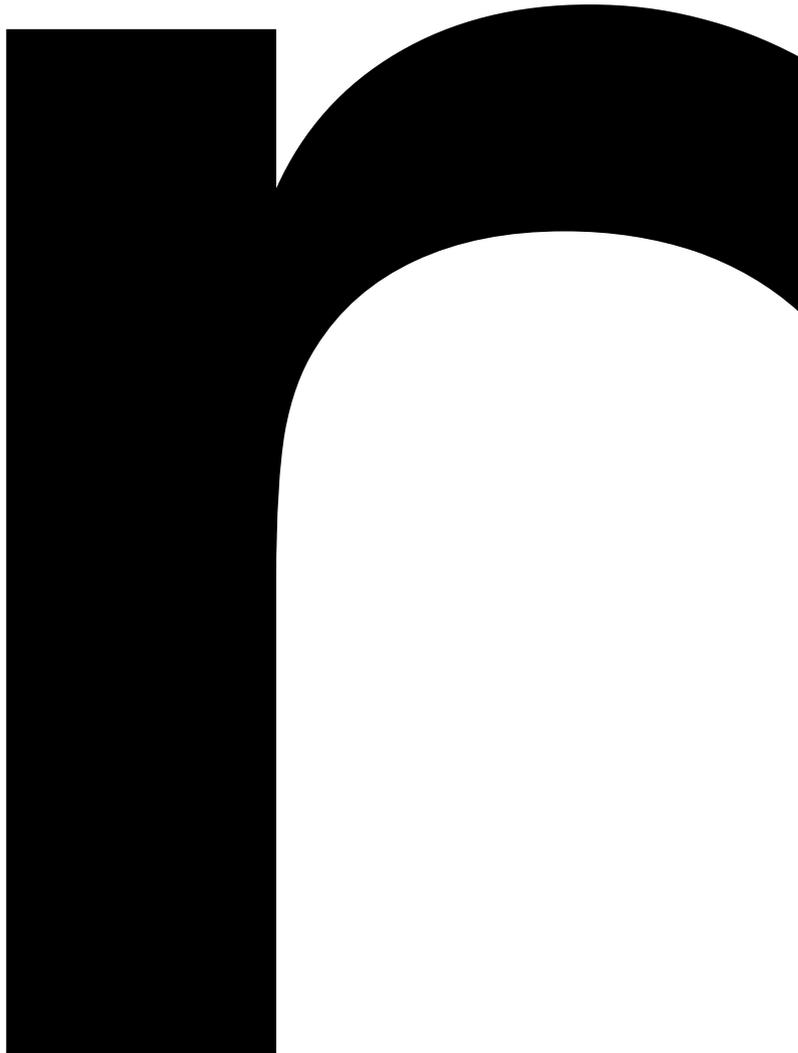
e



n

S





sa

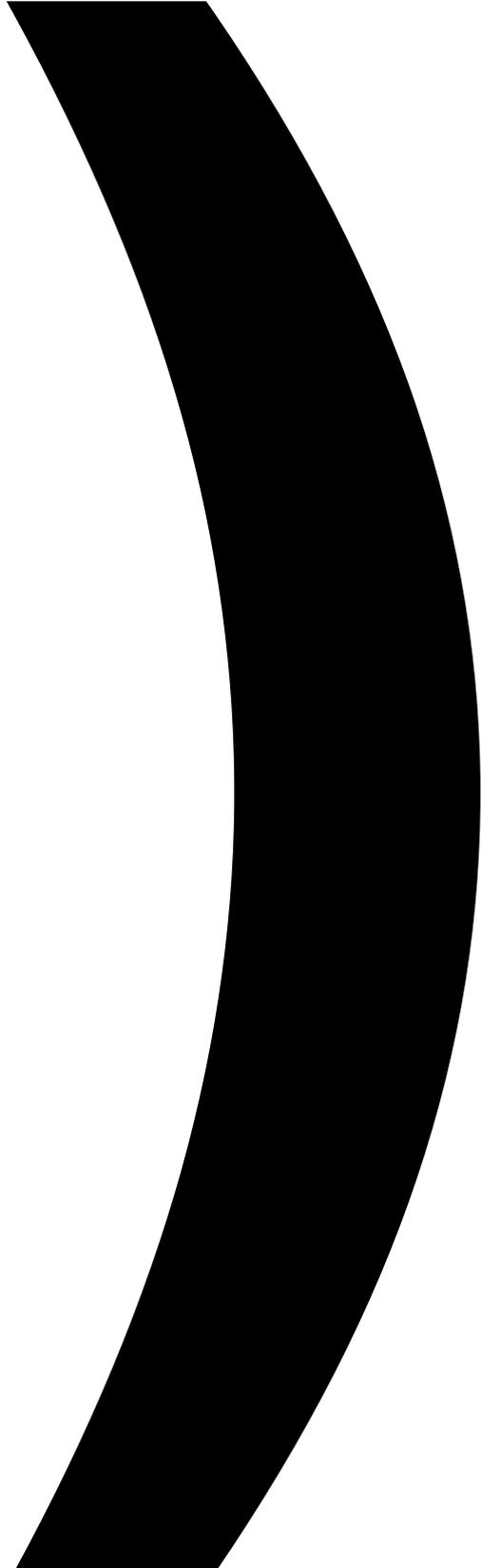
h

J

u

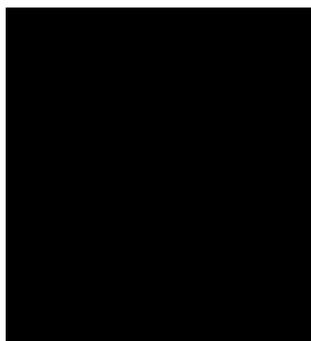
n

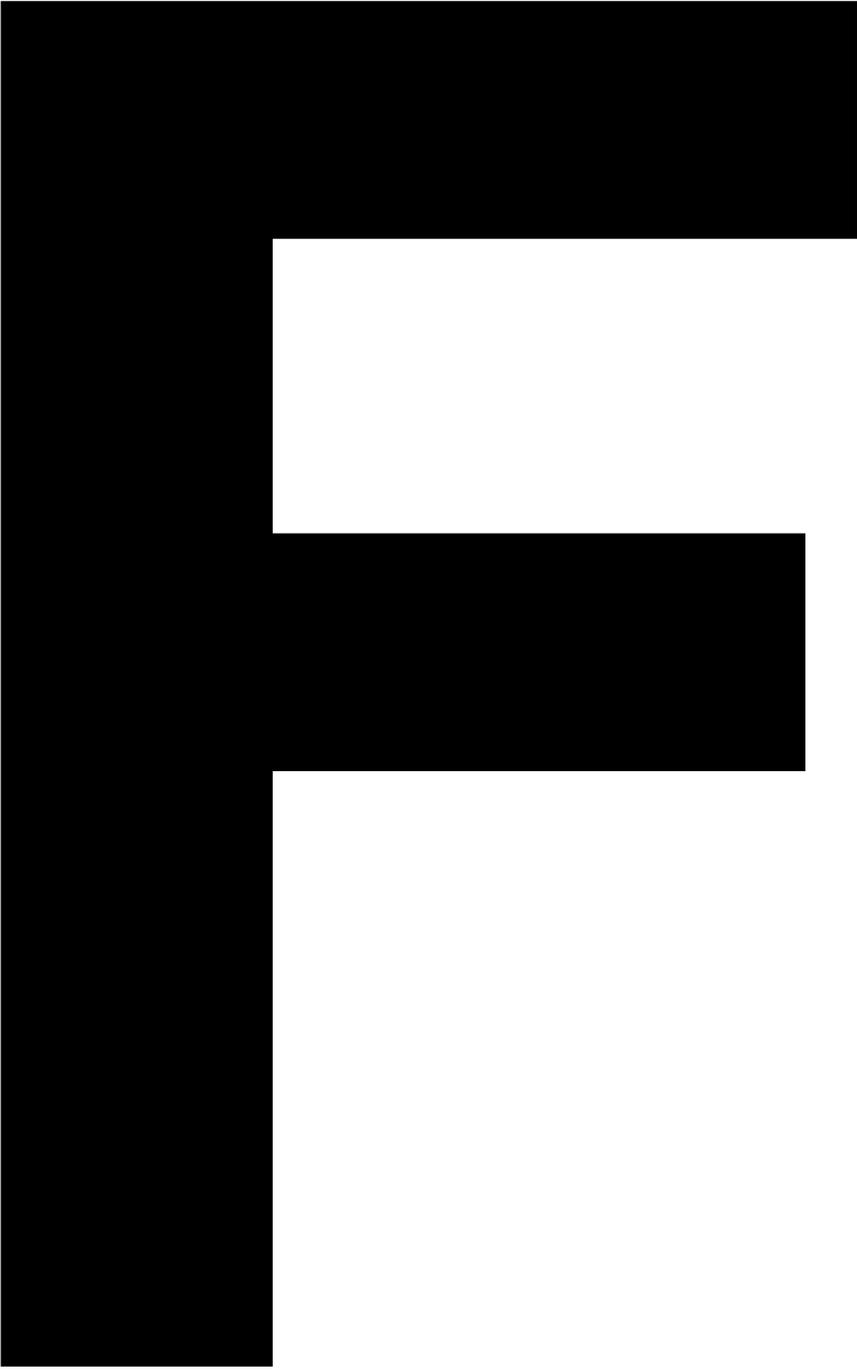
Q

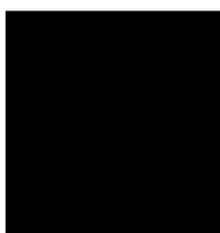
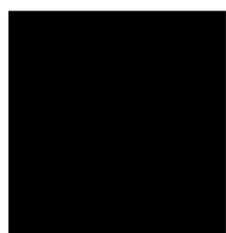


sa

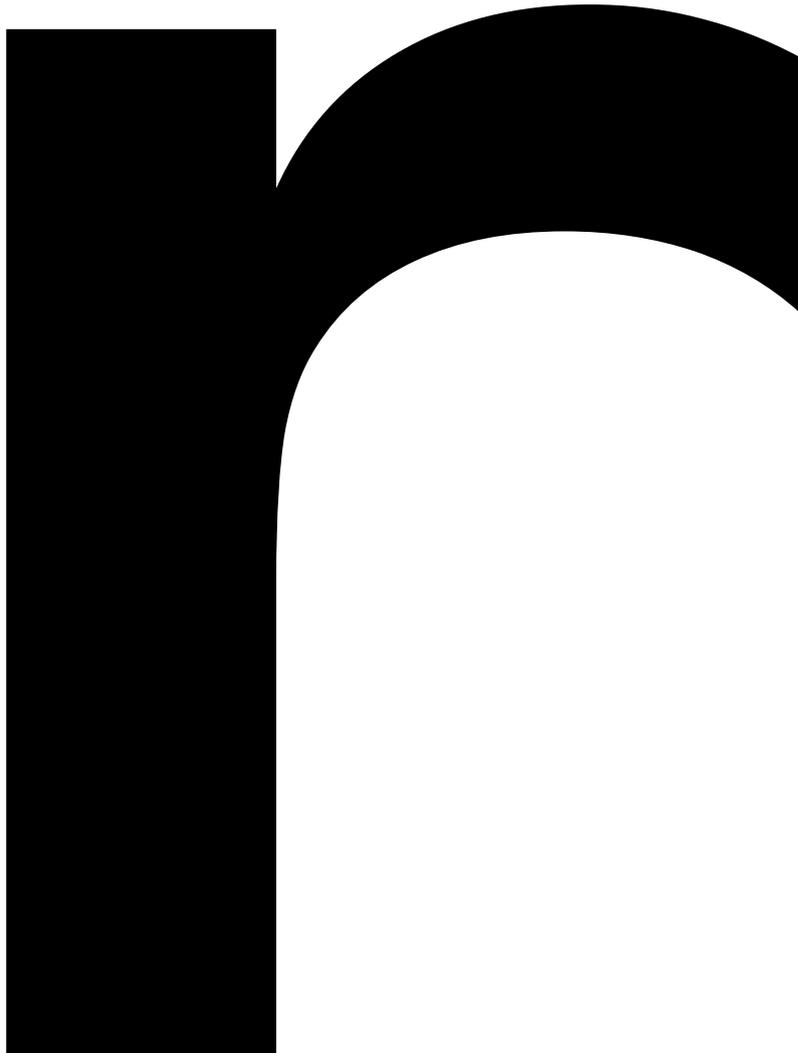
n







u

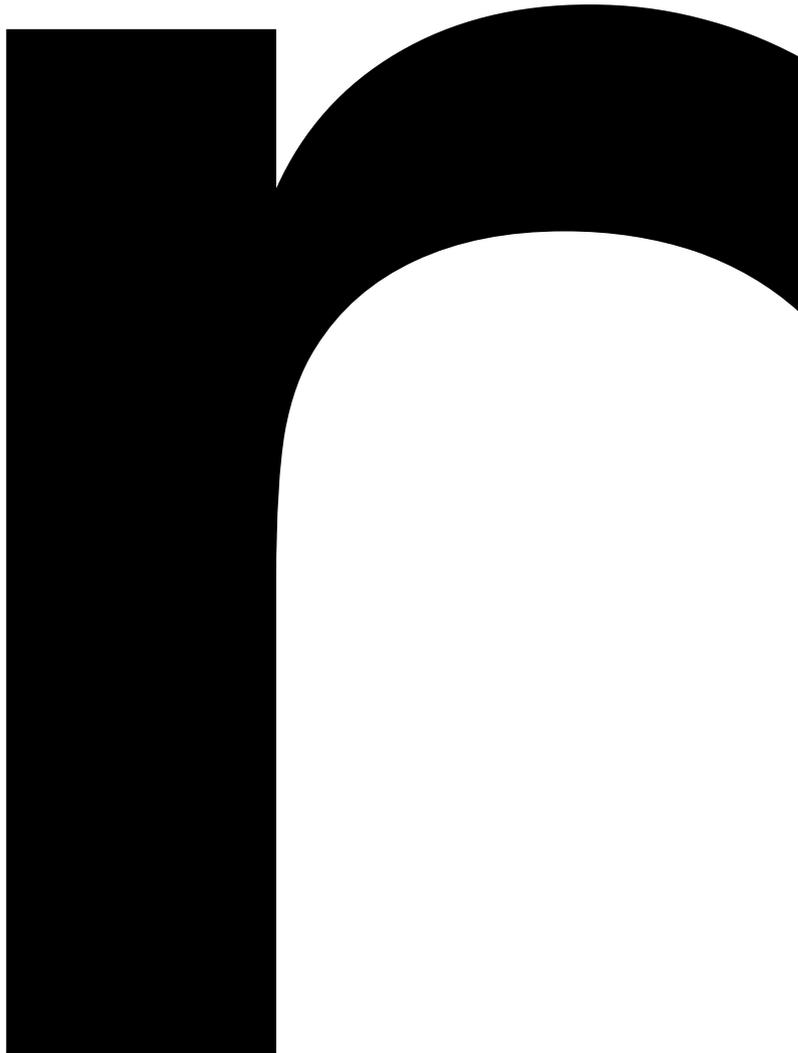


S

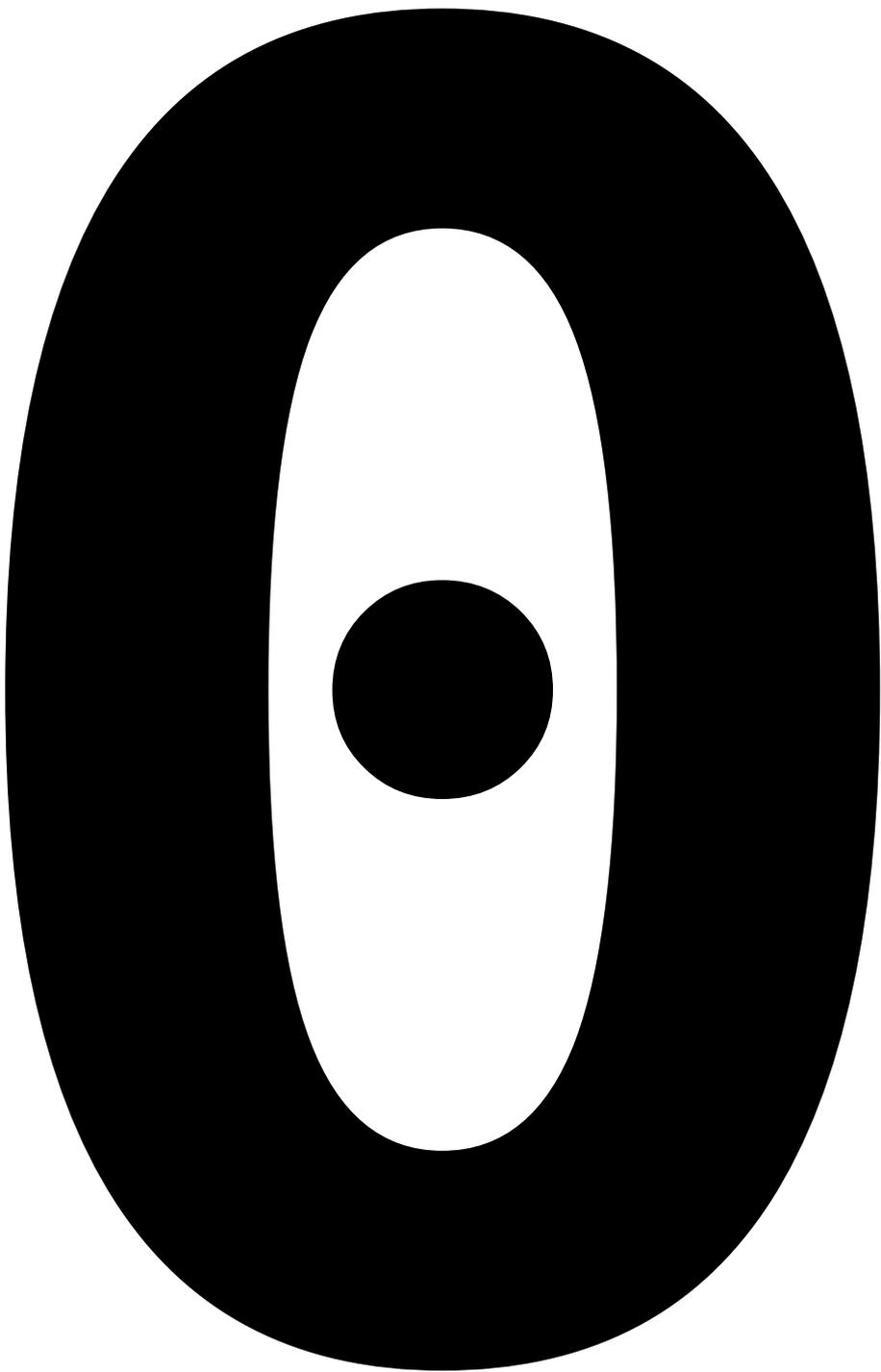
J

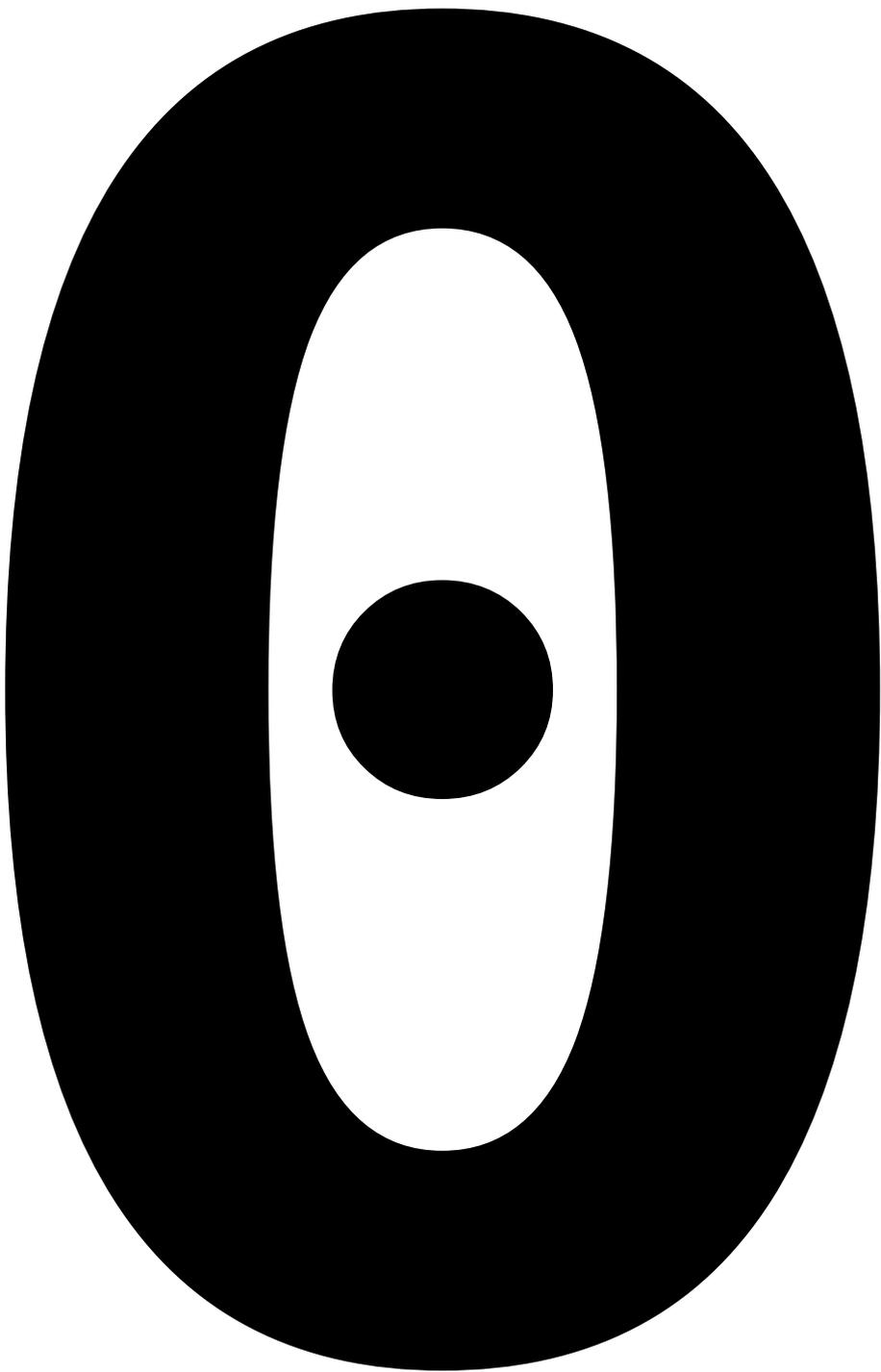
sa

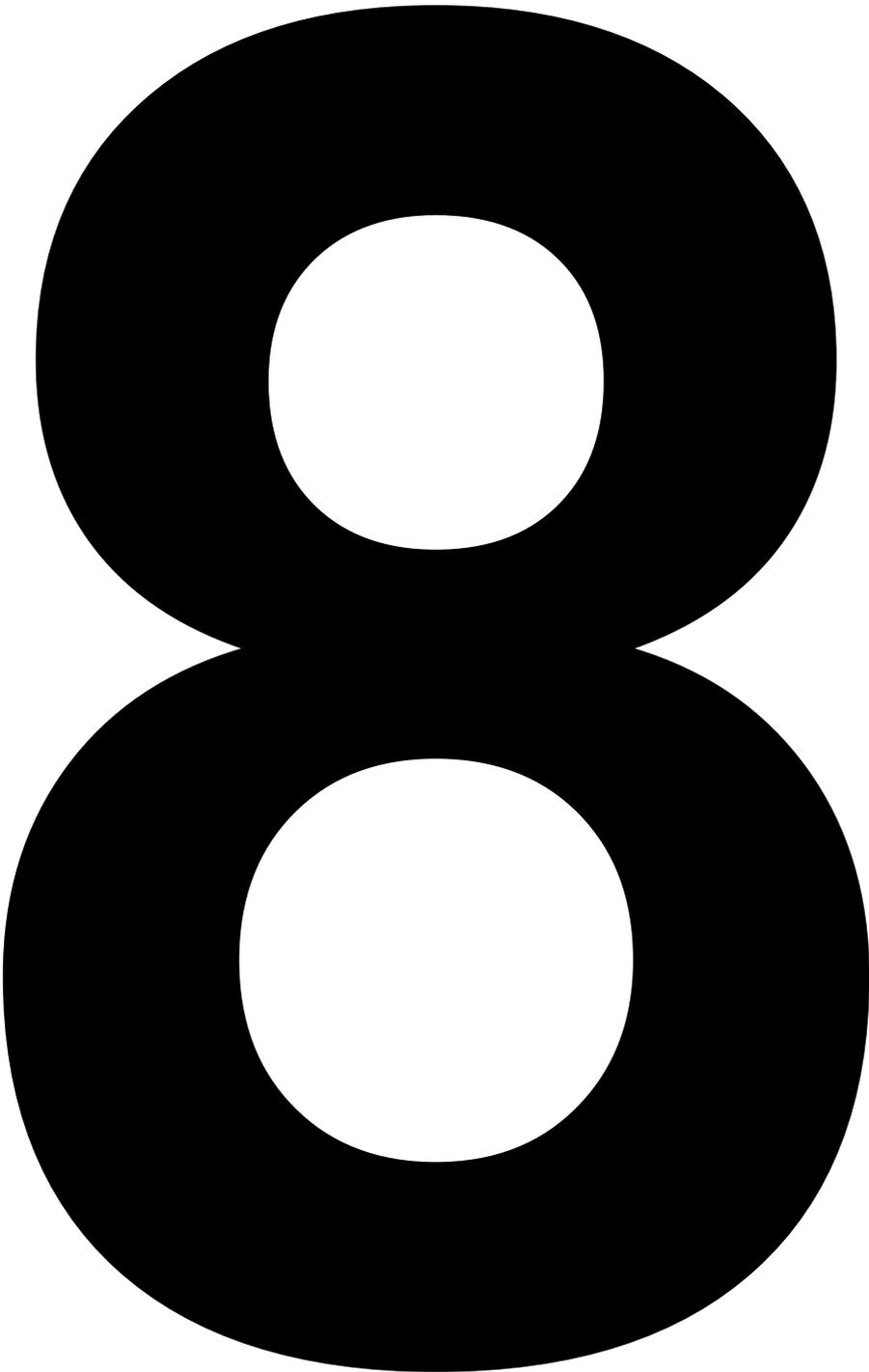
h



2

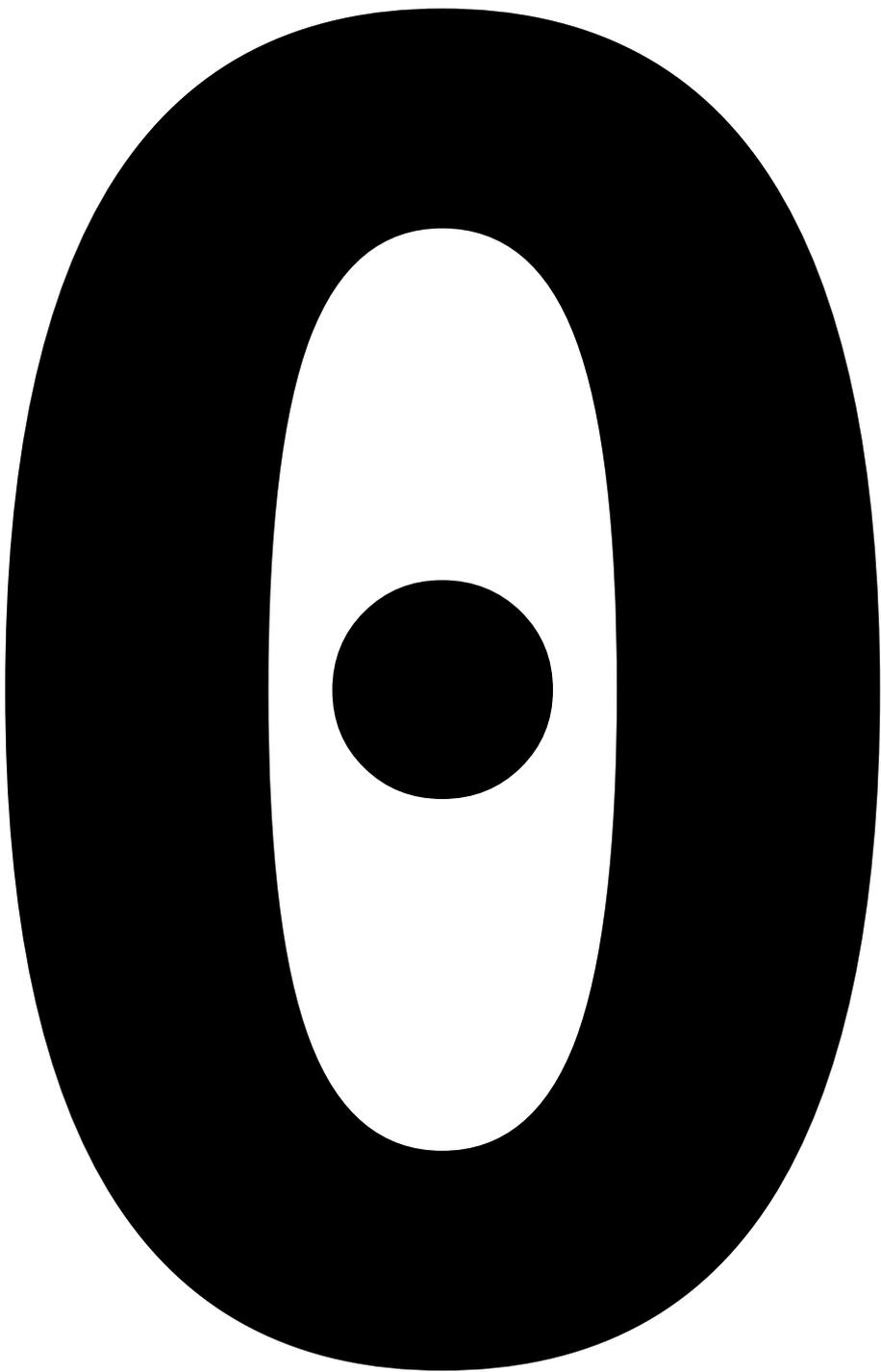


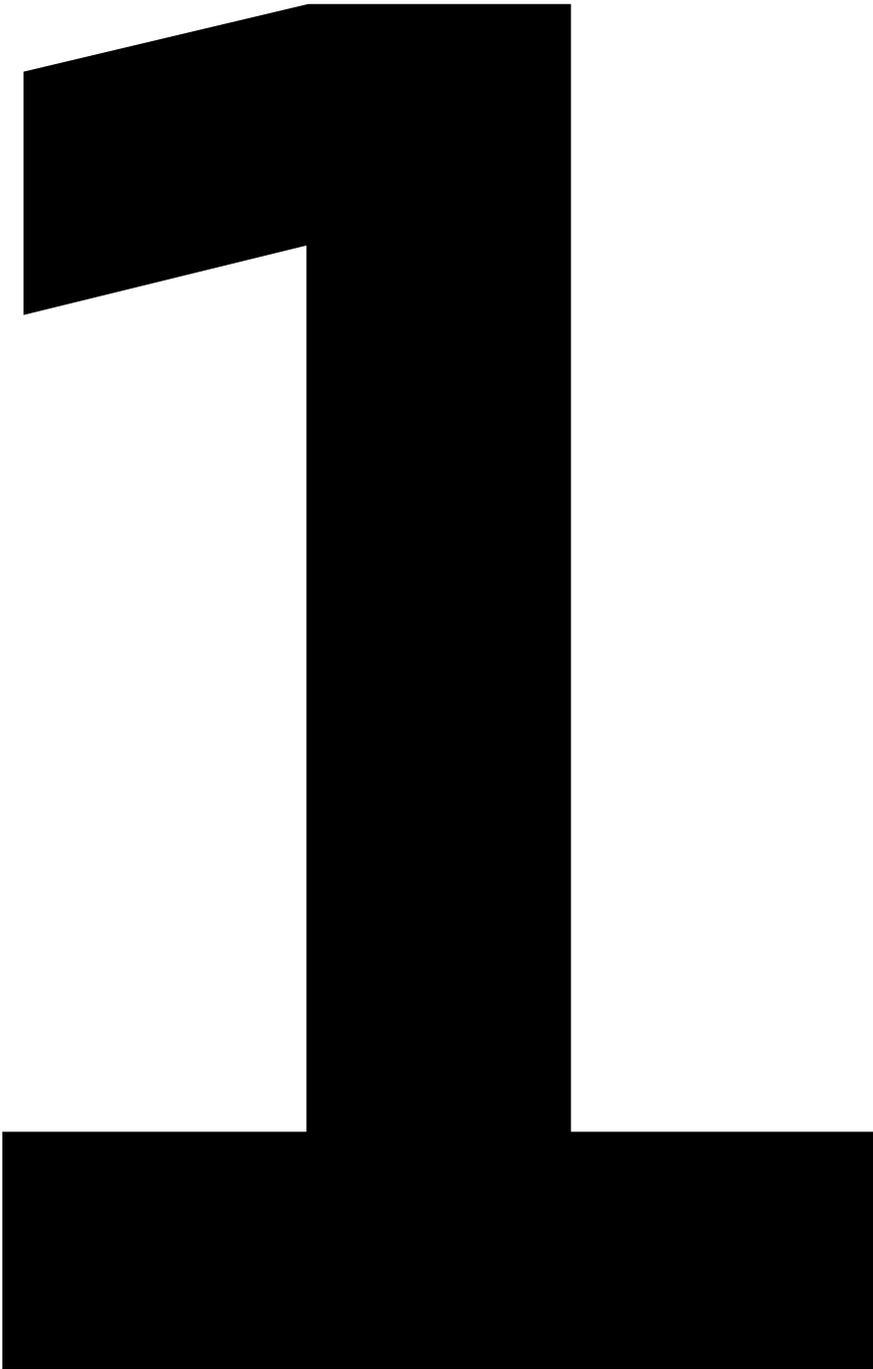






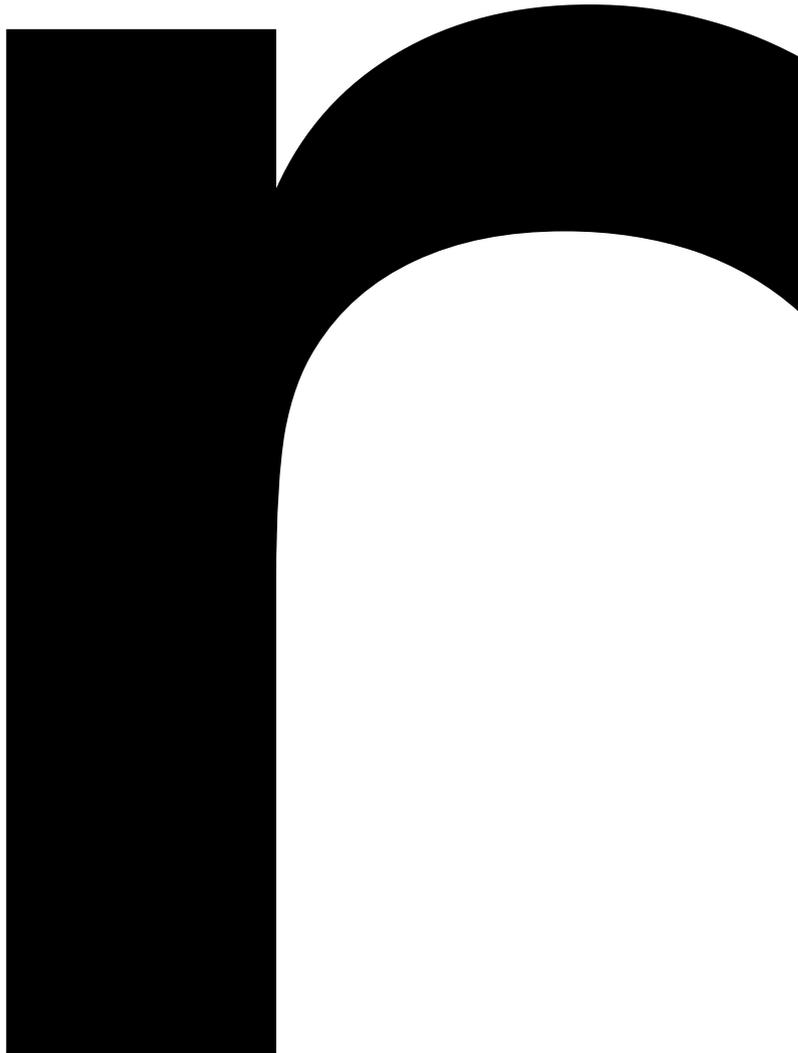
2

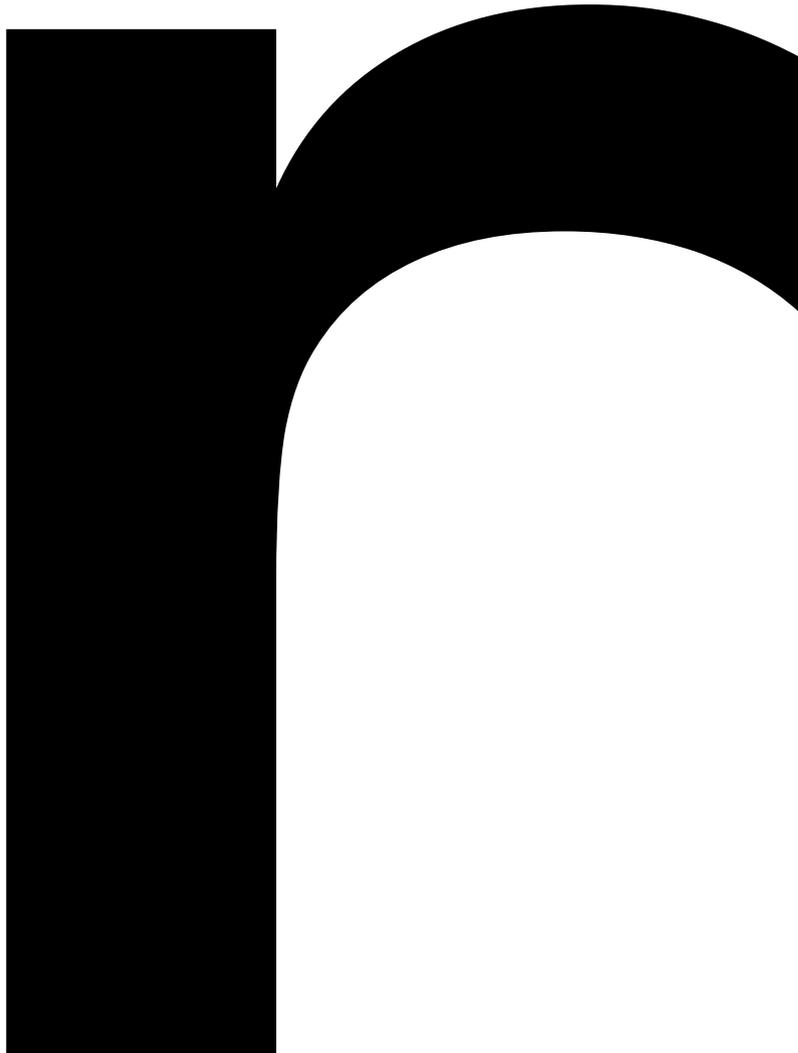




2

e





e

C

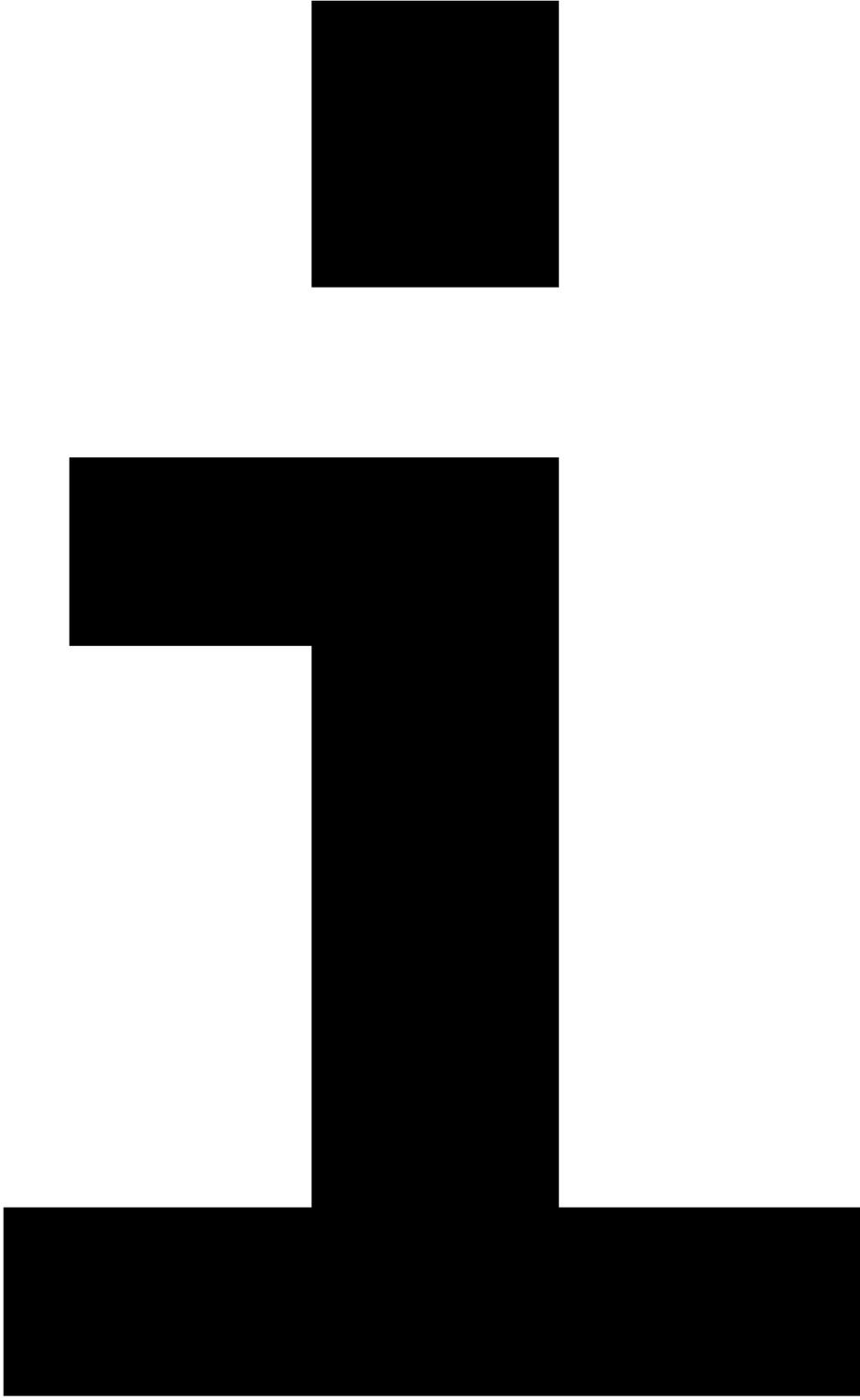
h

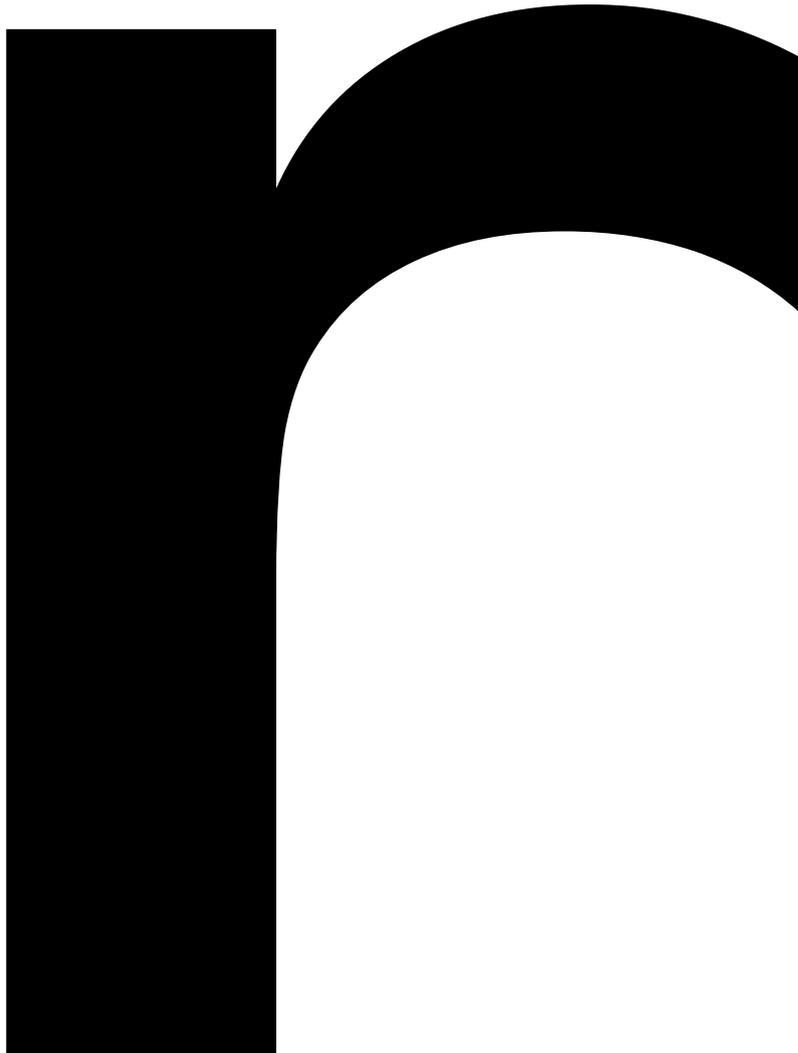
n

e

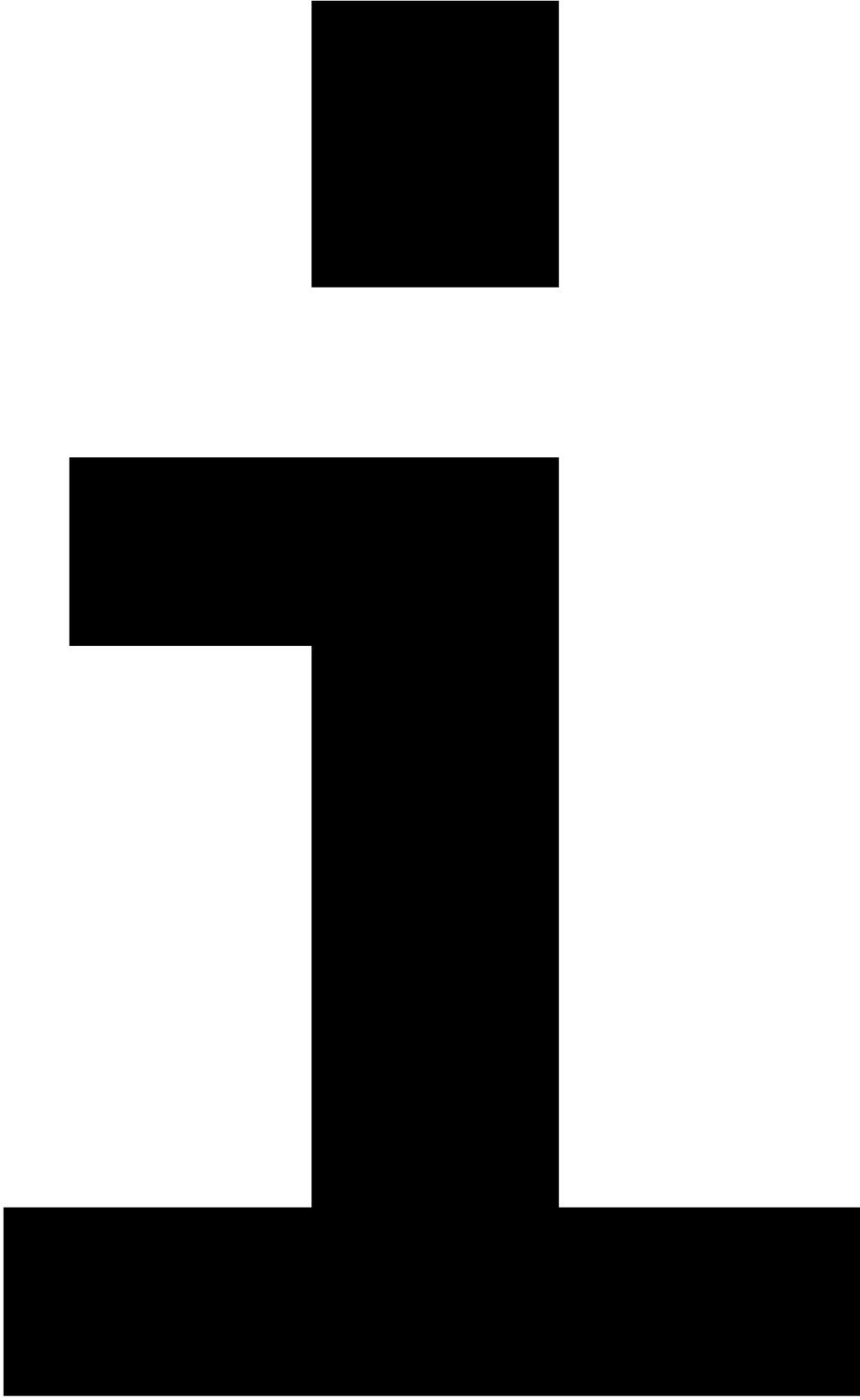
n

w





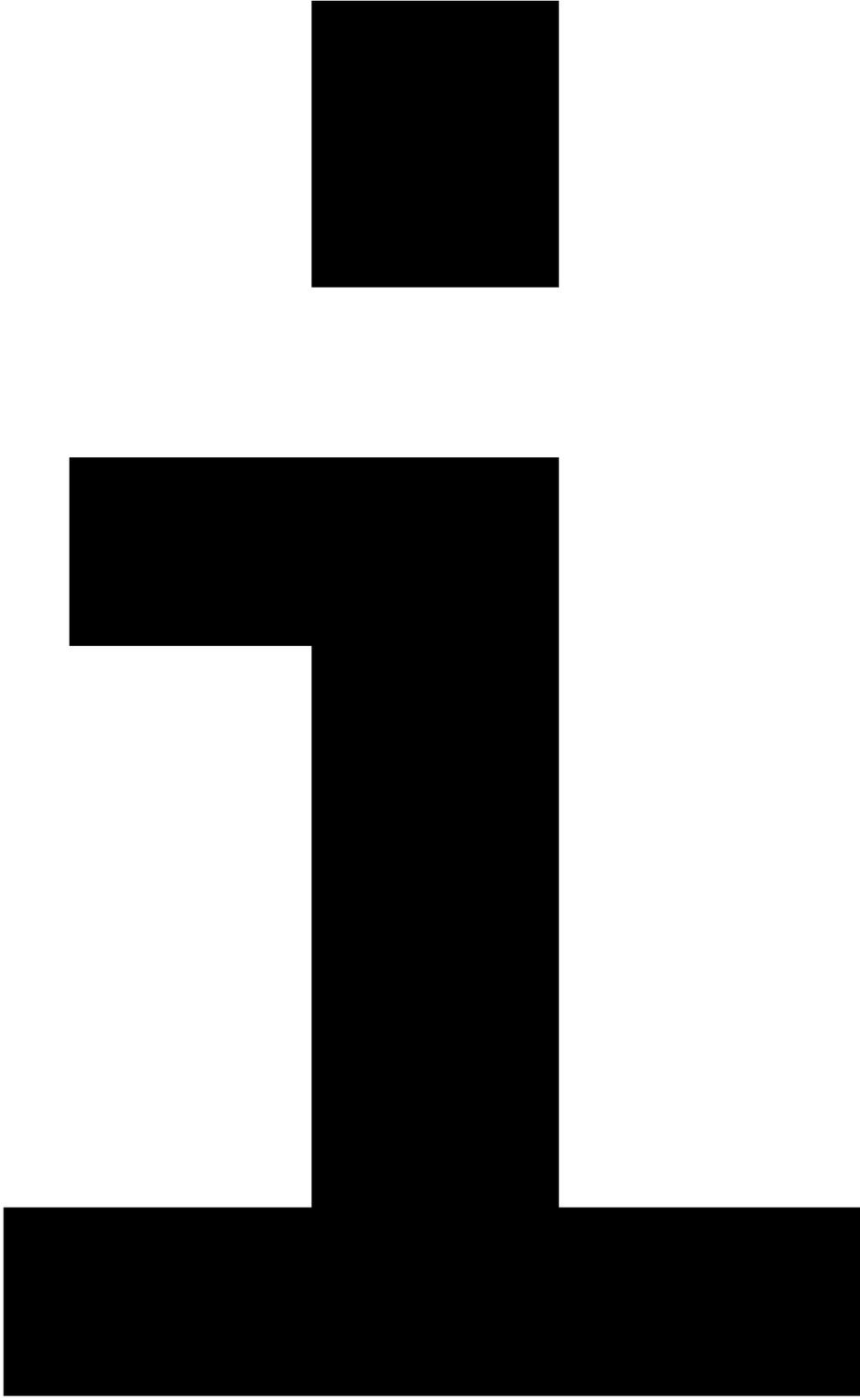
e

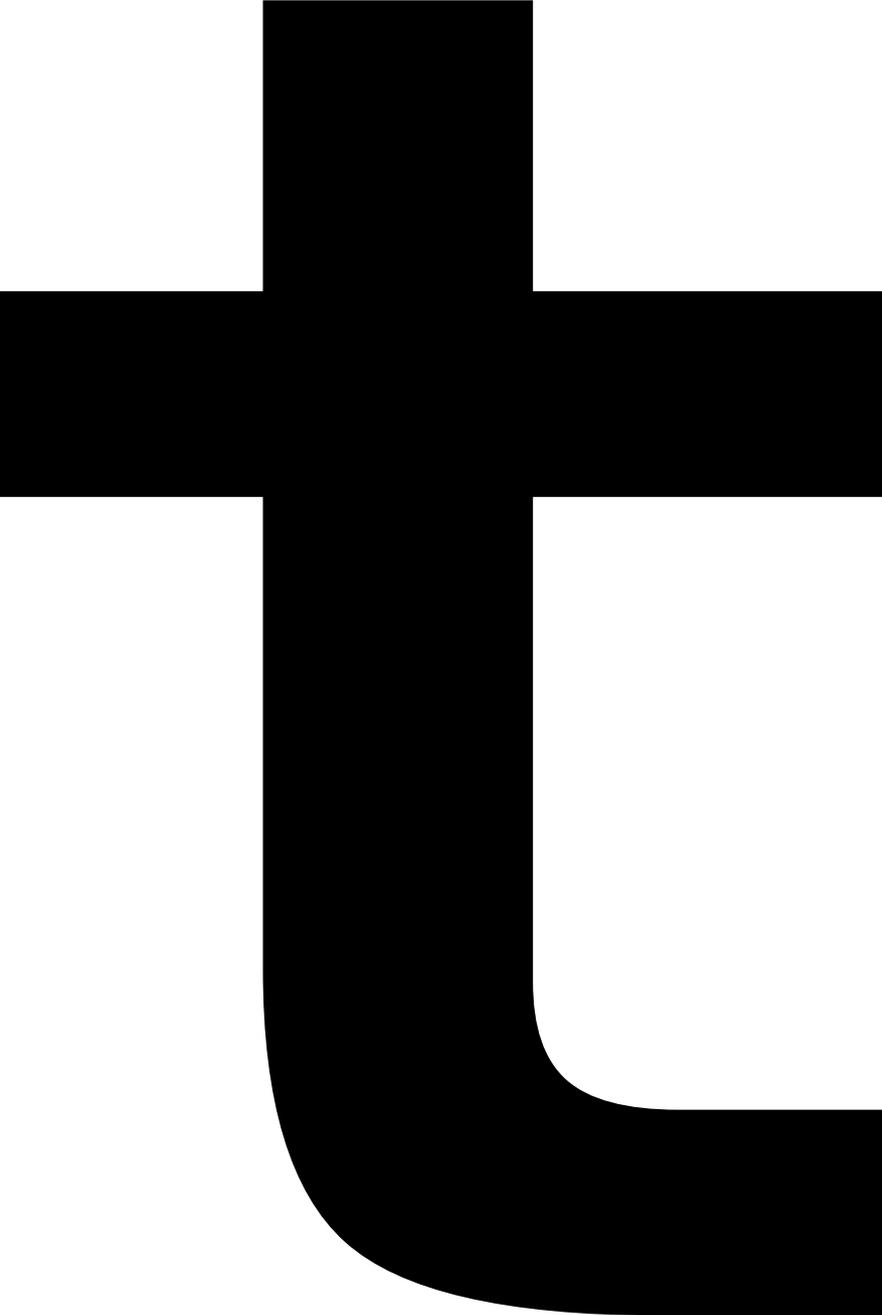


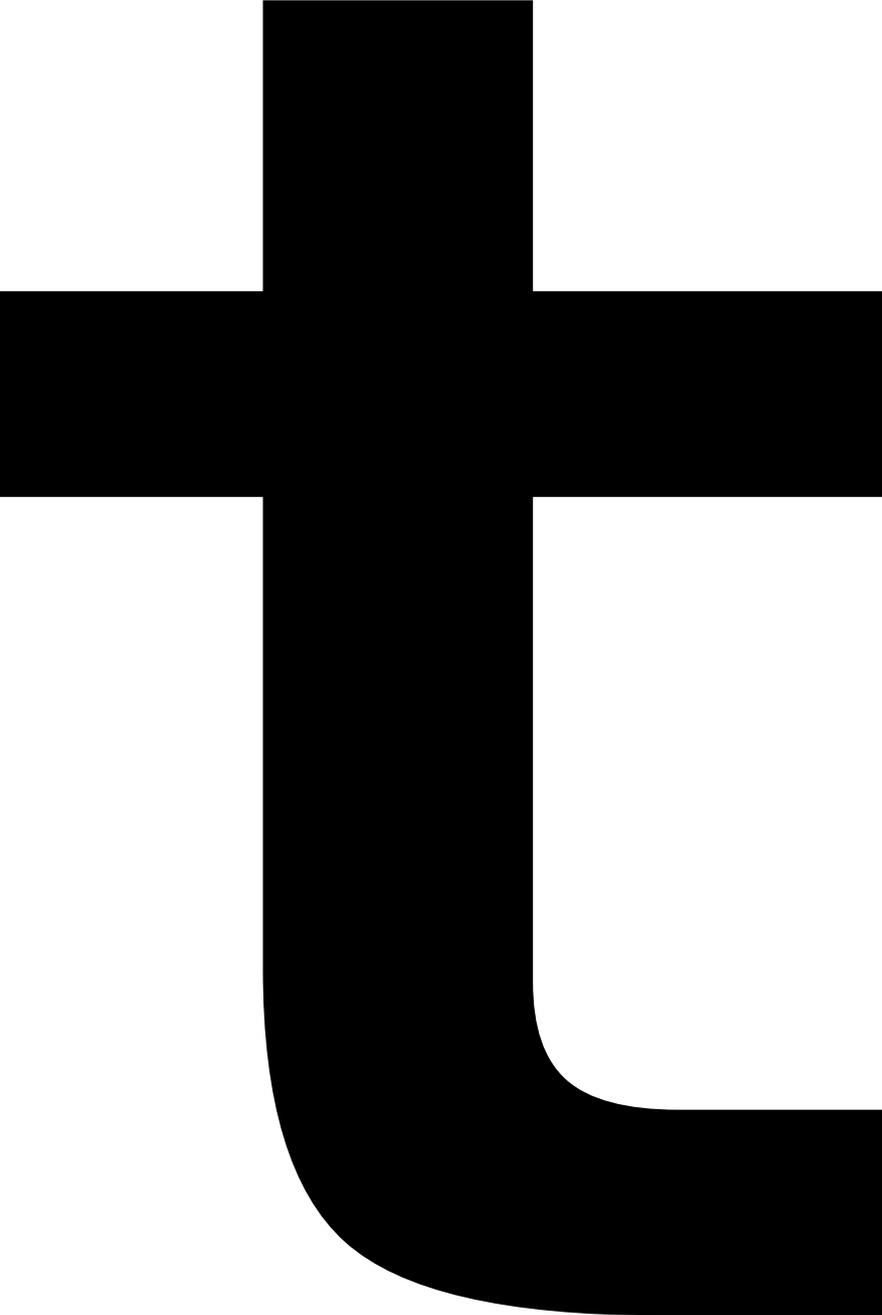
n

e

m

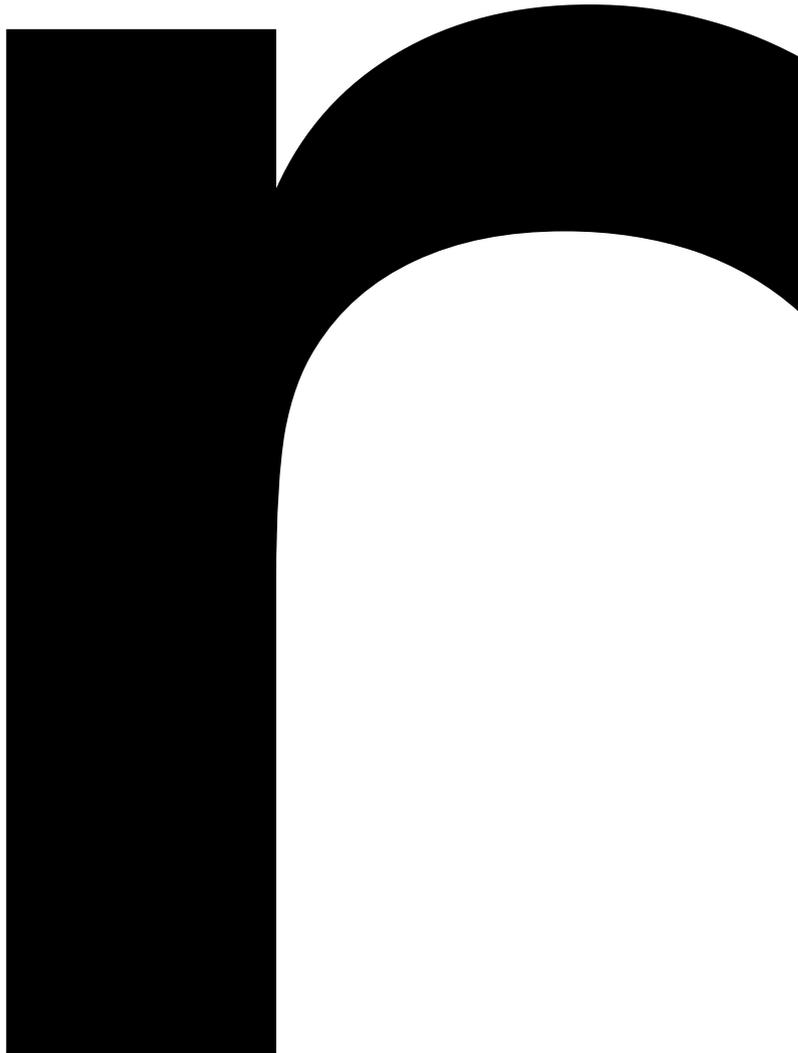






J

e



e

A

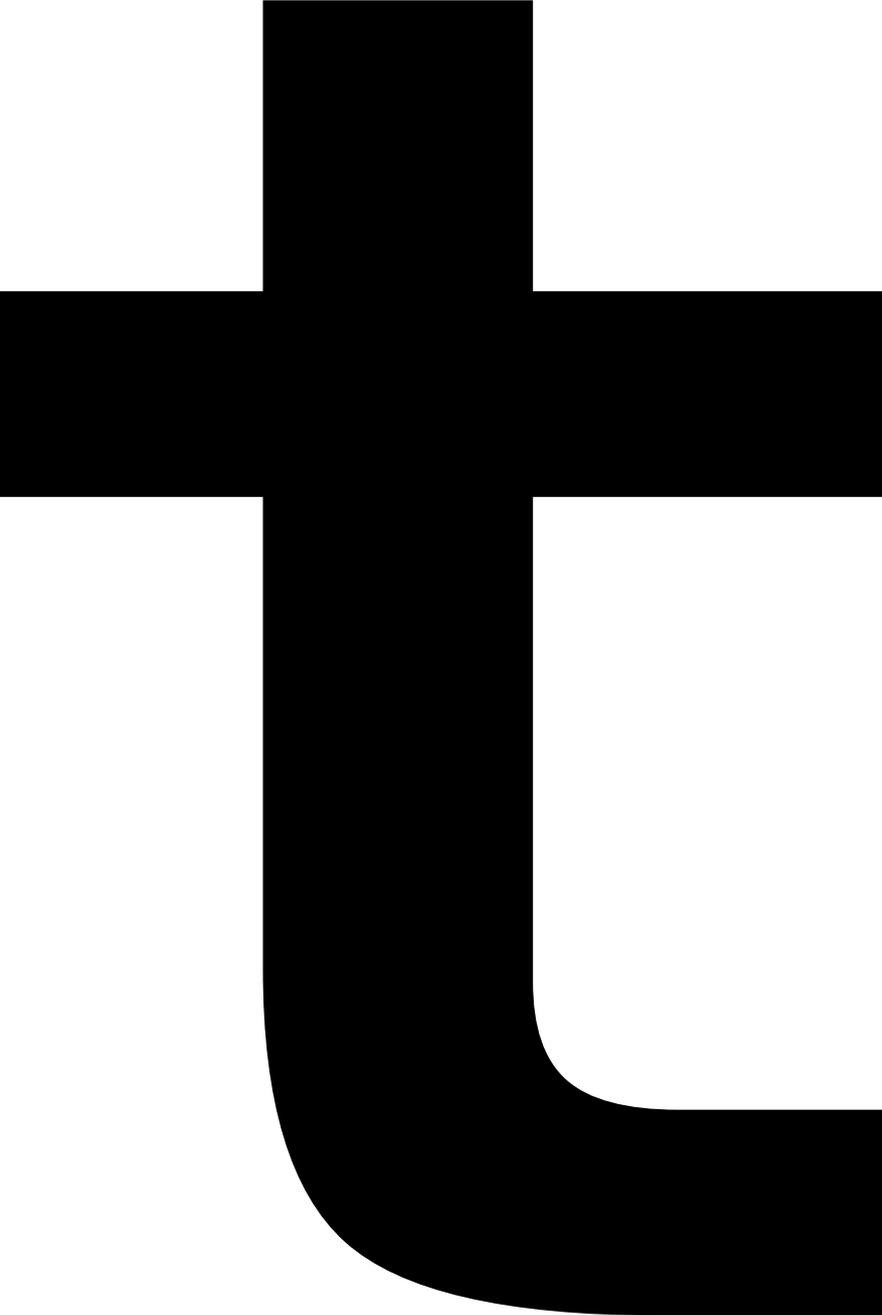
u

S

10

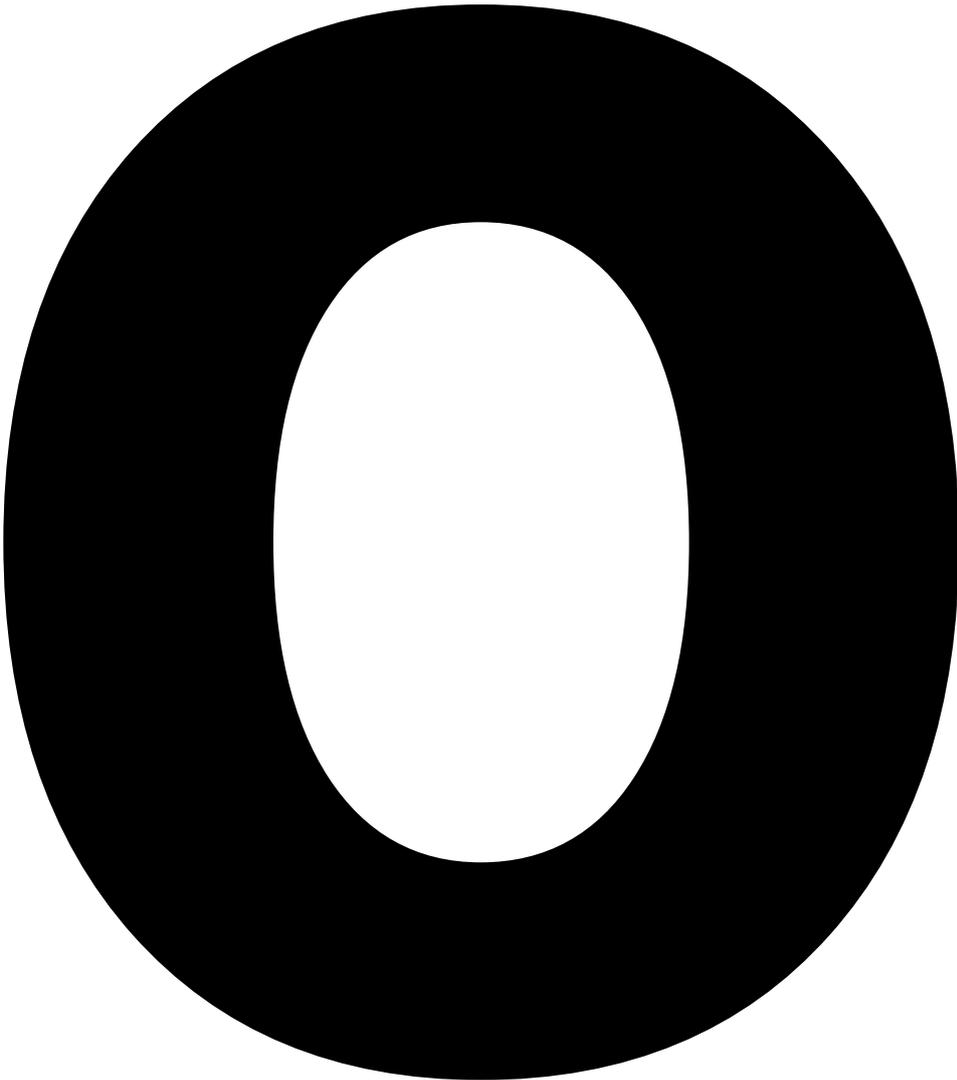
e

u

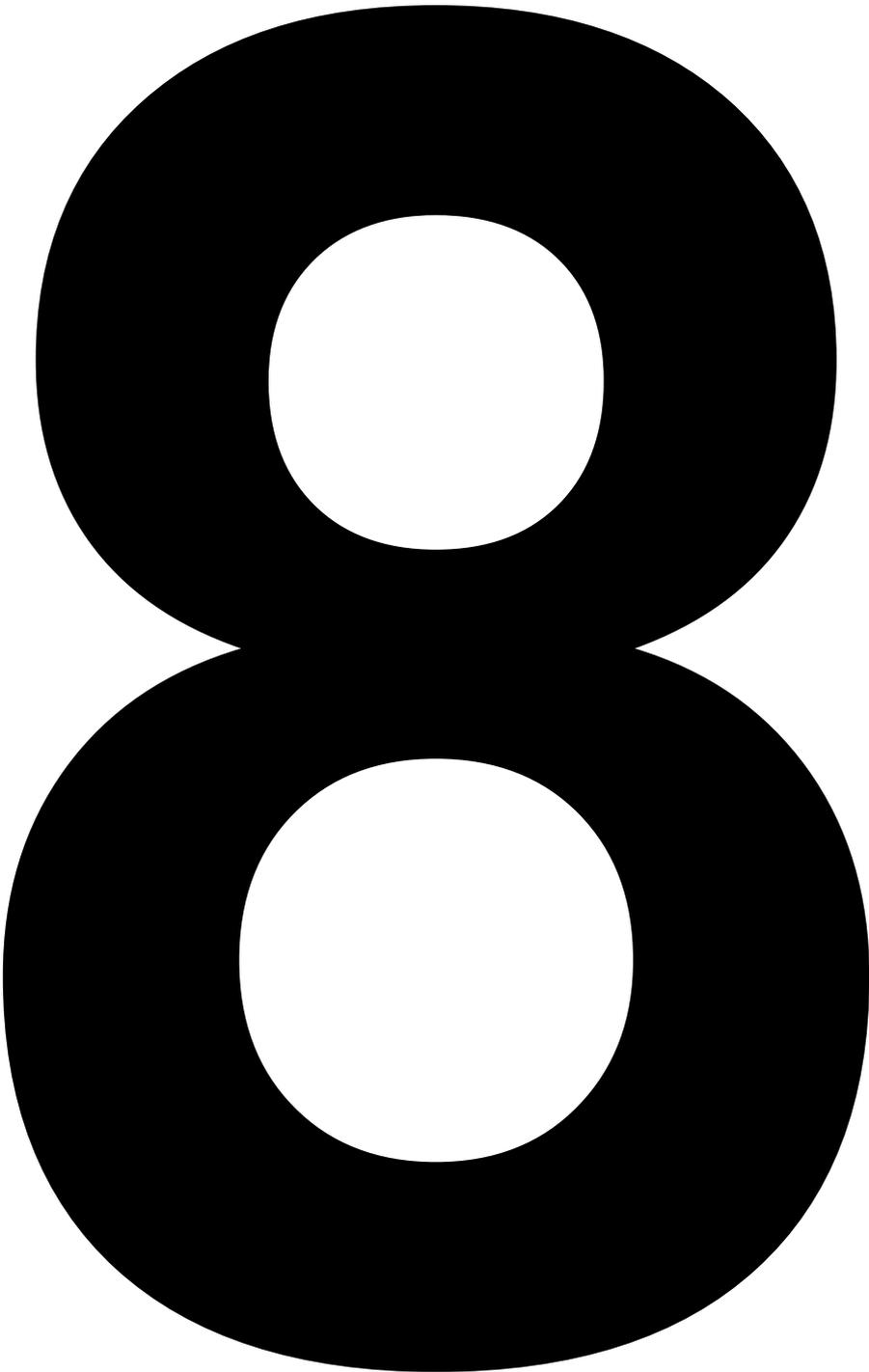


e

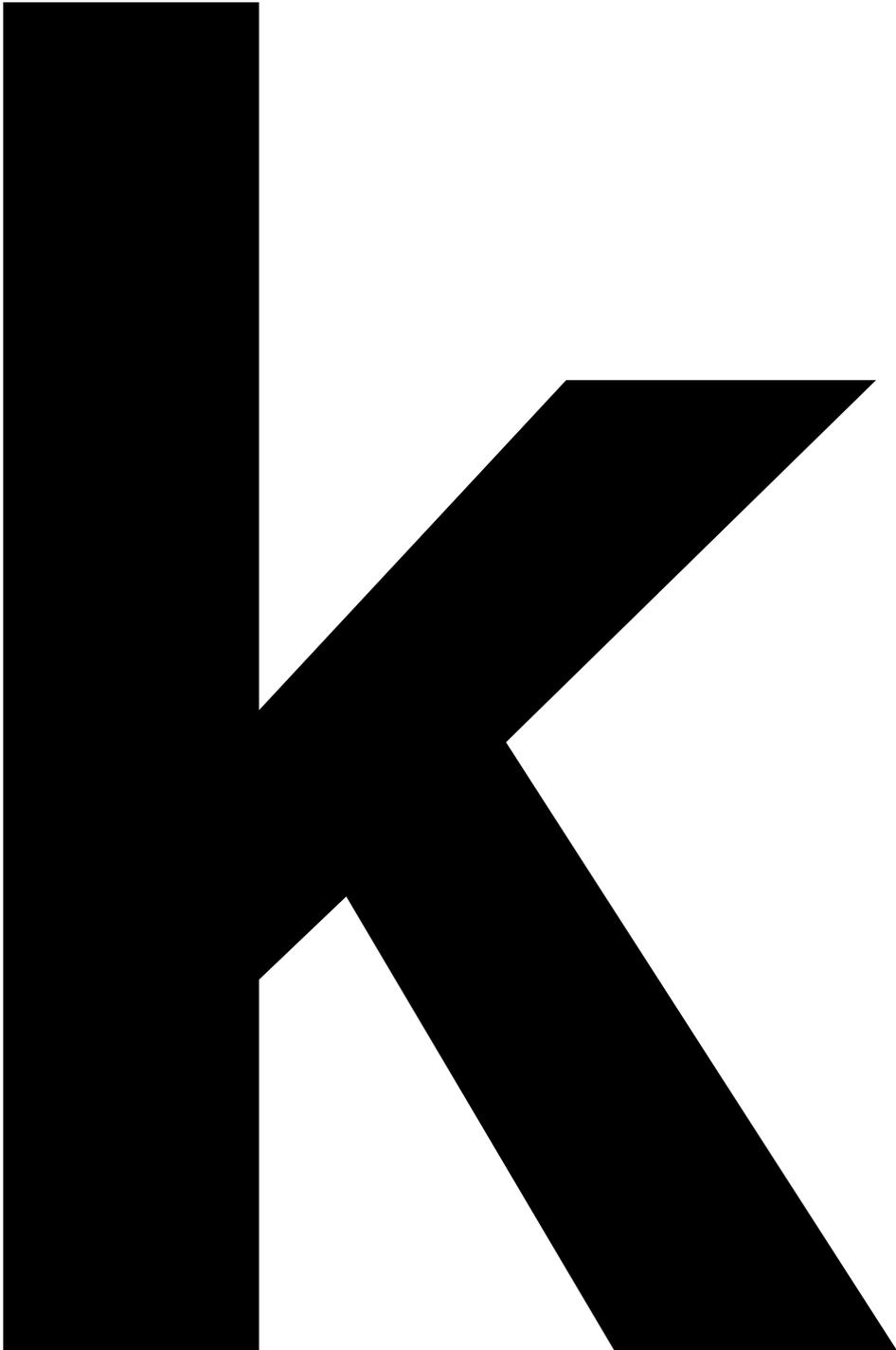
V



n



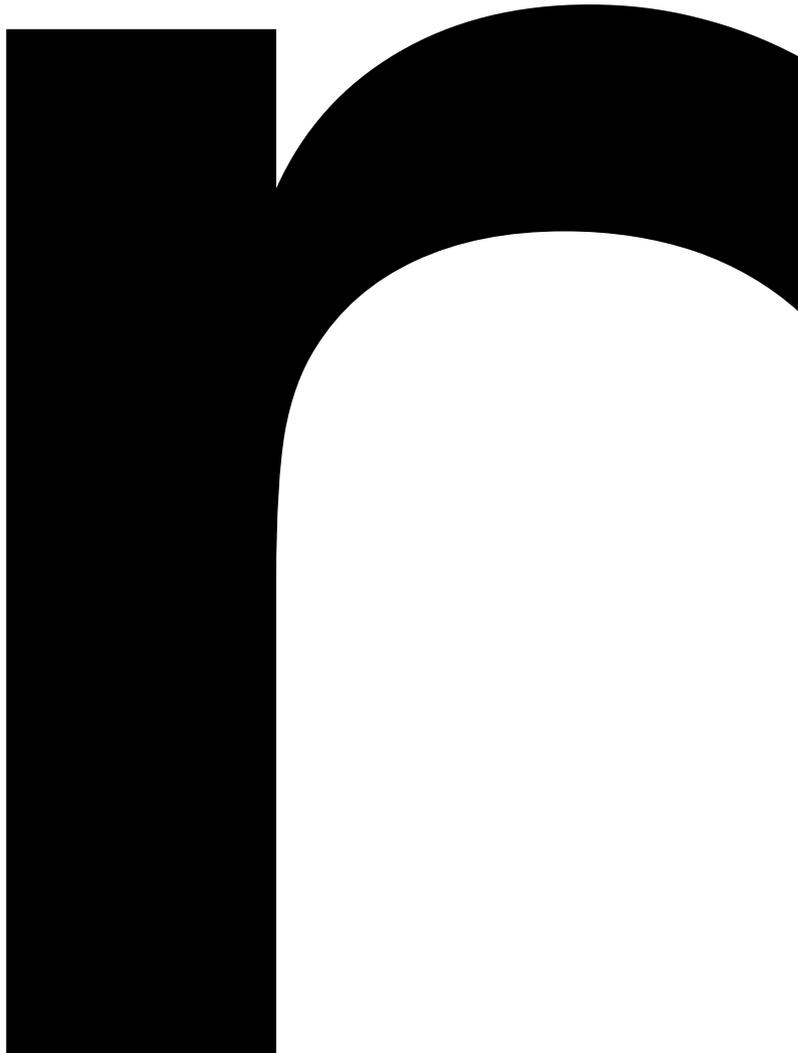
6

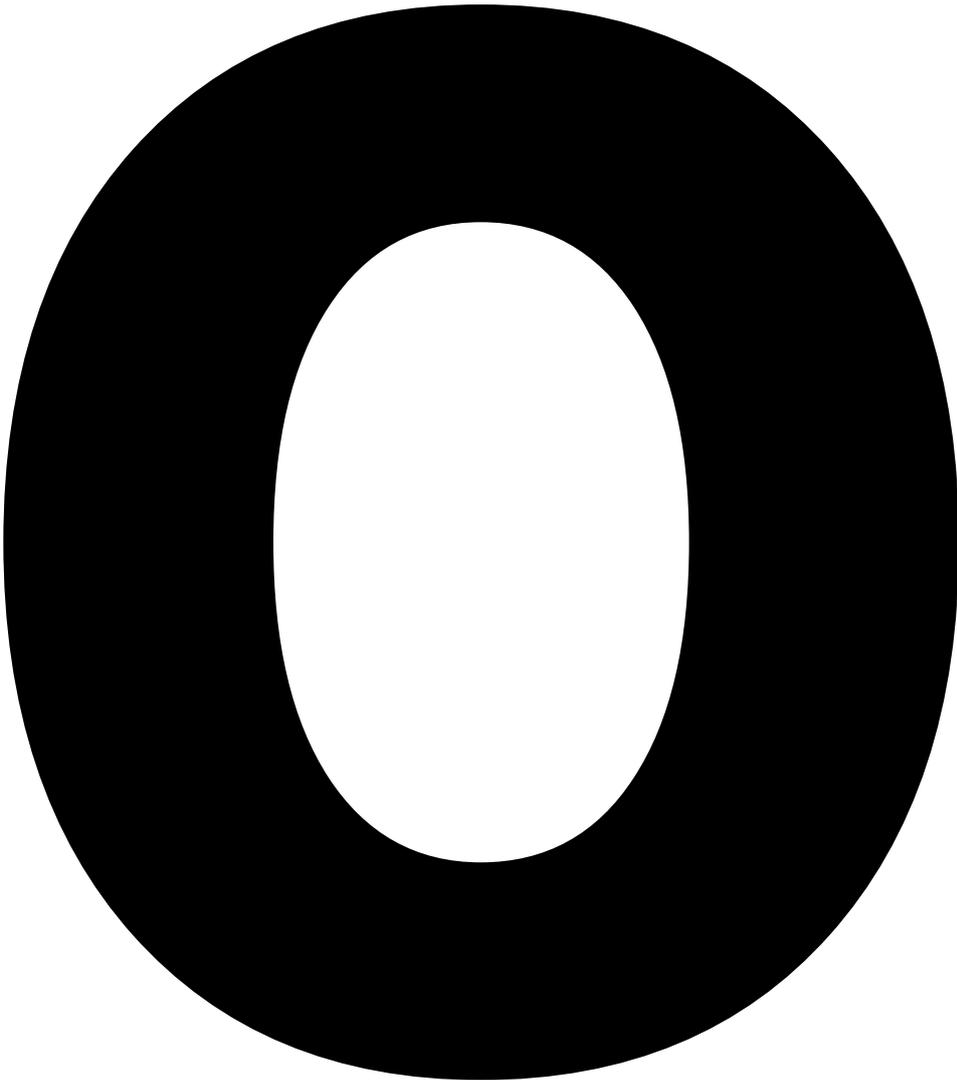


w

h

o





m

2

u

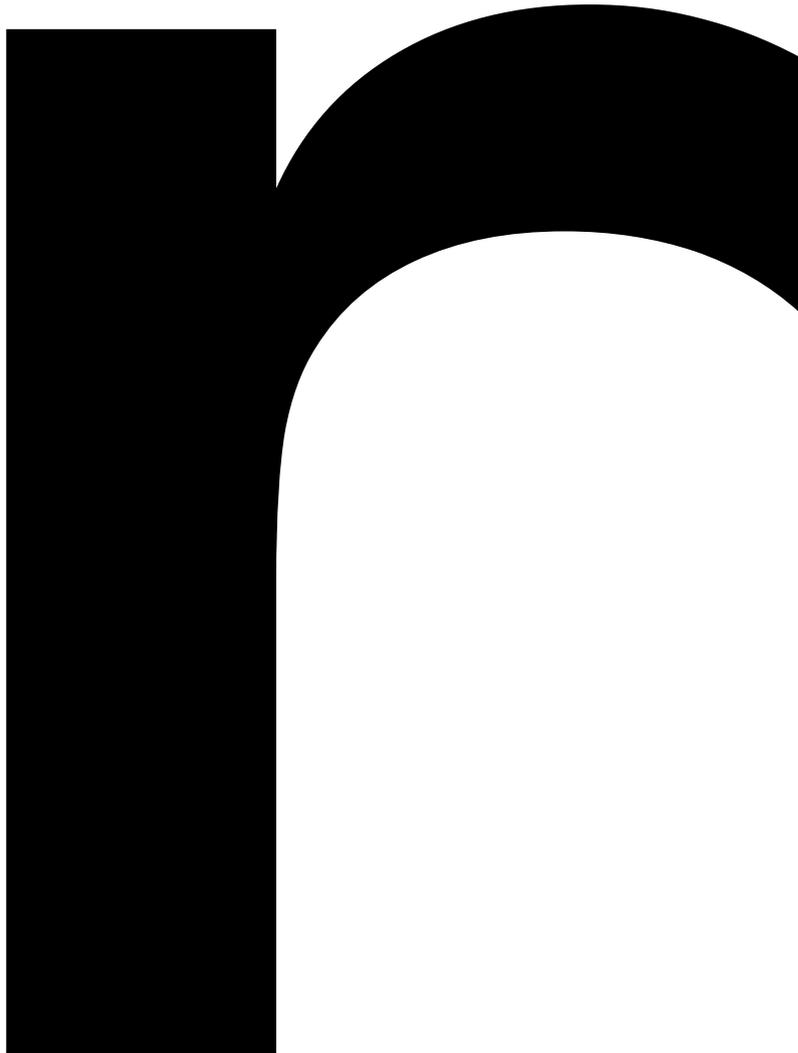
n

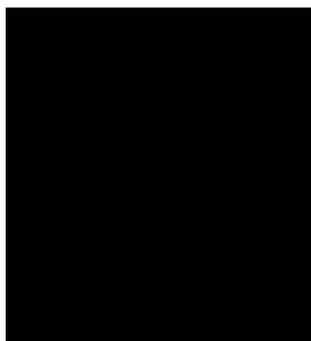
Q

J

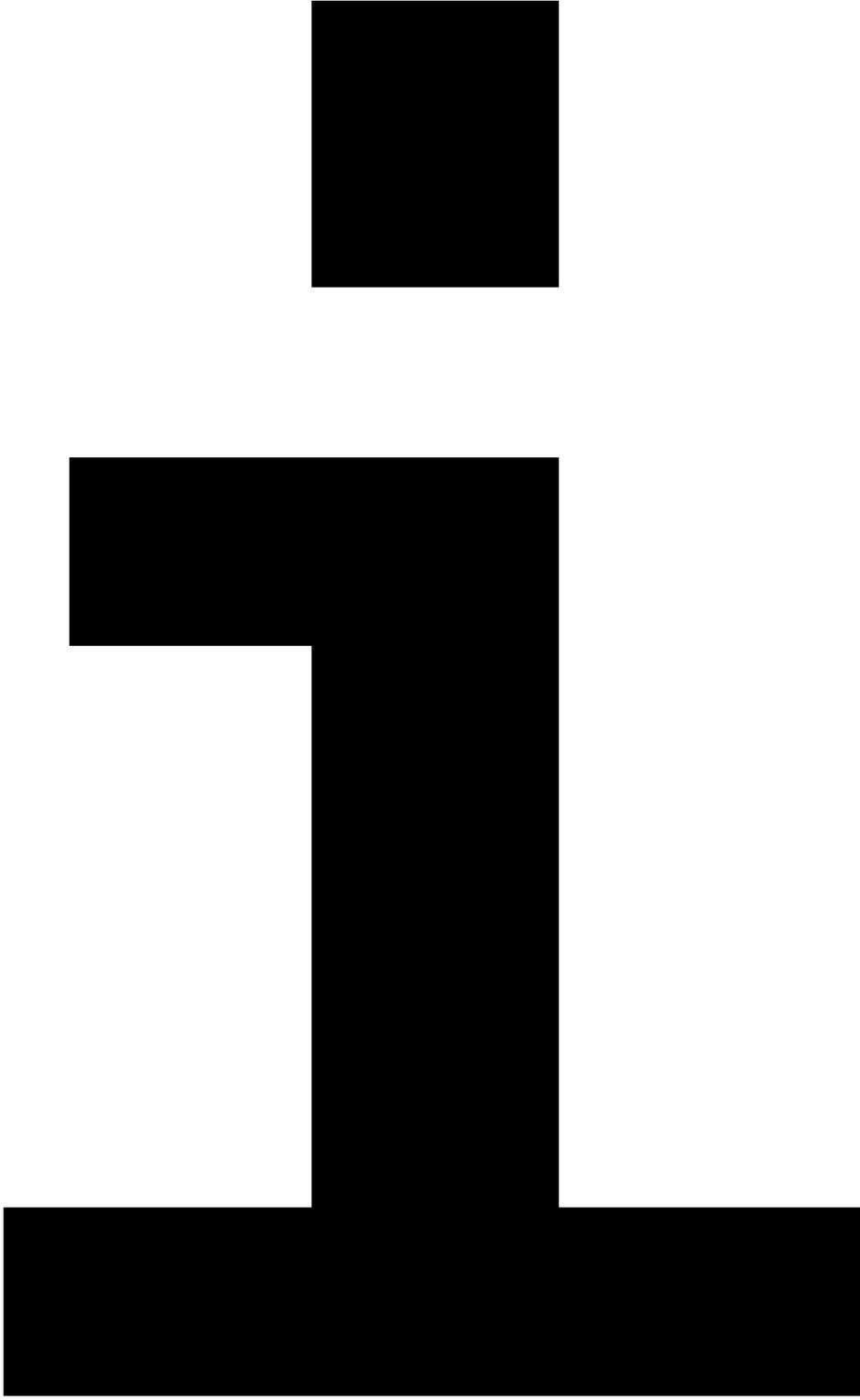
sa

h





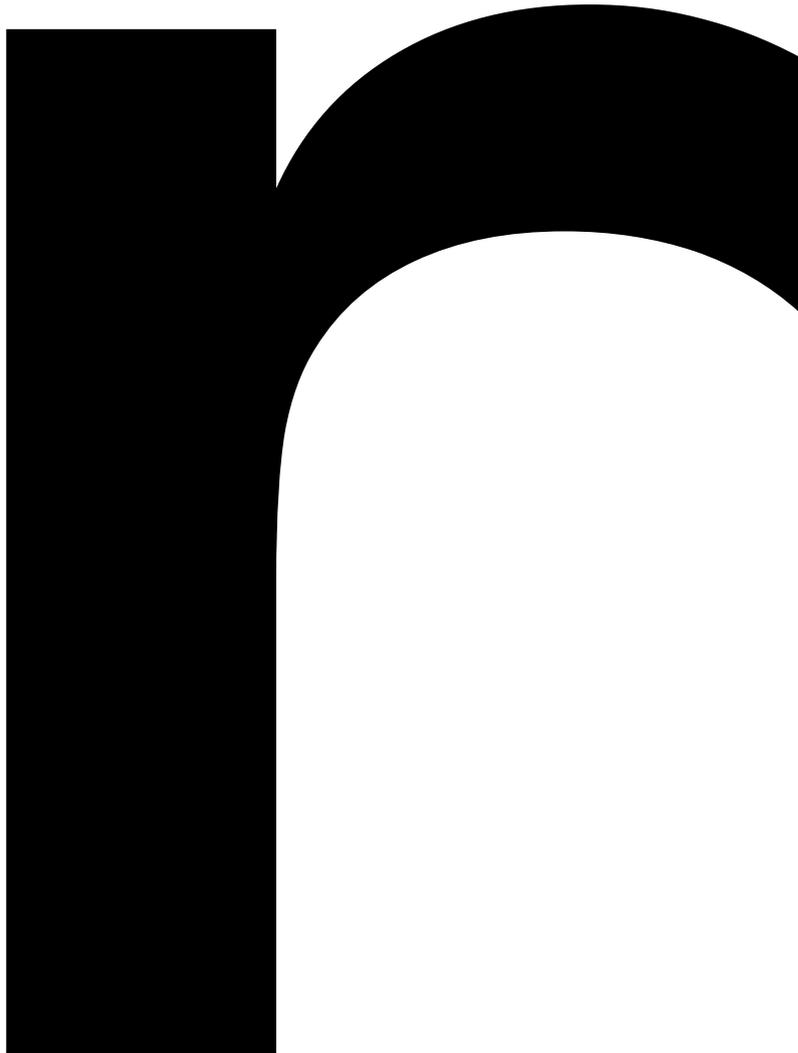
D



e

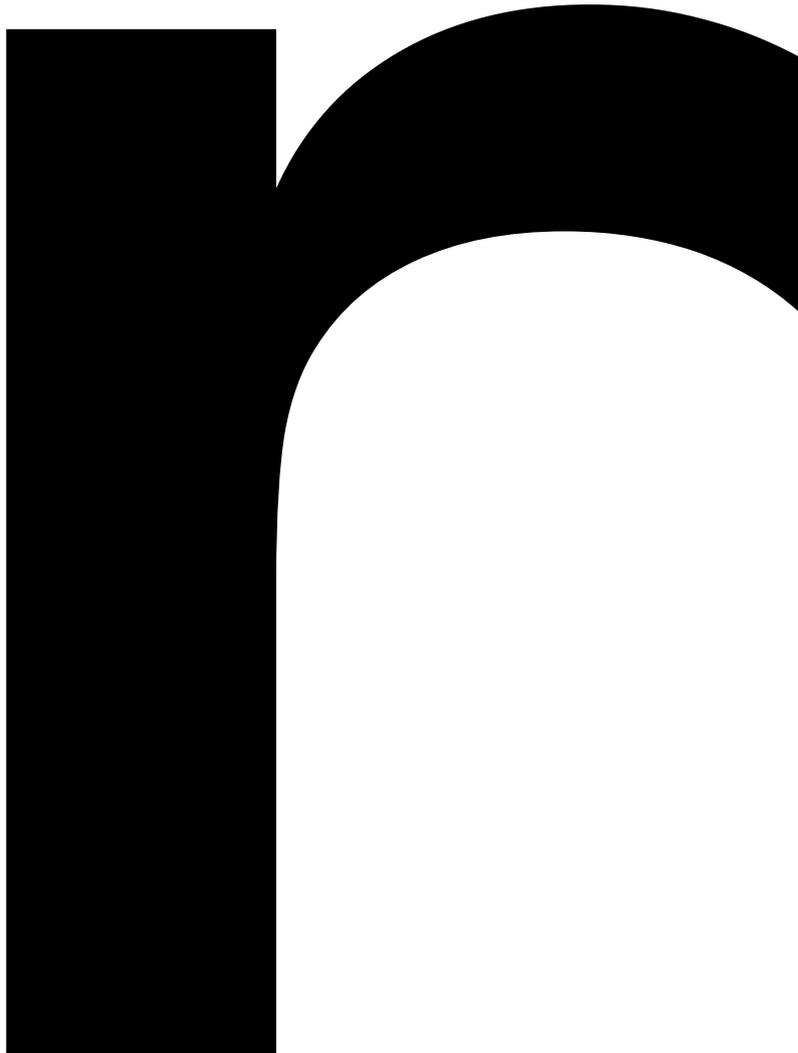
S

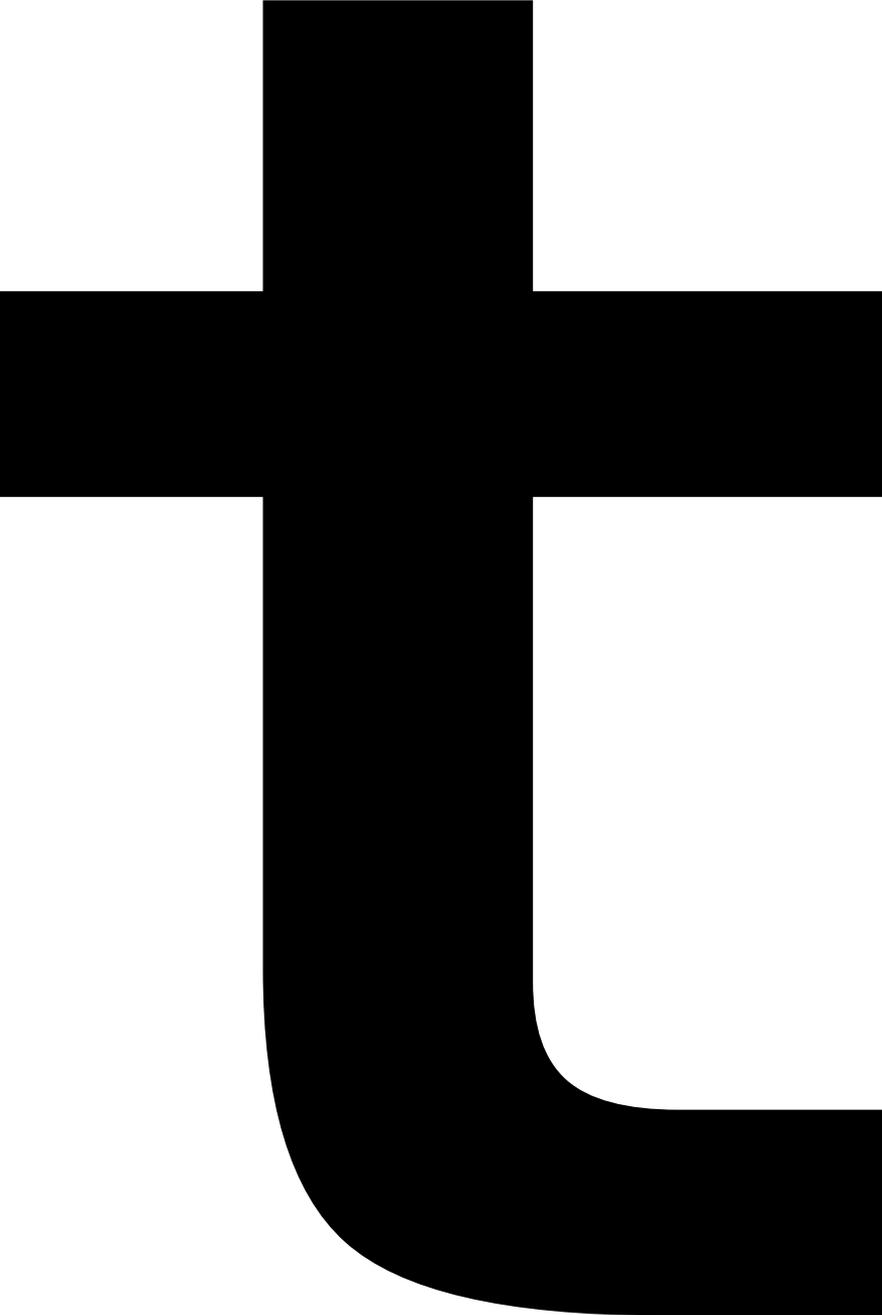
e



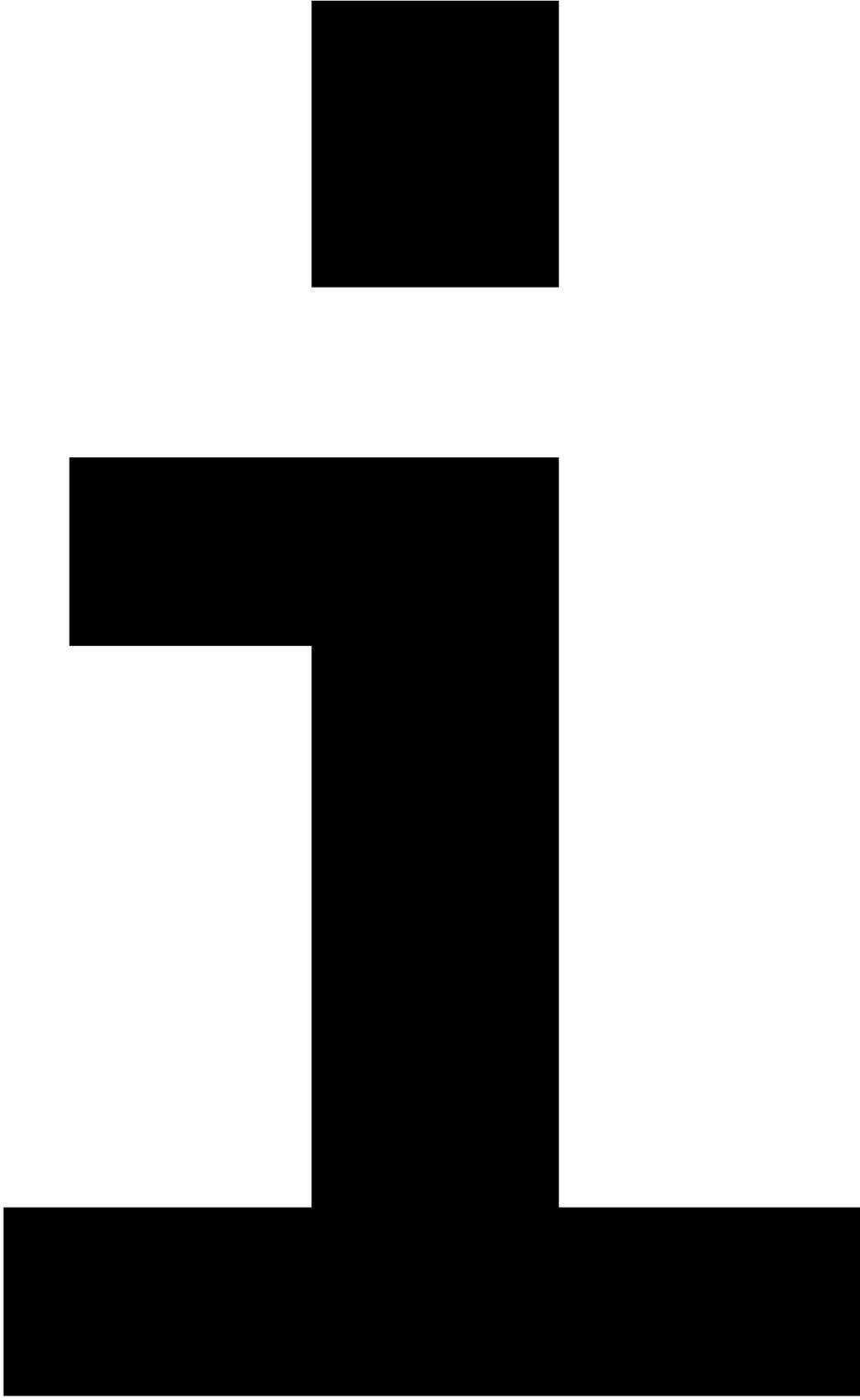
w

e

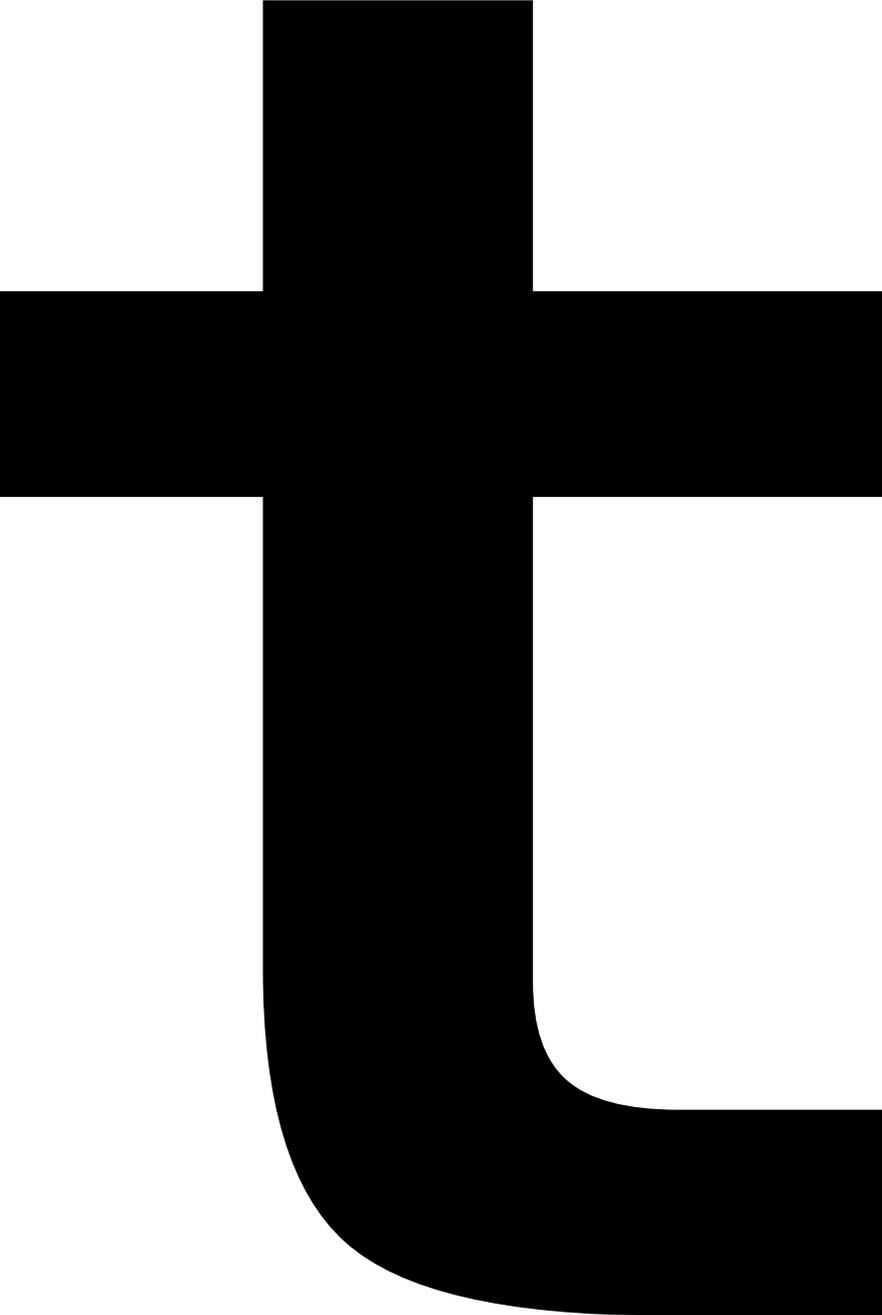


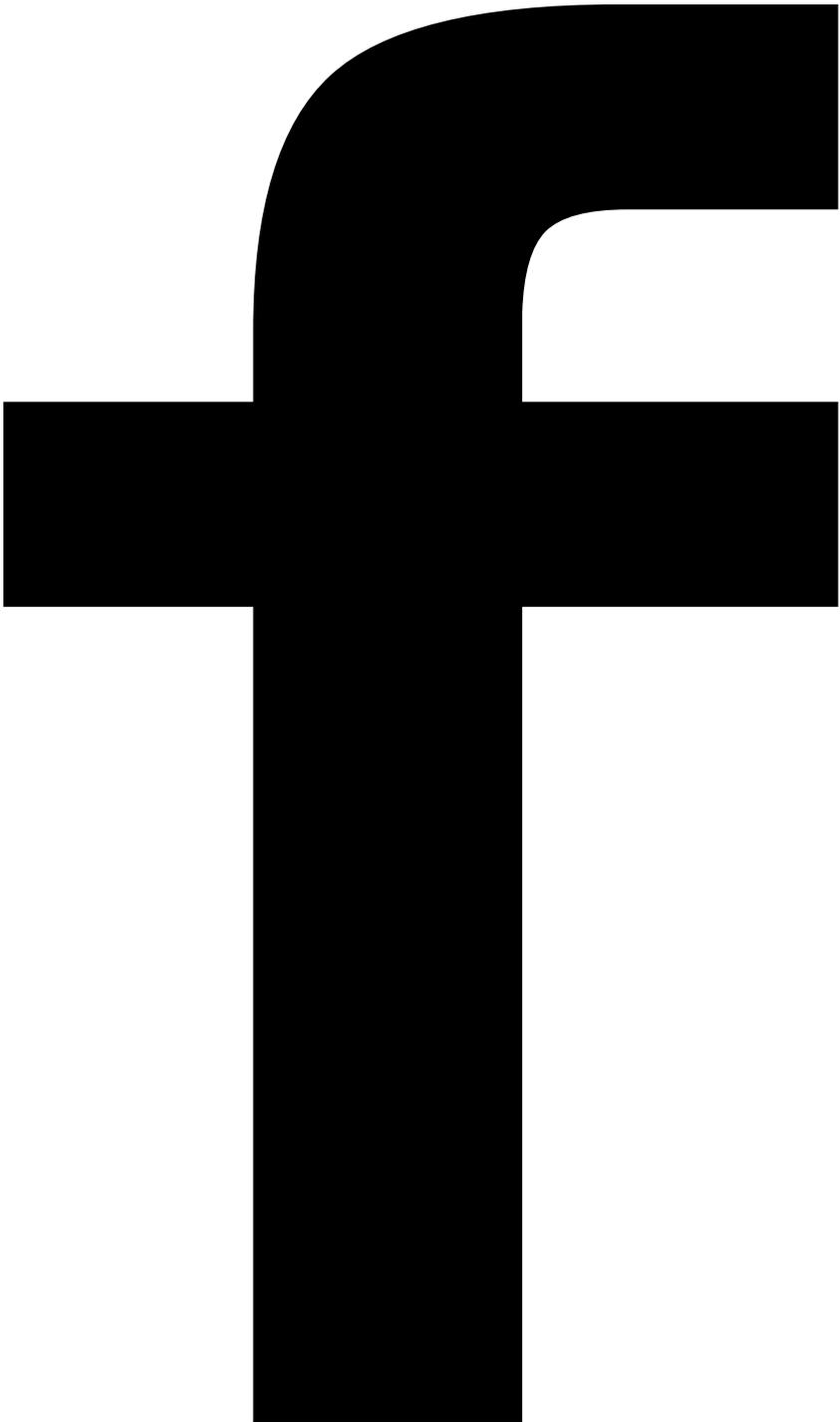


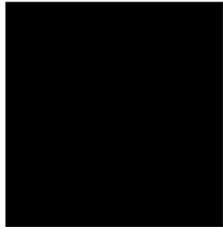
Q



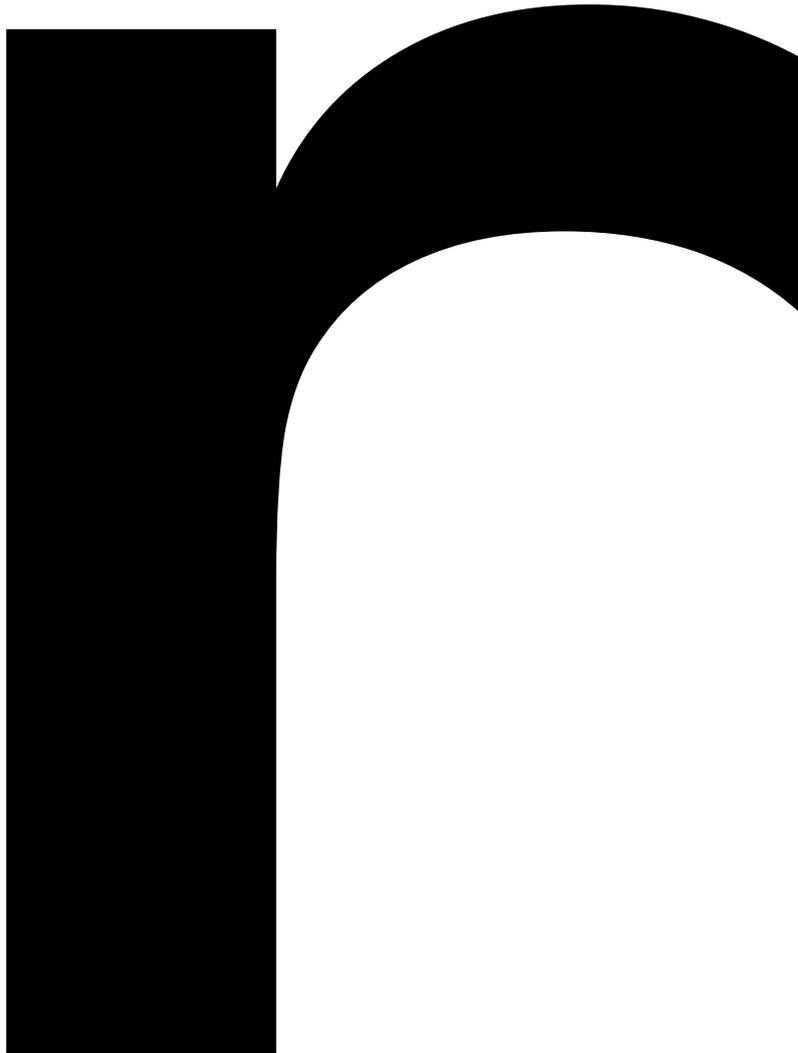
J

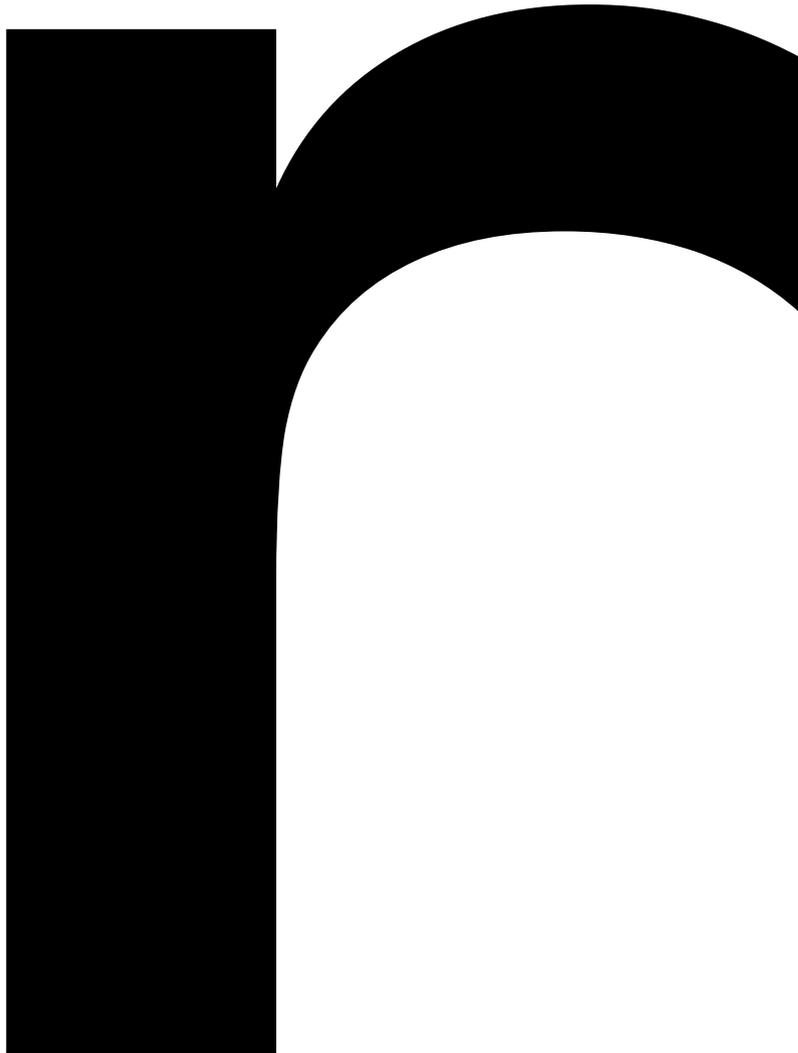






u

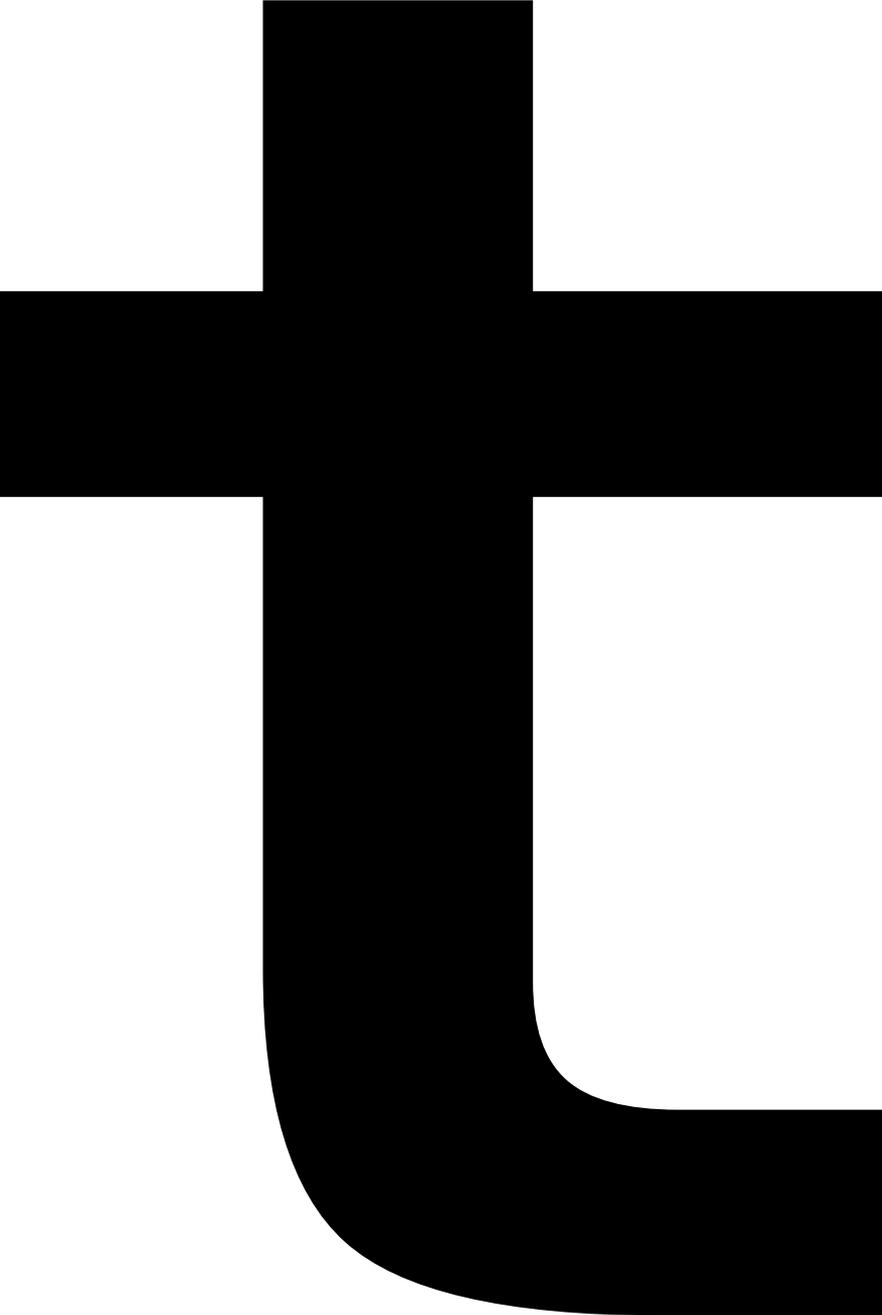


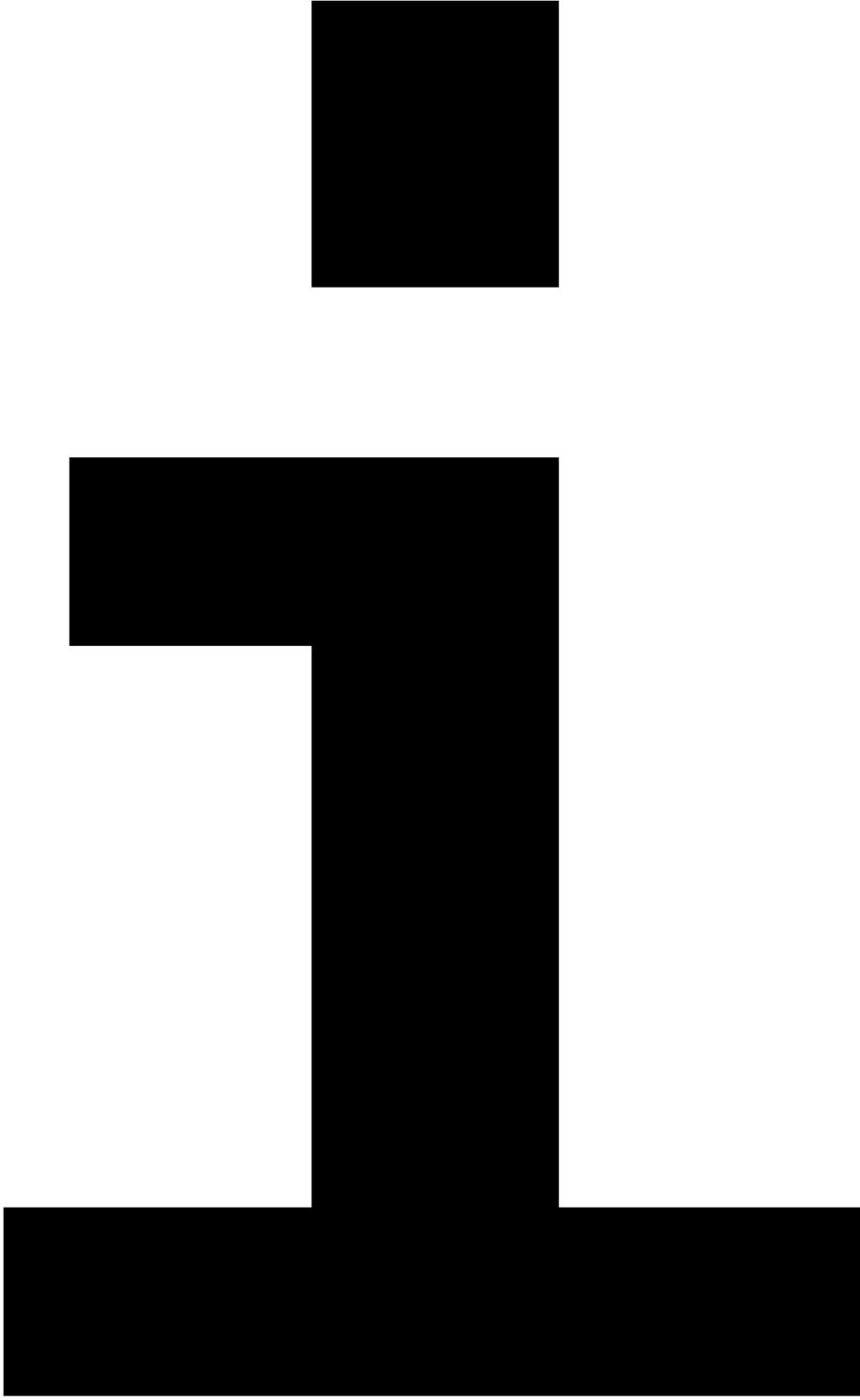


e

J

sa





V

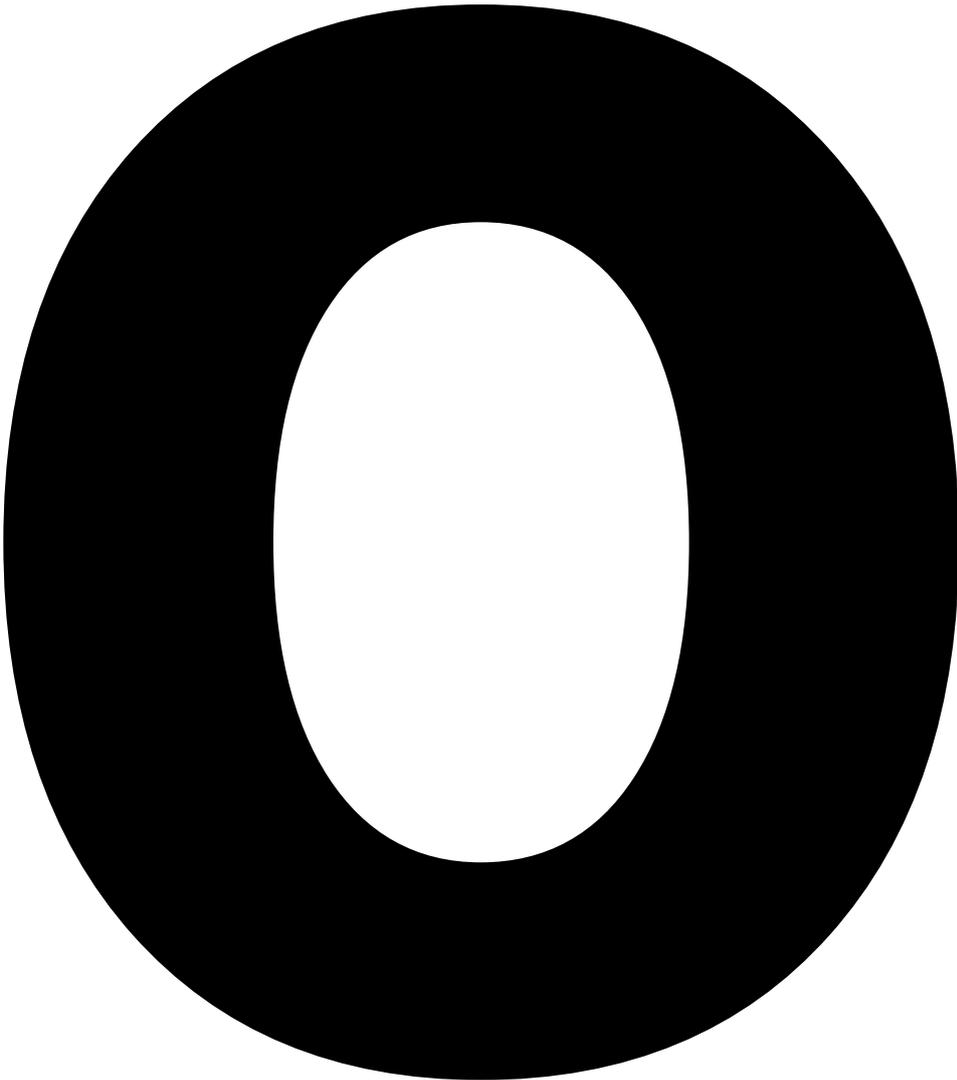
n

e

u

e

M

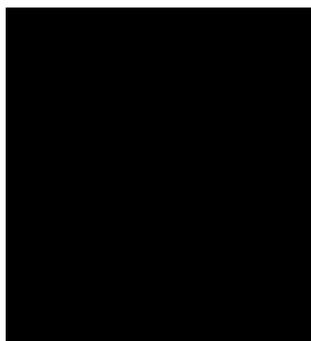


Q

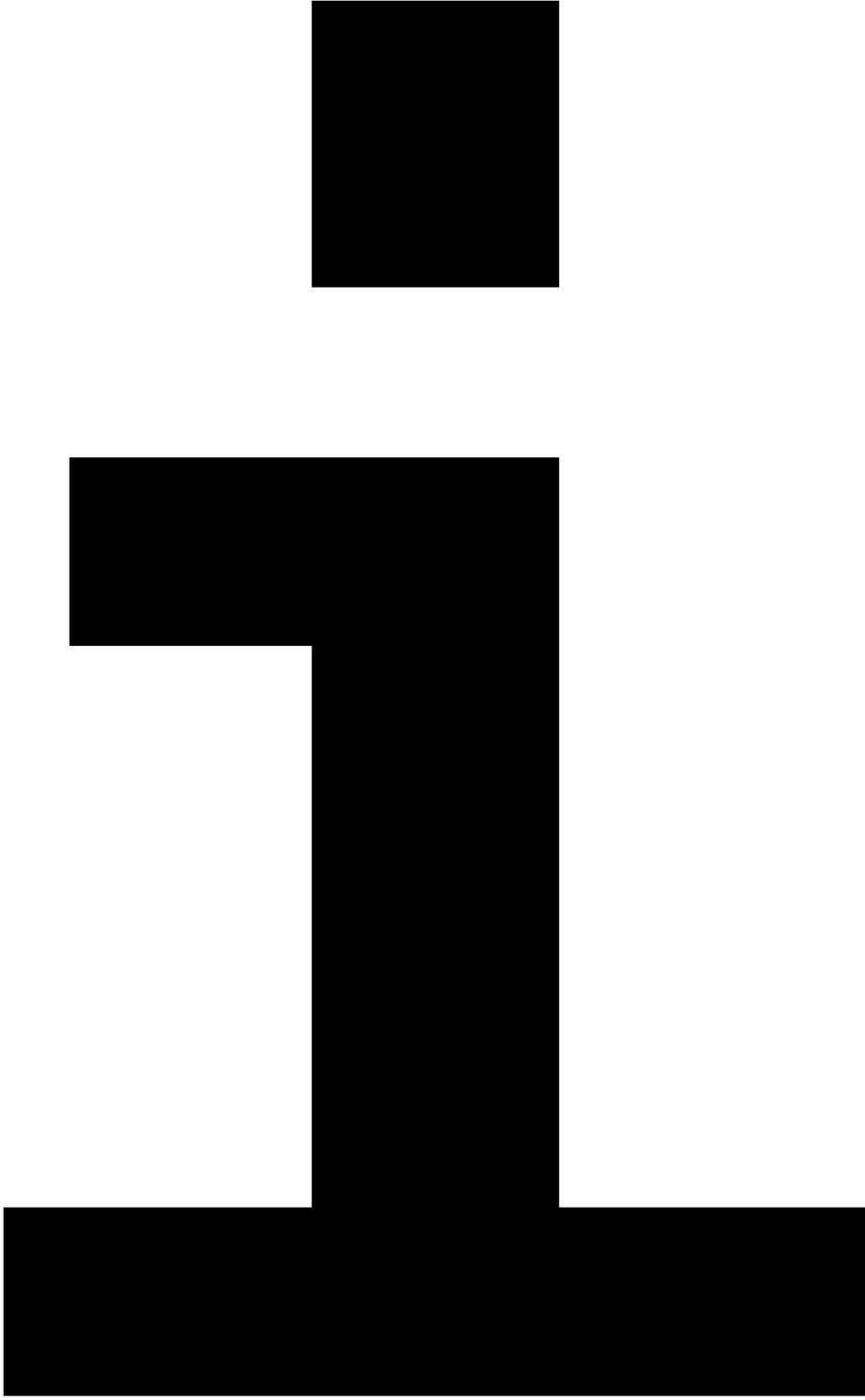
u

J

e

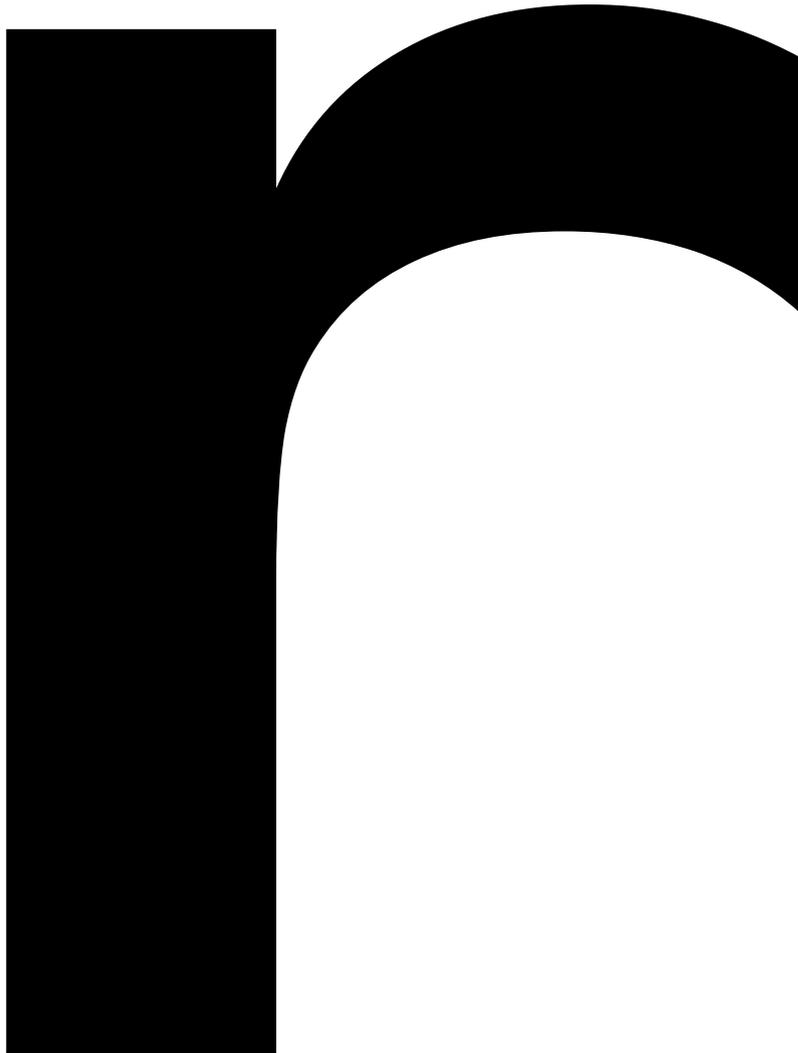


D

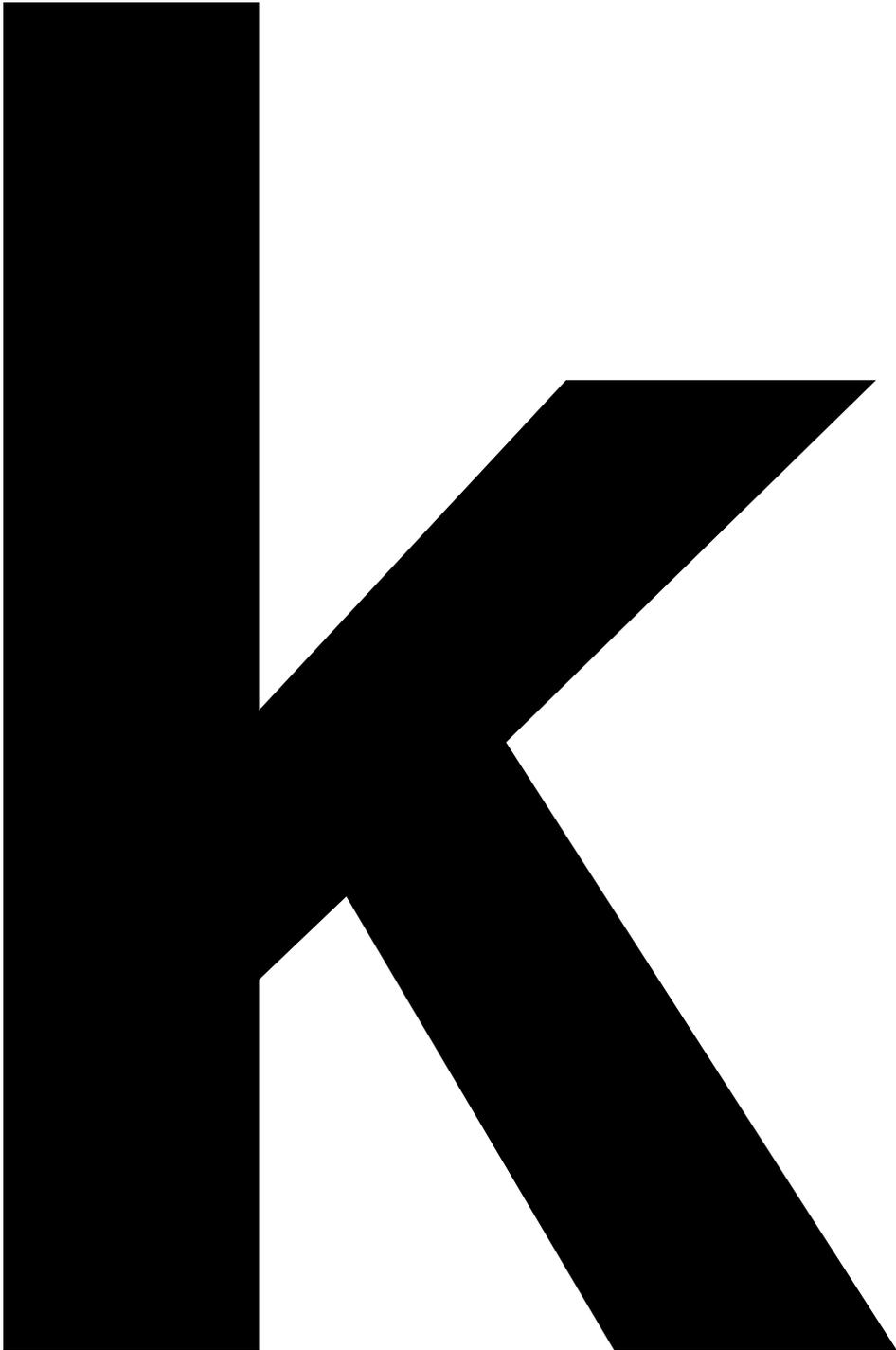


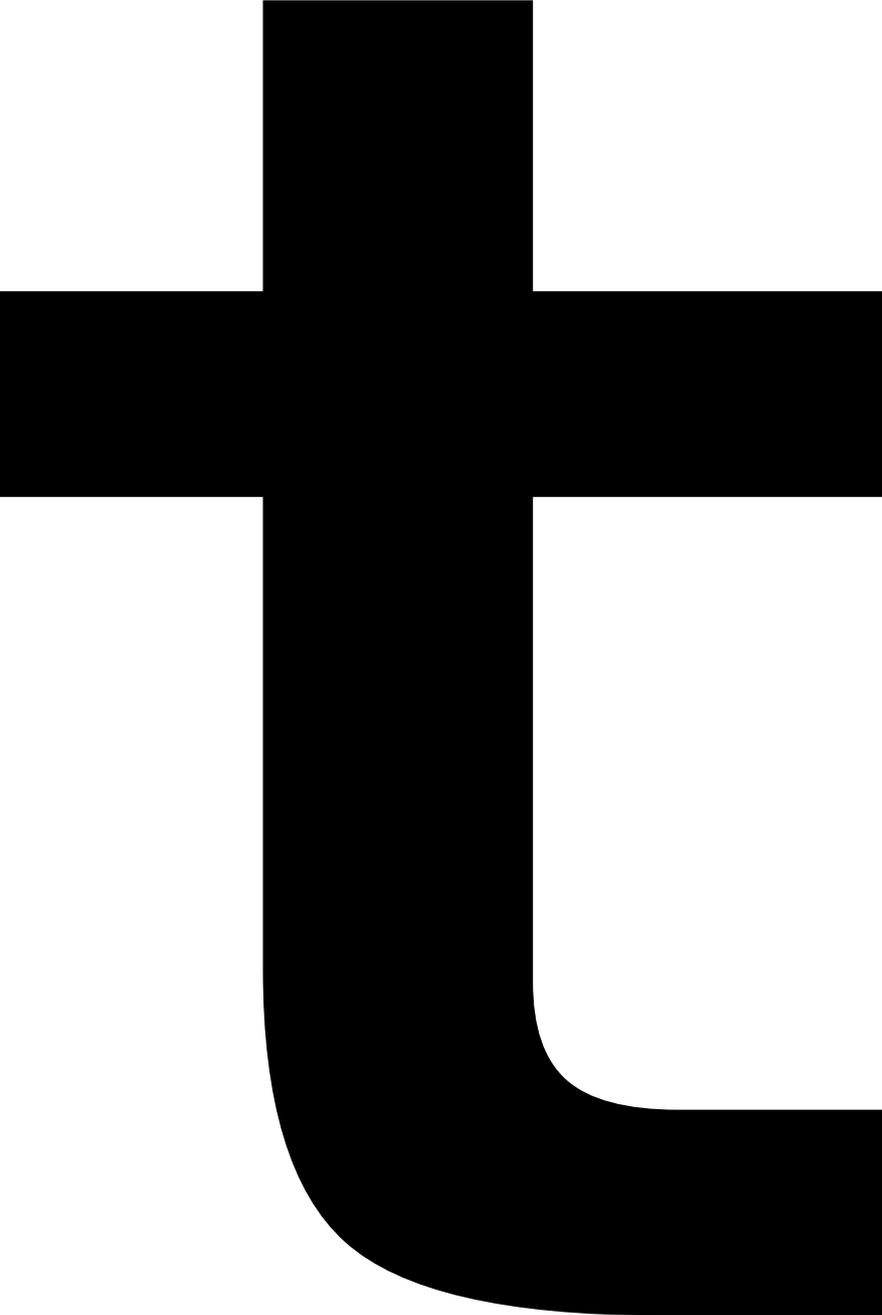
e

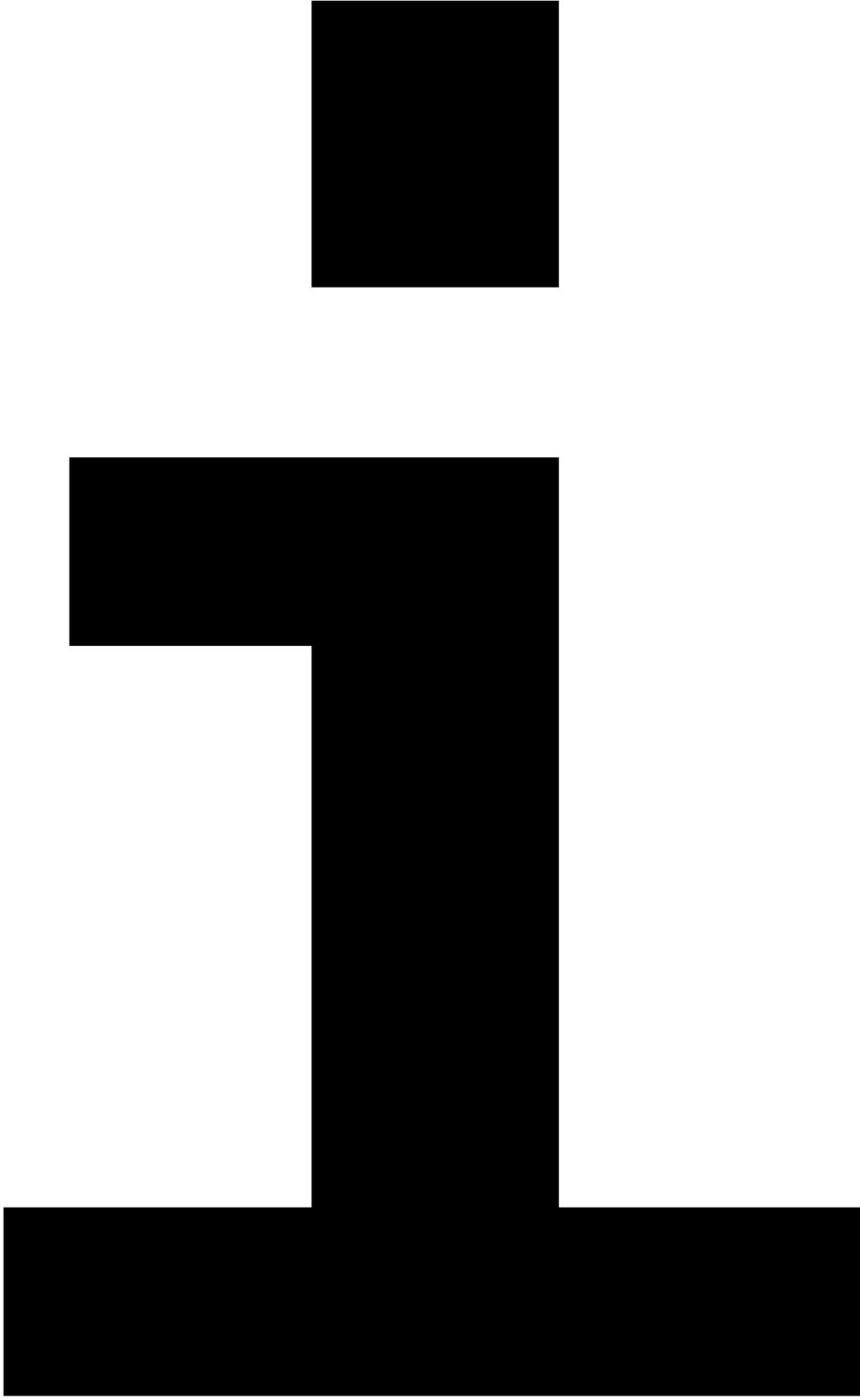
o



sa





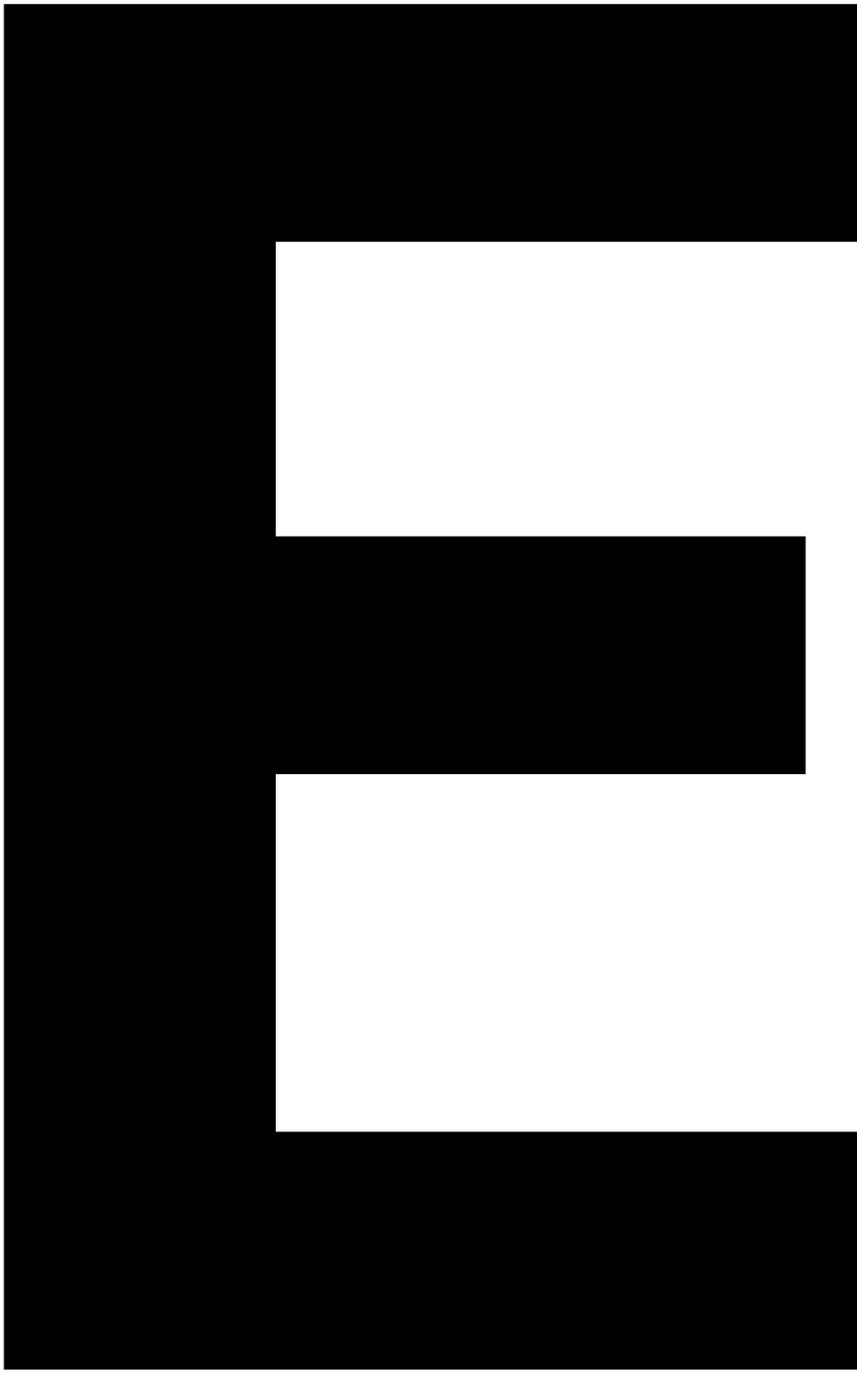


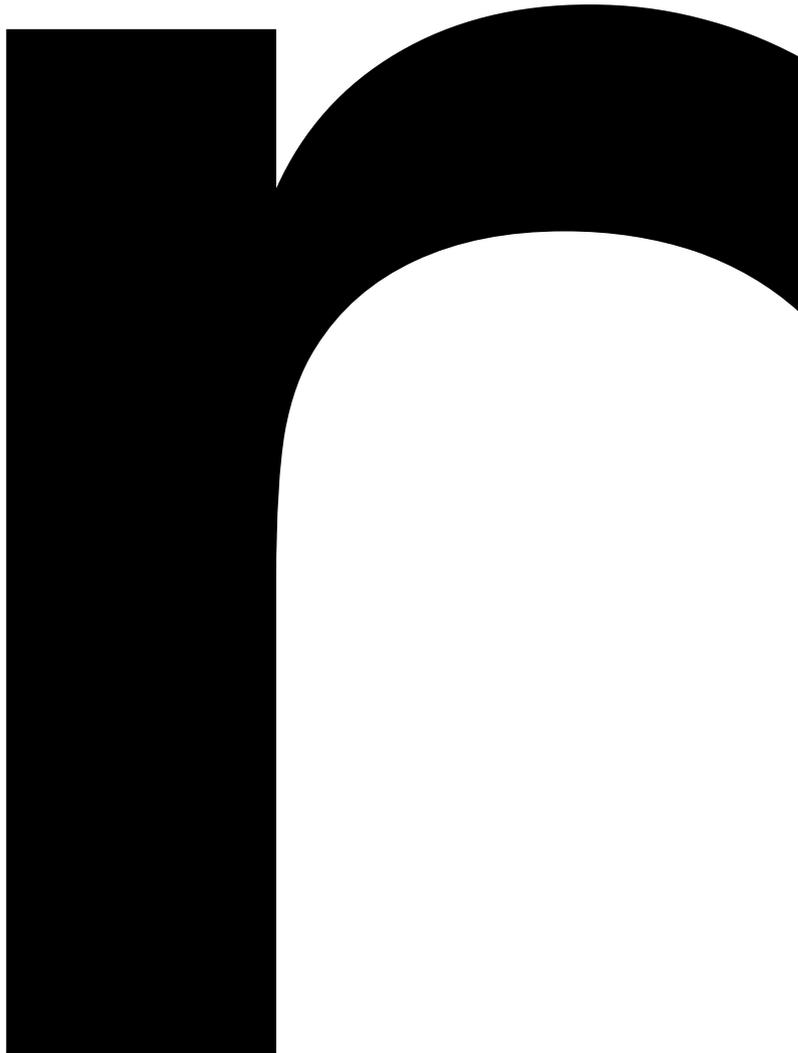
S

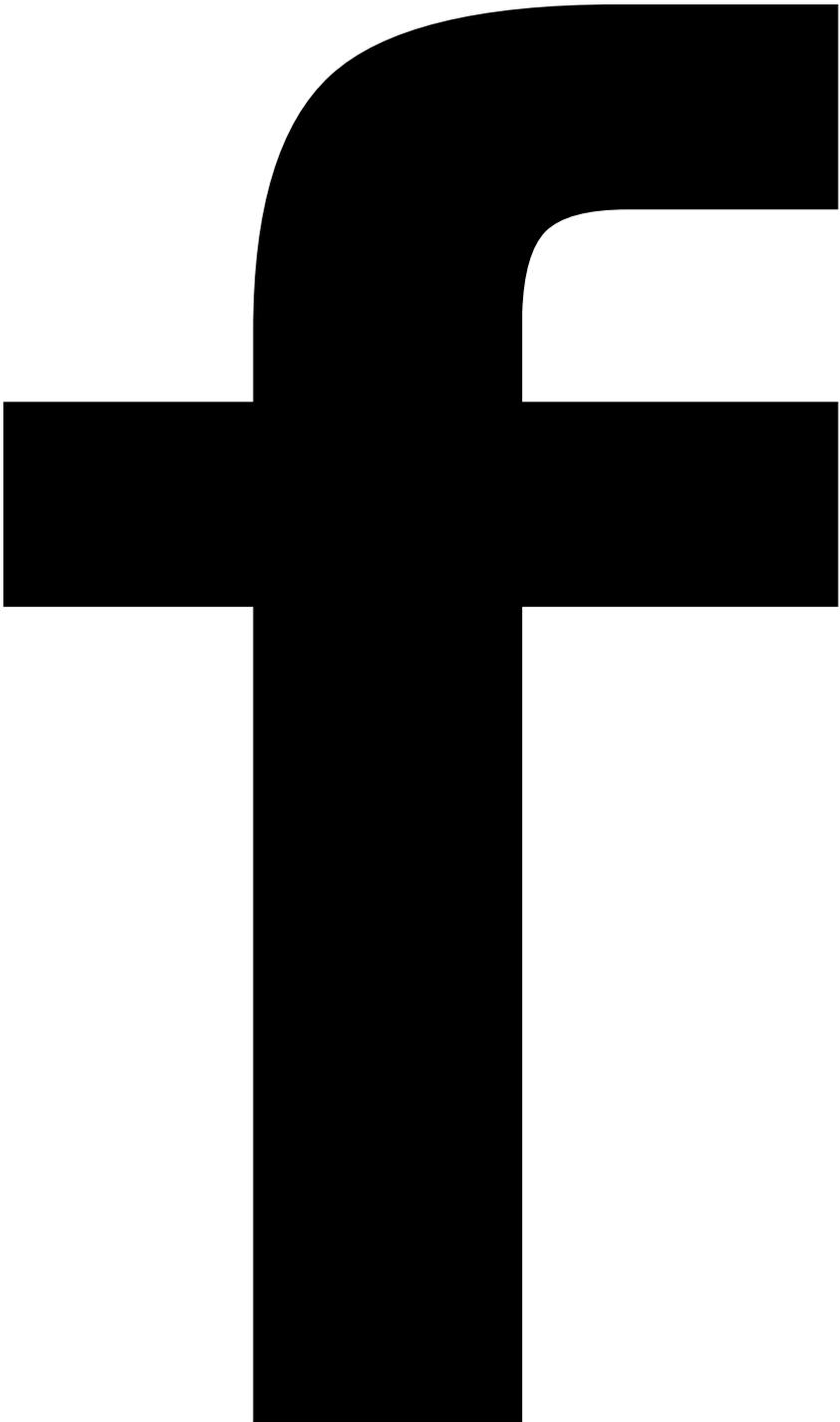
C

h

e

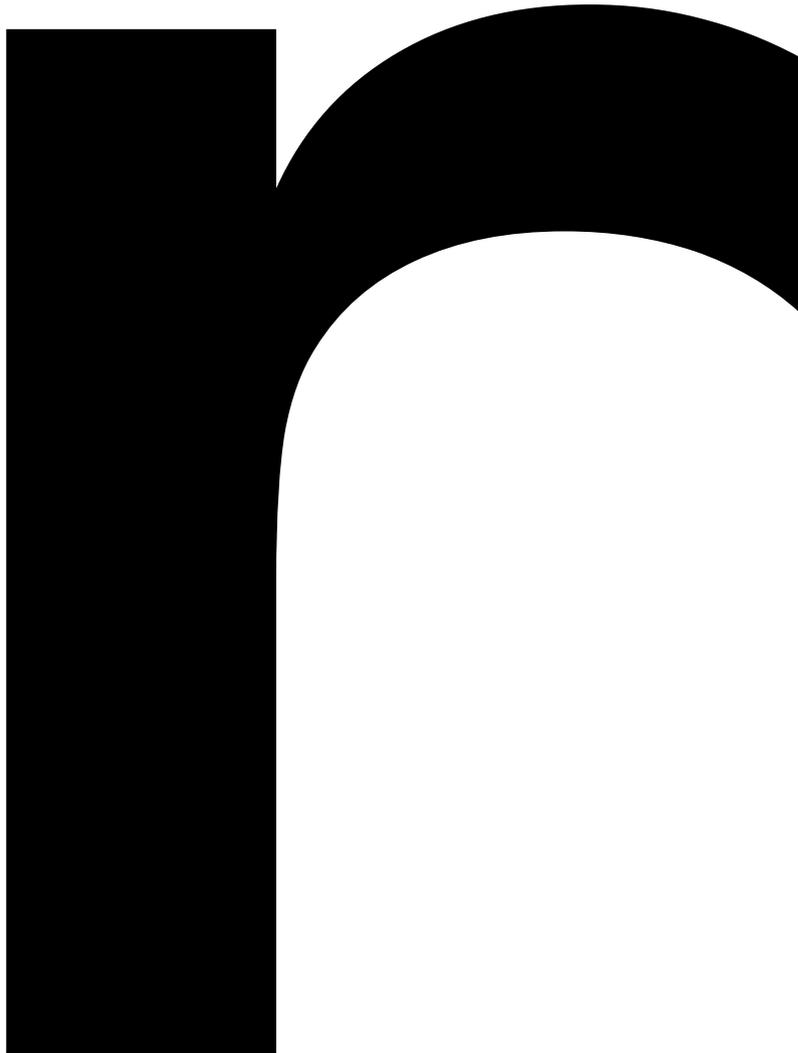






sa

h

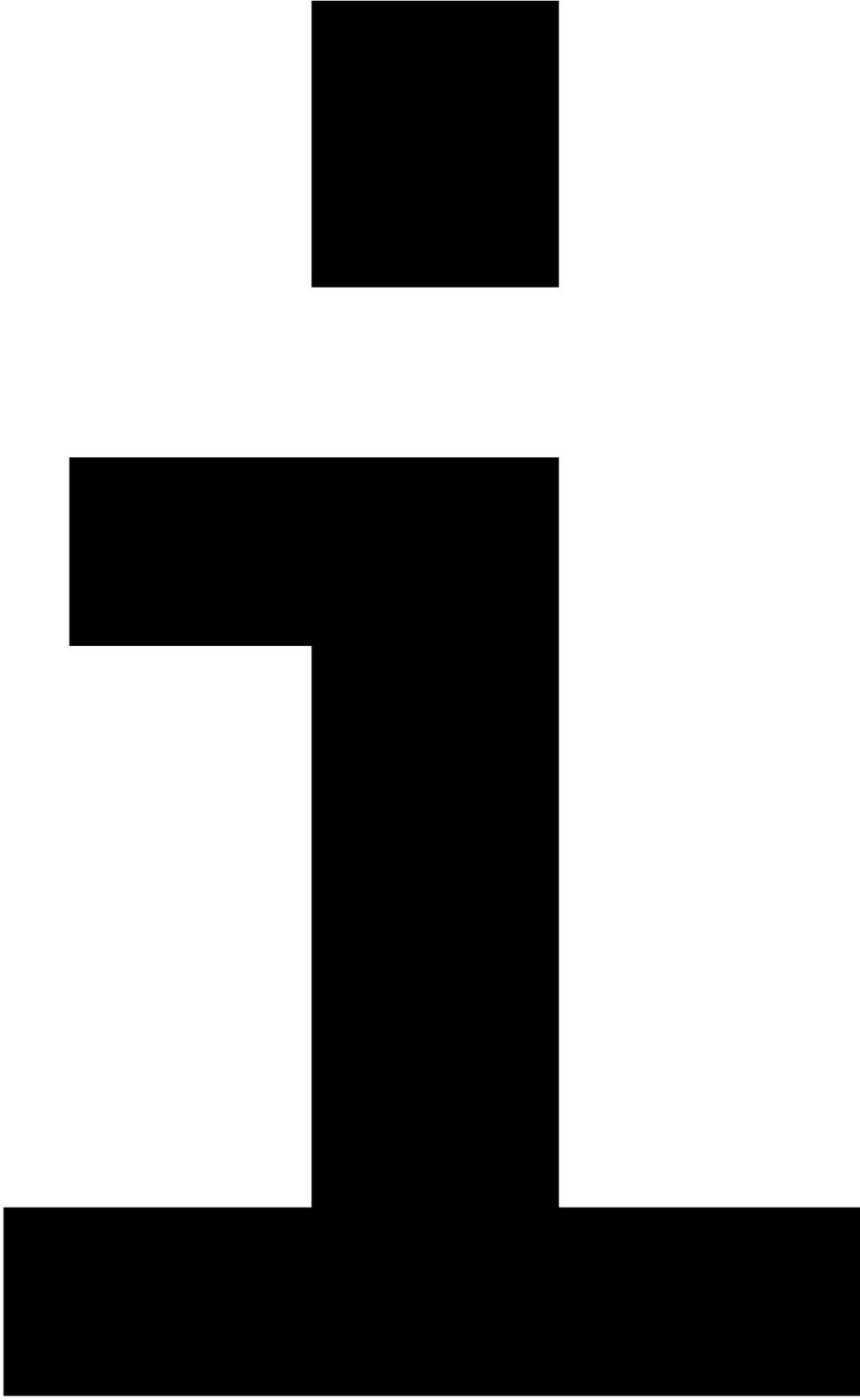


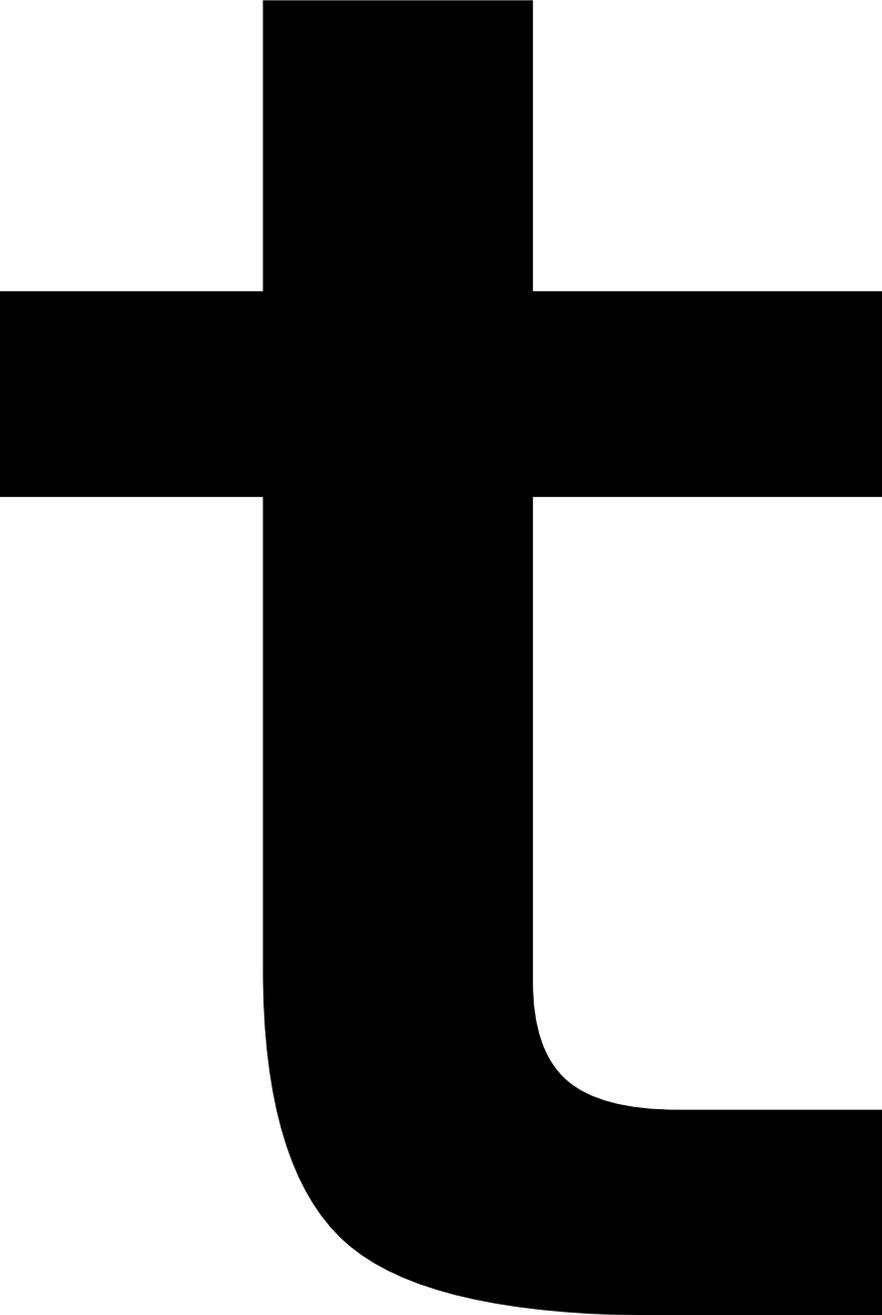
u

n

Q

m





A

n

J

sa

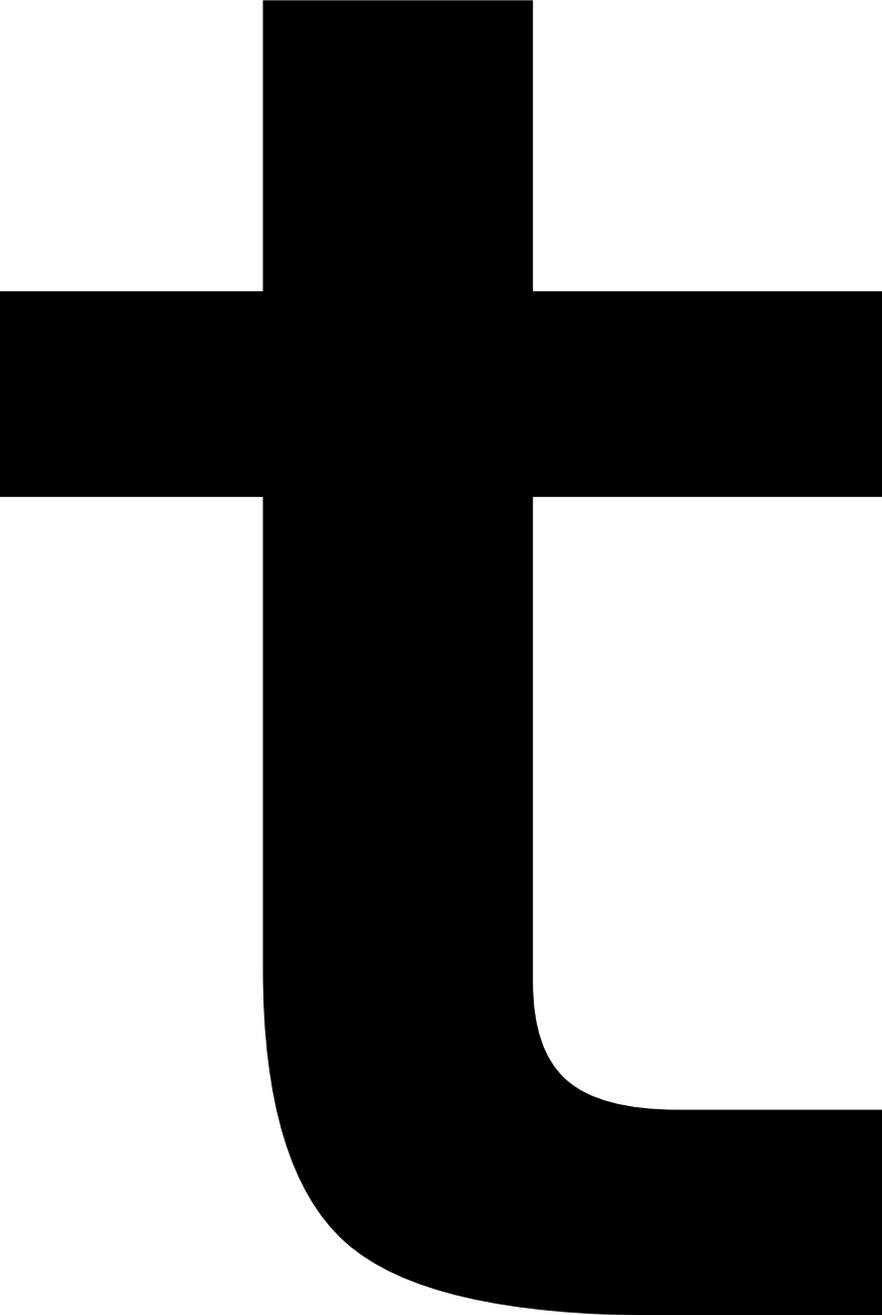
Q

e

n

h

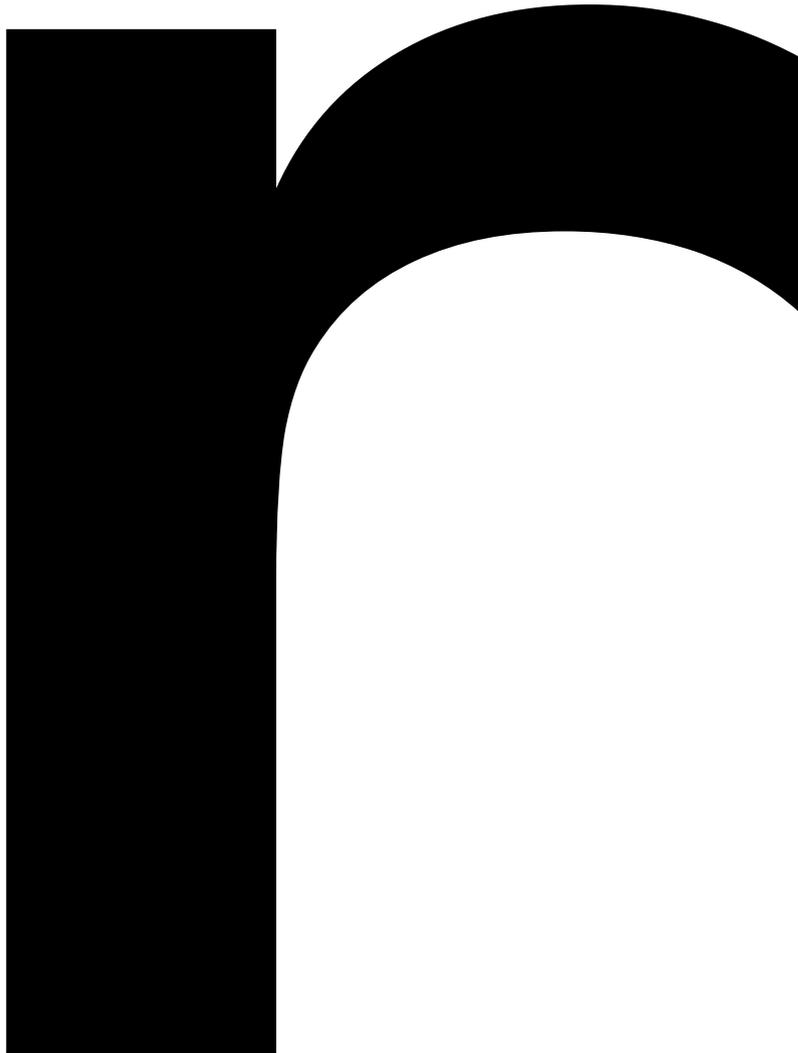
sa



sa

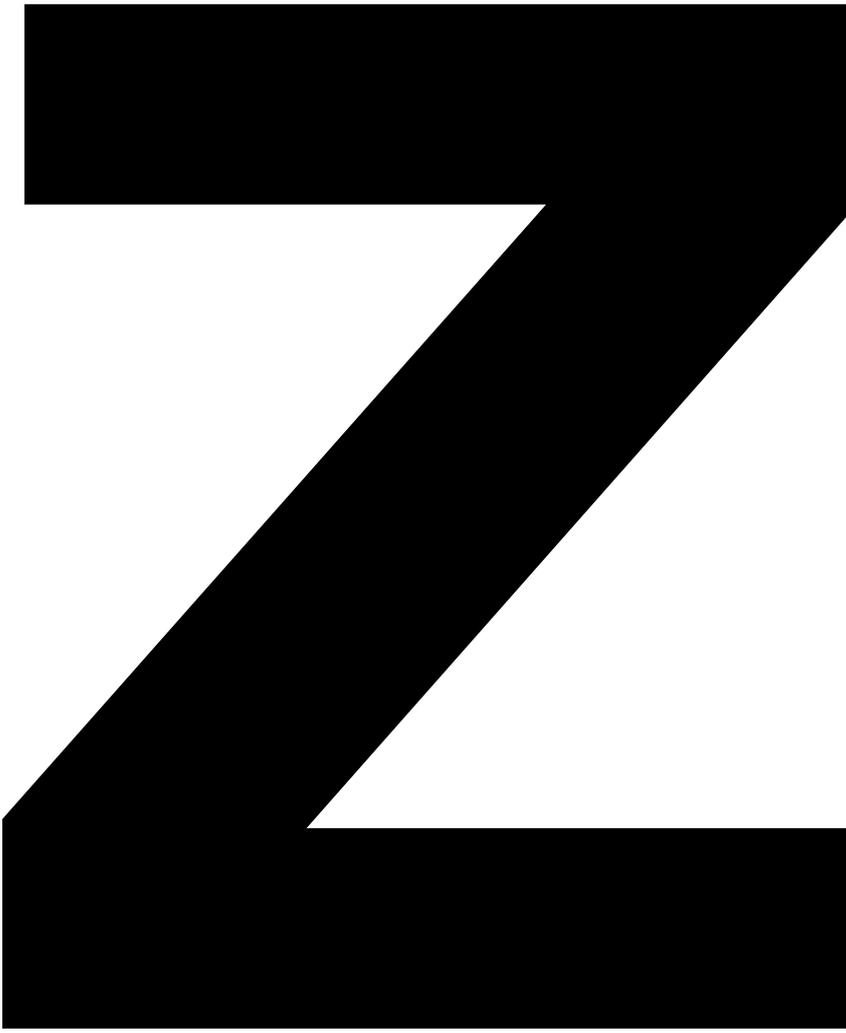
10

e

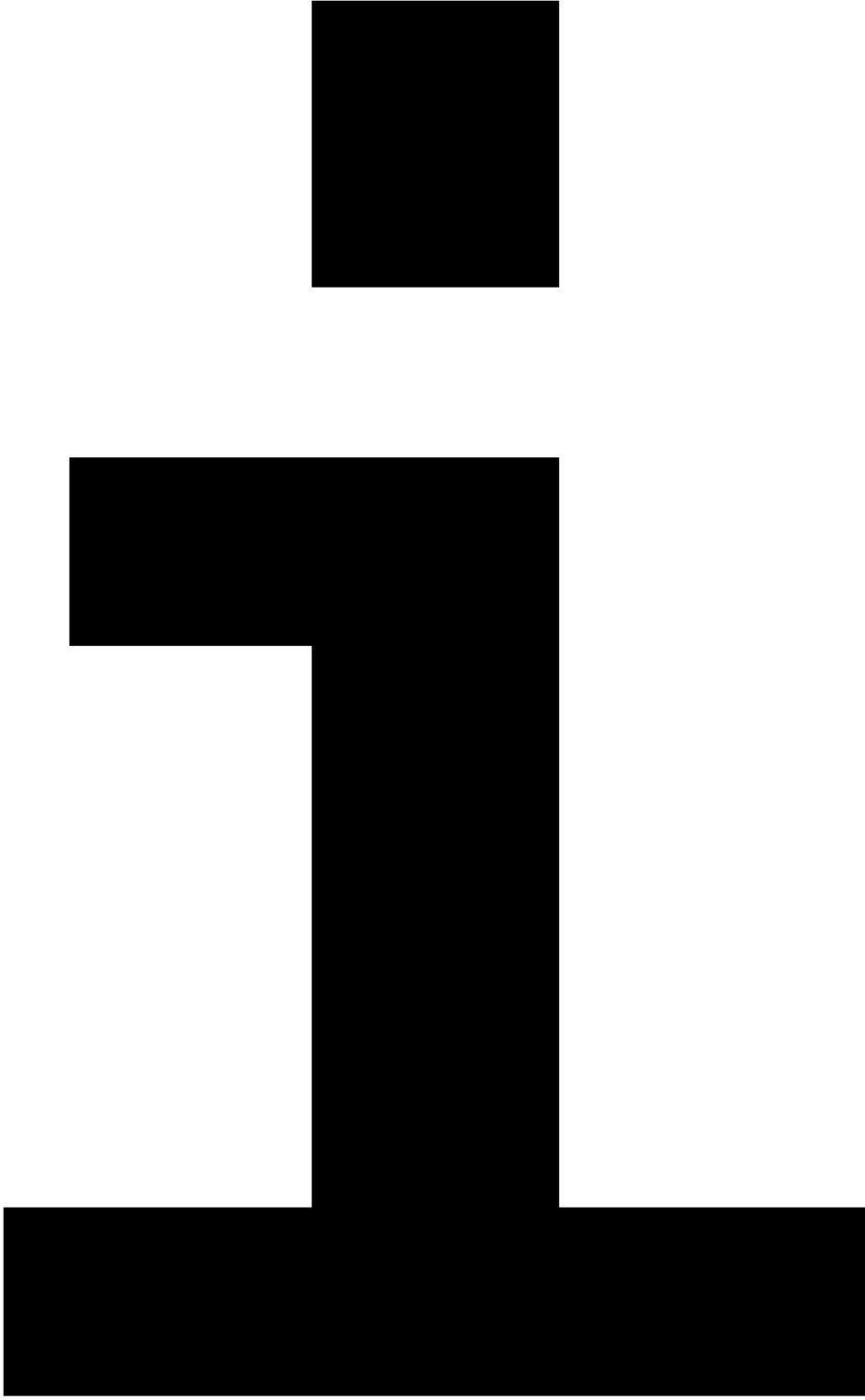


Q

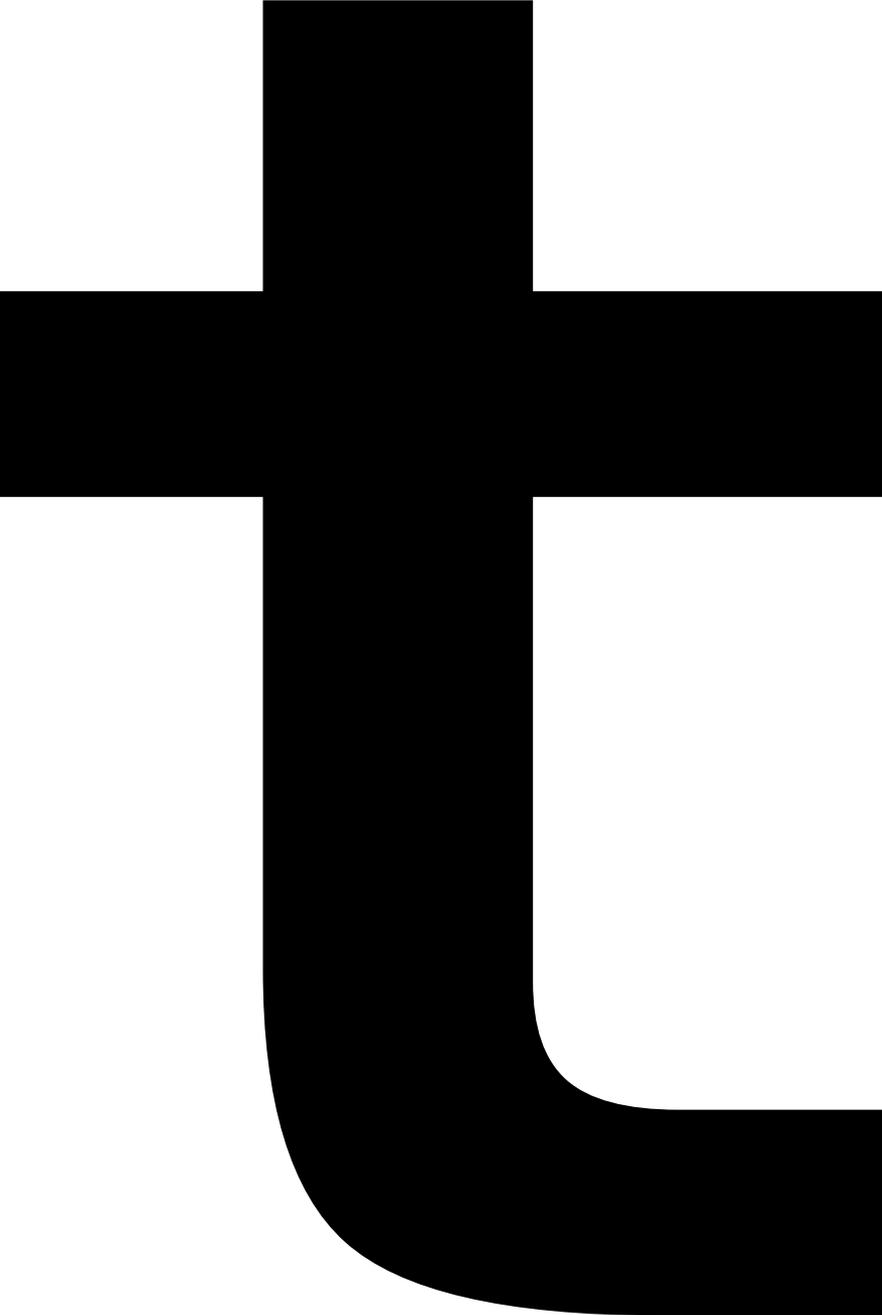
e

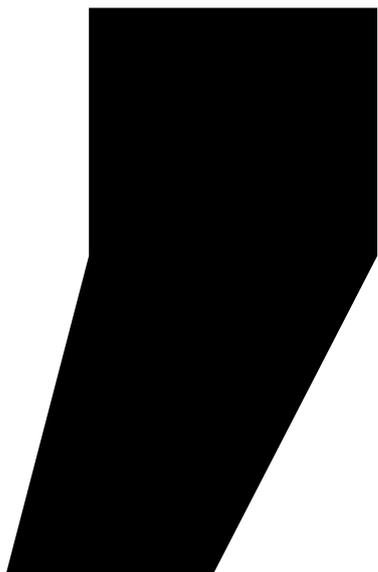


e



Q





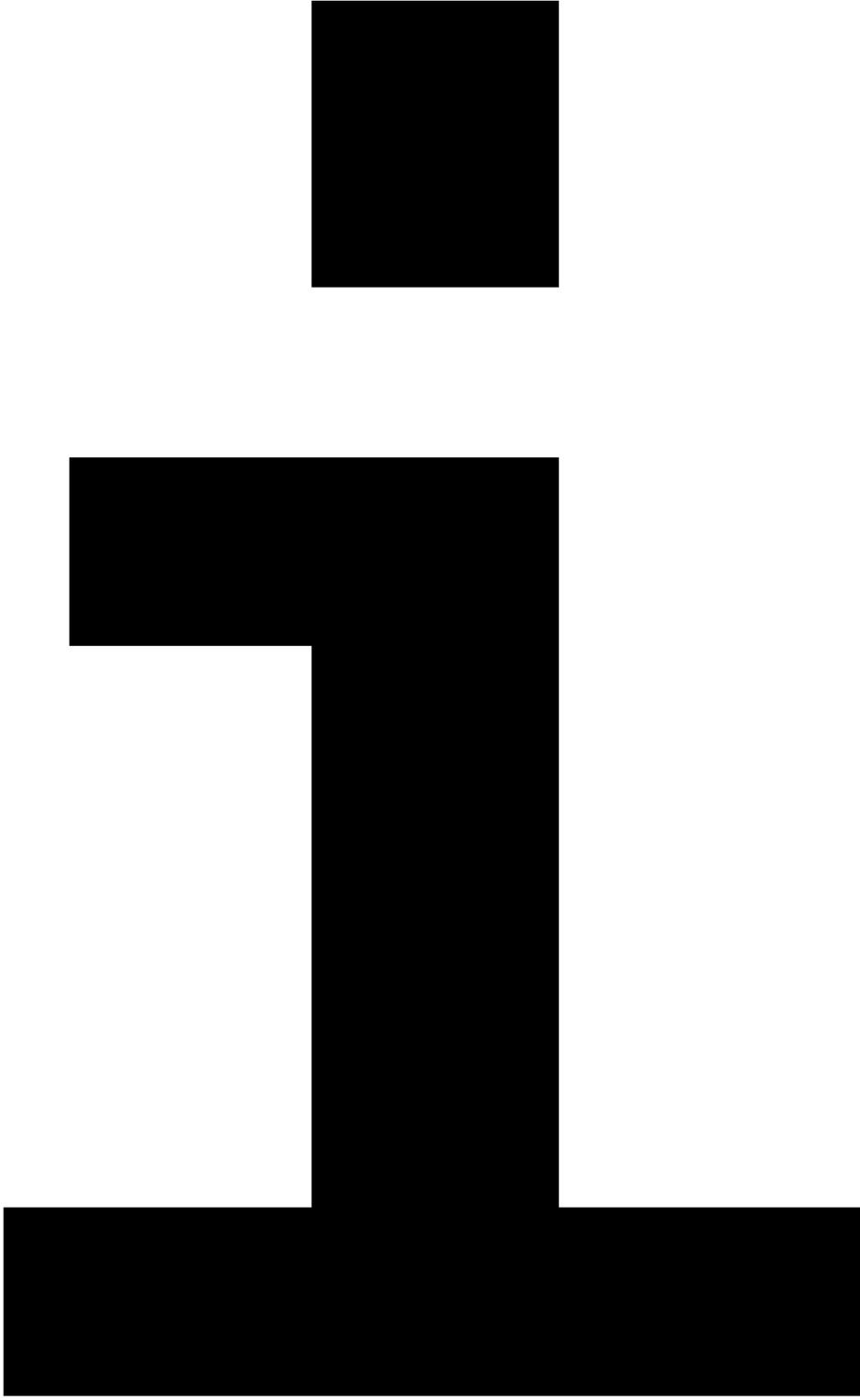
Q

sa

S

S

Q



e

A

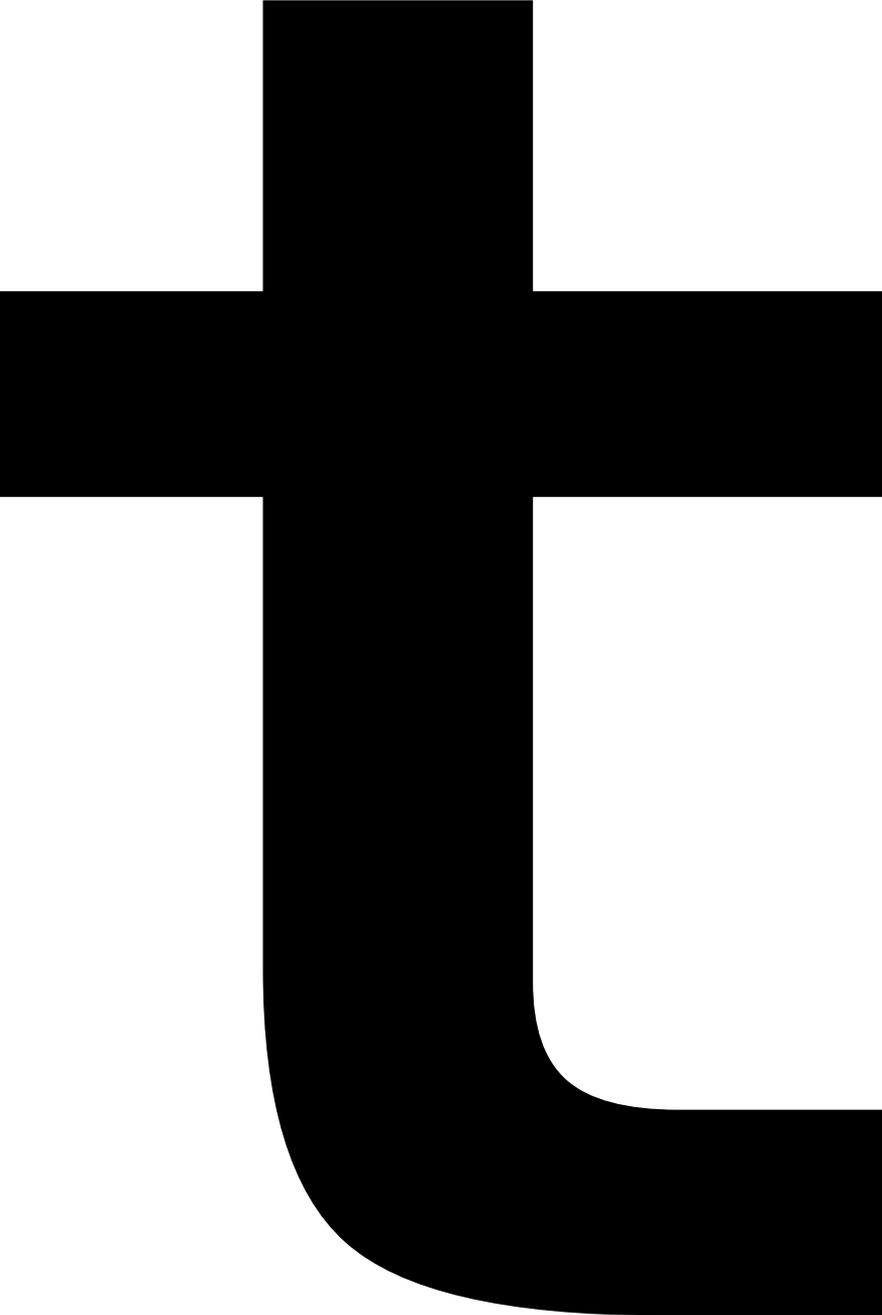
u

S

10

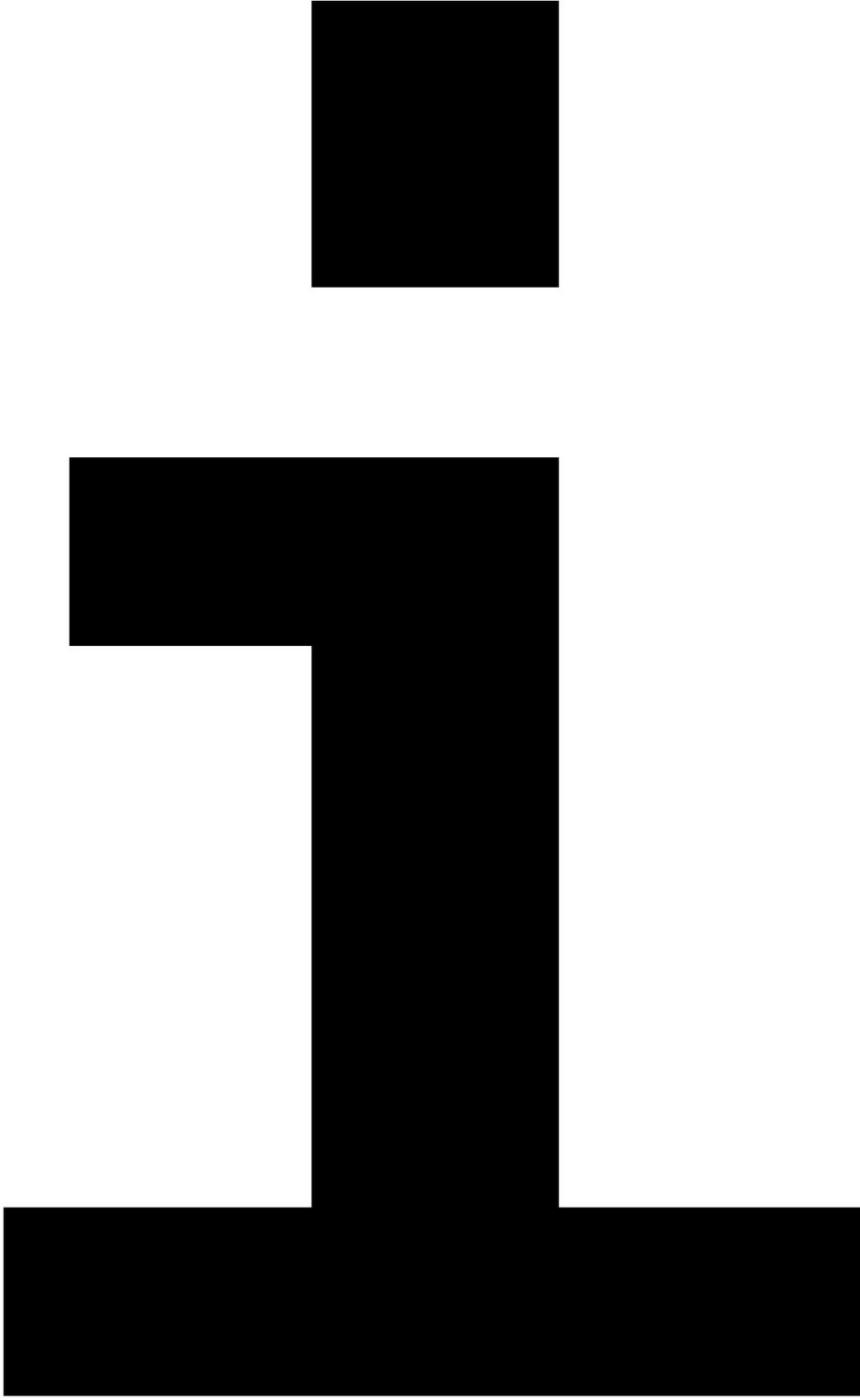
e

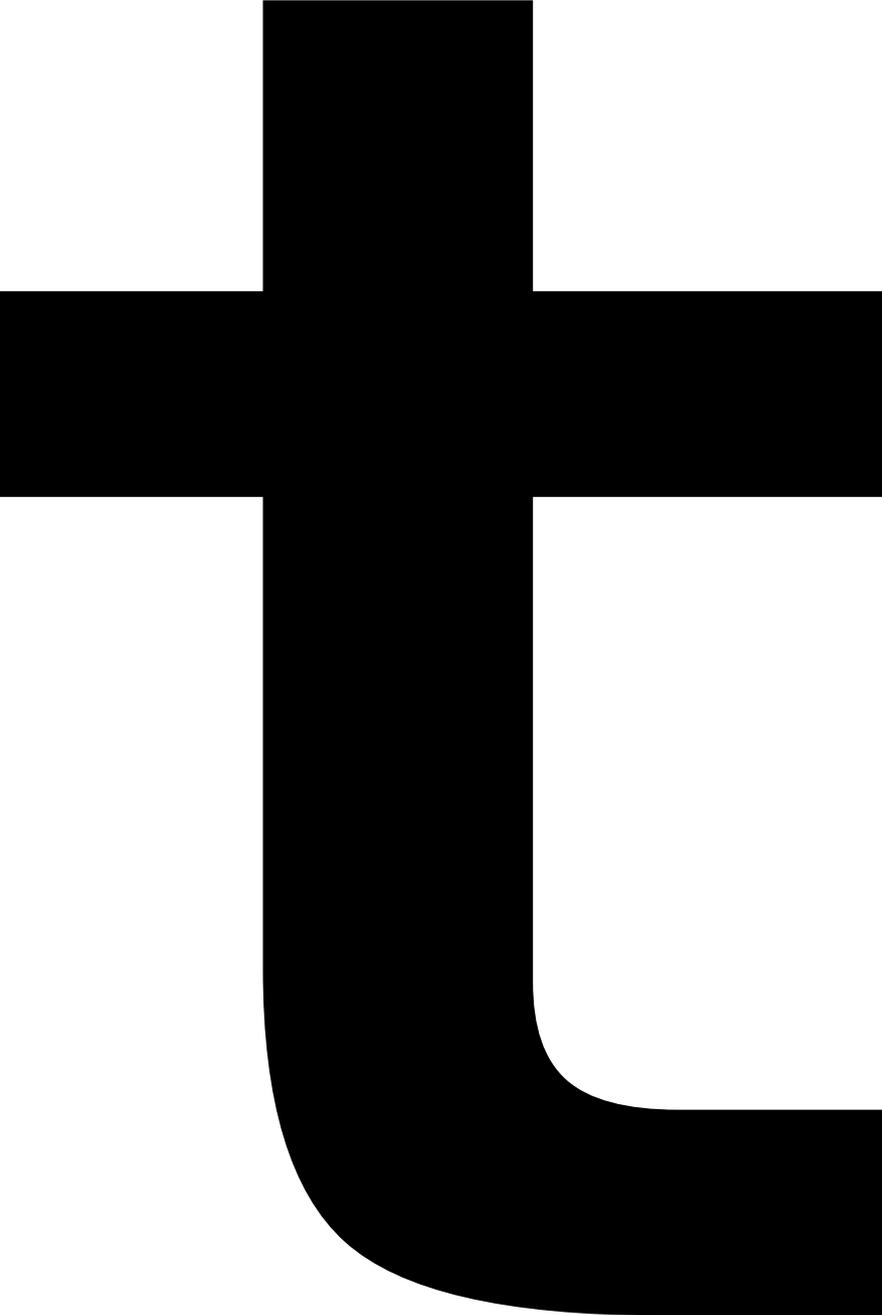
u



e

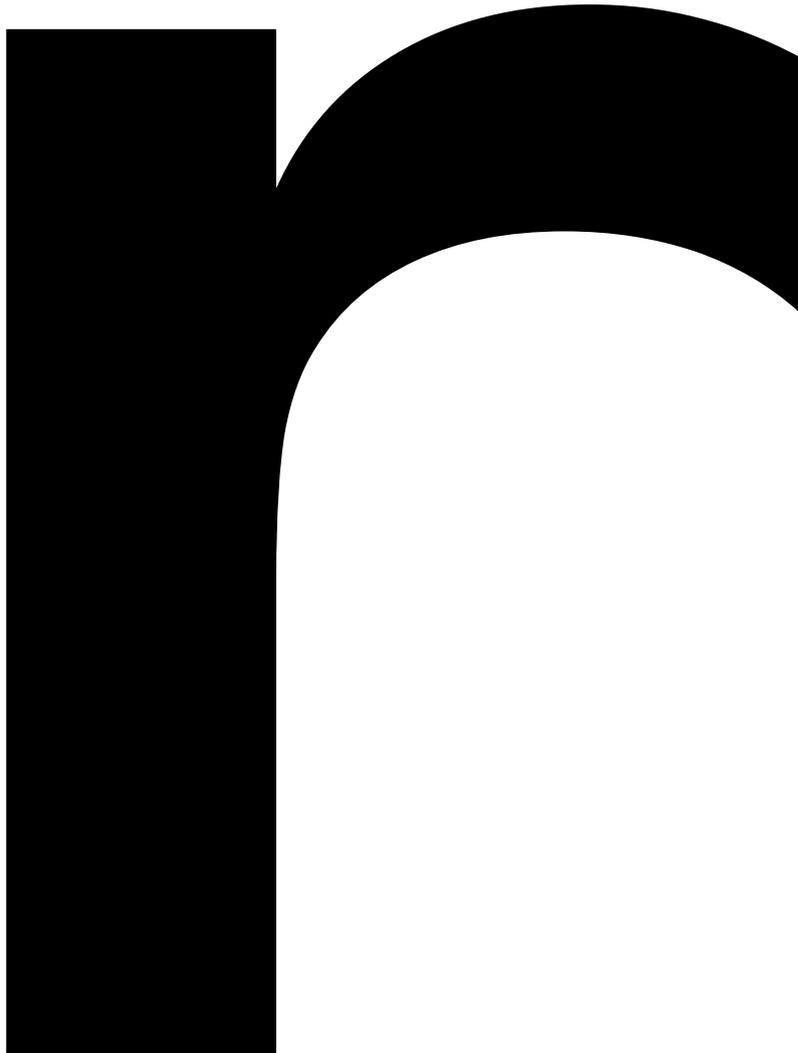
m





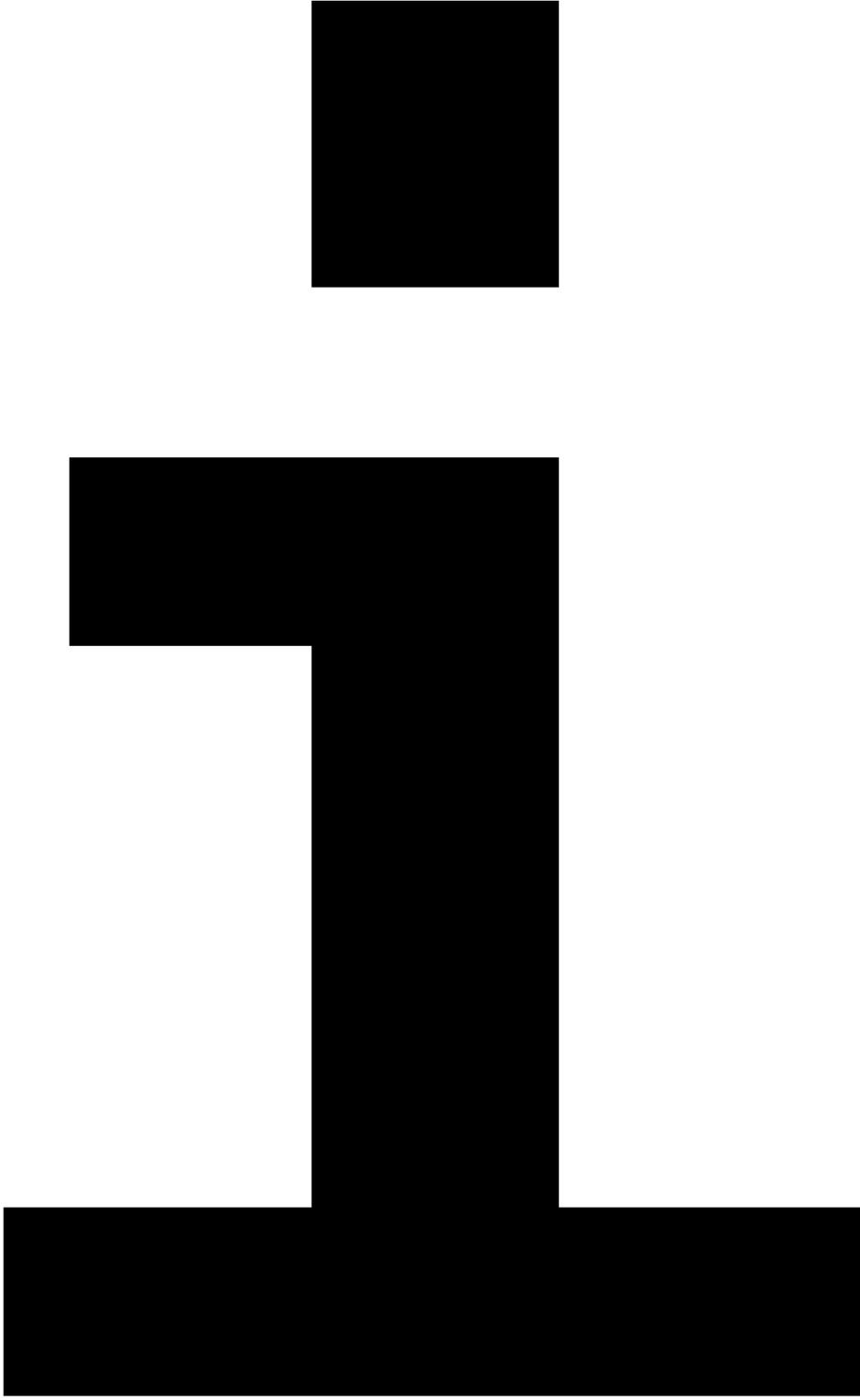
Q

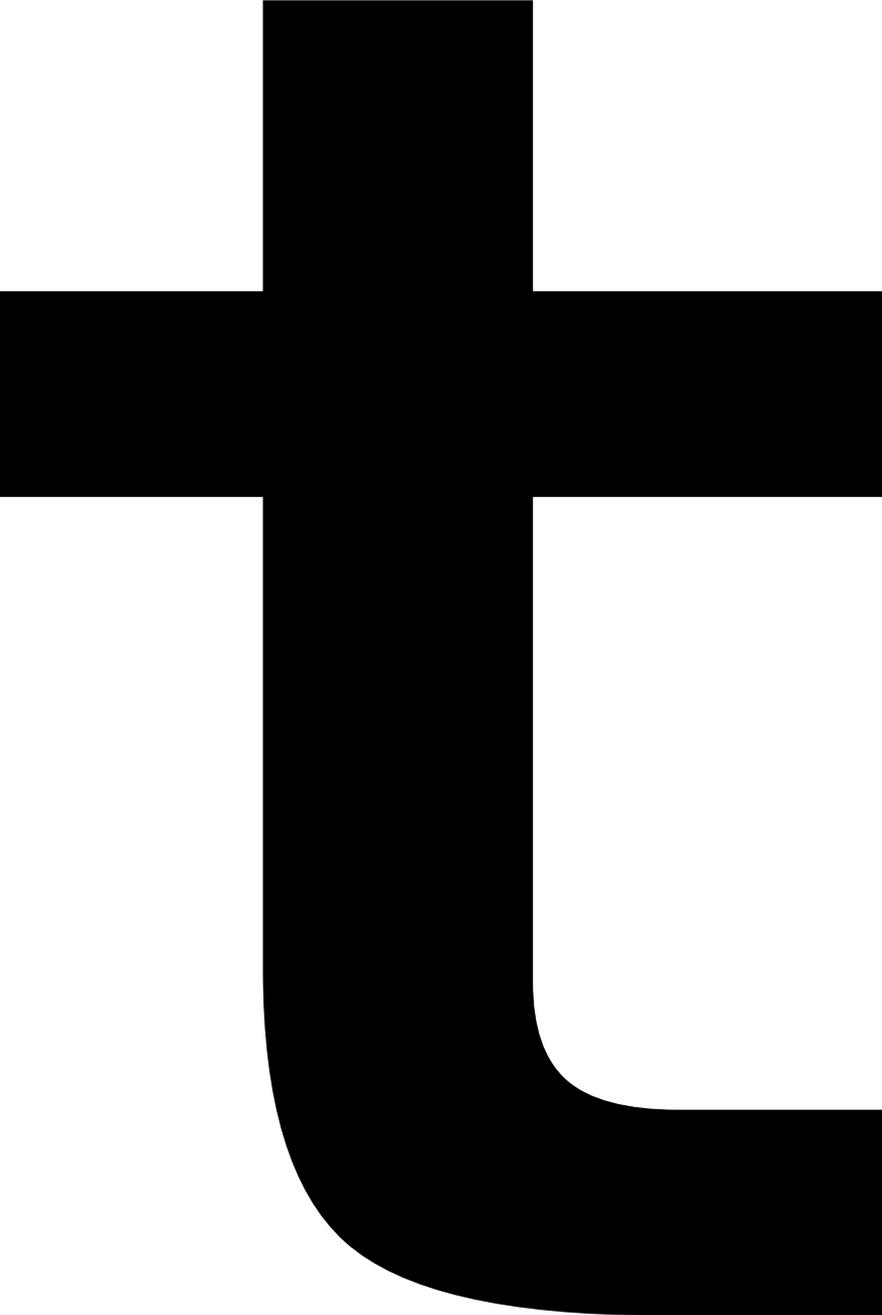
e





e

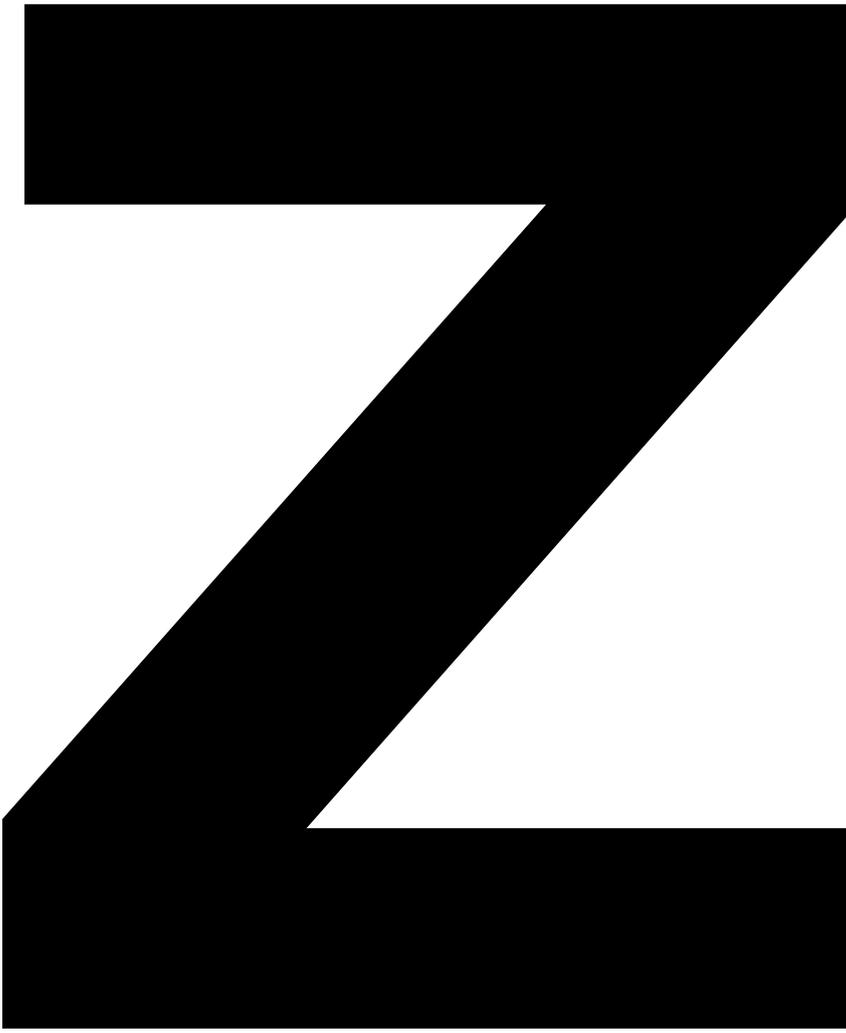




sa

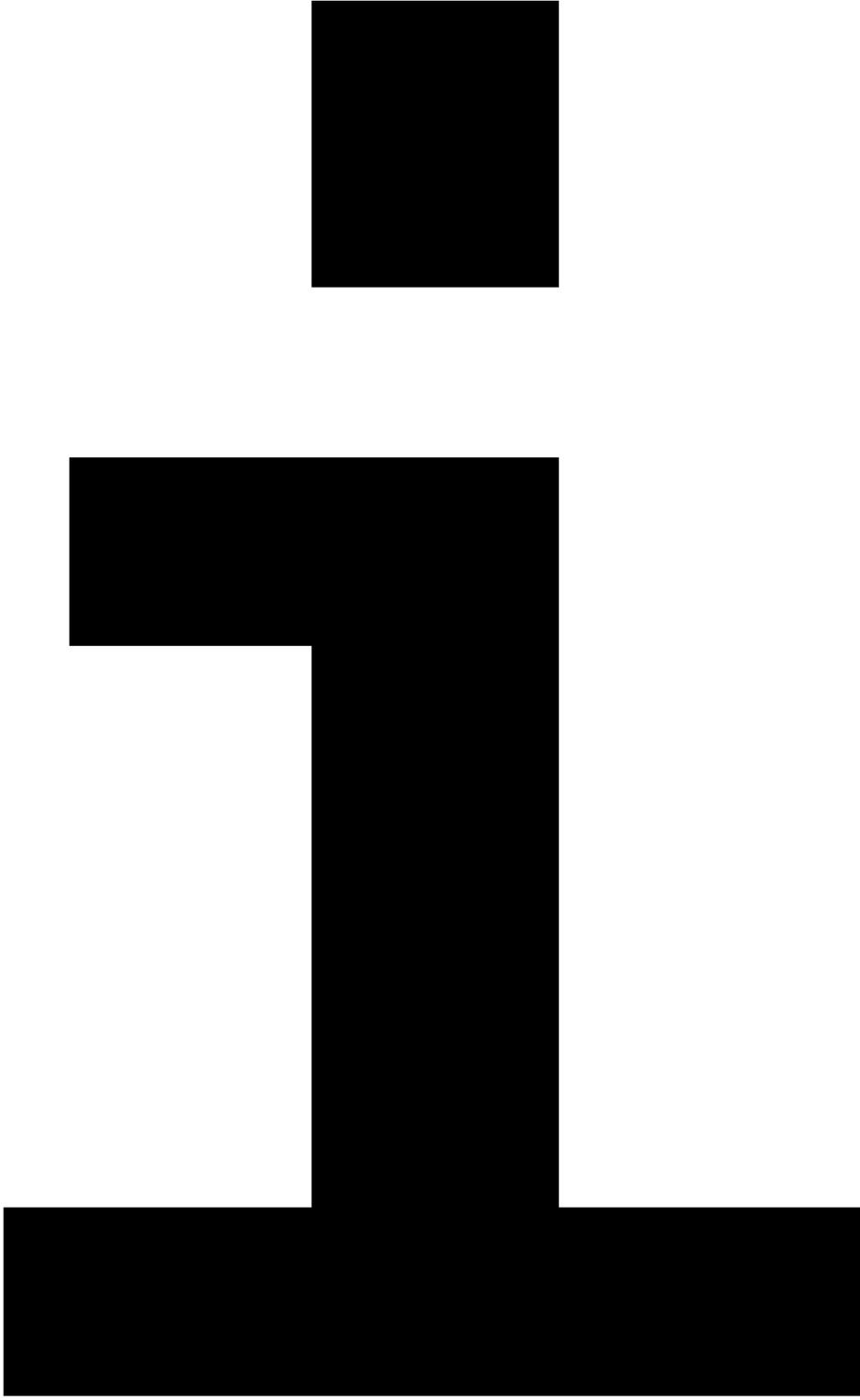
u

S

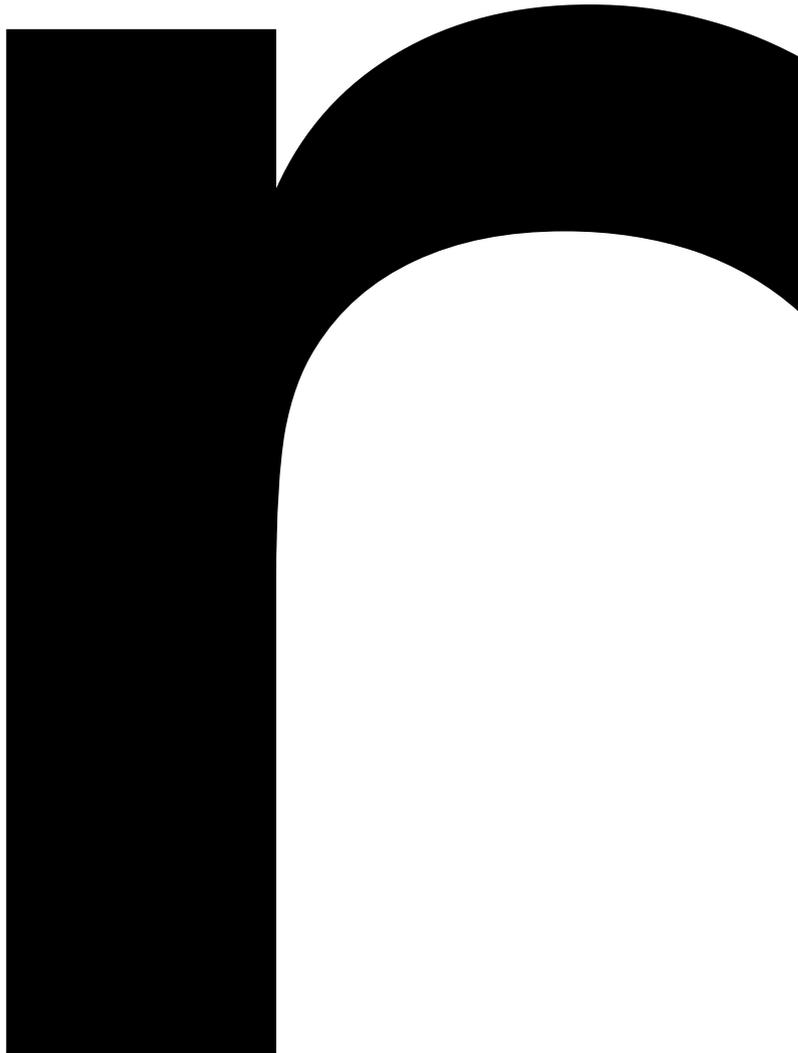


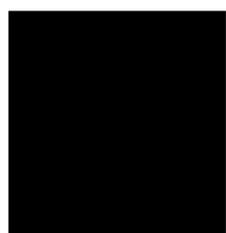
w

e



G





u

n

Q

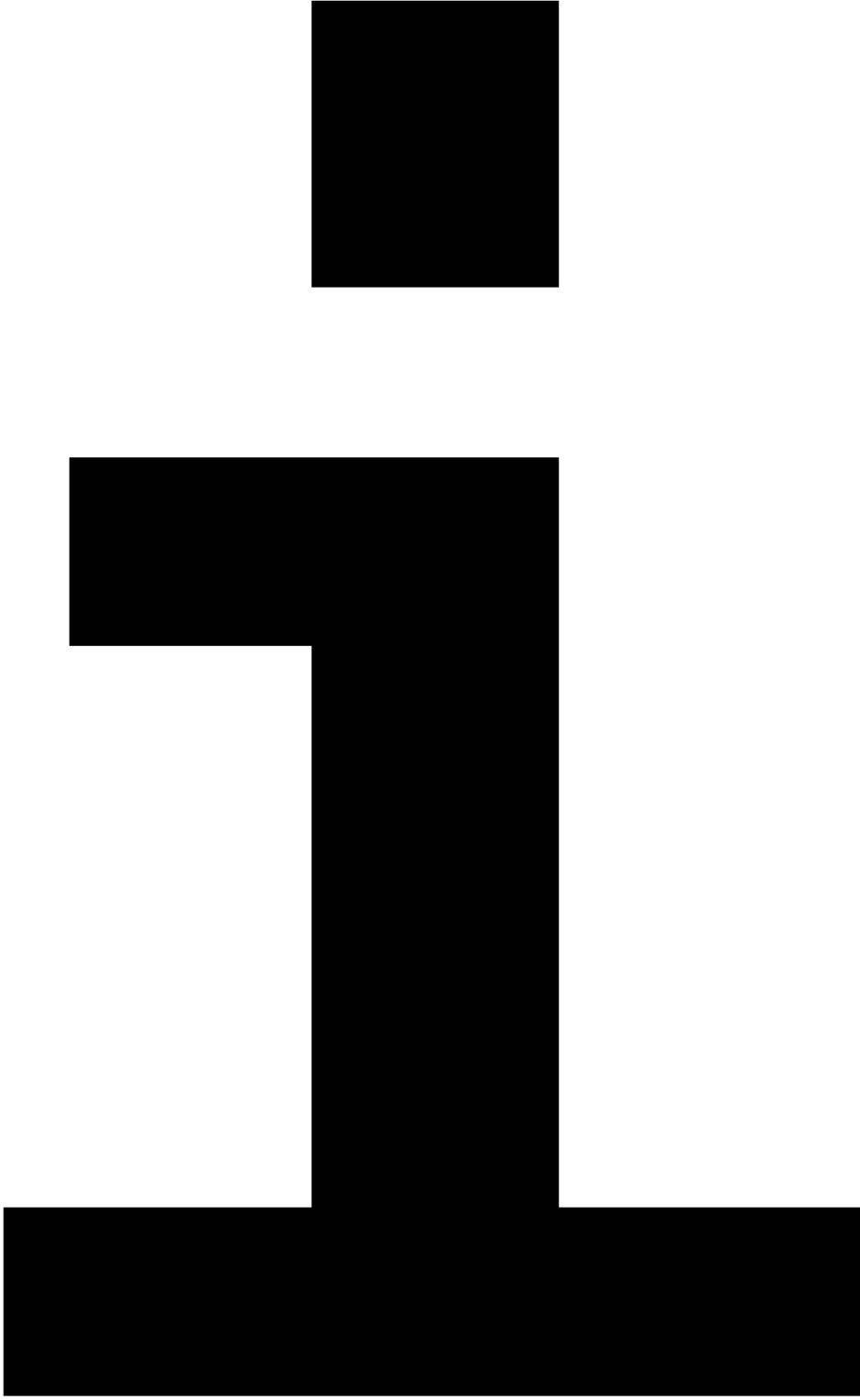
e

n

sa

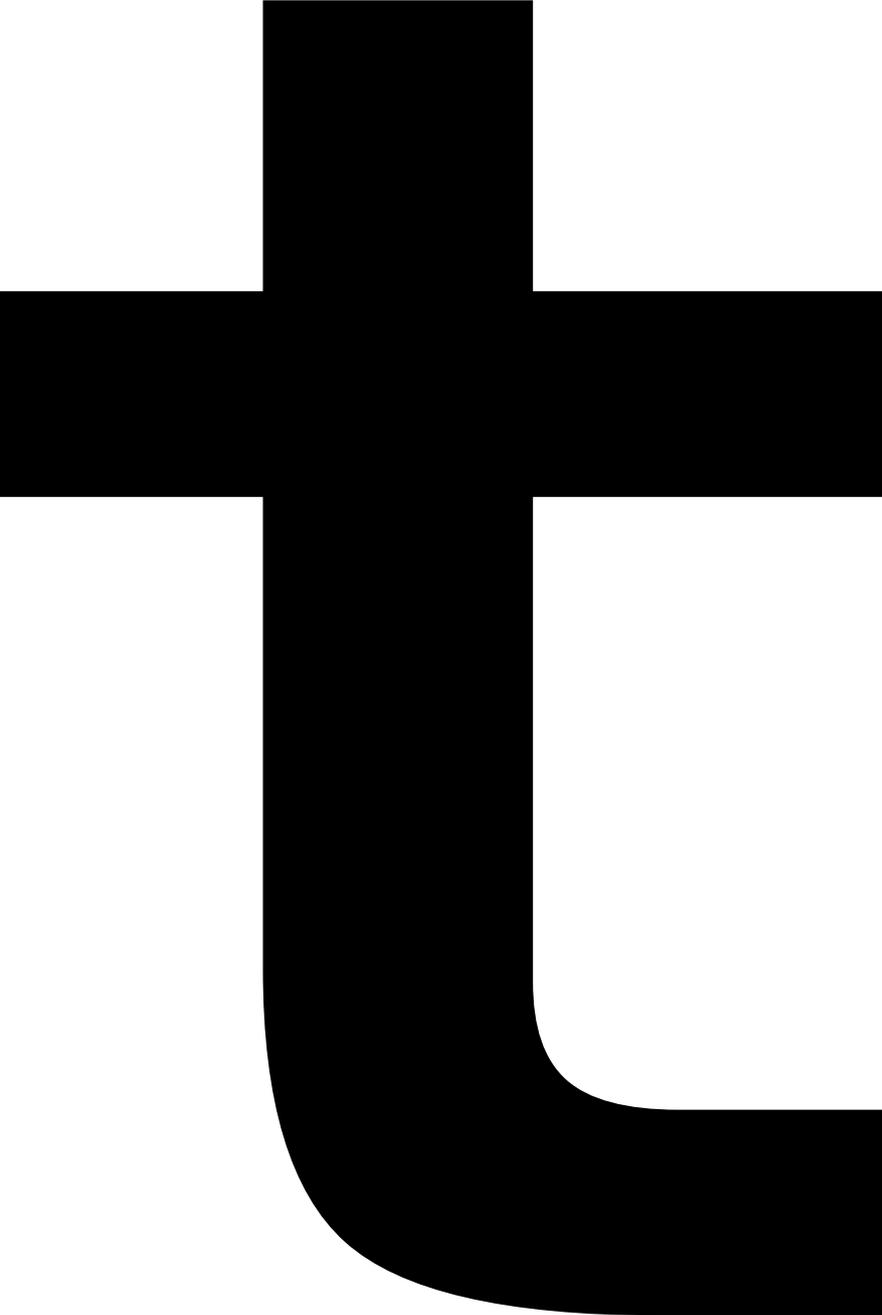
10

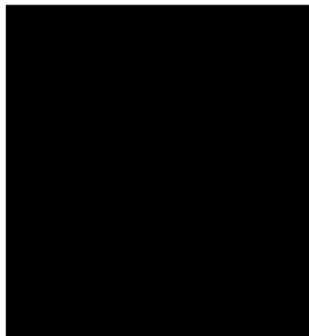
n



m

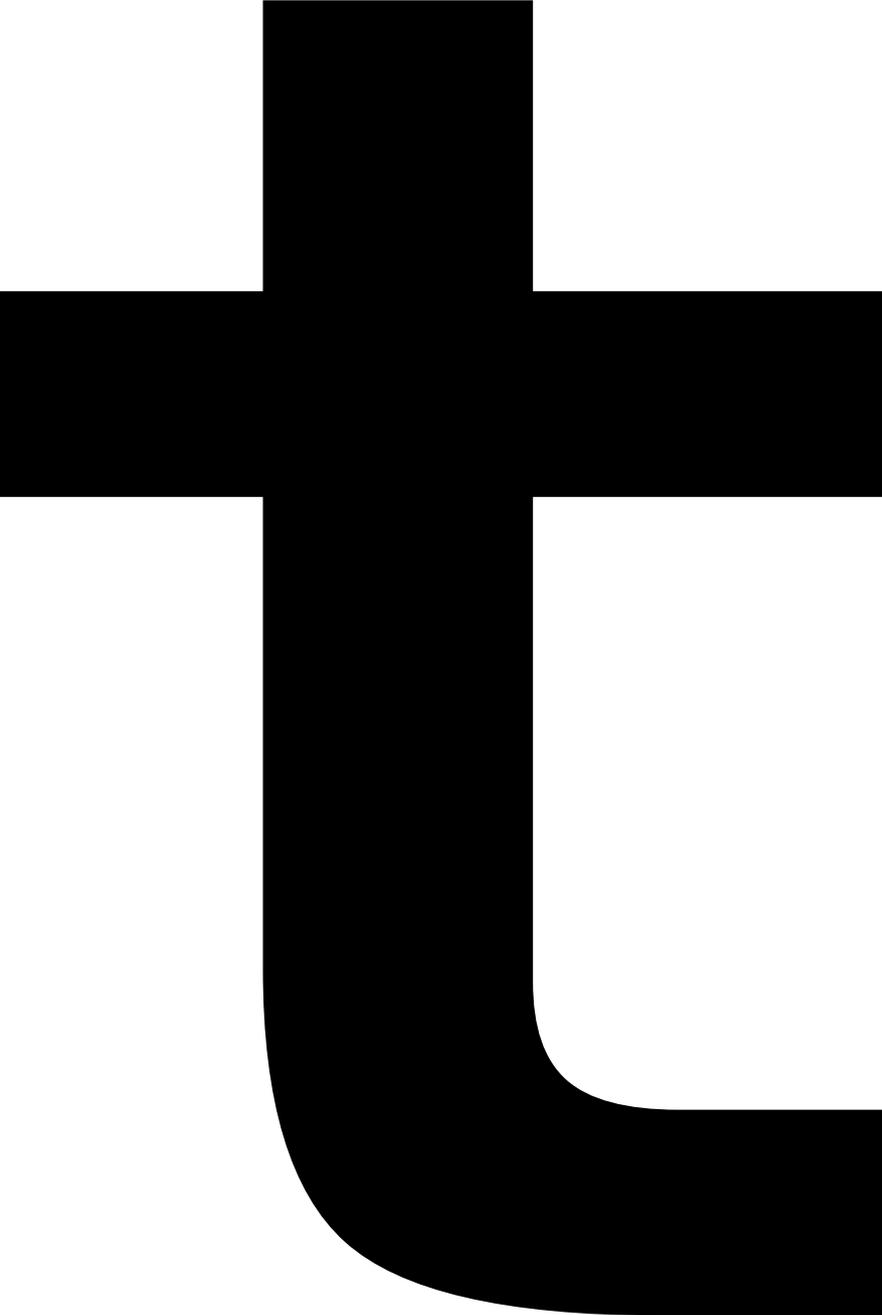
m



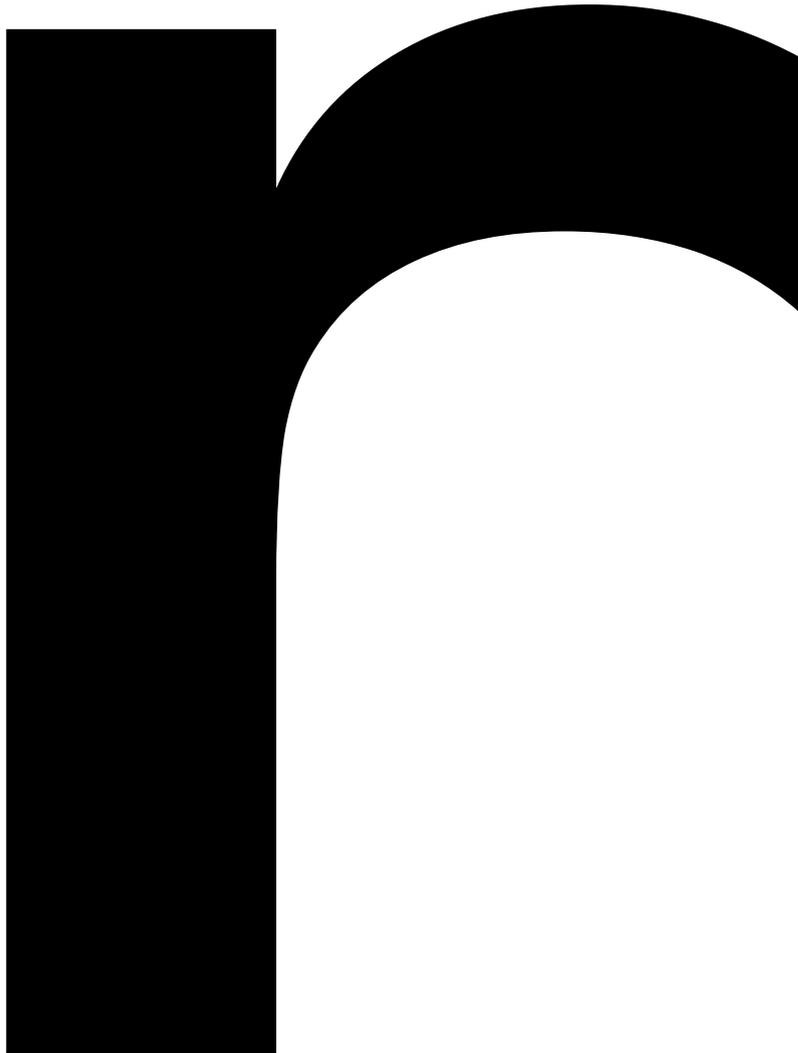


A

J



e



u

n

Q

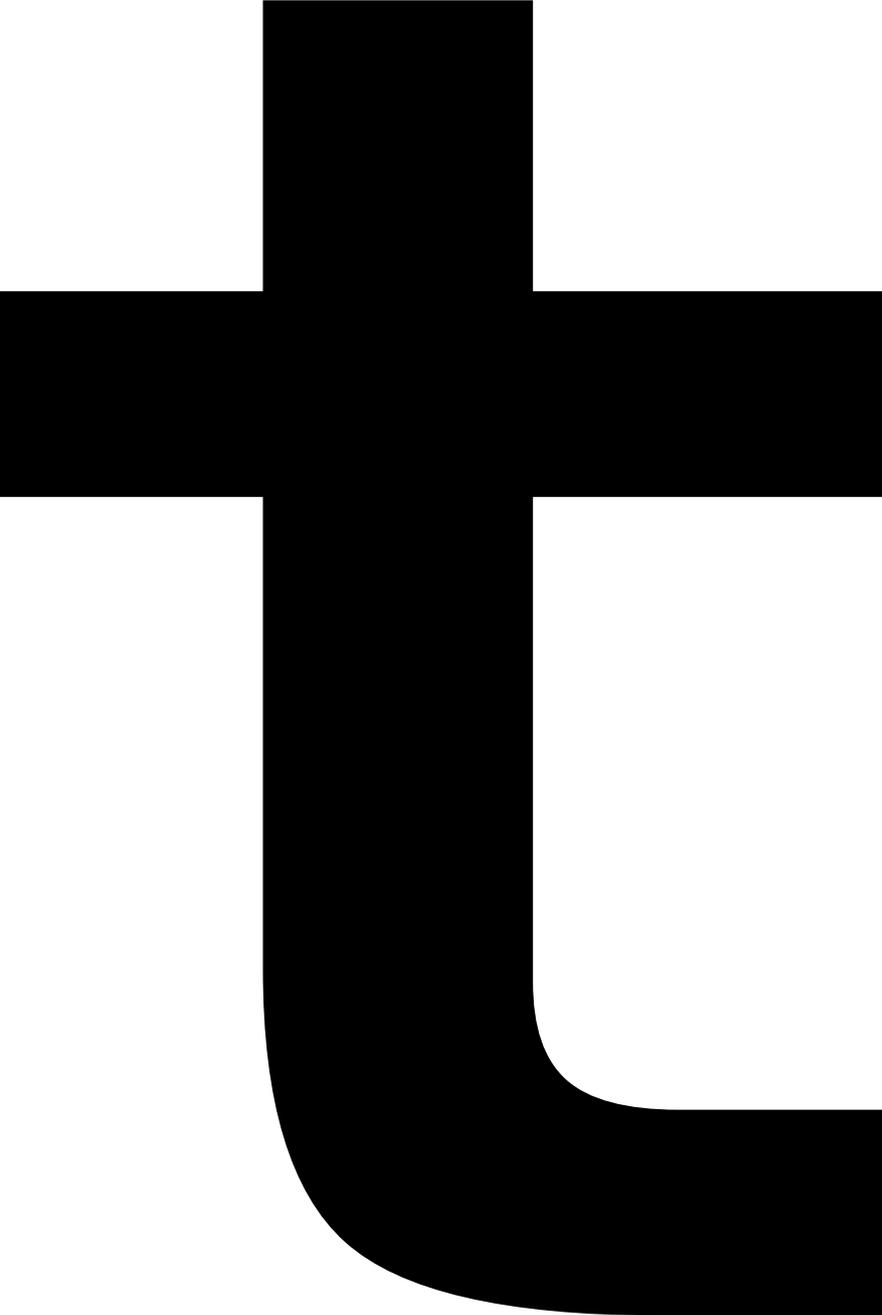
u

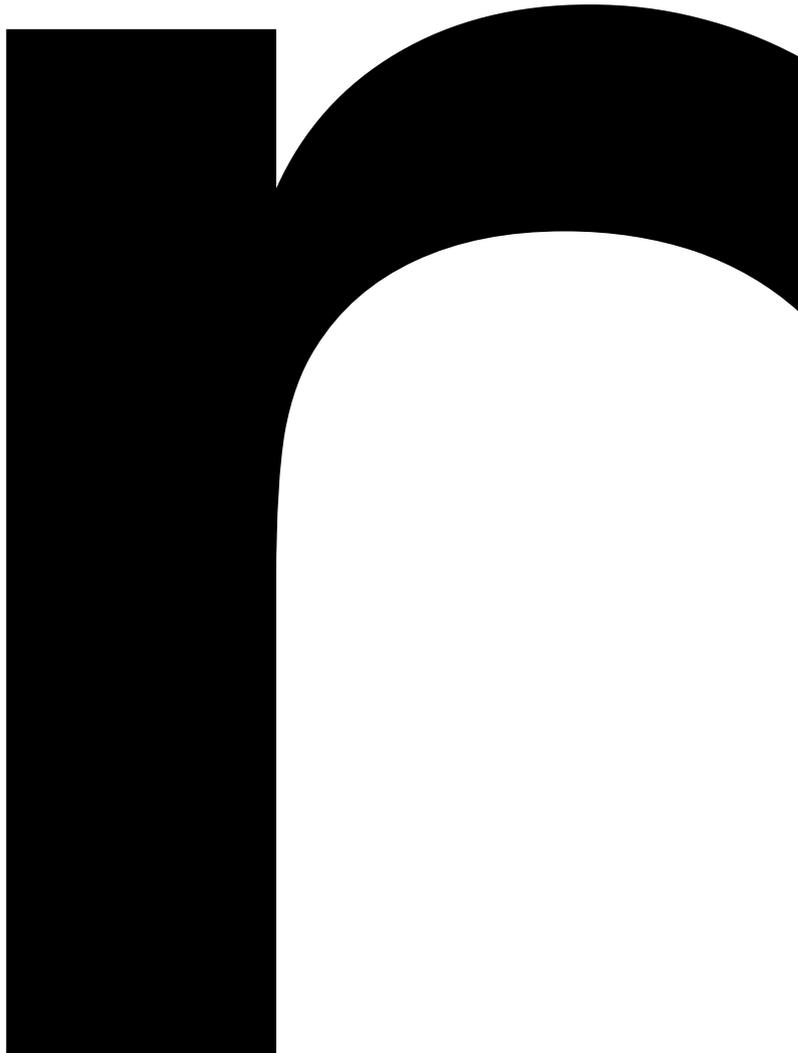
n

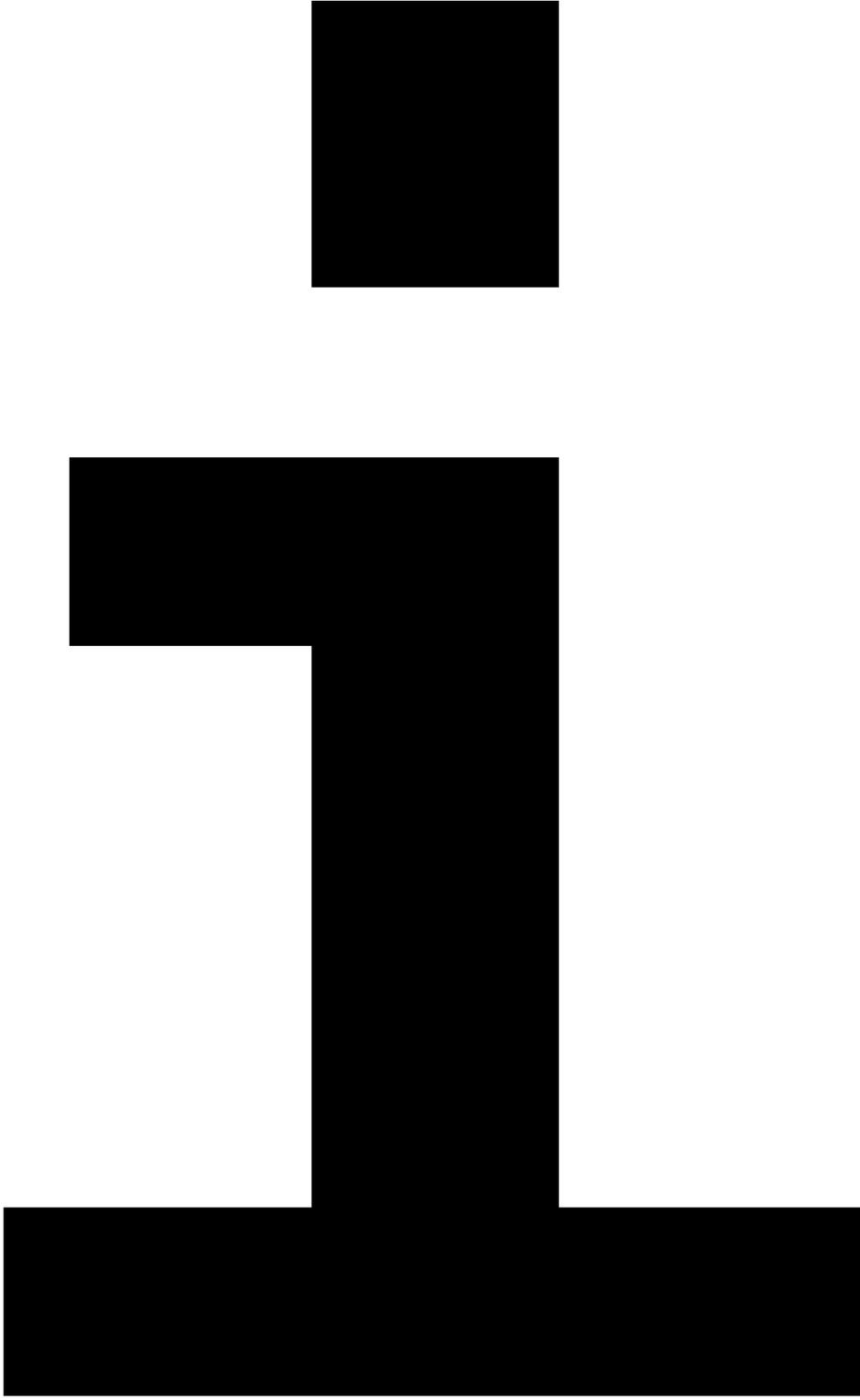
Q

B

e





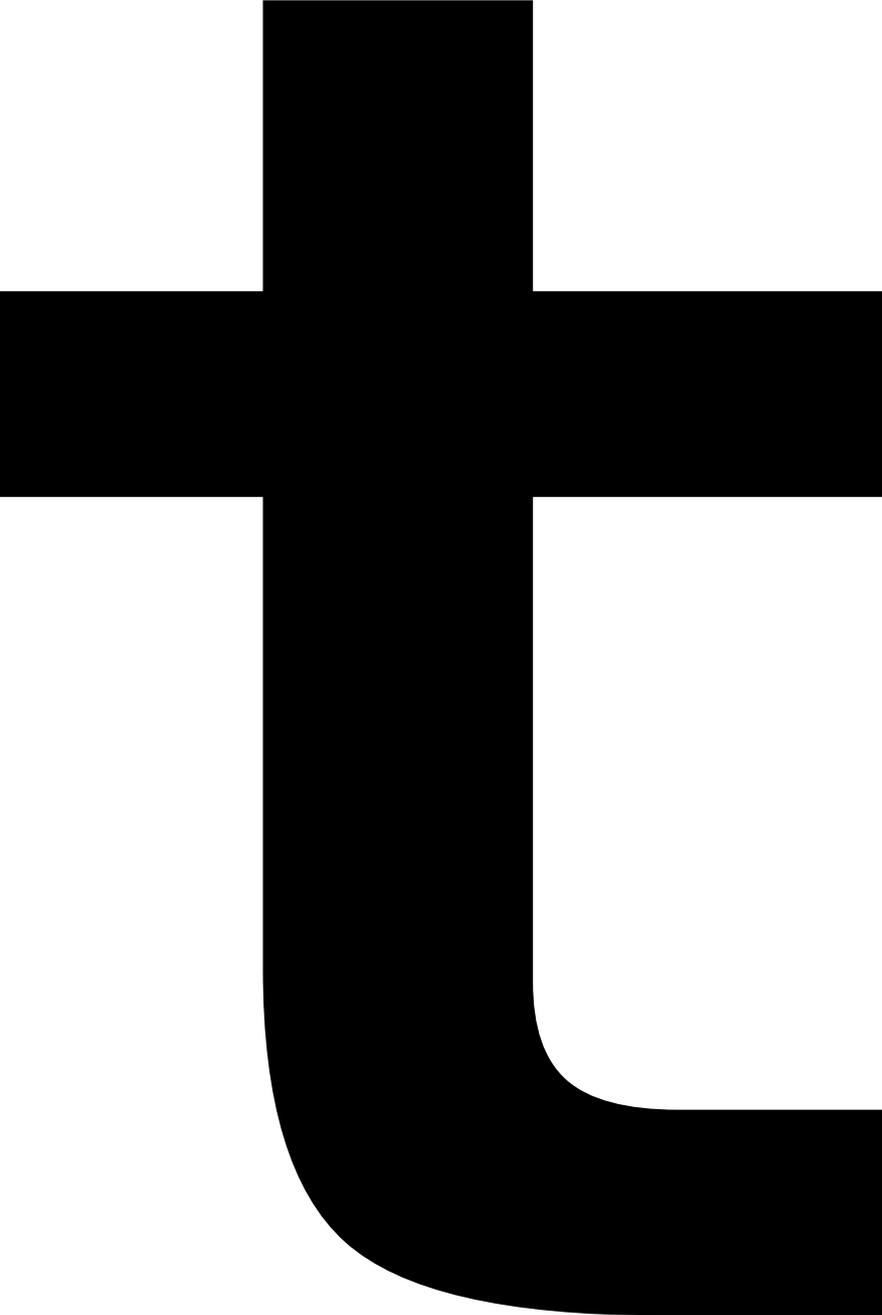


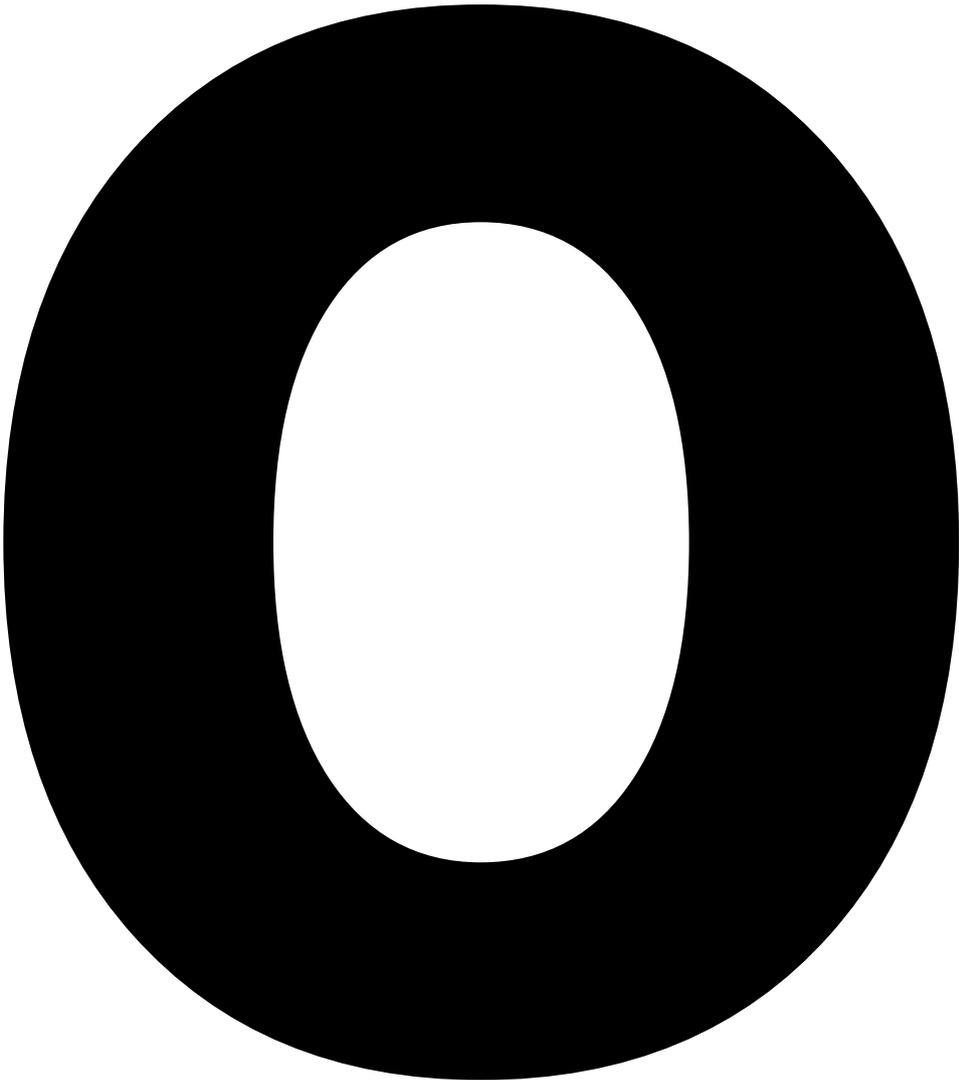
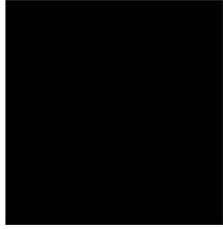
e

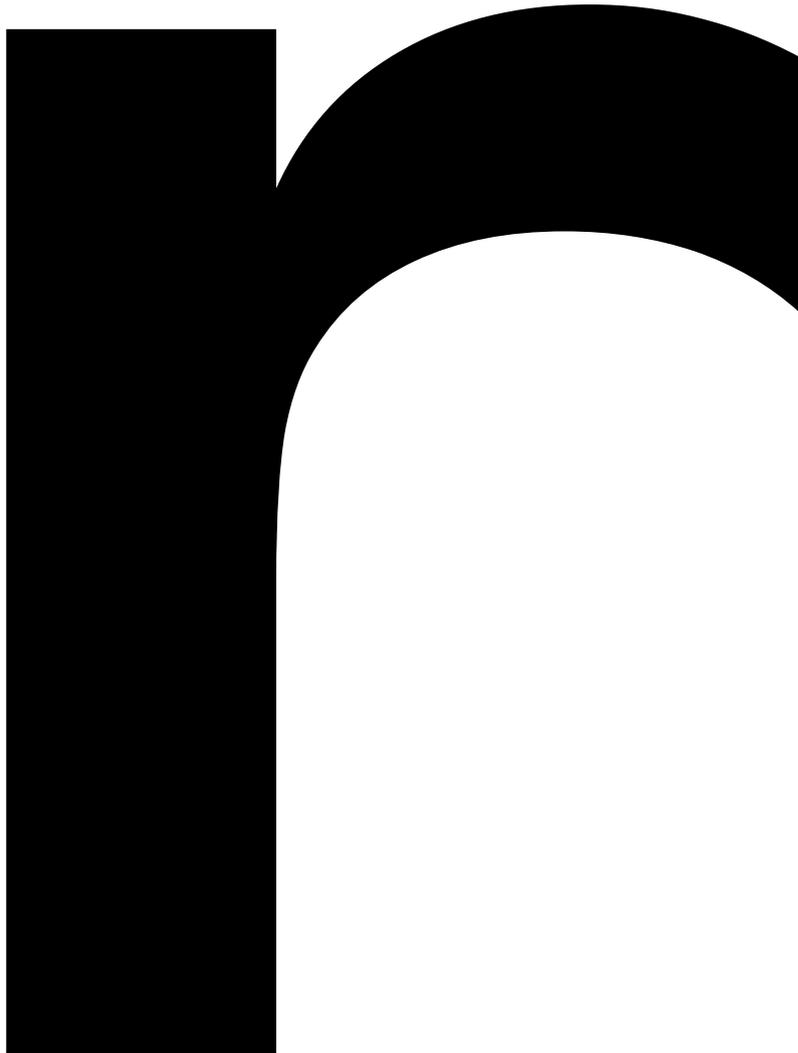
10

S

S







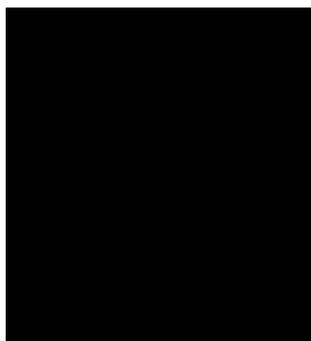
u

n

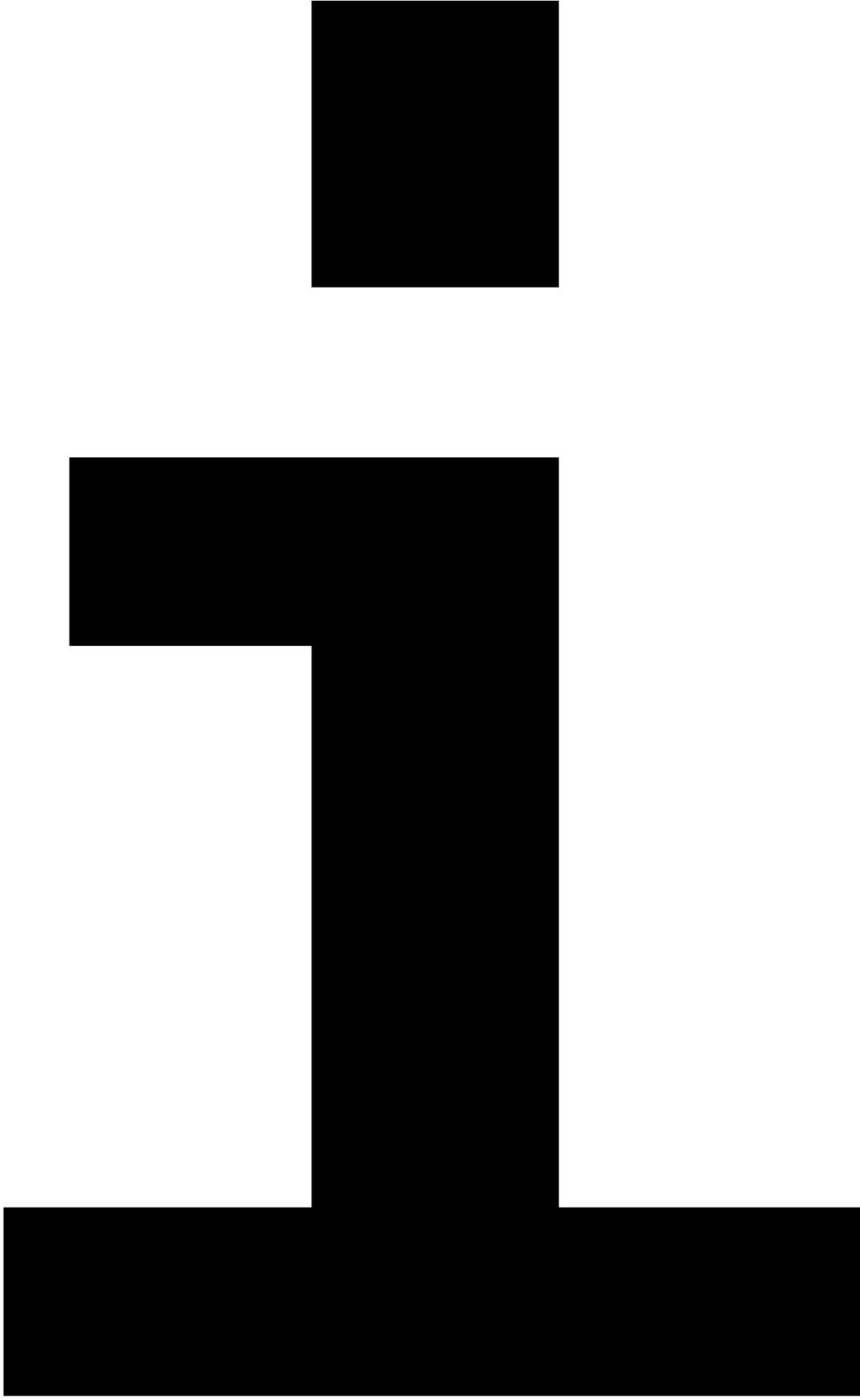
Q

e

n



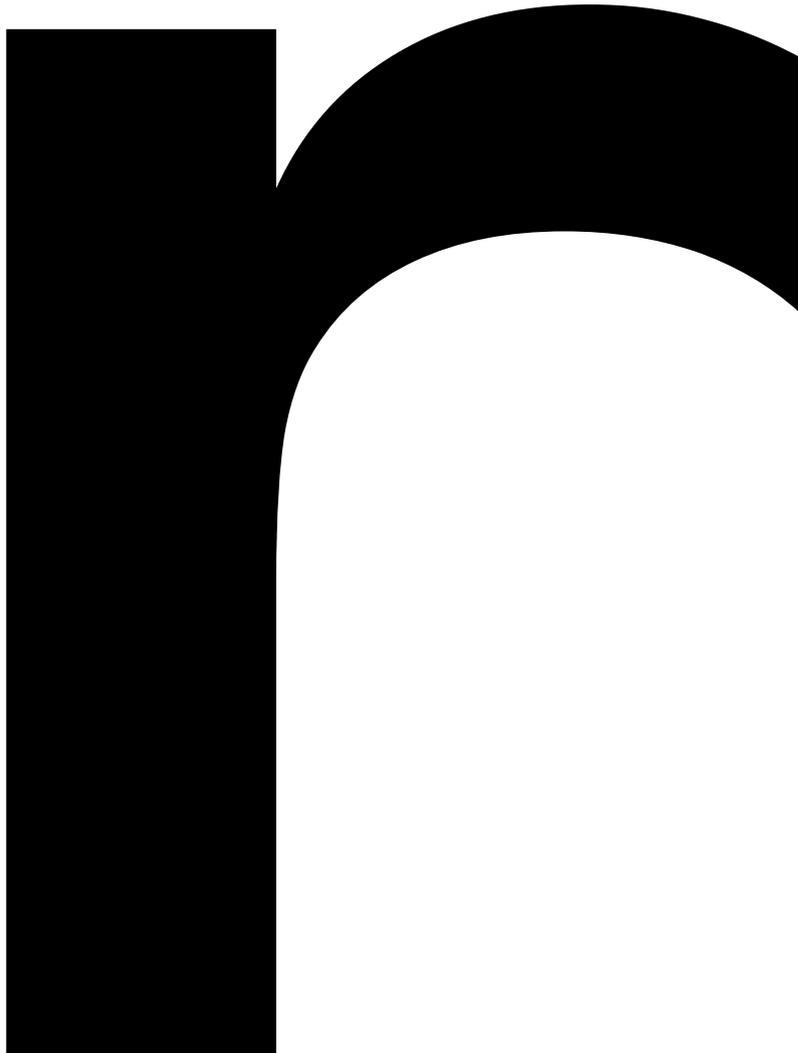
D



e

V

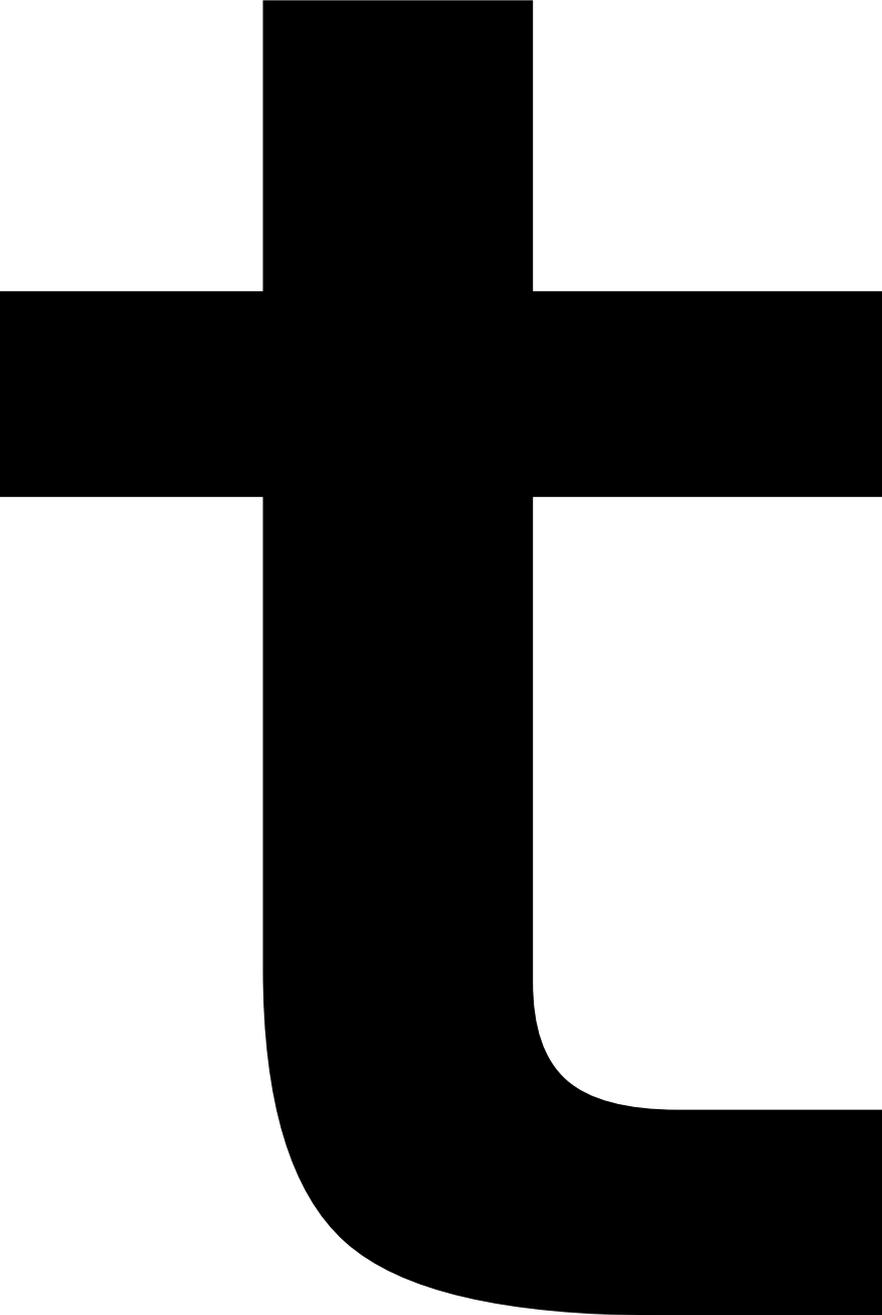
e



J

u

S



e

w

e

Q

e

n

A

J

T

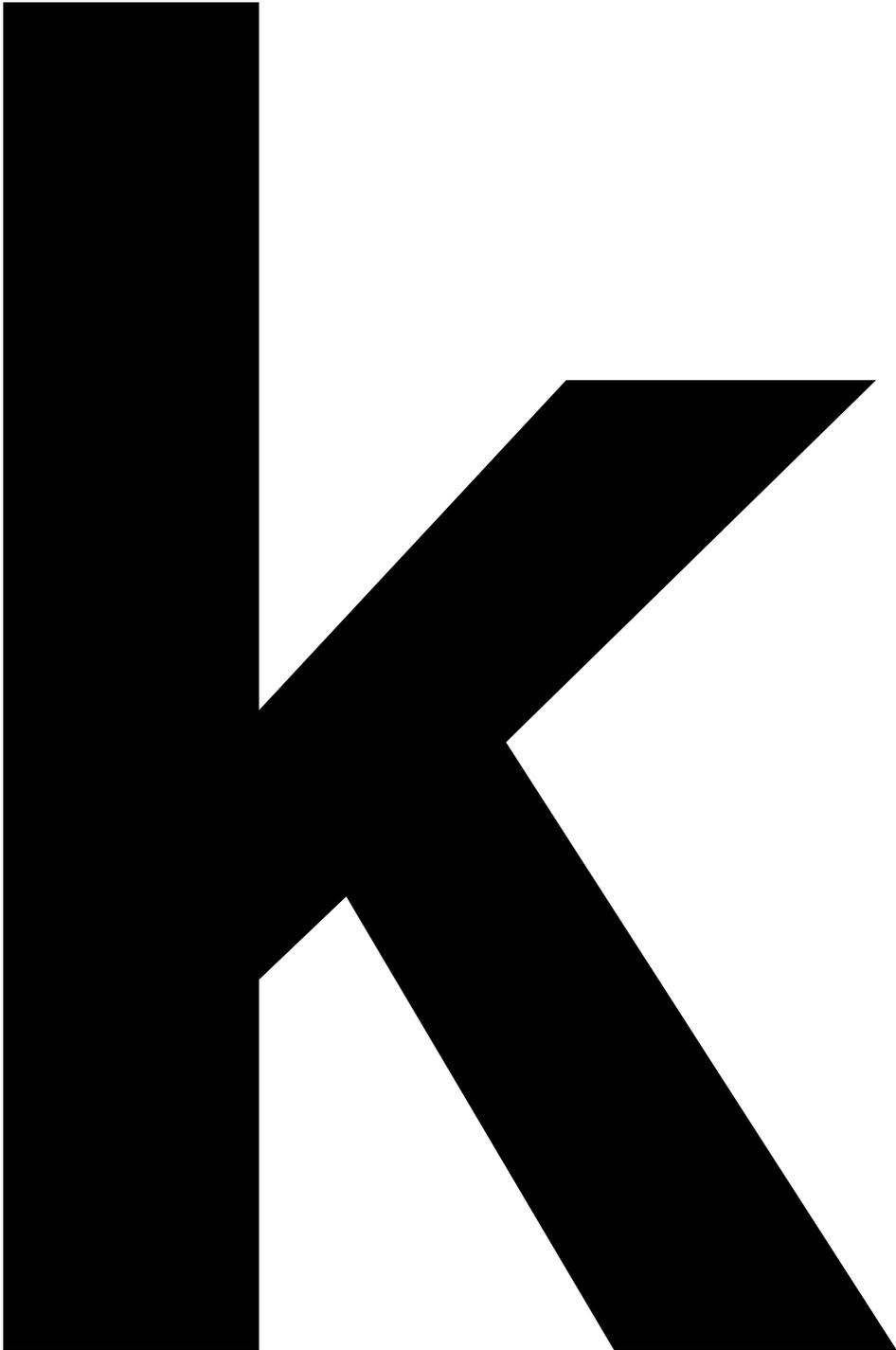
e

r

u

n

q



sa

n

n

m

sa

n

sa

n

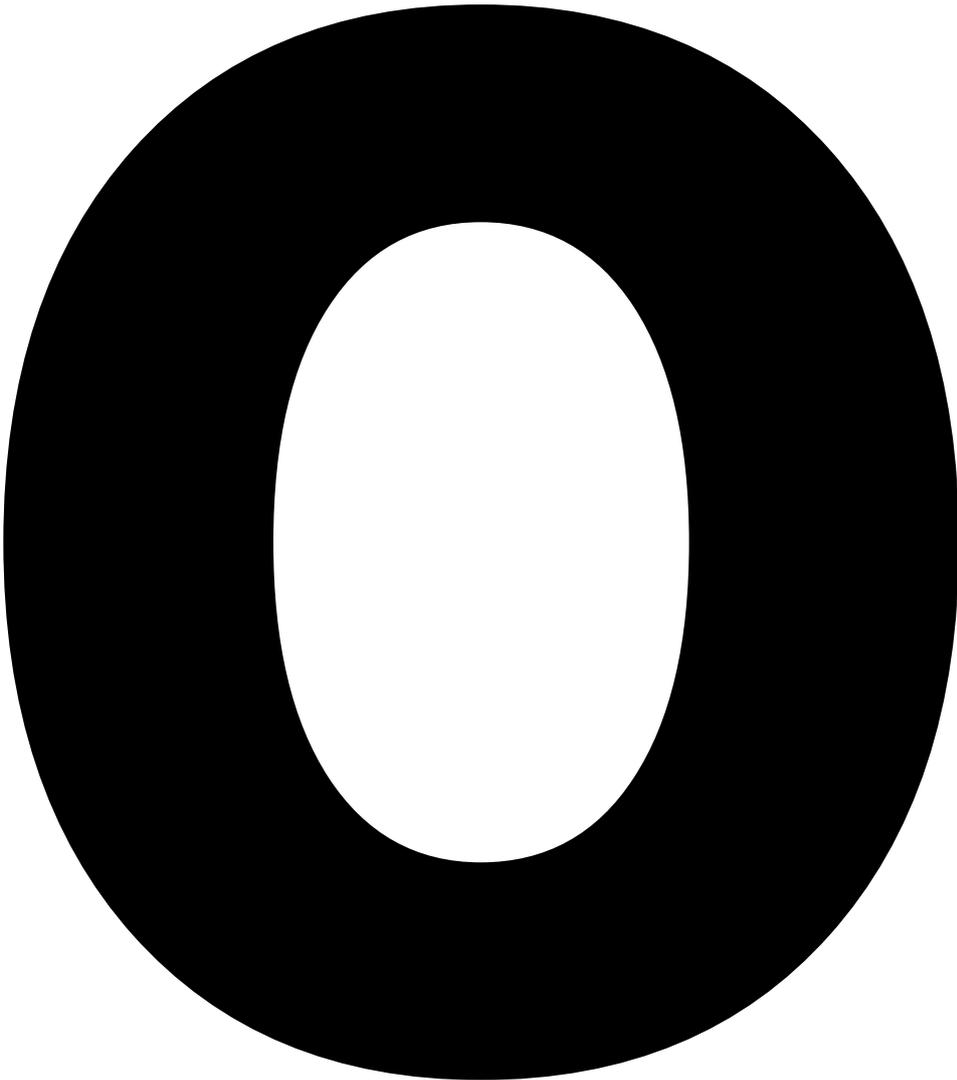
h

sa

n

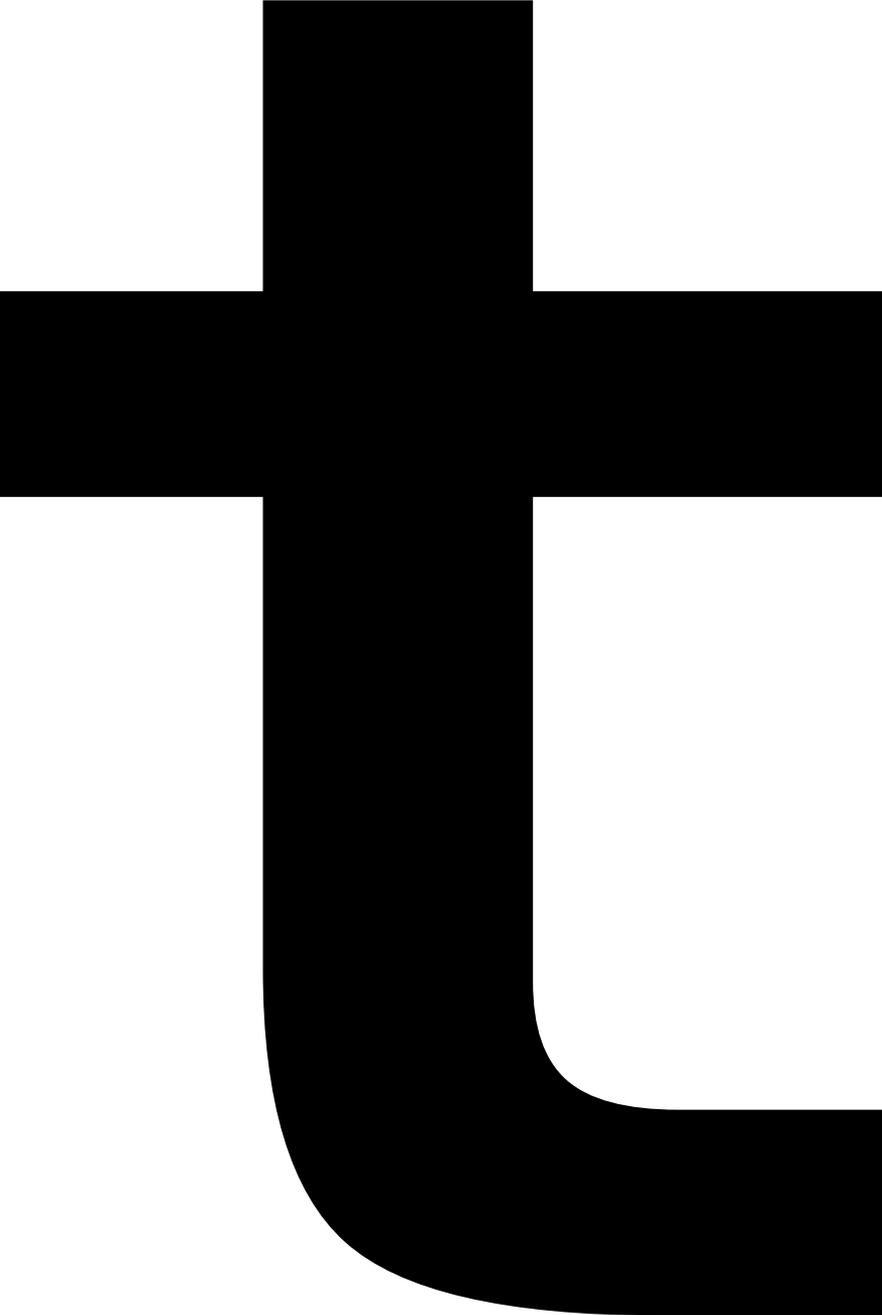
Q

V

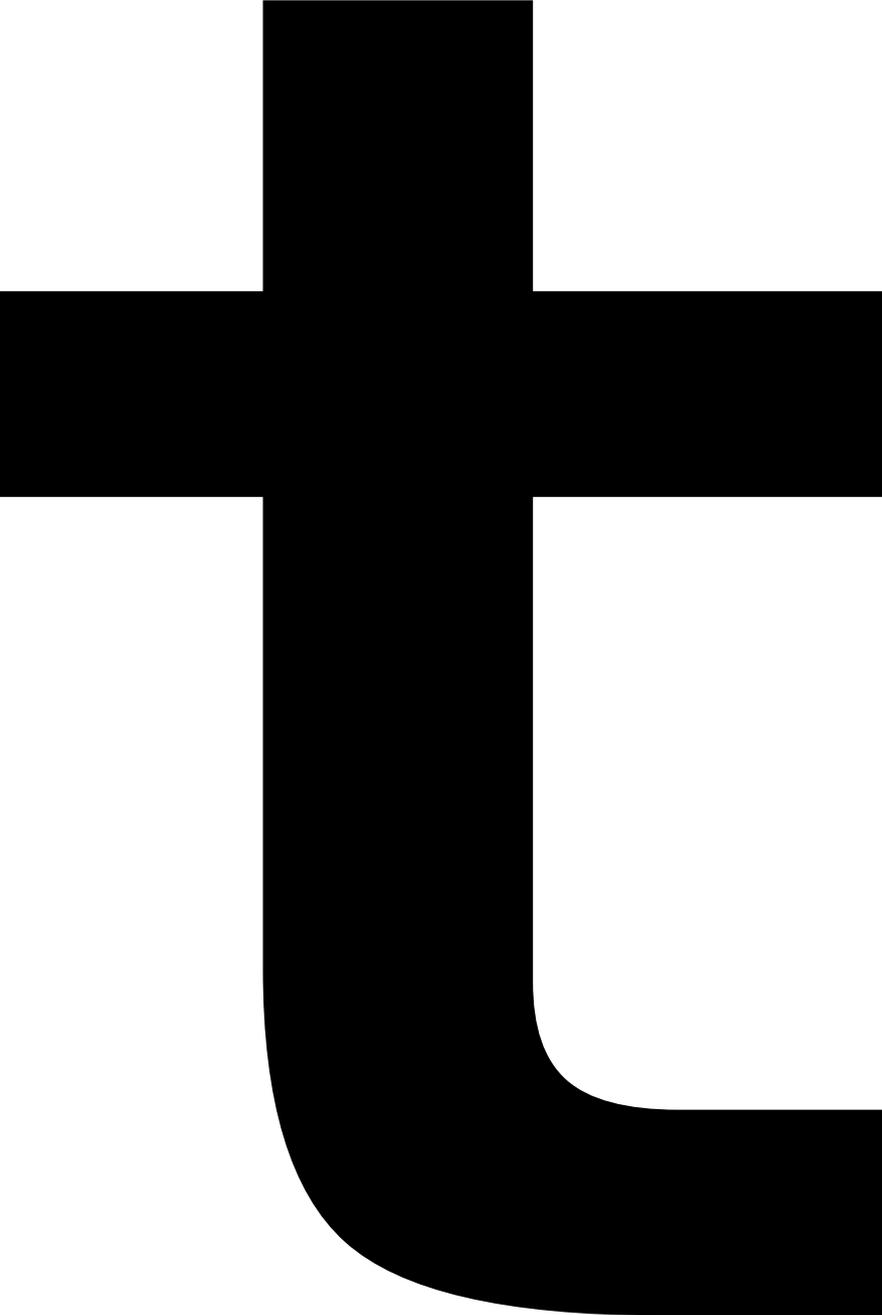


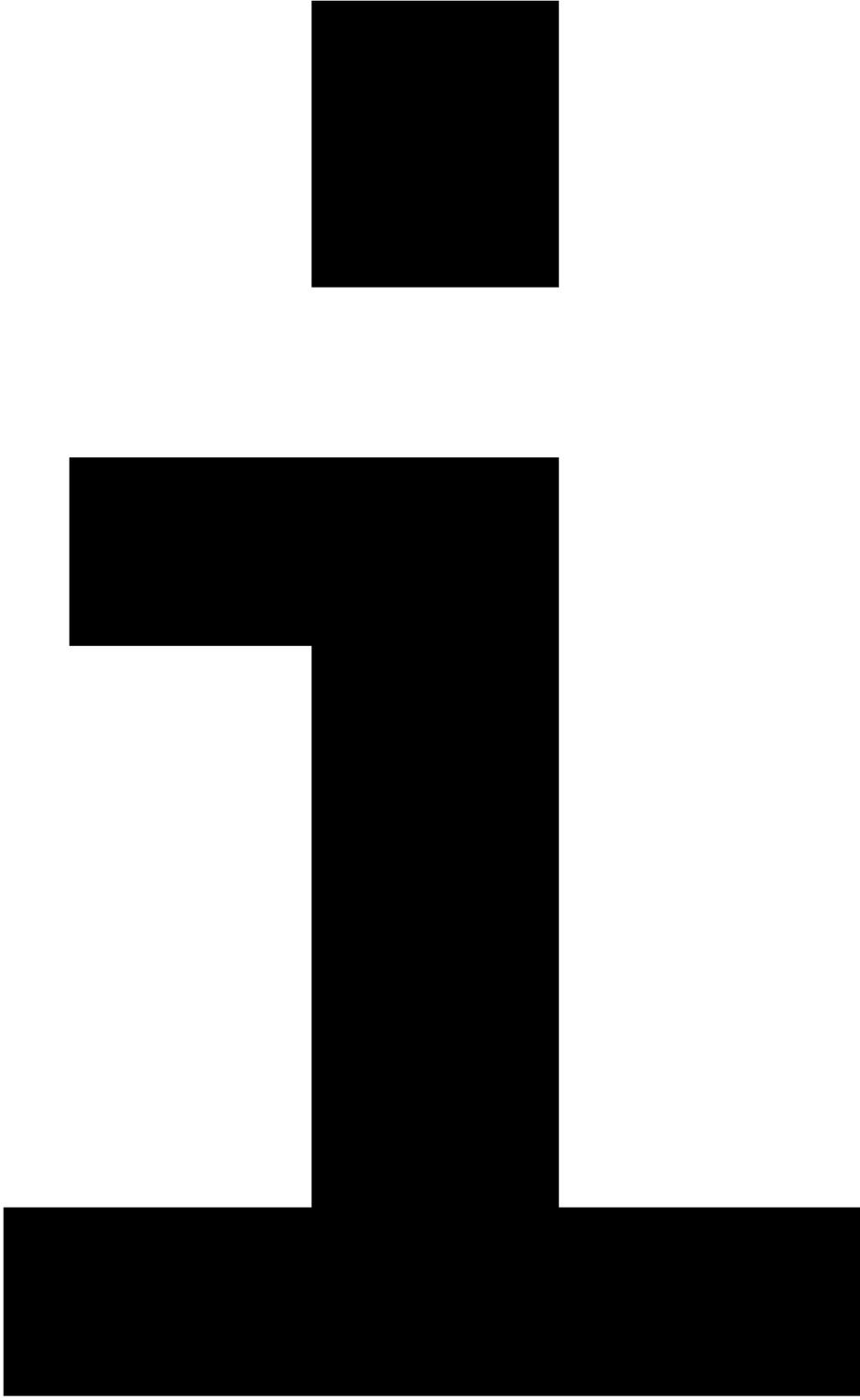
n

S

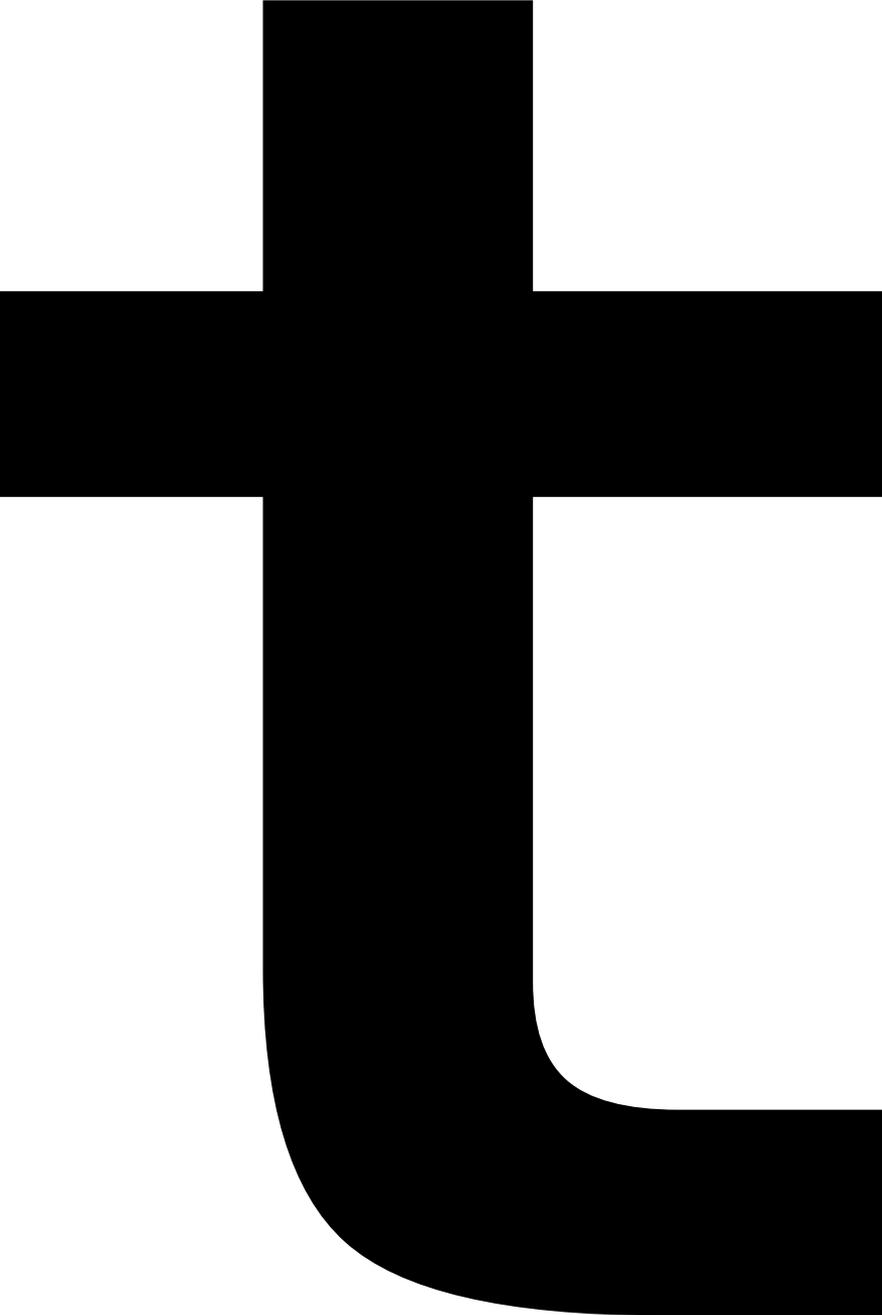


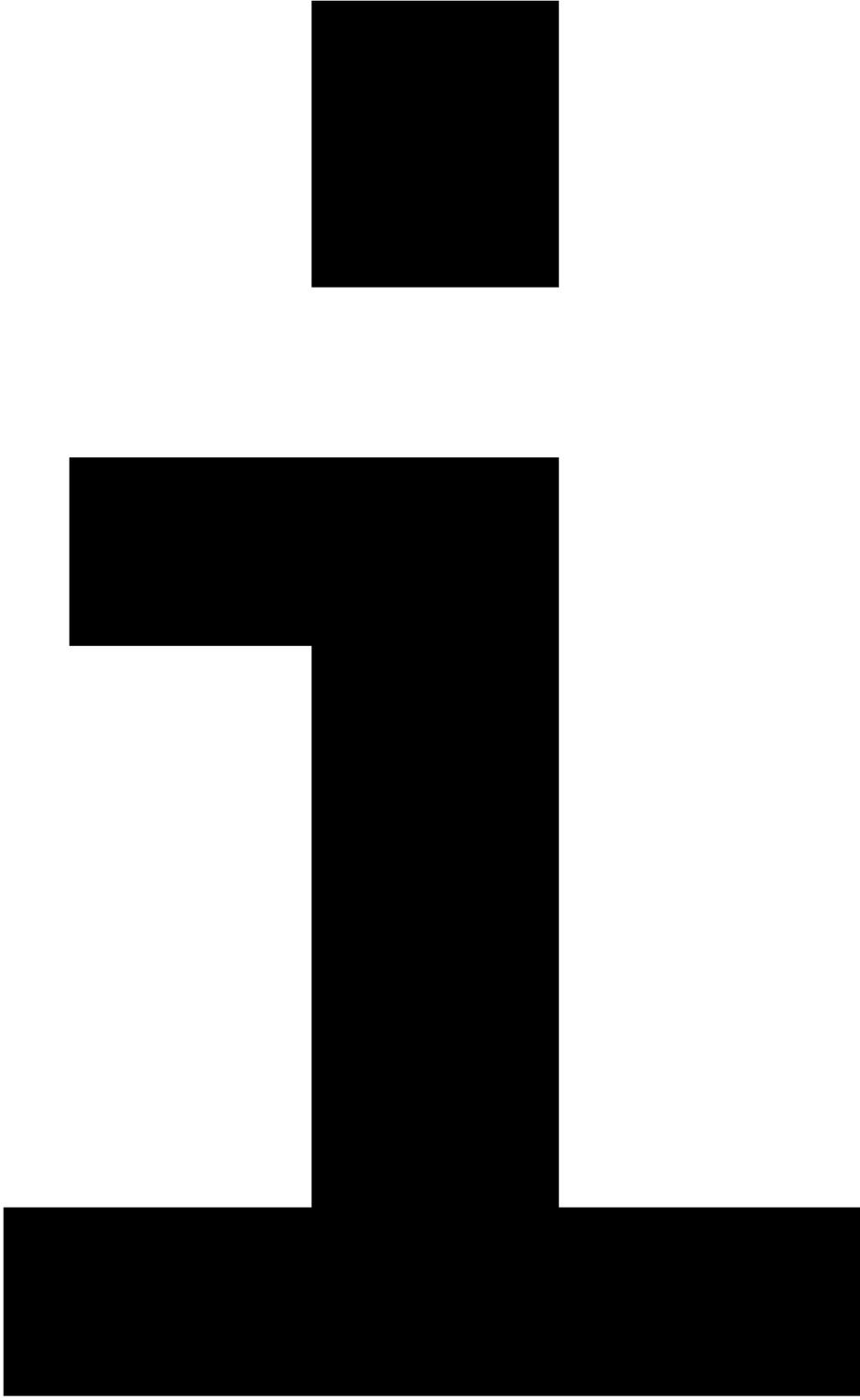
sa

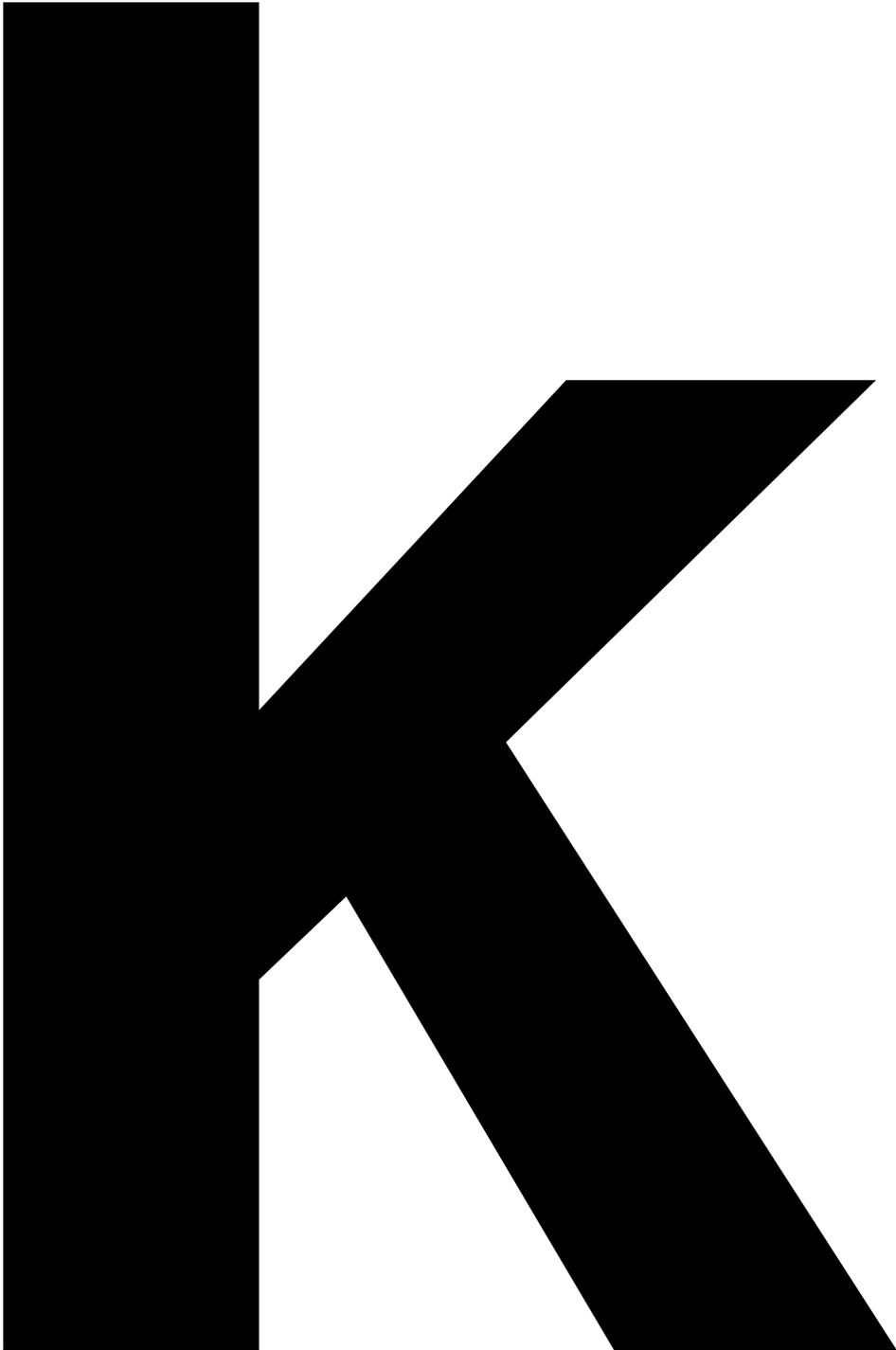




S



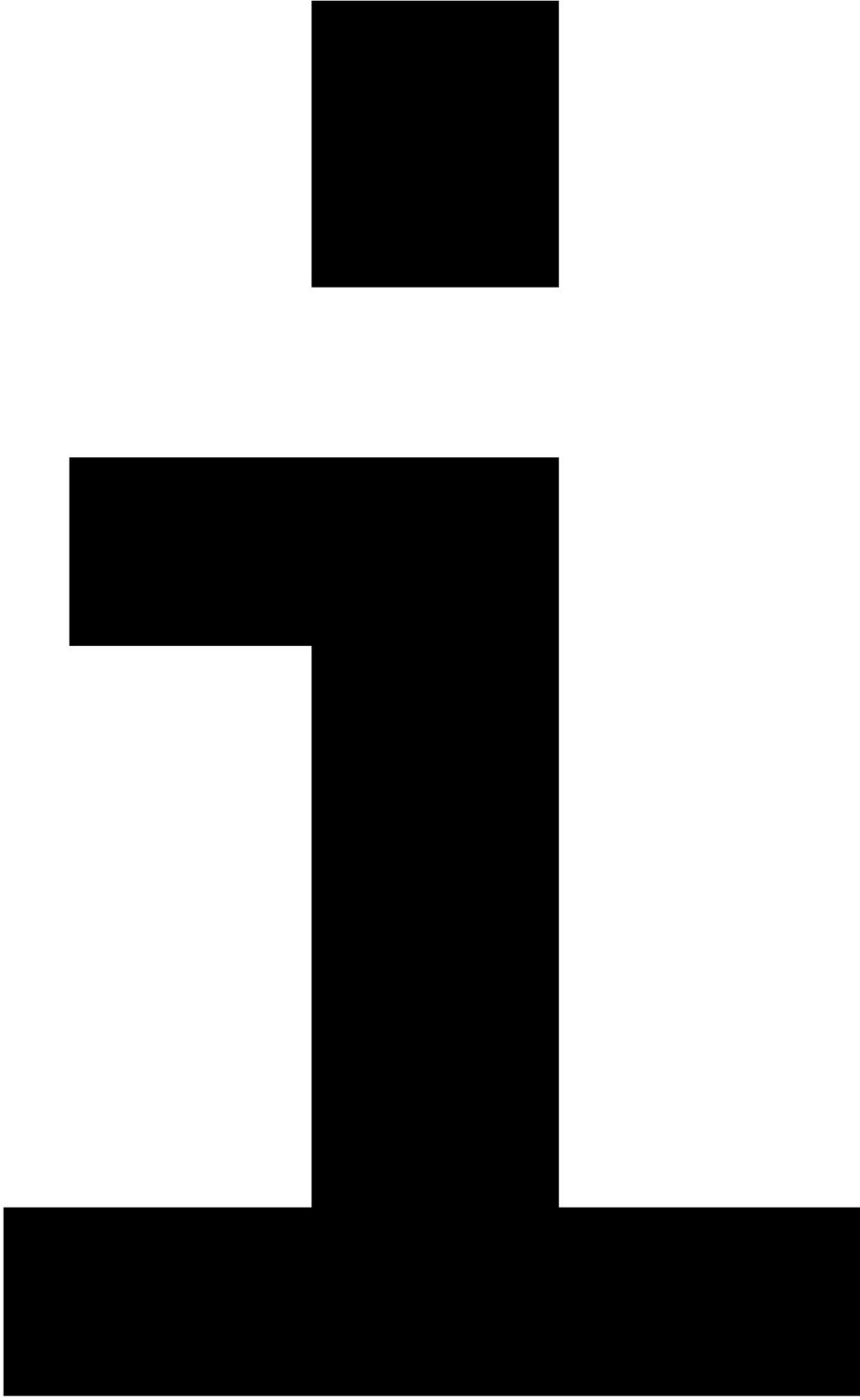


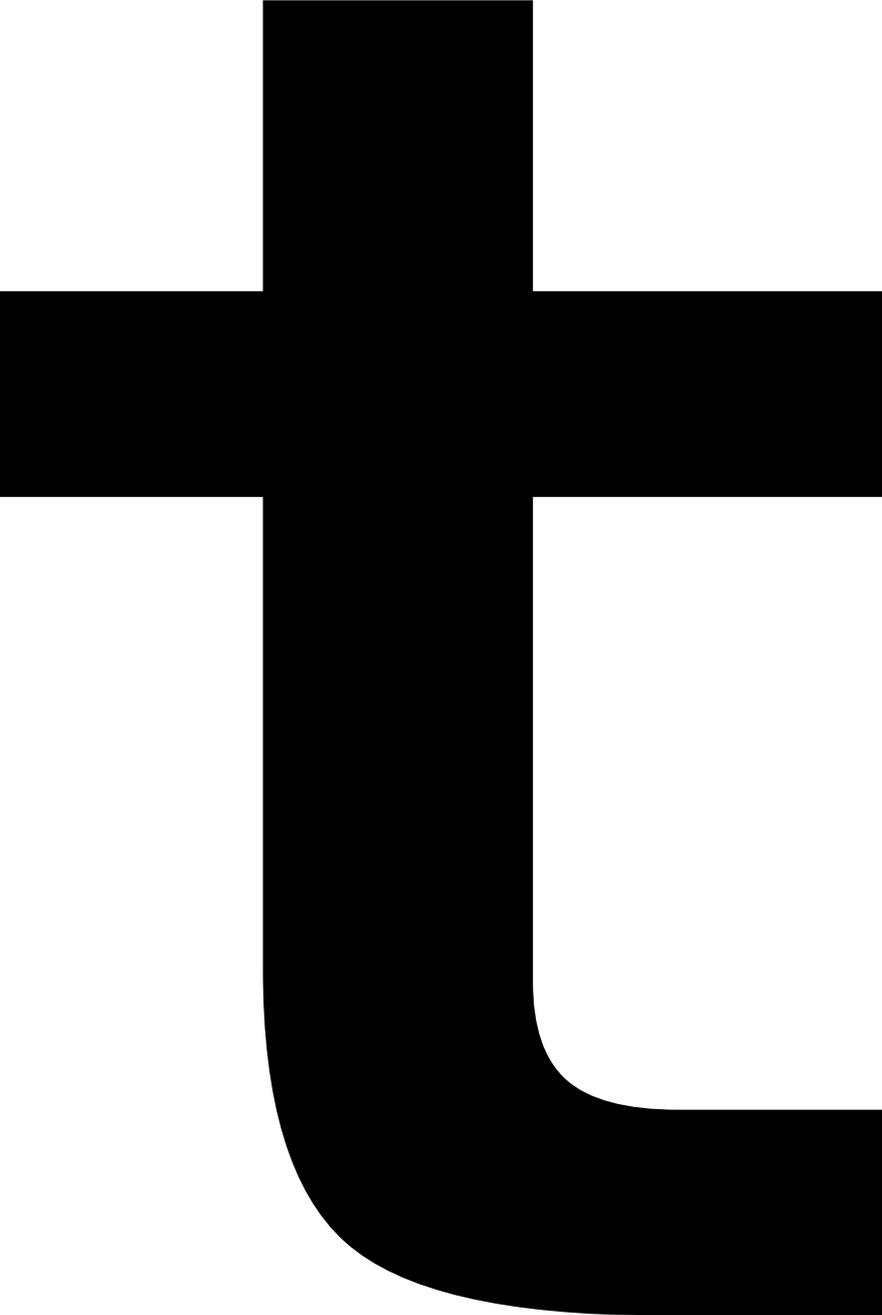


e

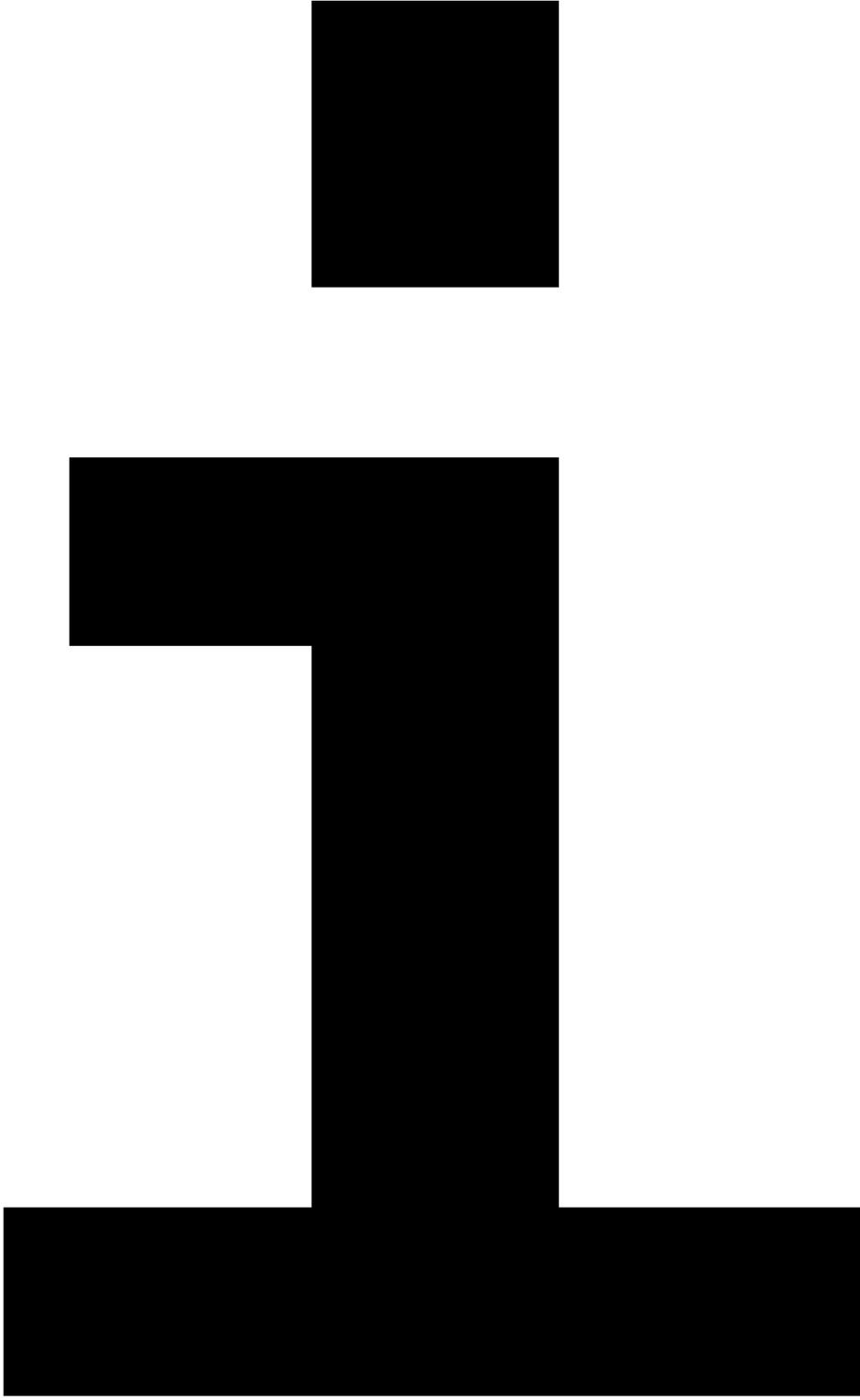
n

m





m

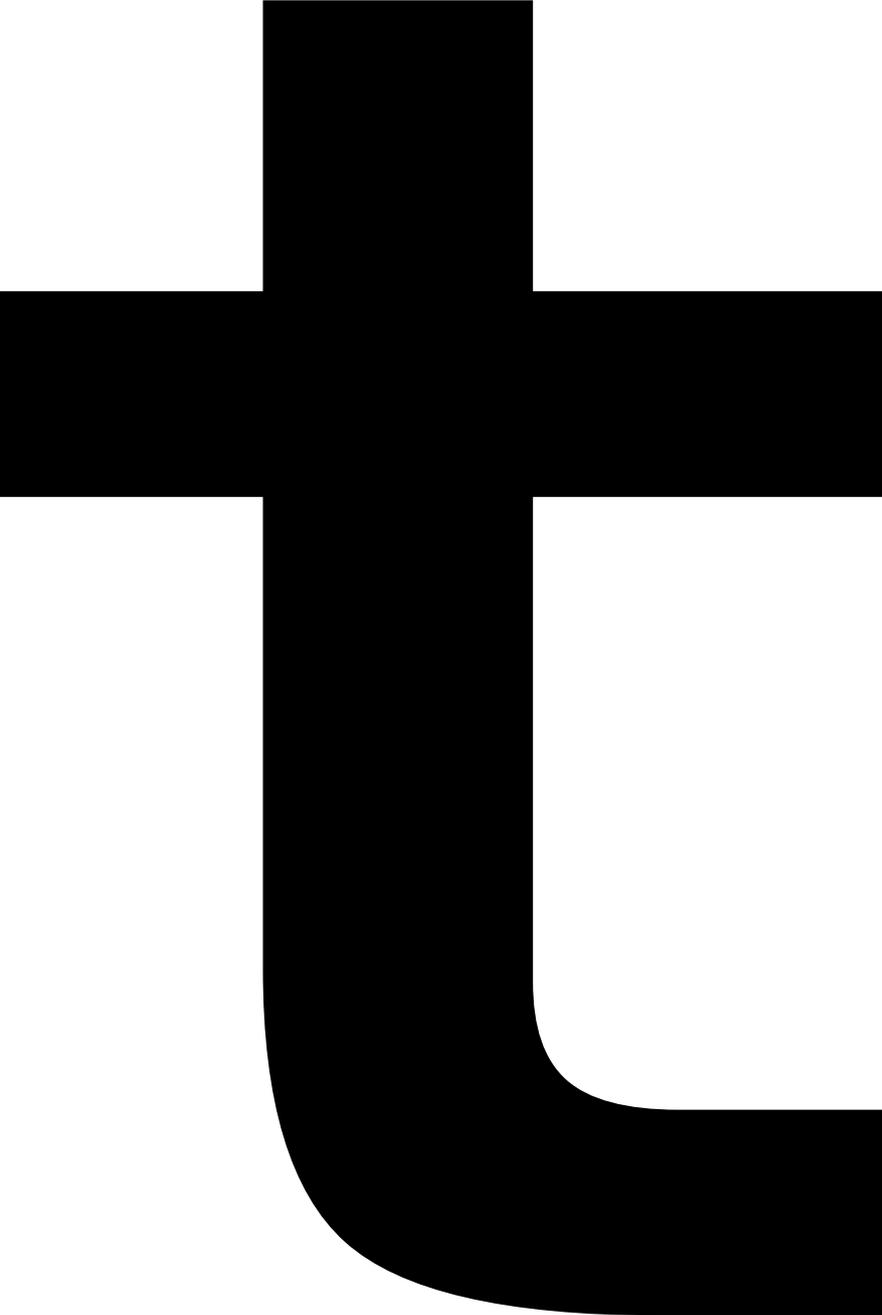


n

Q

e

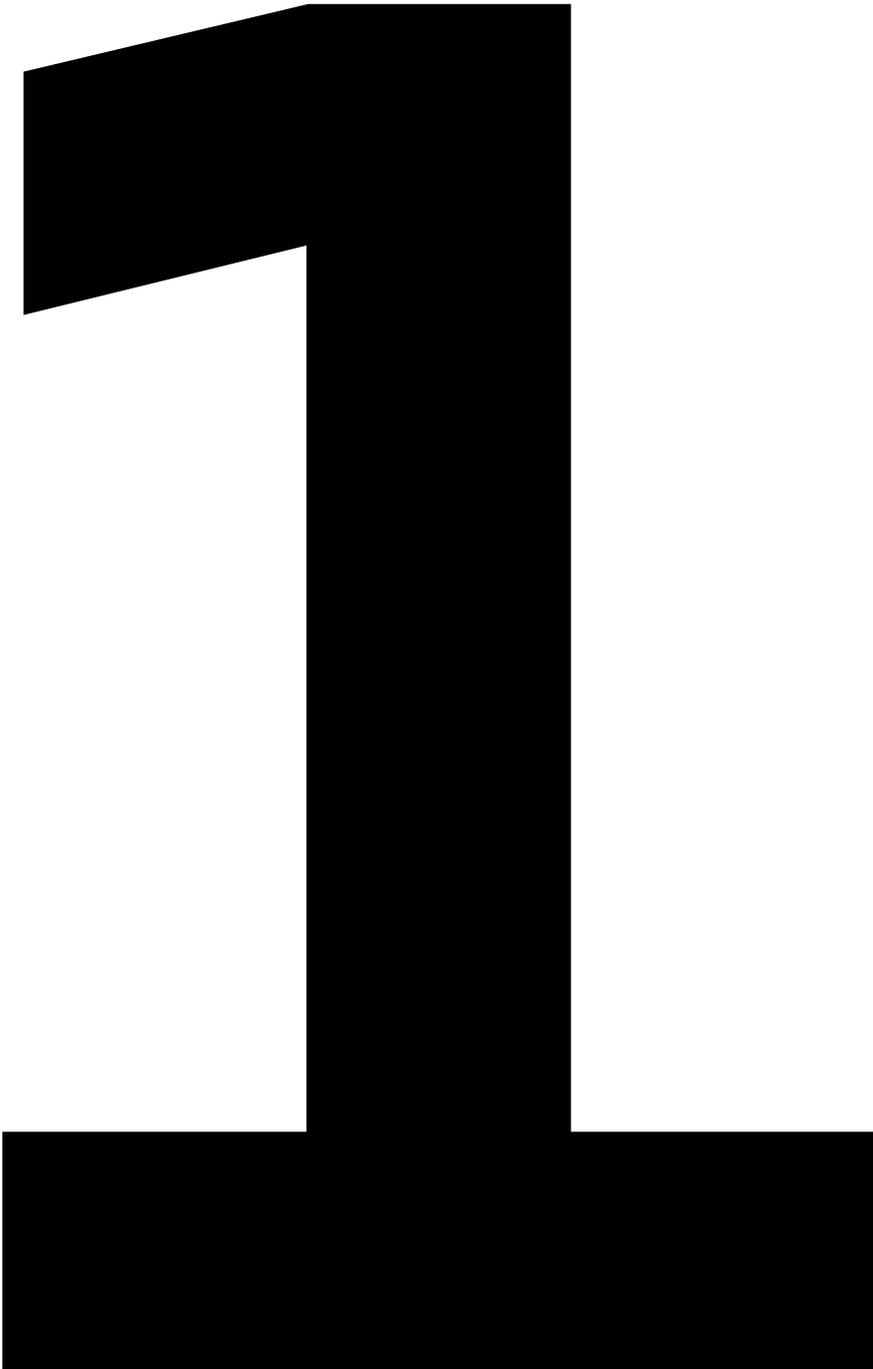
S

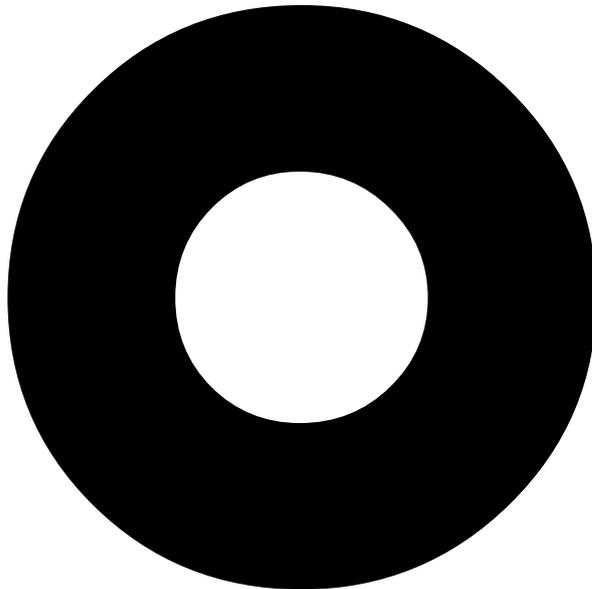
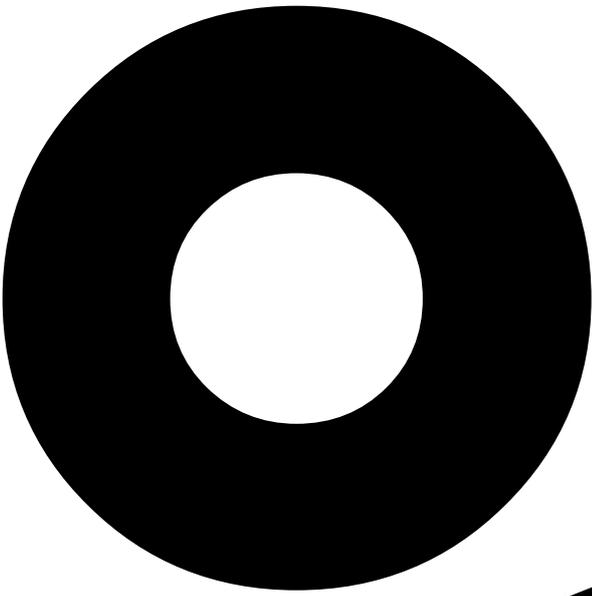


e

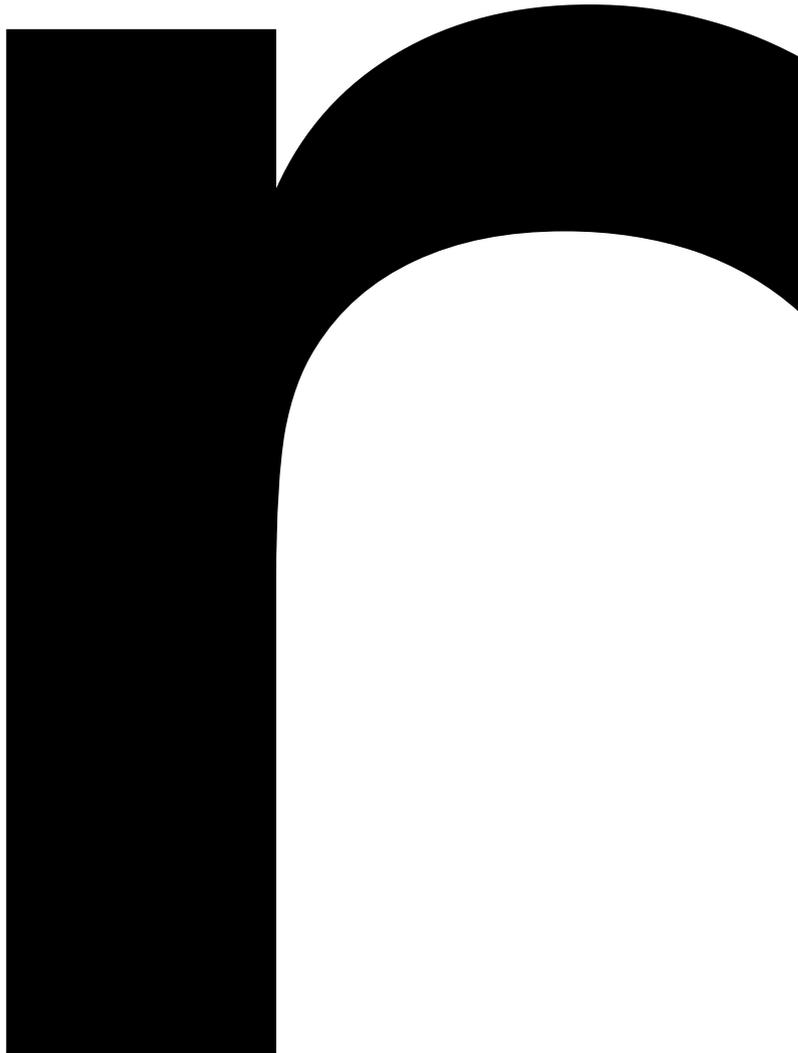
n

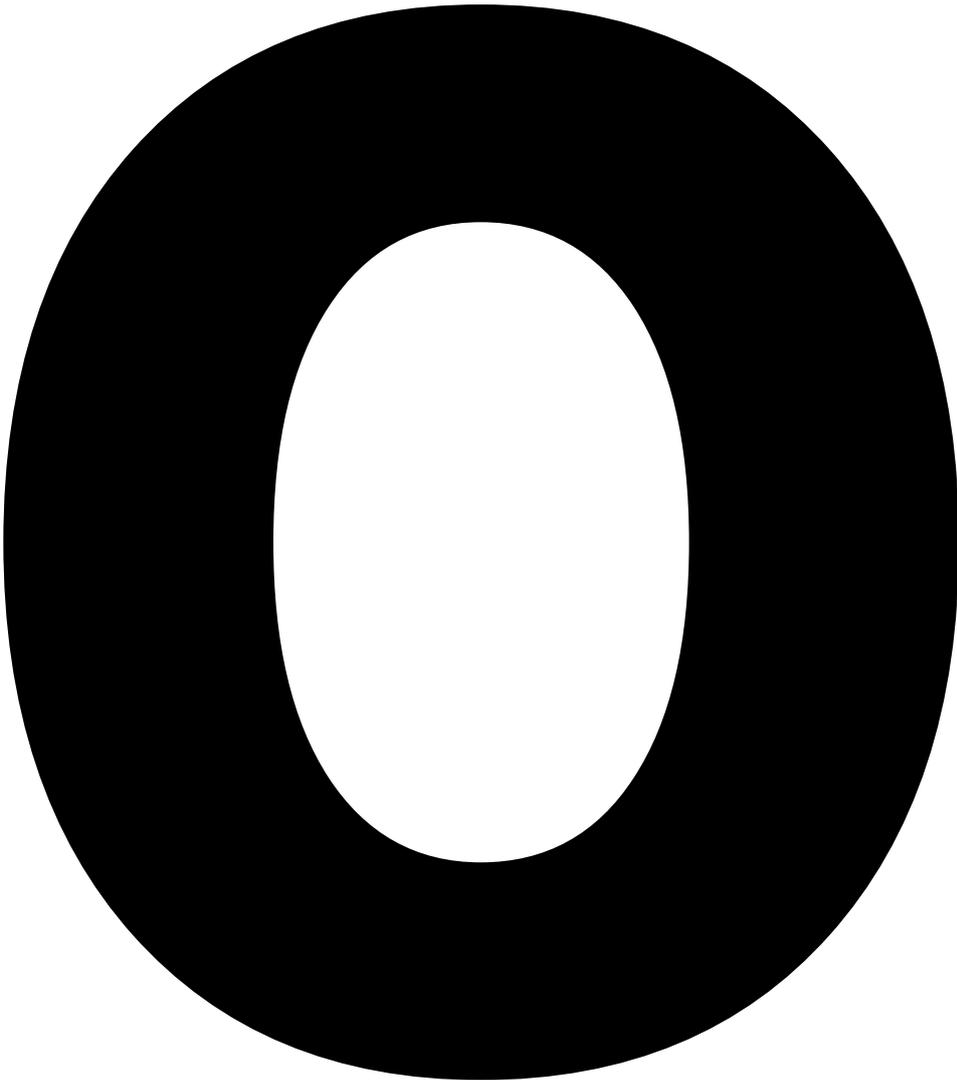
S





o

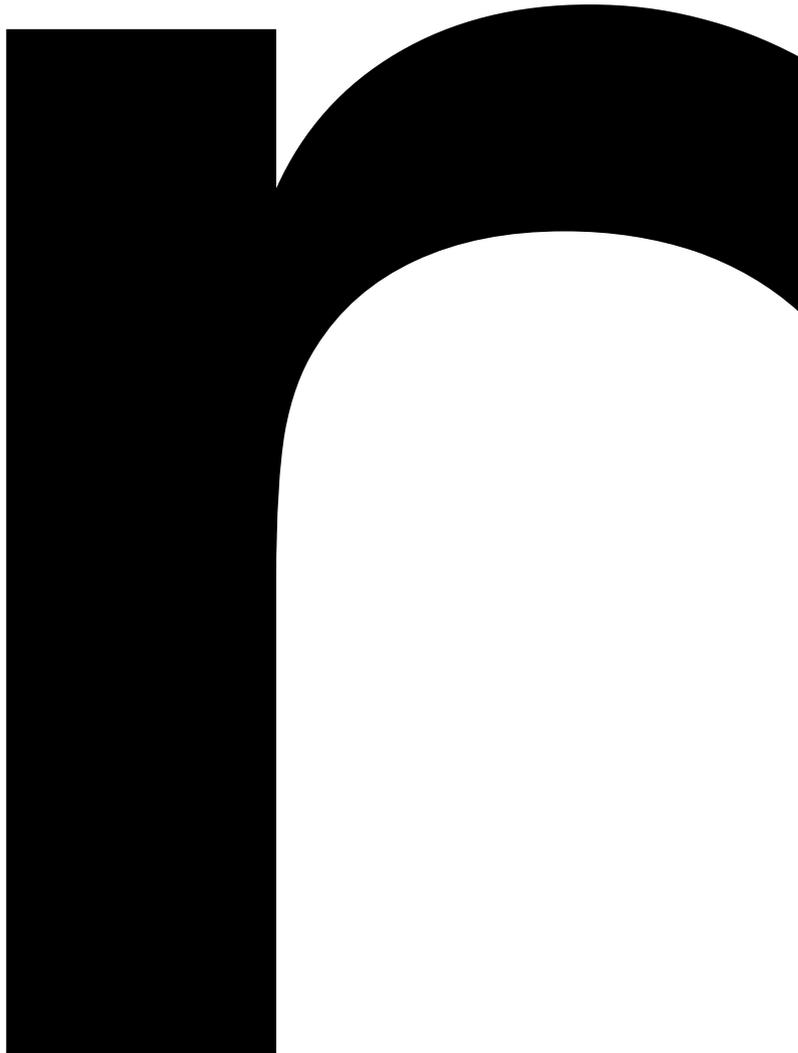




J

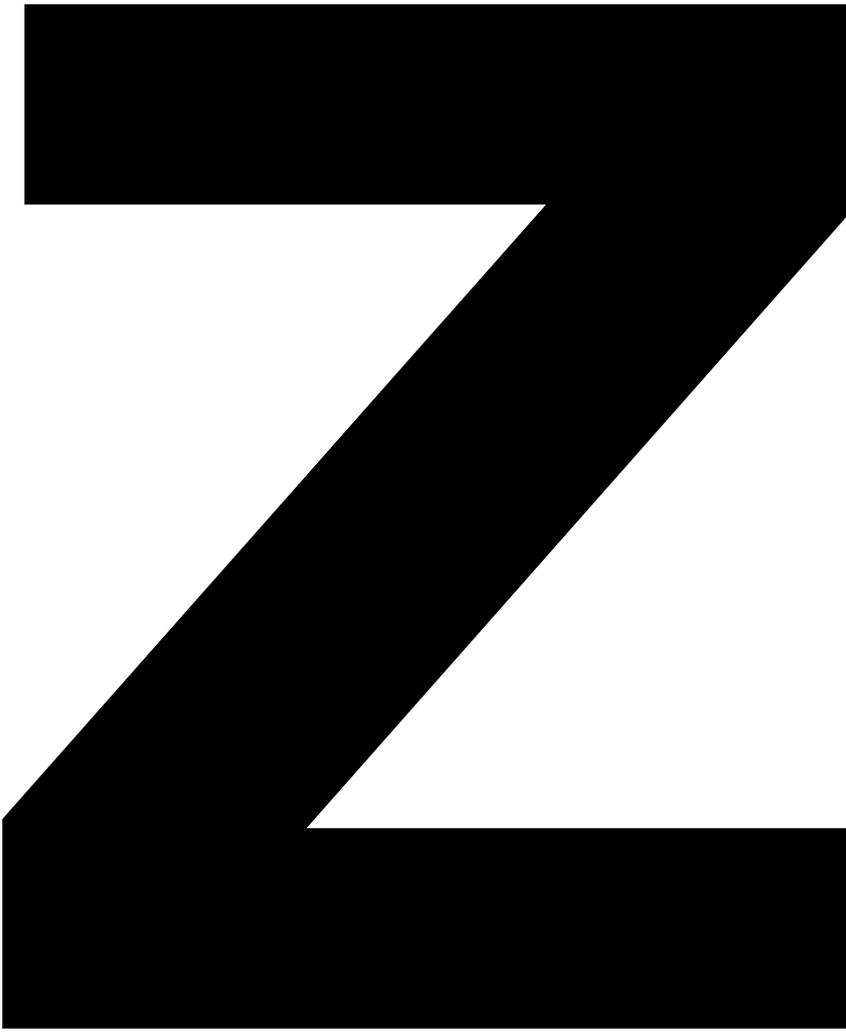
sa

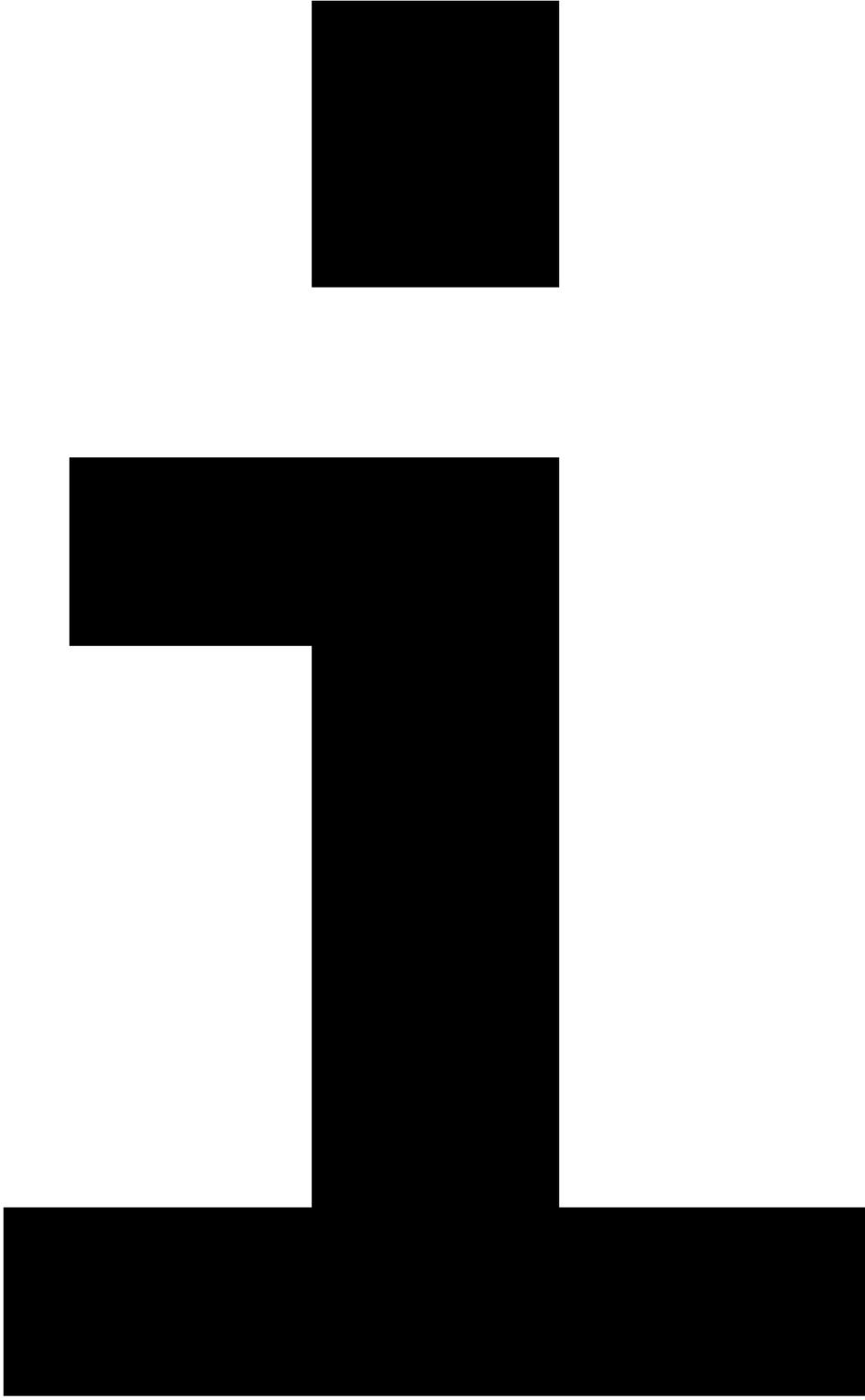
h

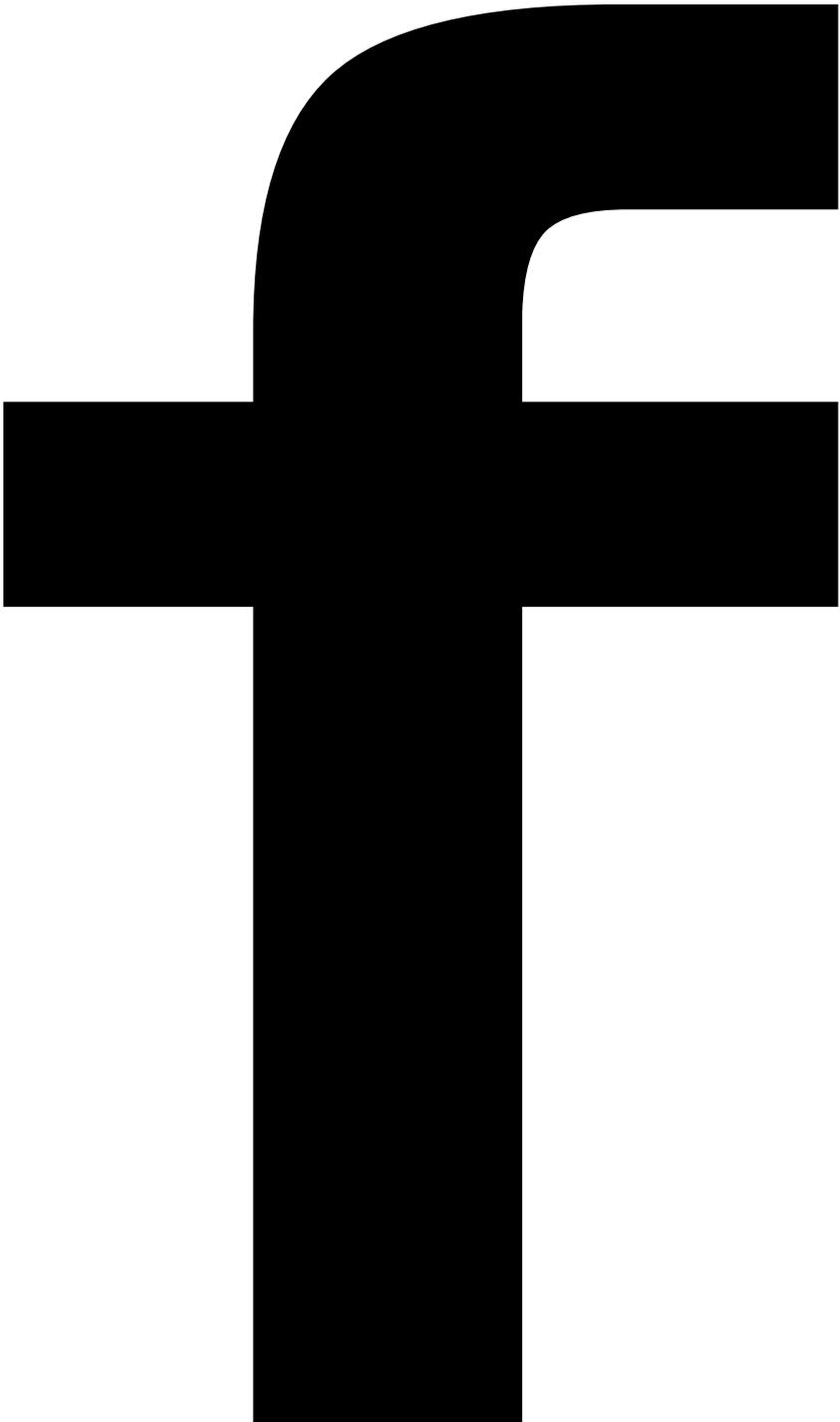


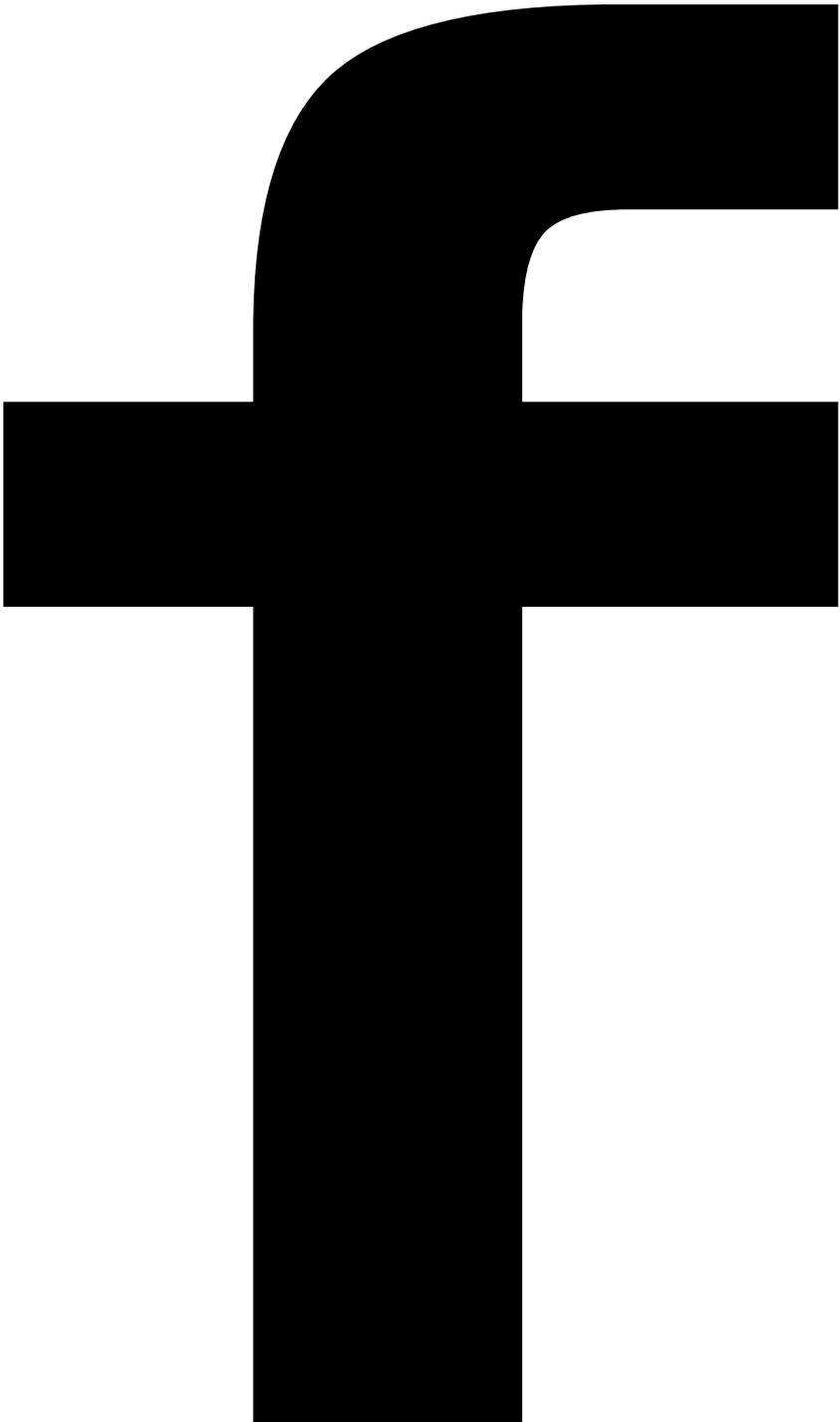
10

e

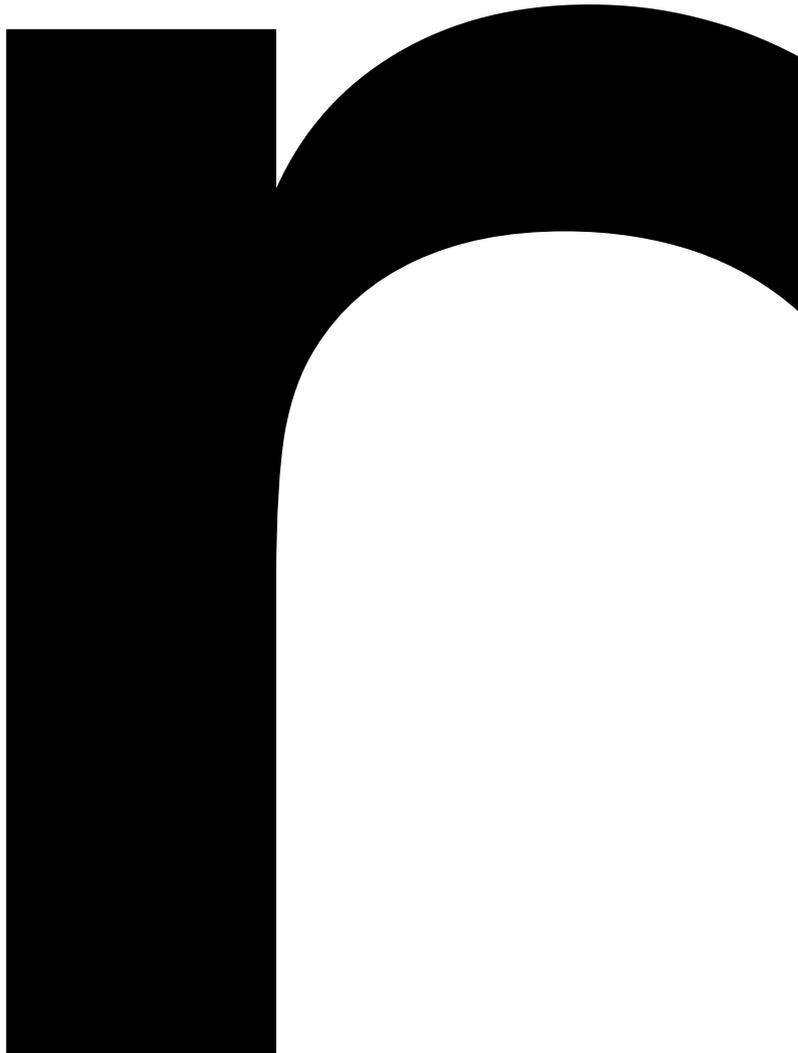




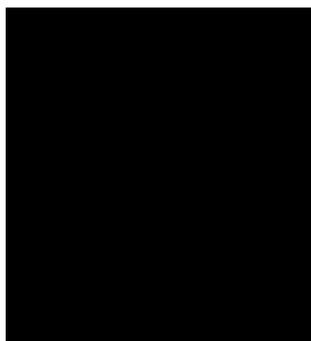


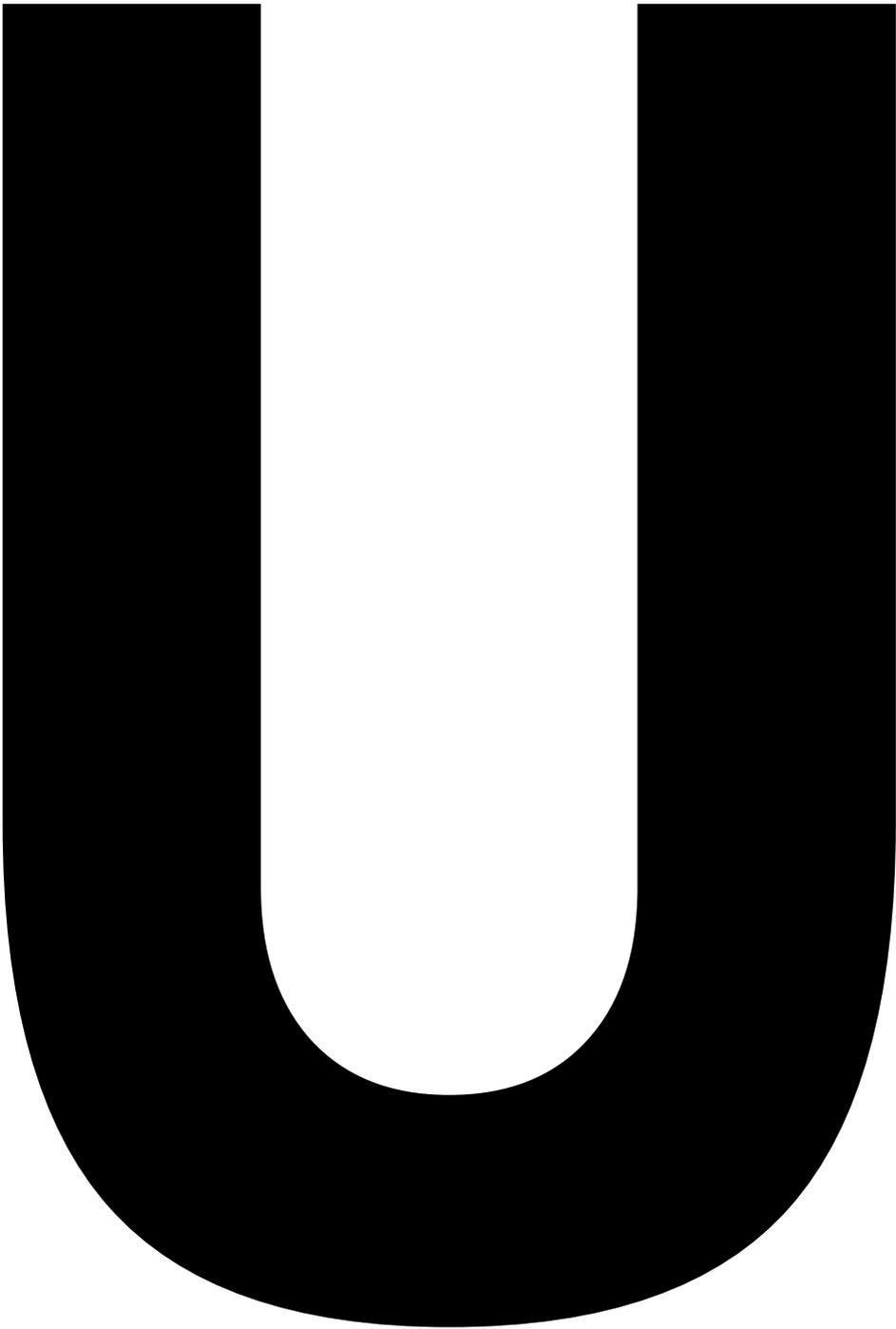


e



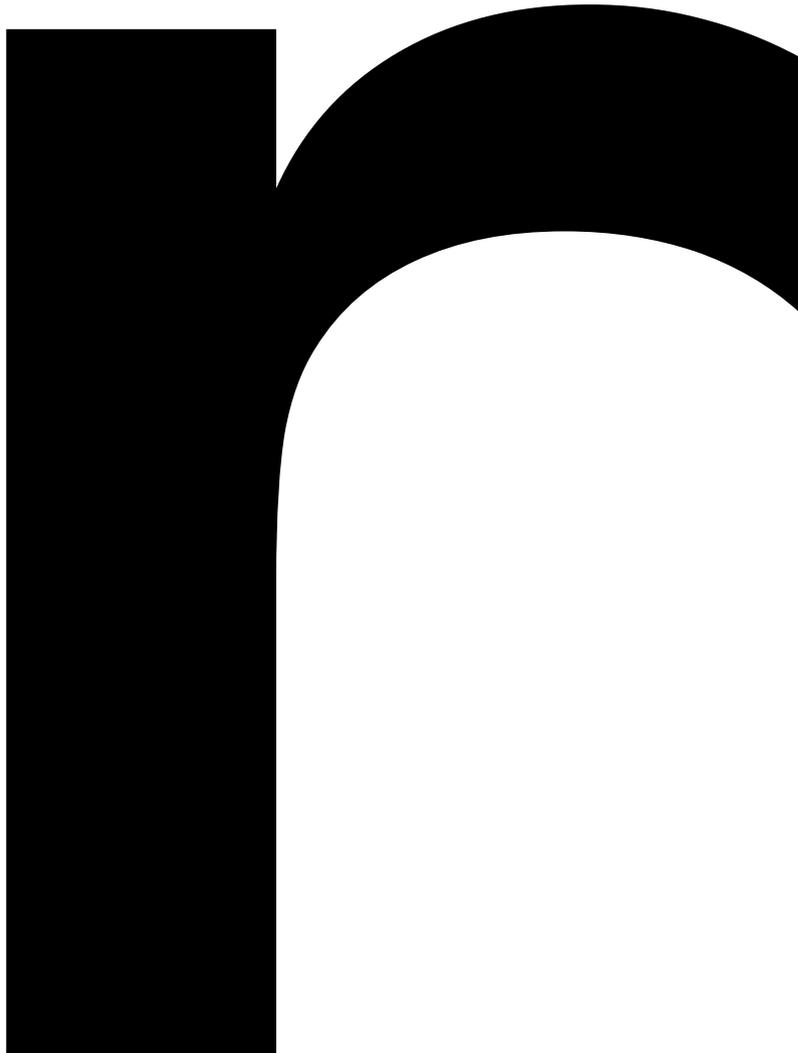
n





10

e

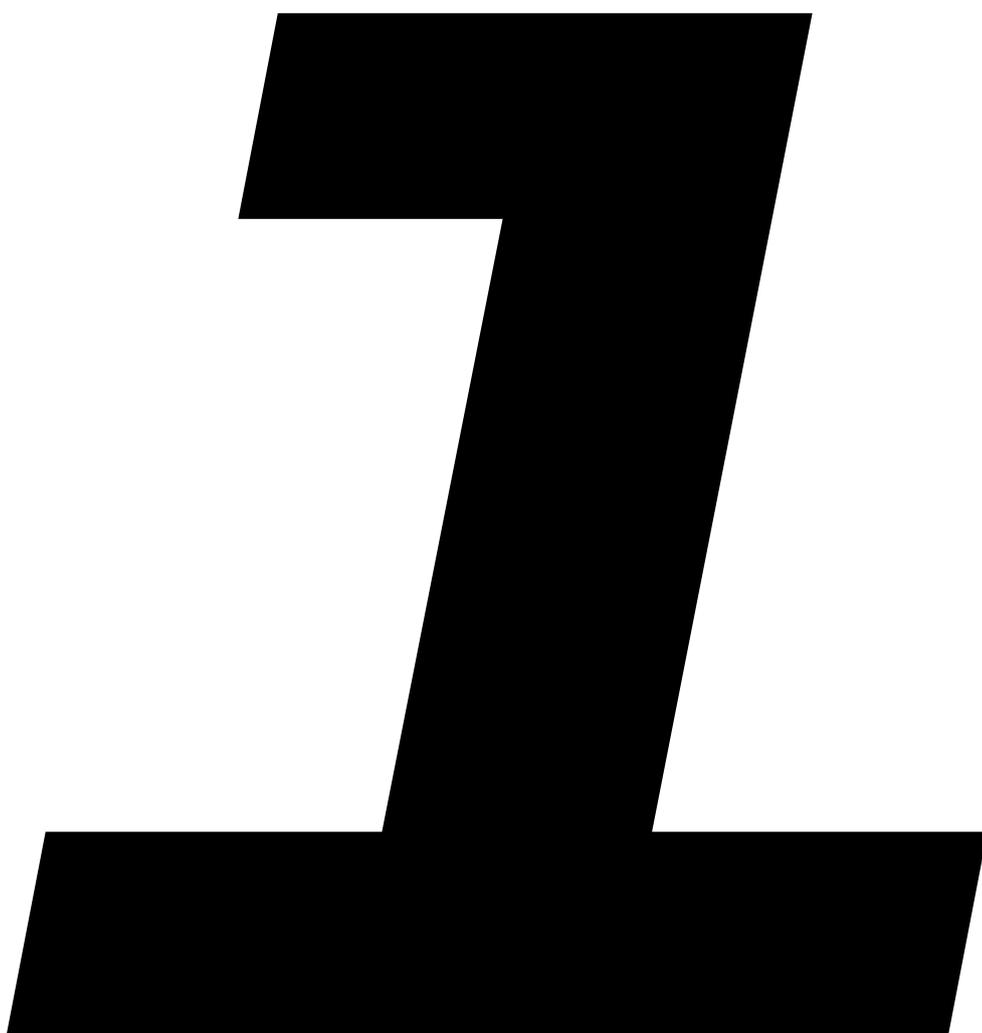


B

e

T

r



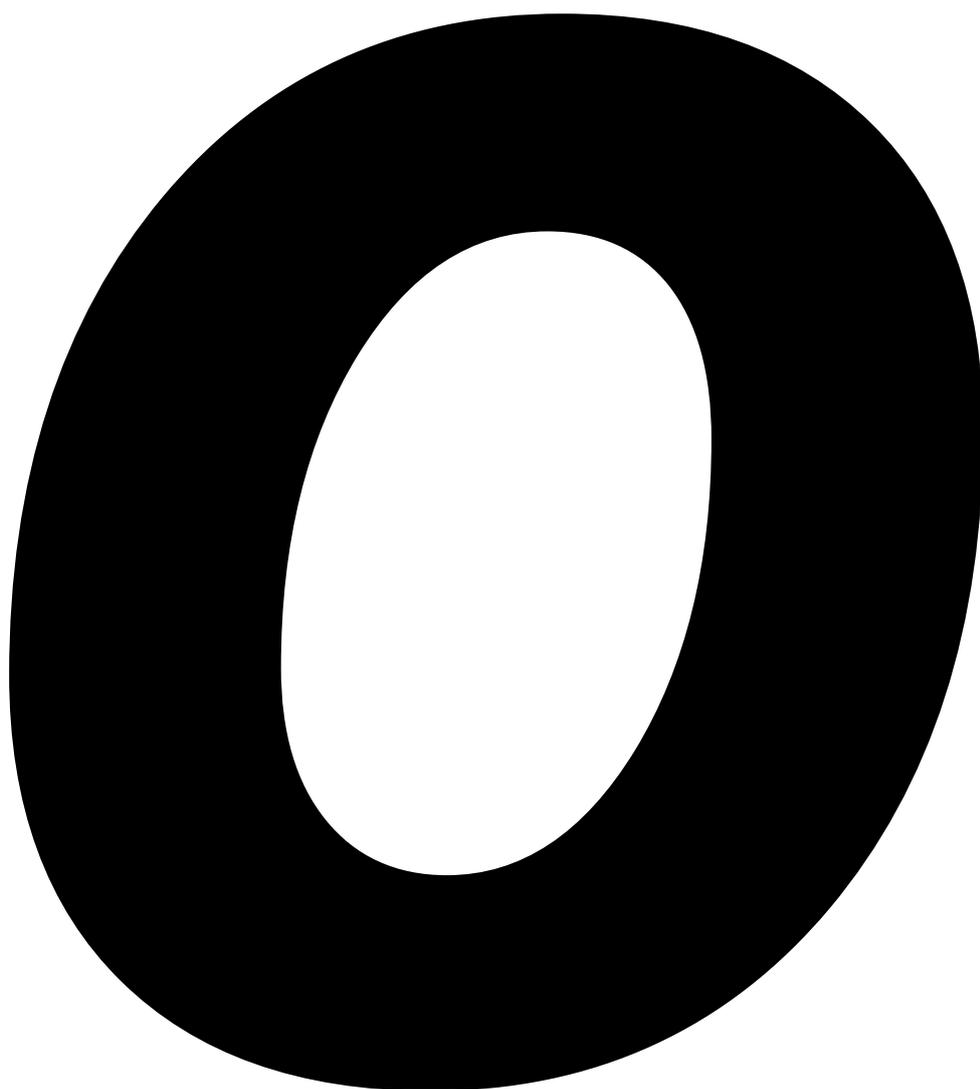
e

b

S

S

T



r

u

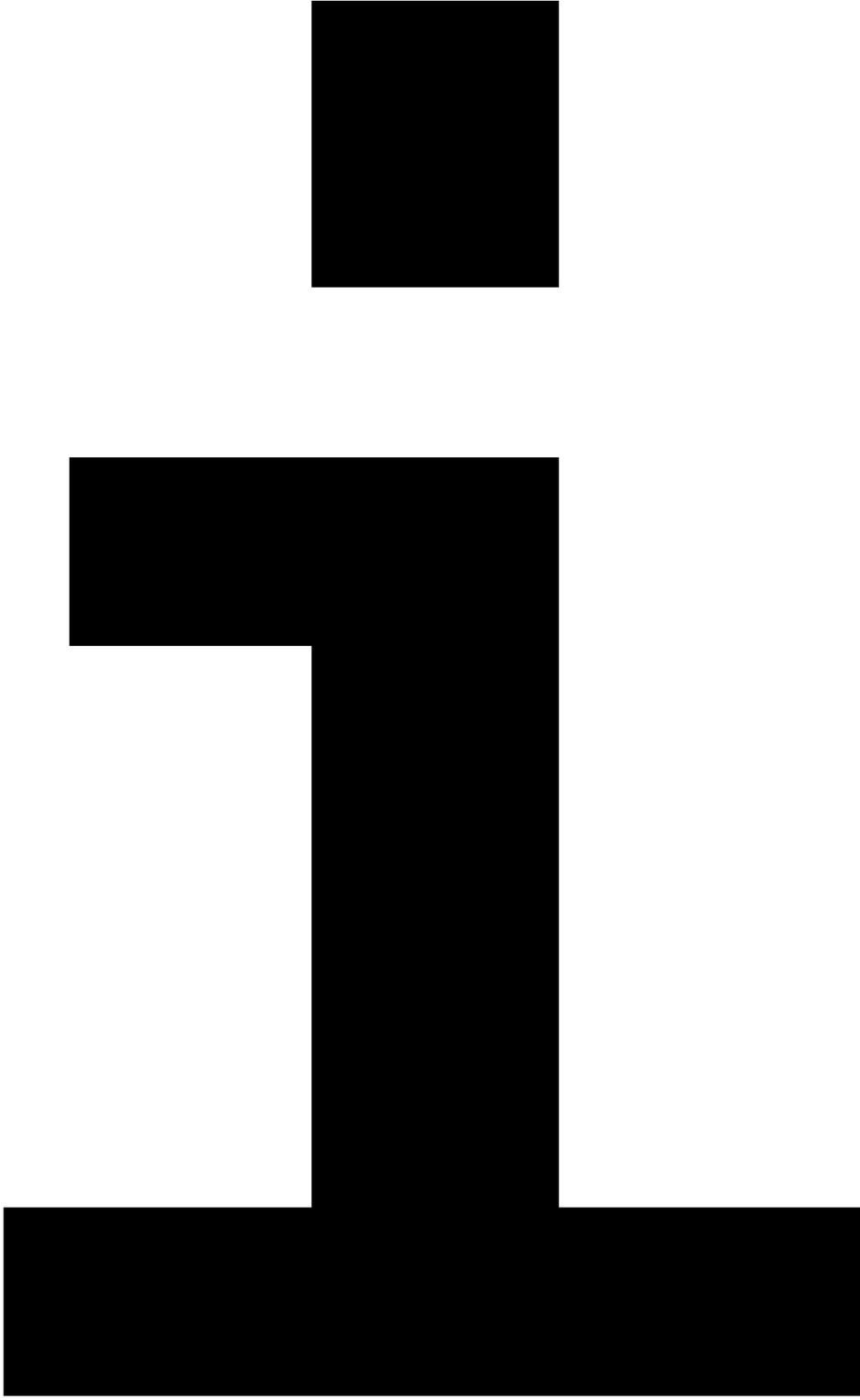
n

q

e

n

J

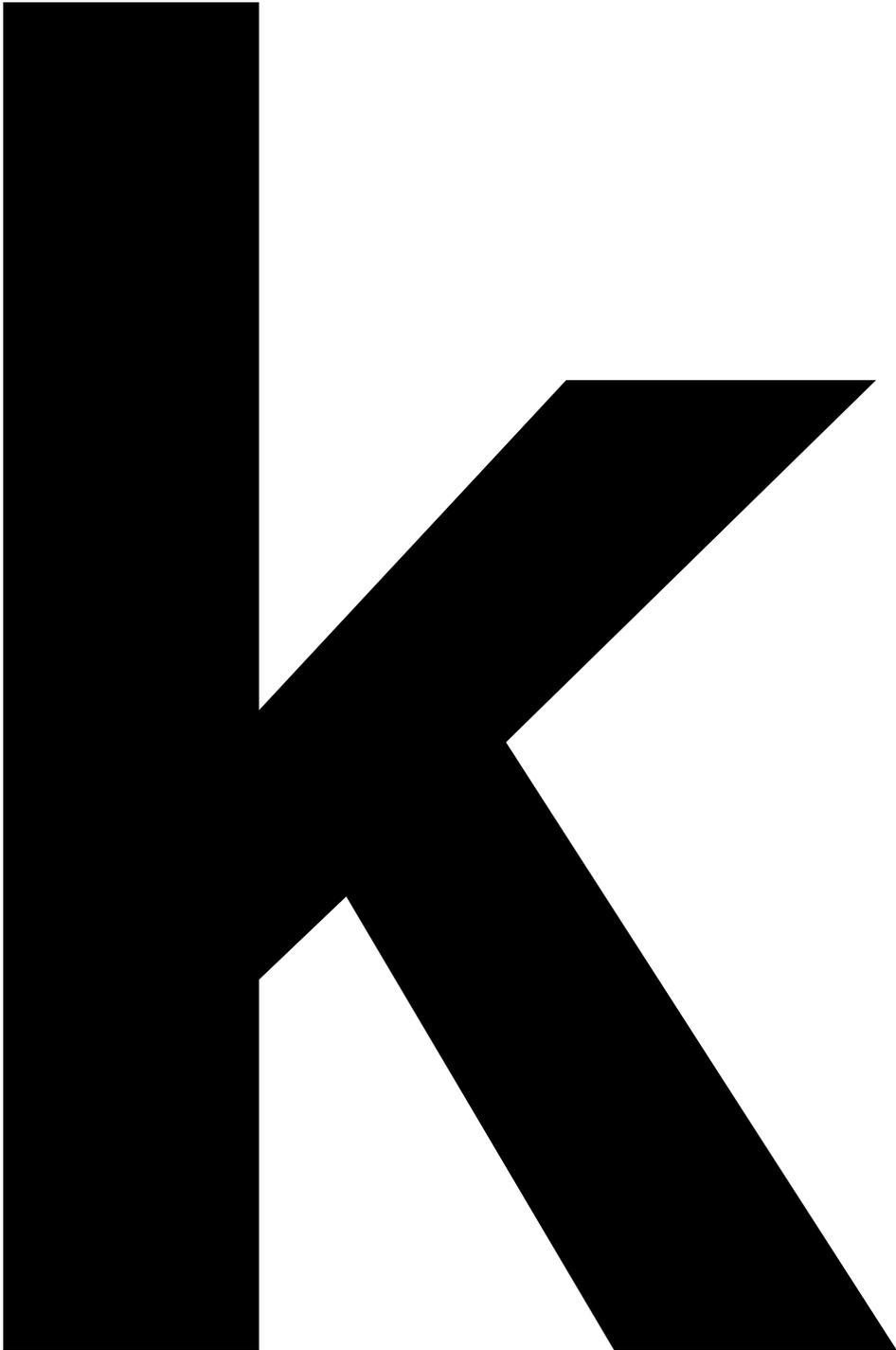


e

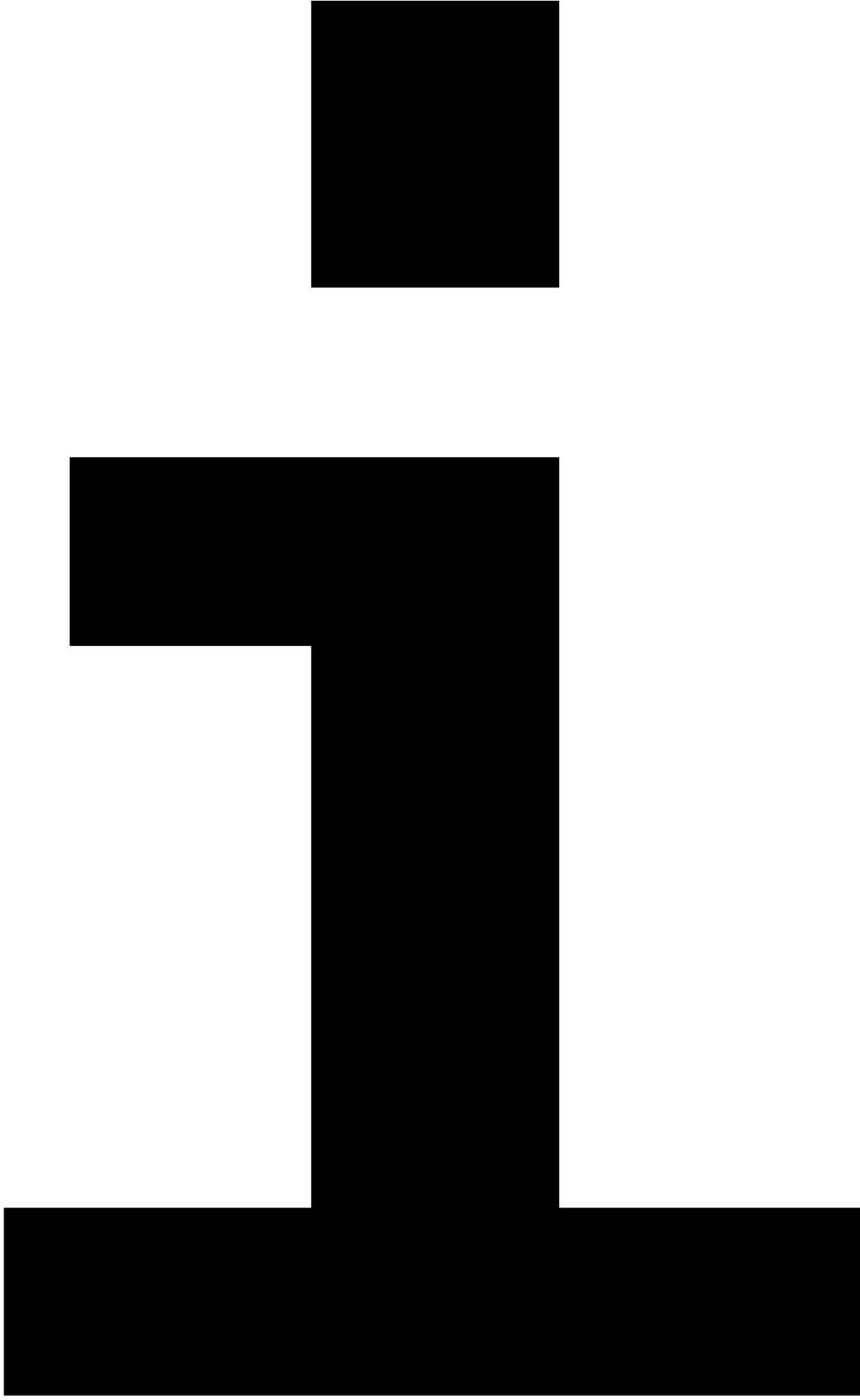
Q

e

n

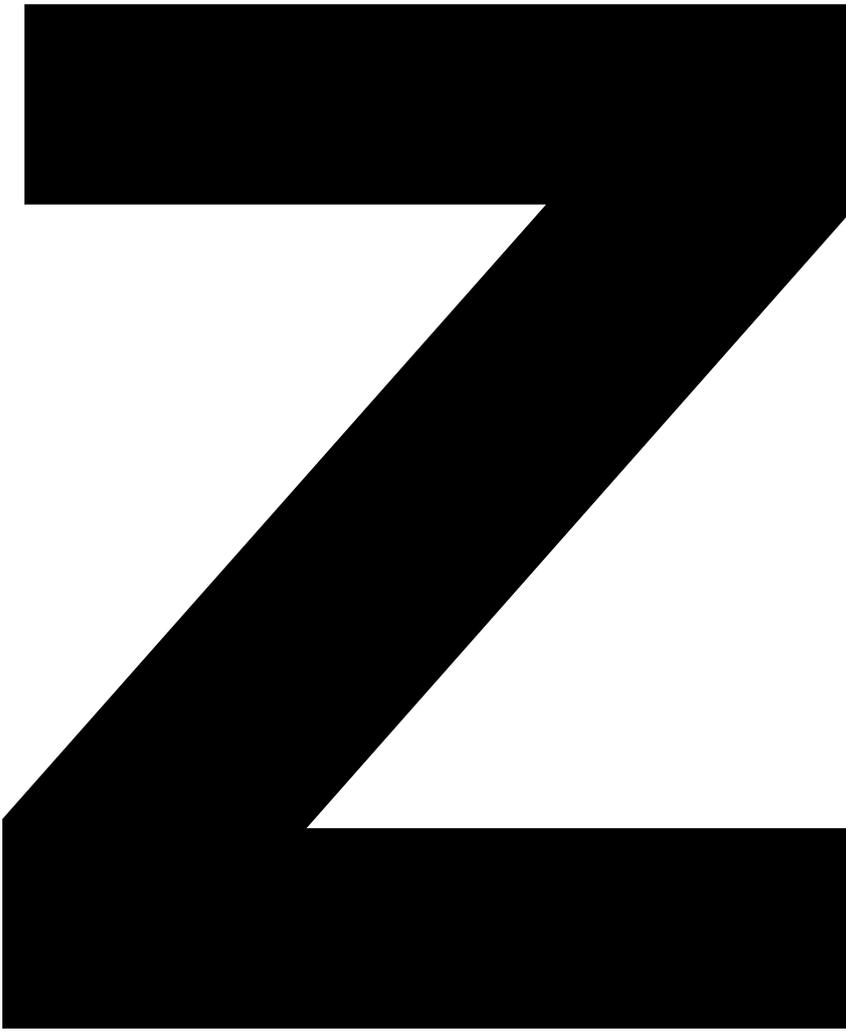


e



n

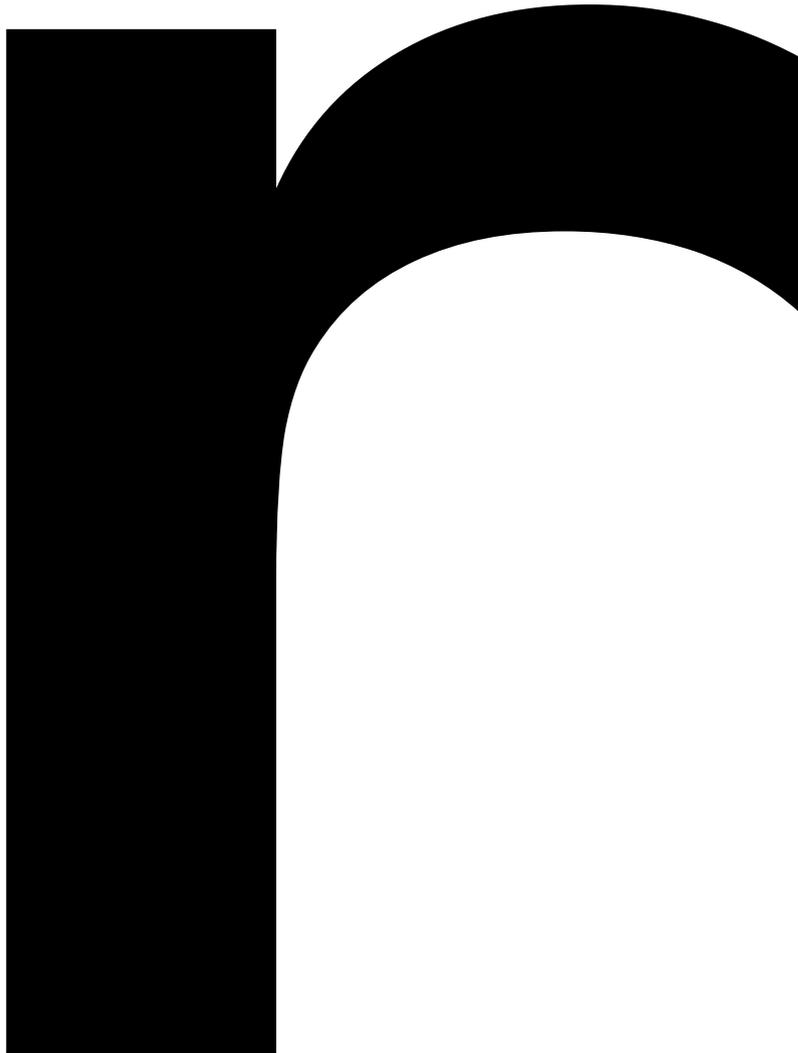
e



u

V

e

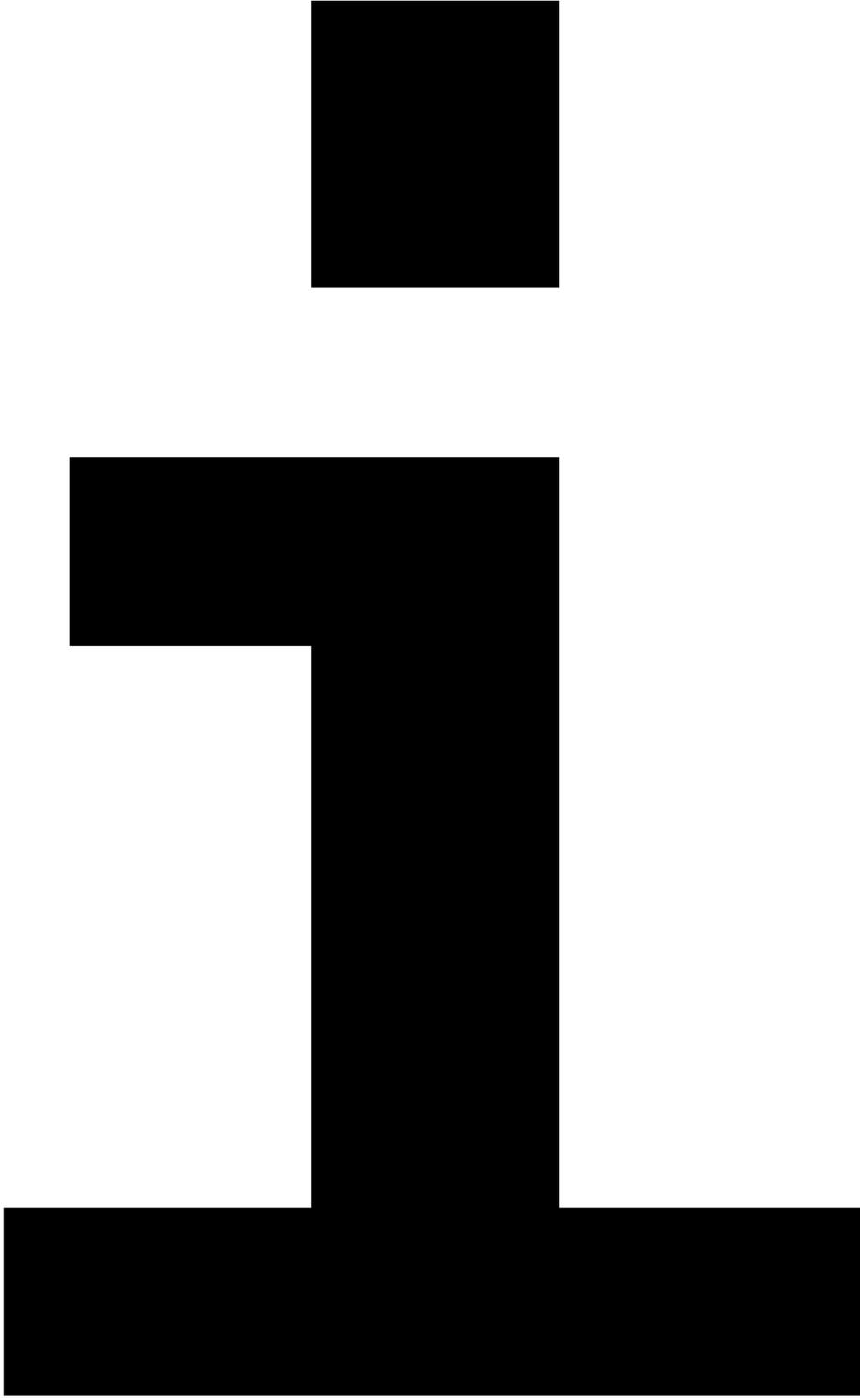


J



S

S

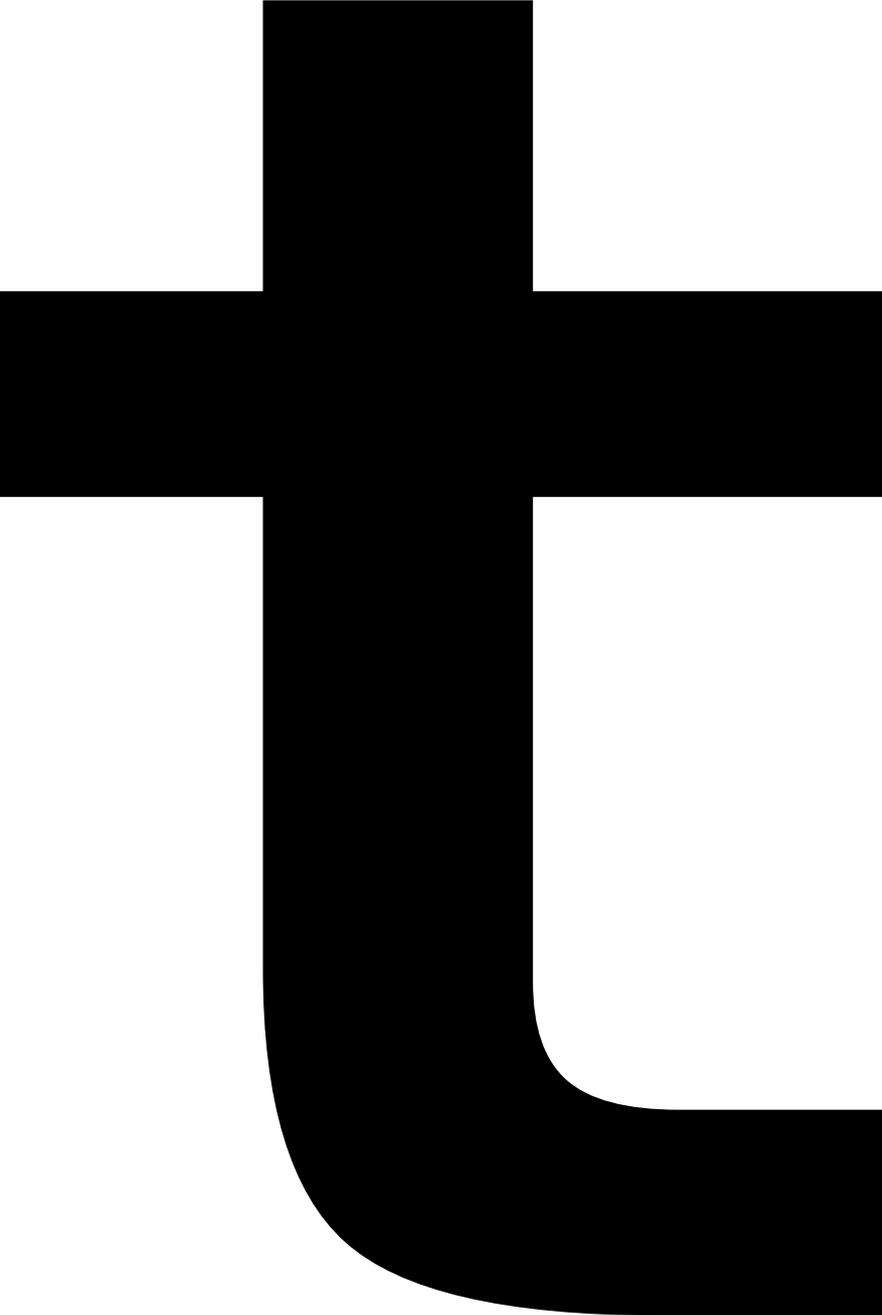


Q

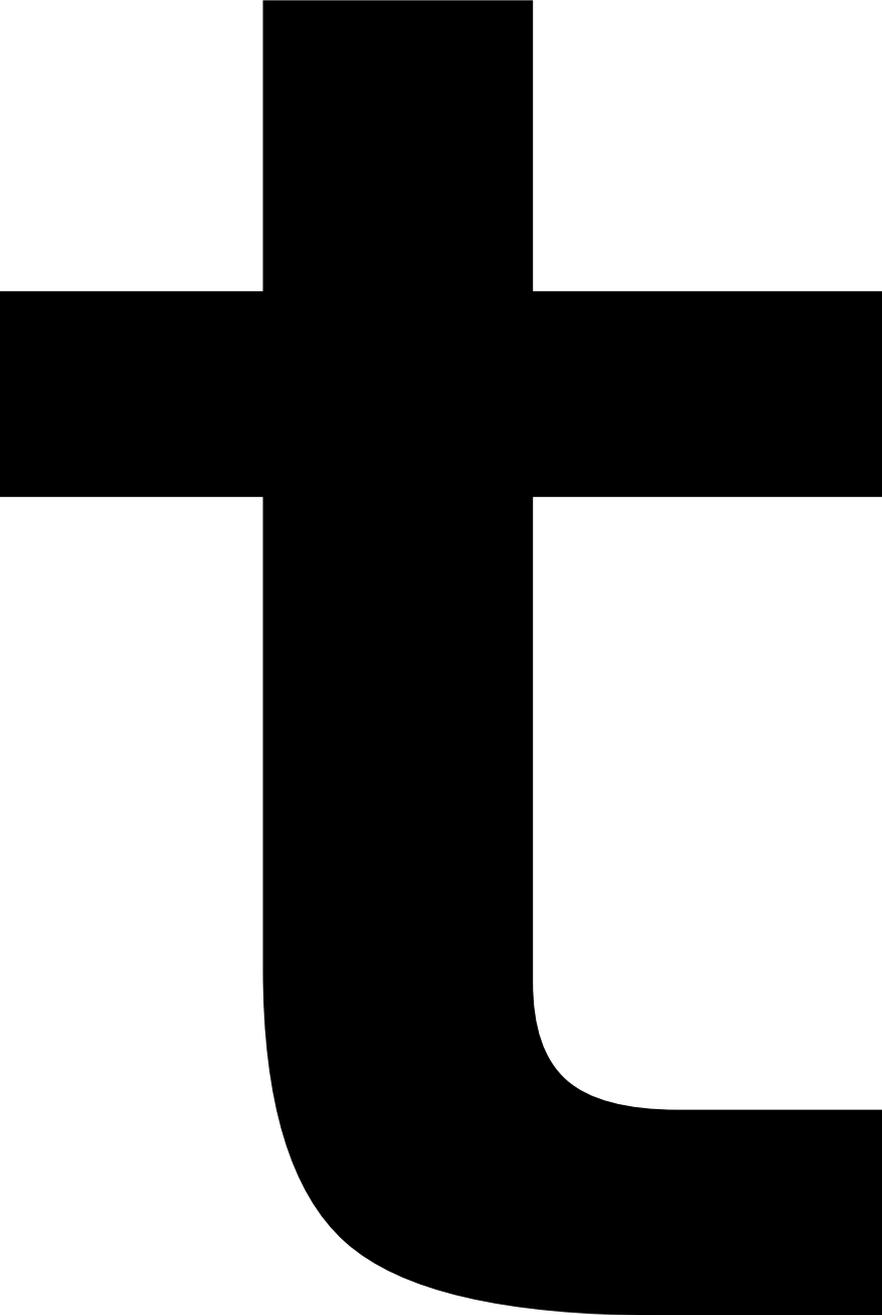
e

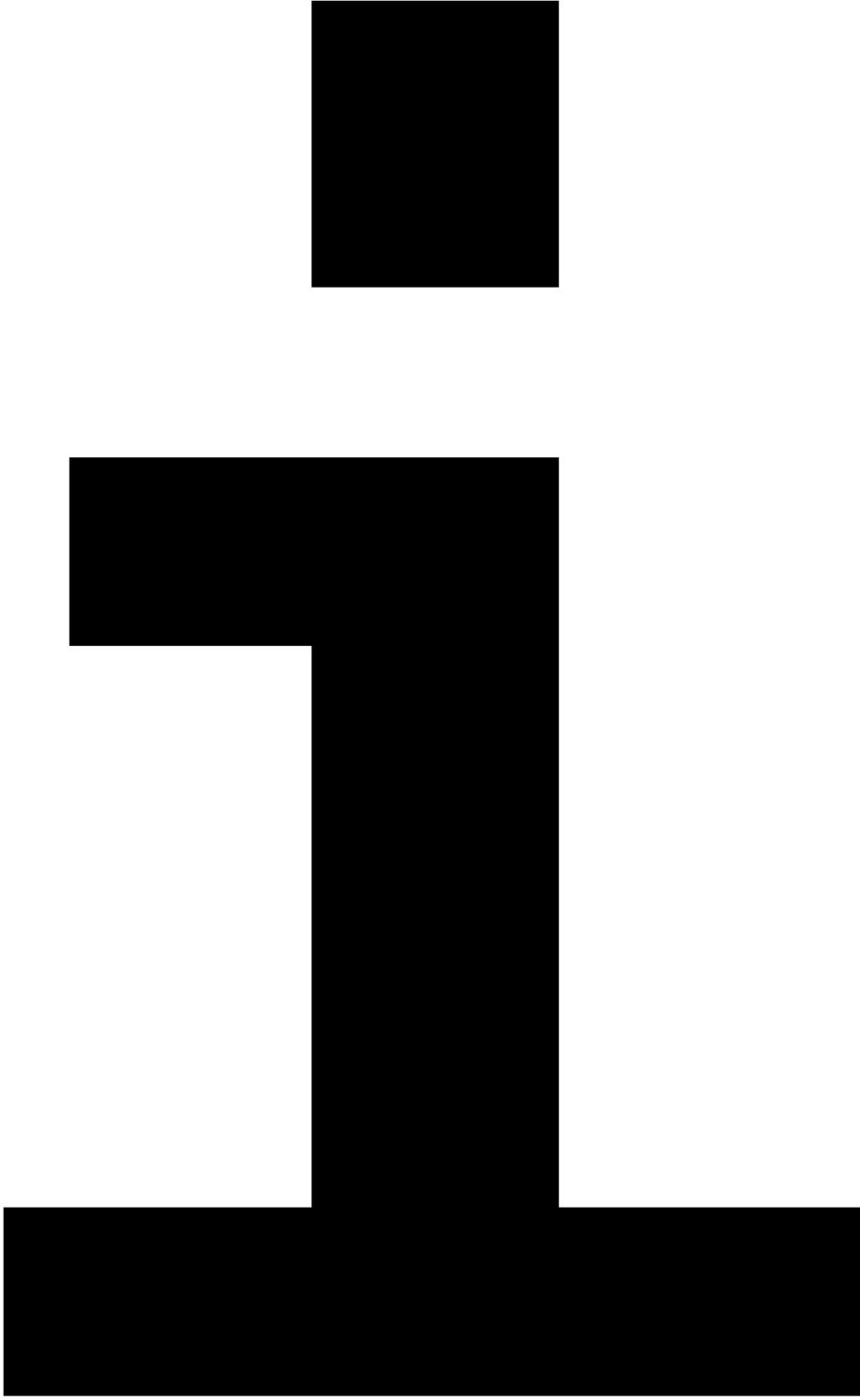
n

S

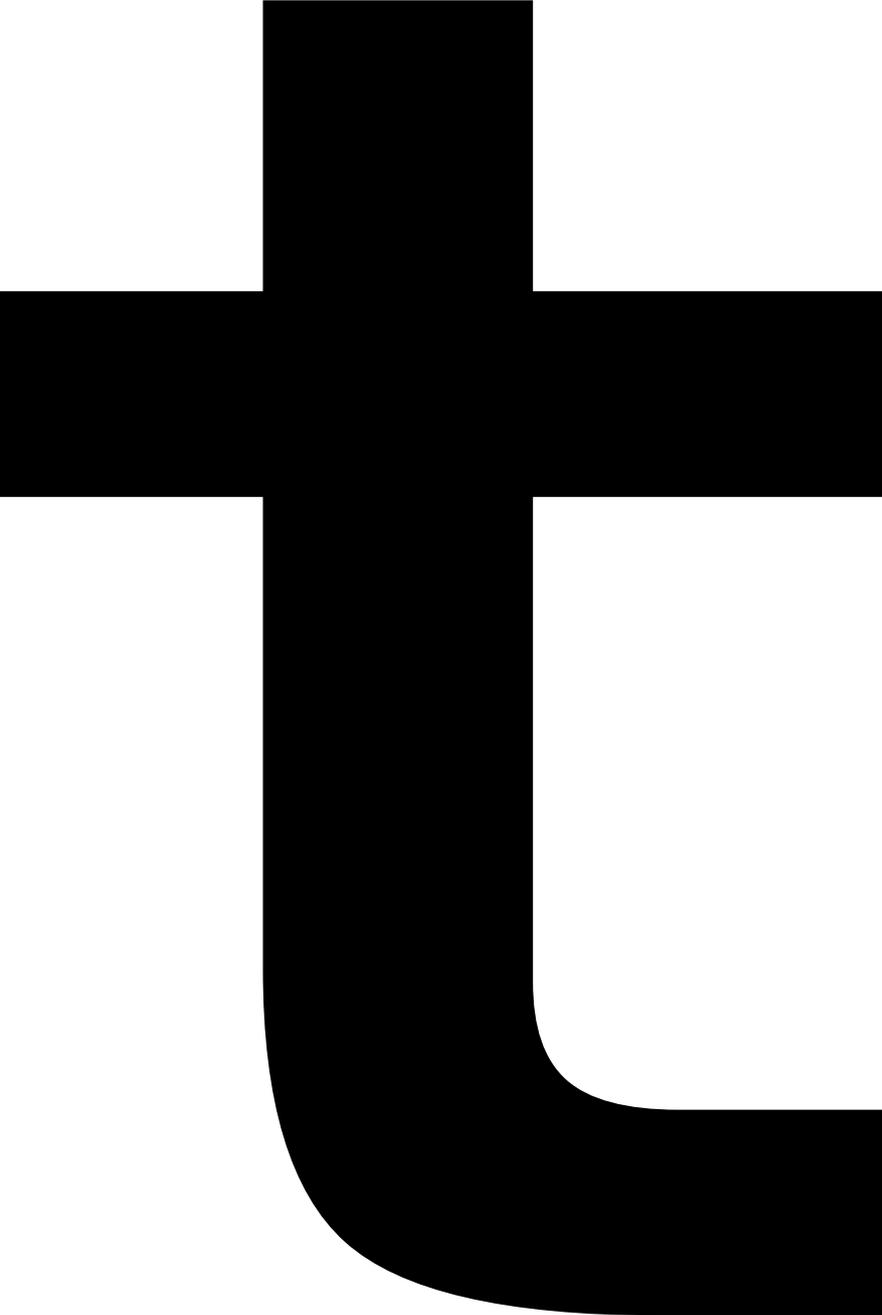


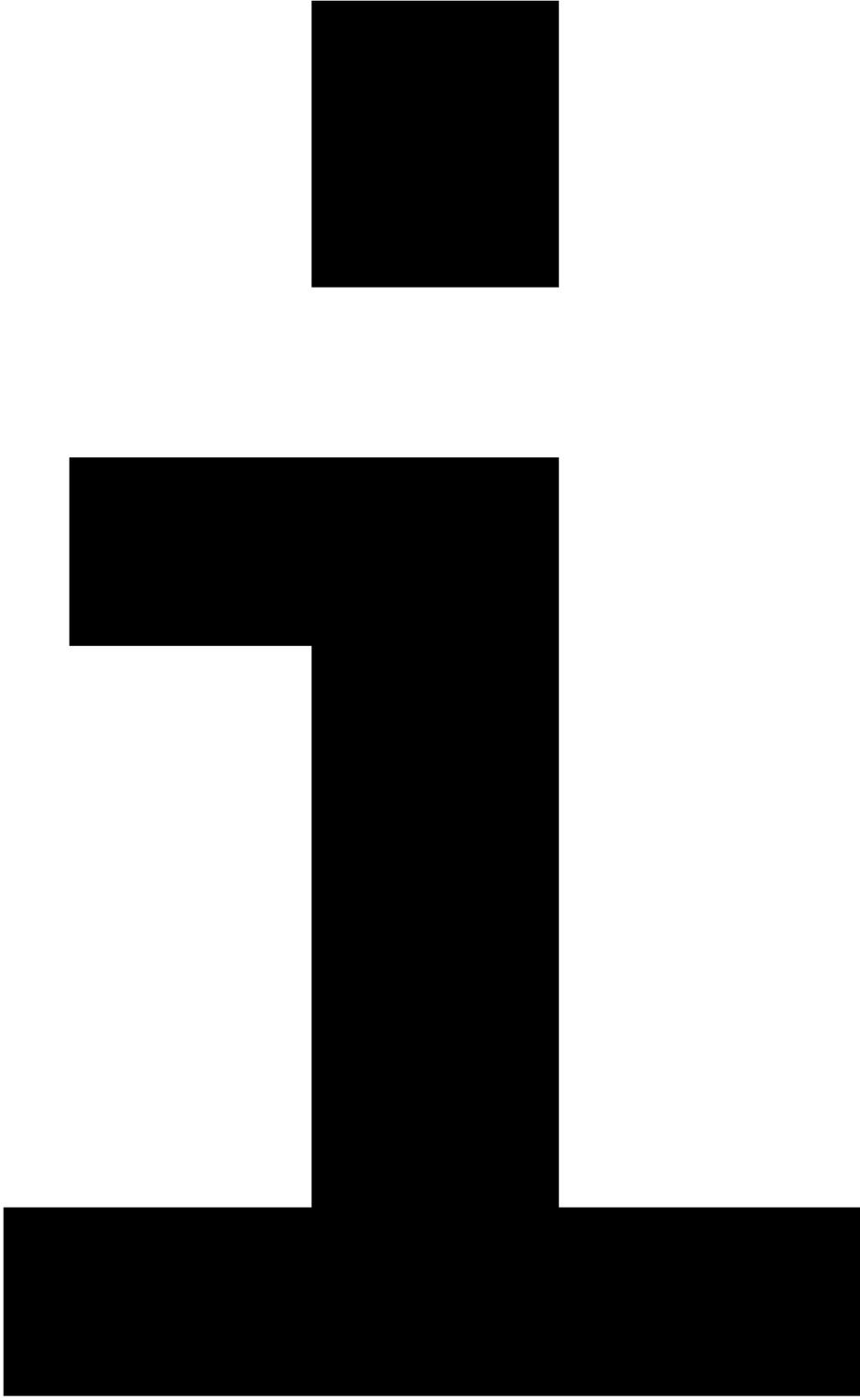
sa

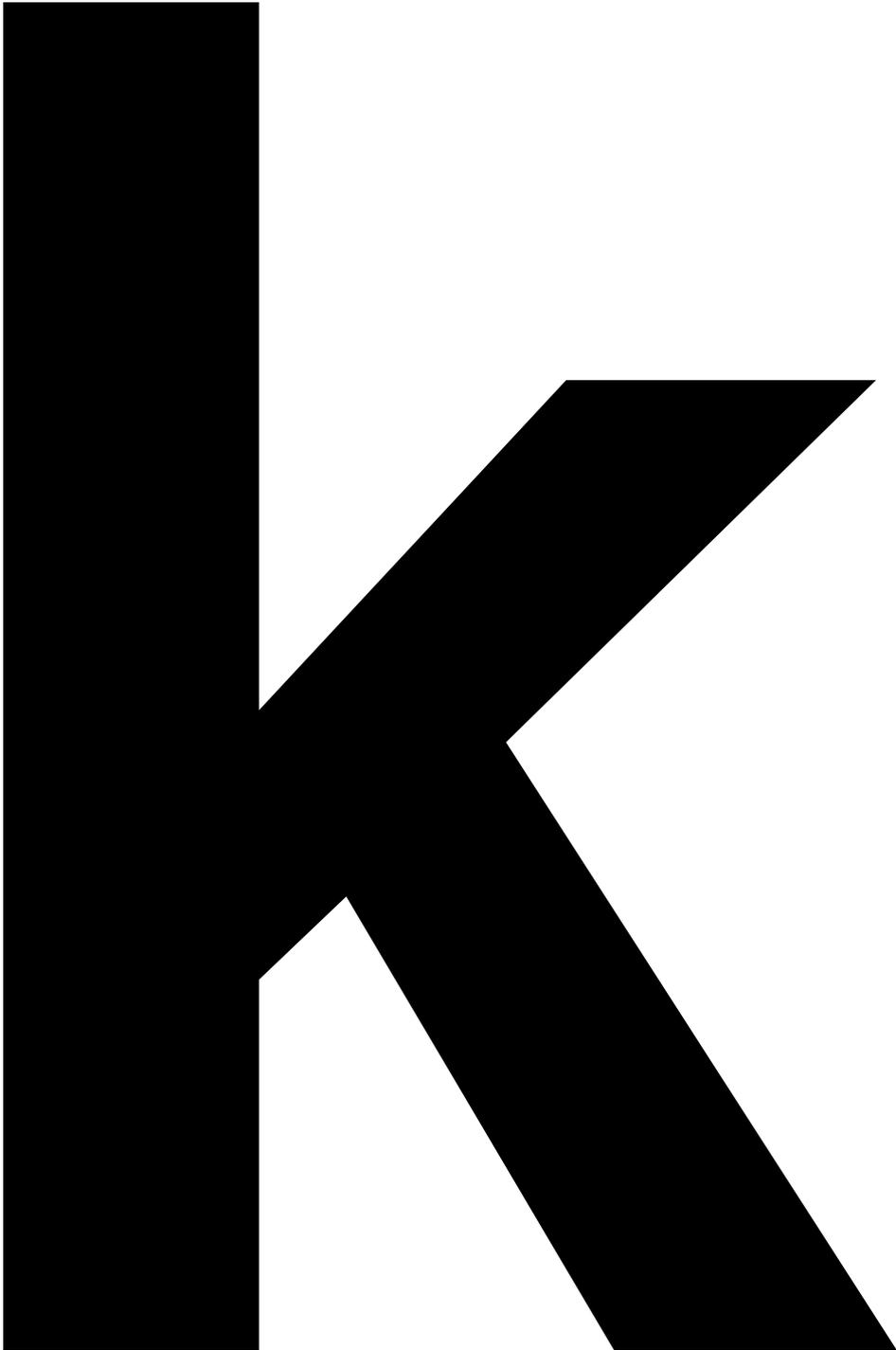




S



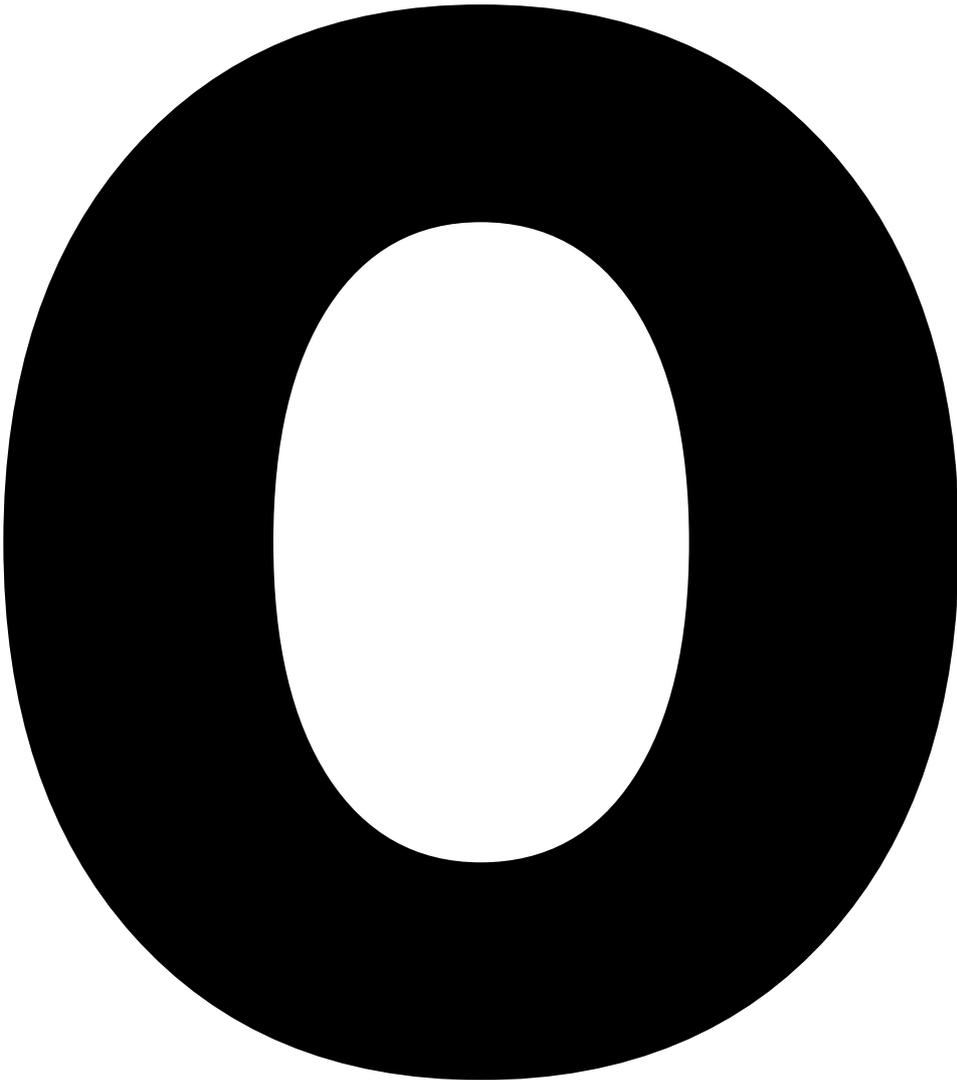


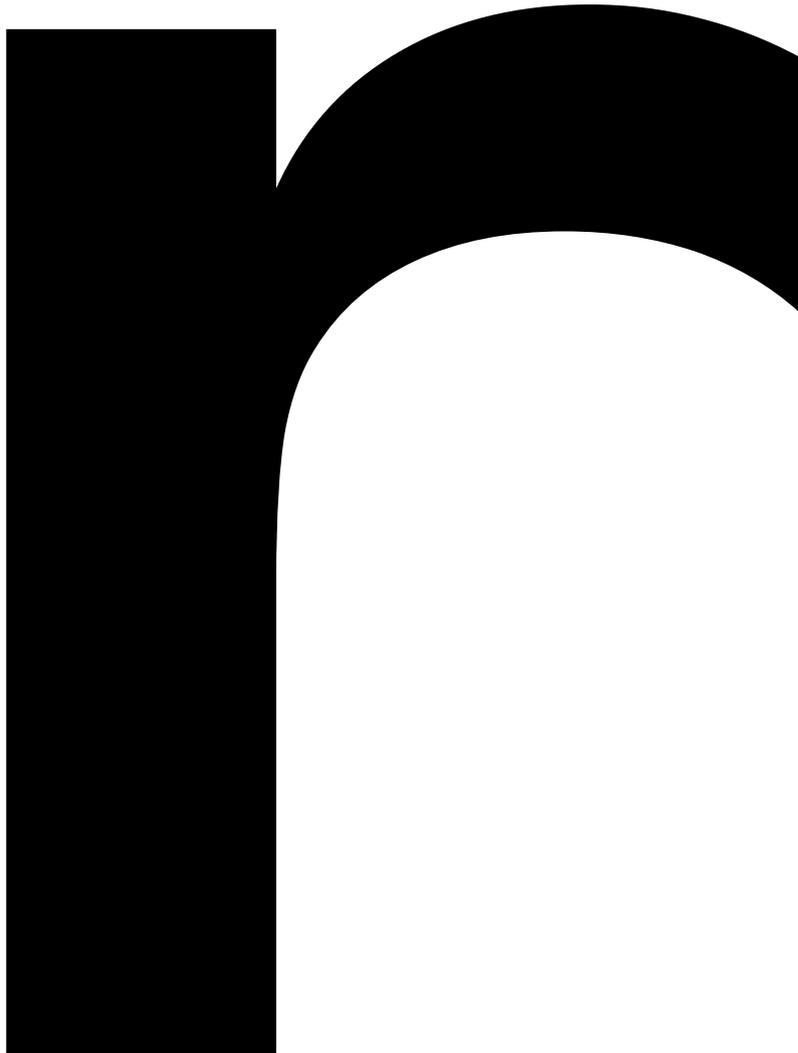


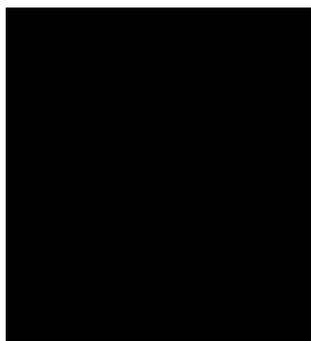
e

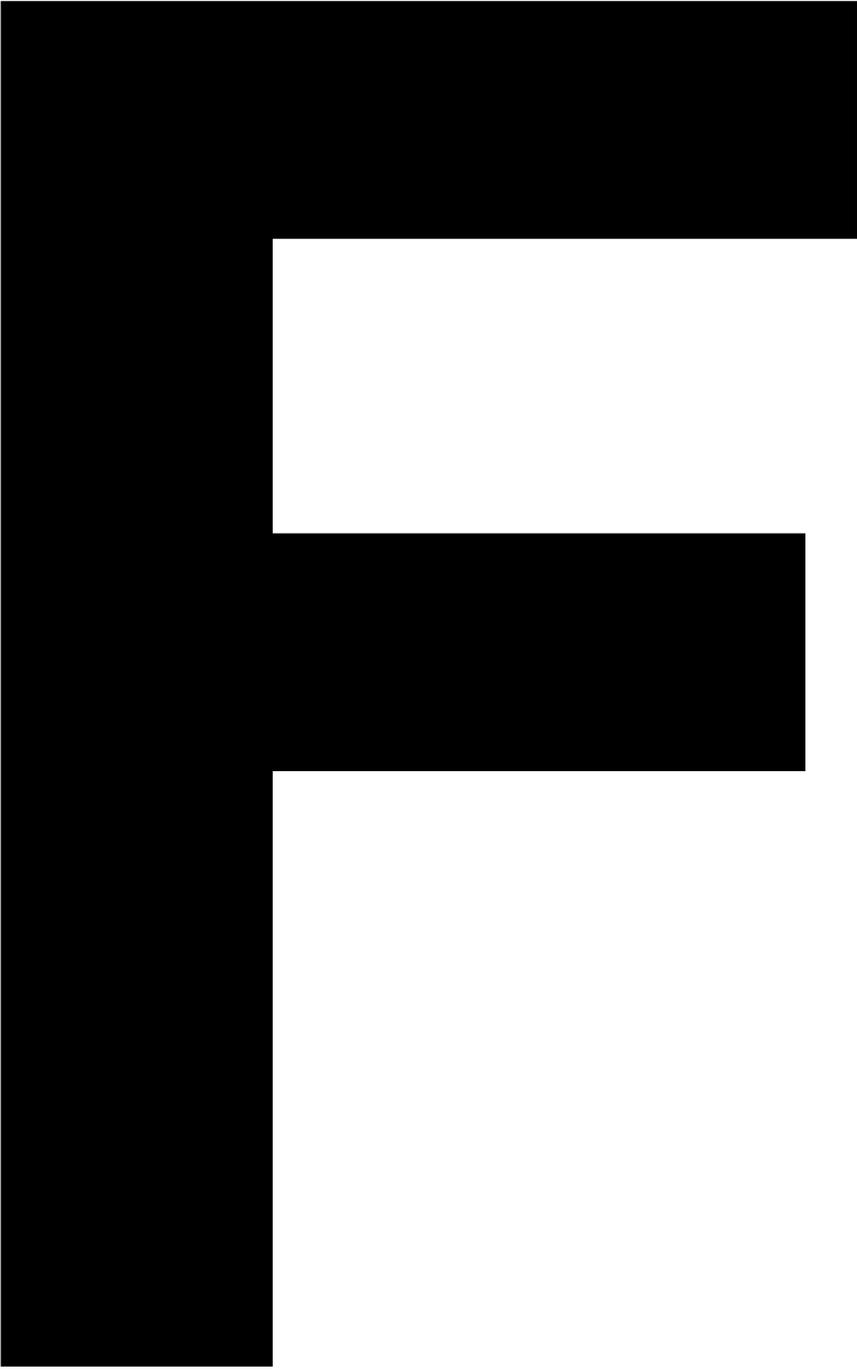
n

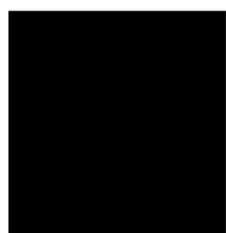
V



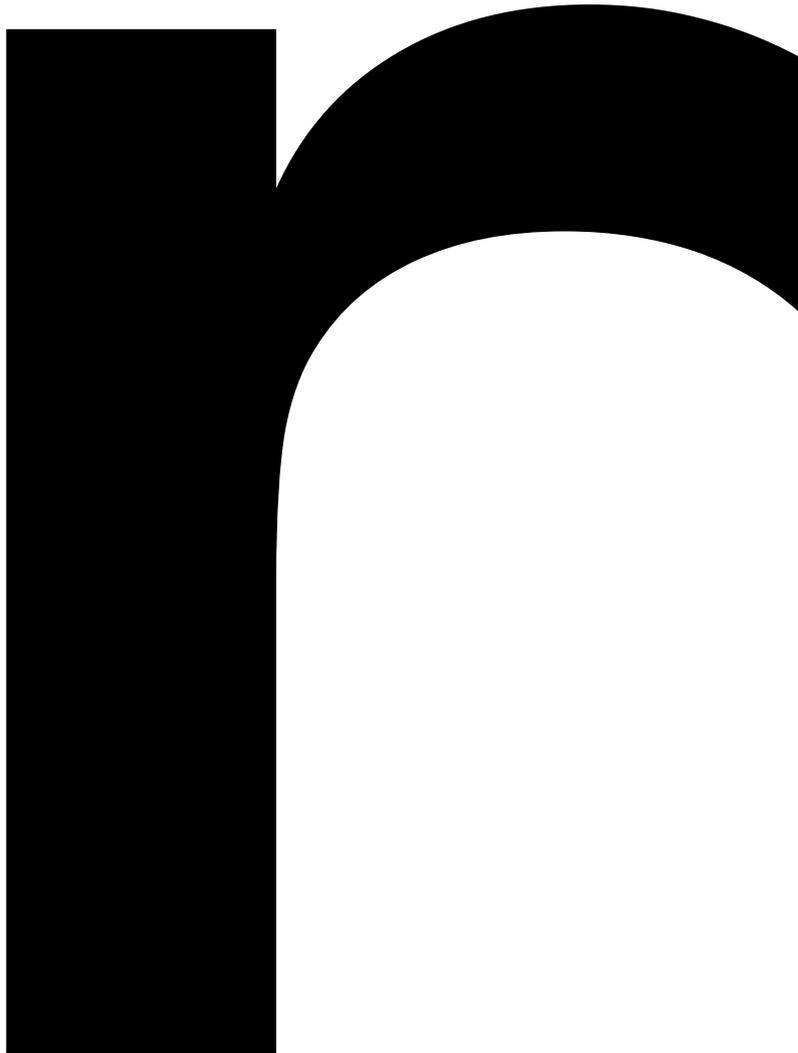








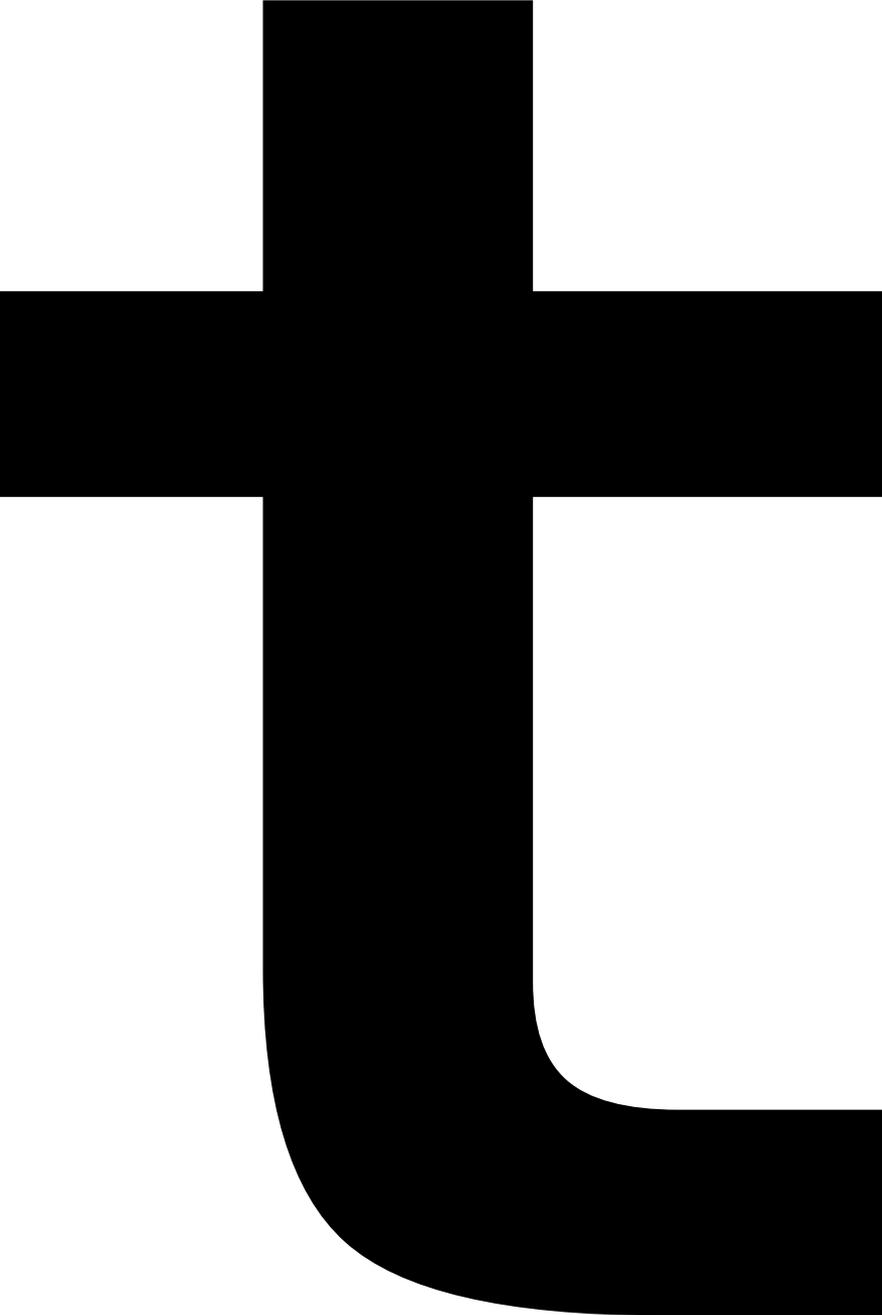
u



D

e

u



S

C

h

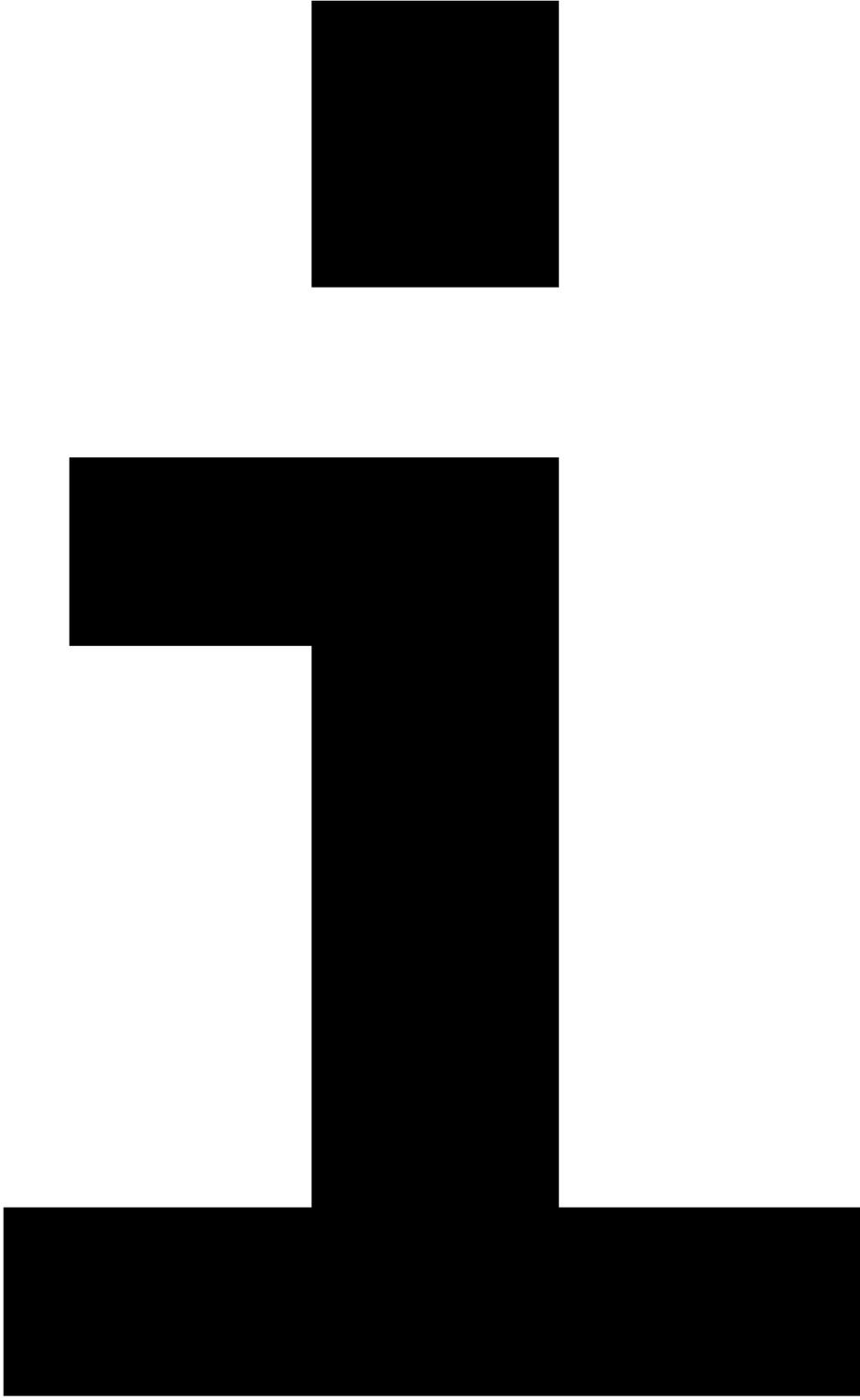
J

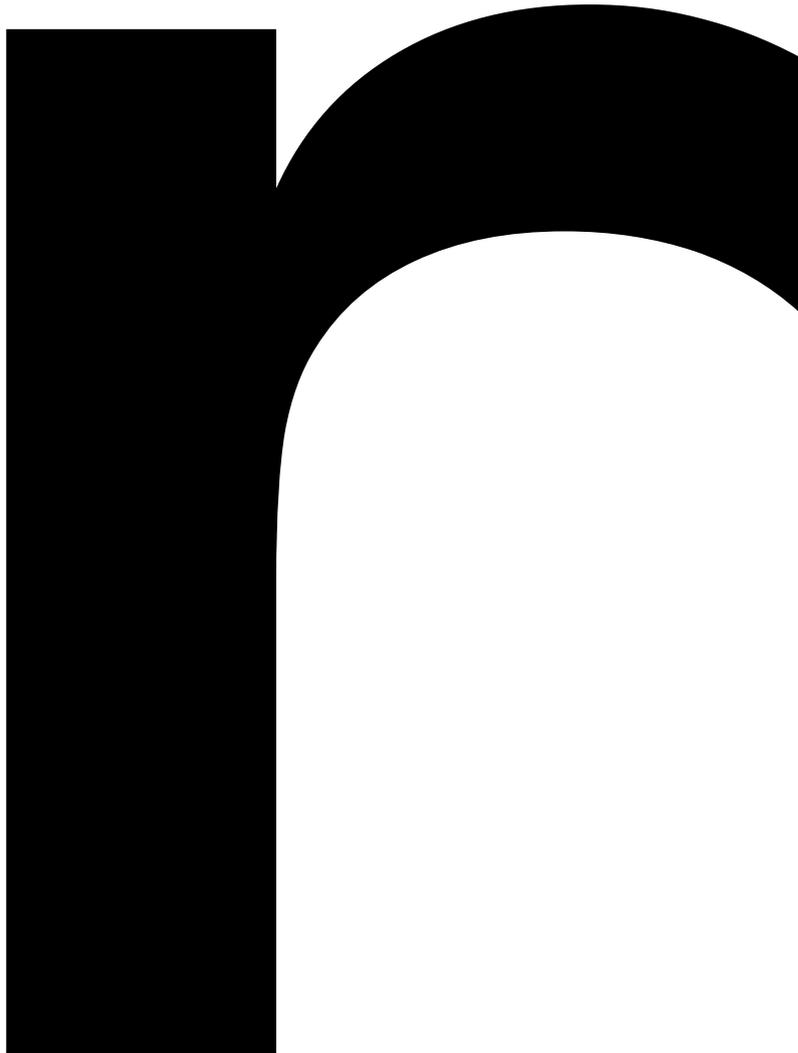
sa

n

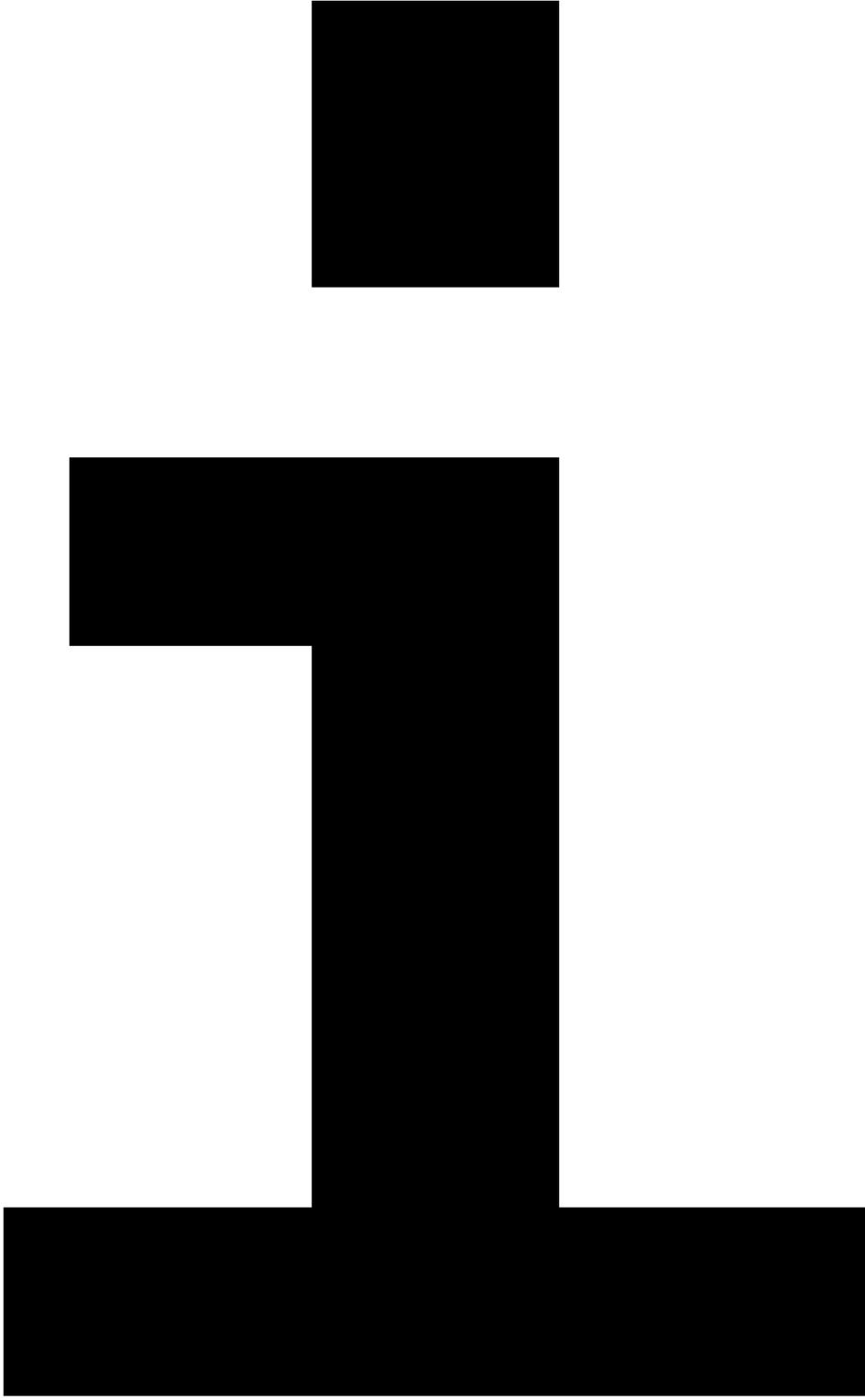
Q

w





Q

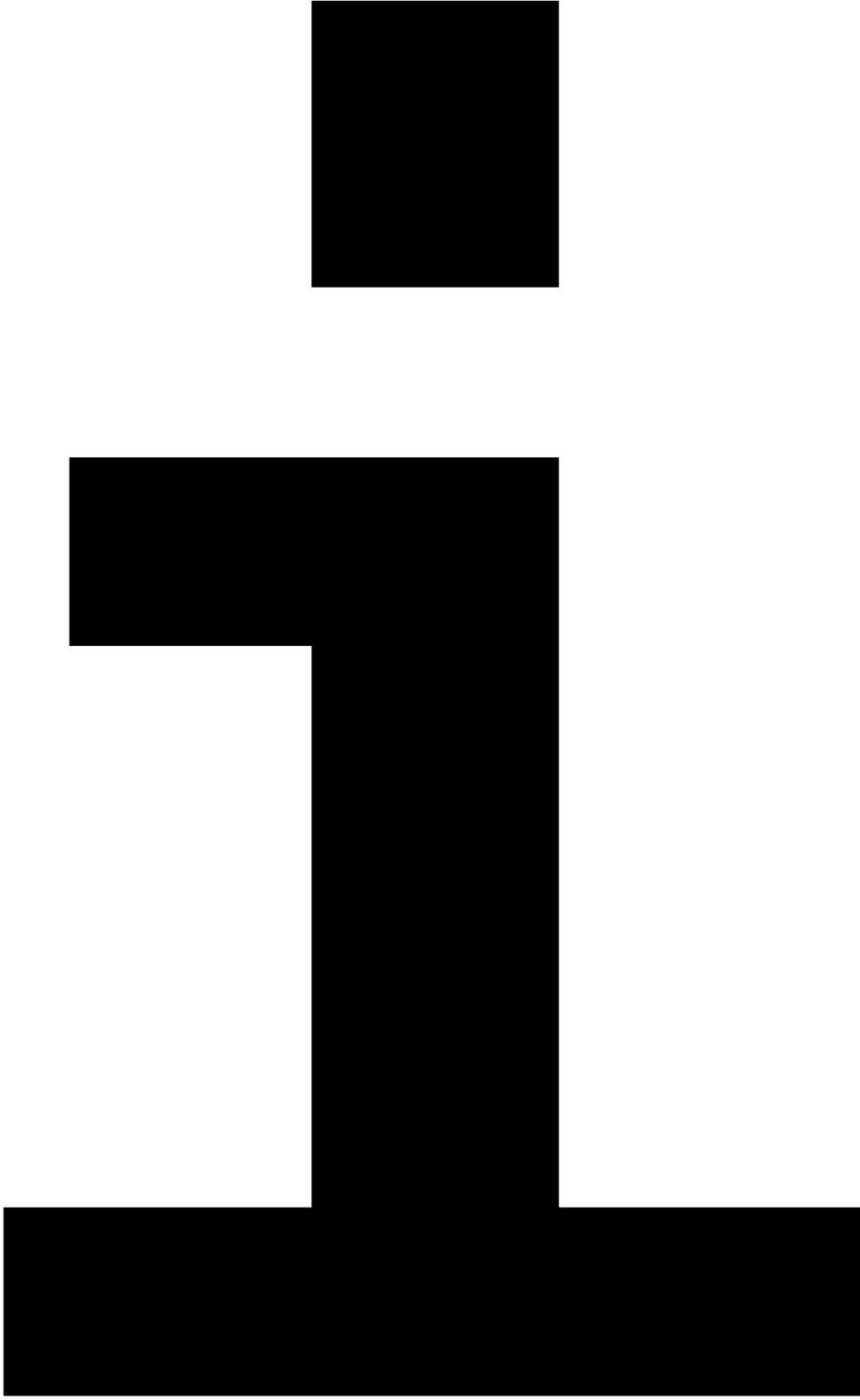


n

Q

e

w



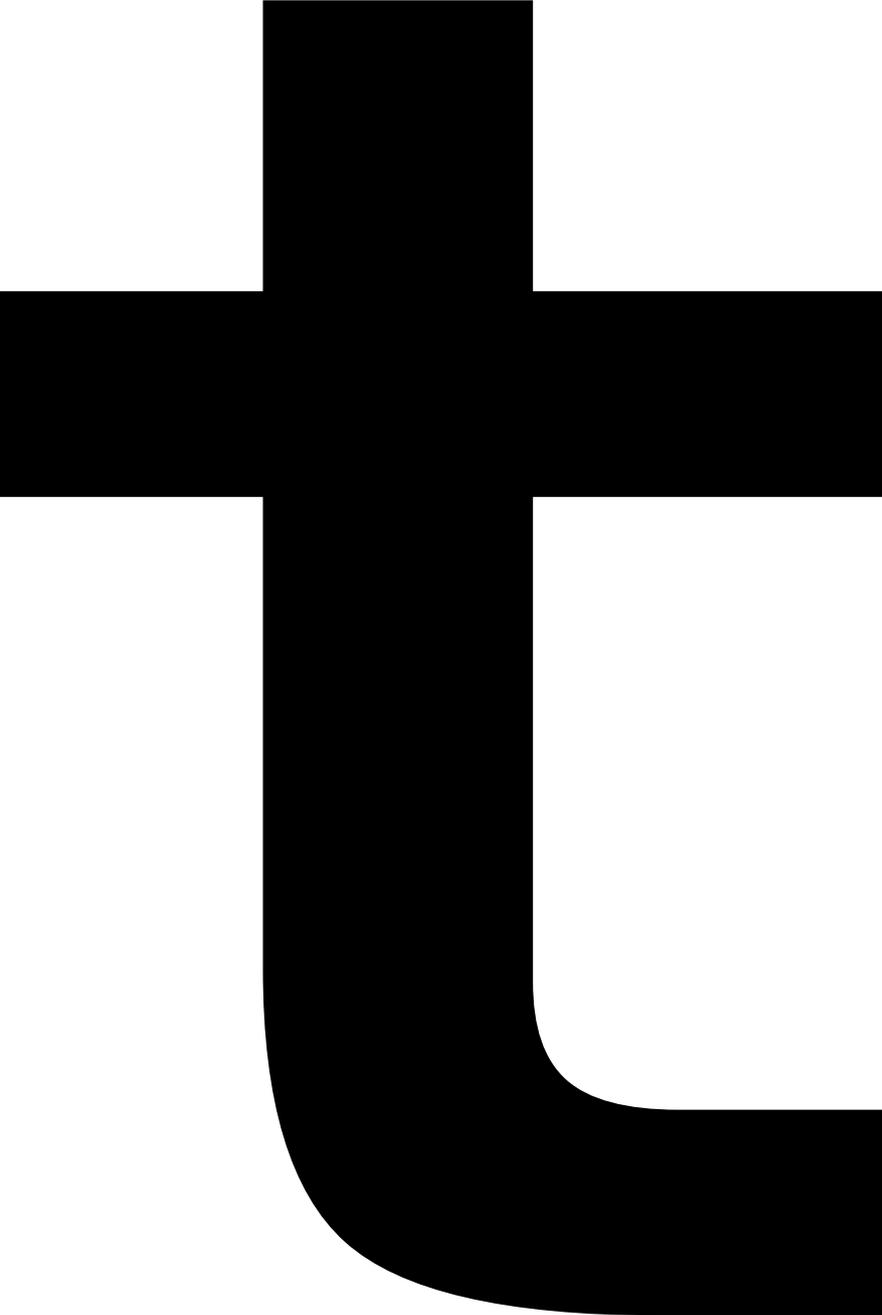
S

S

e

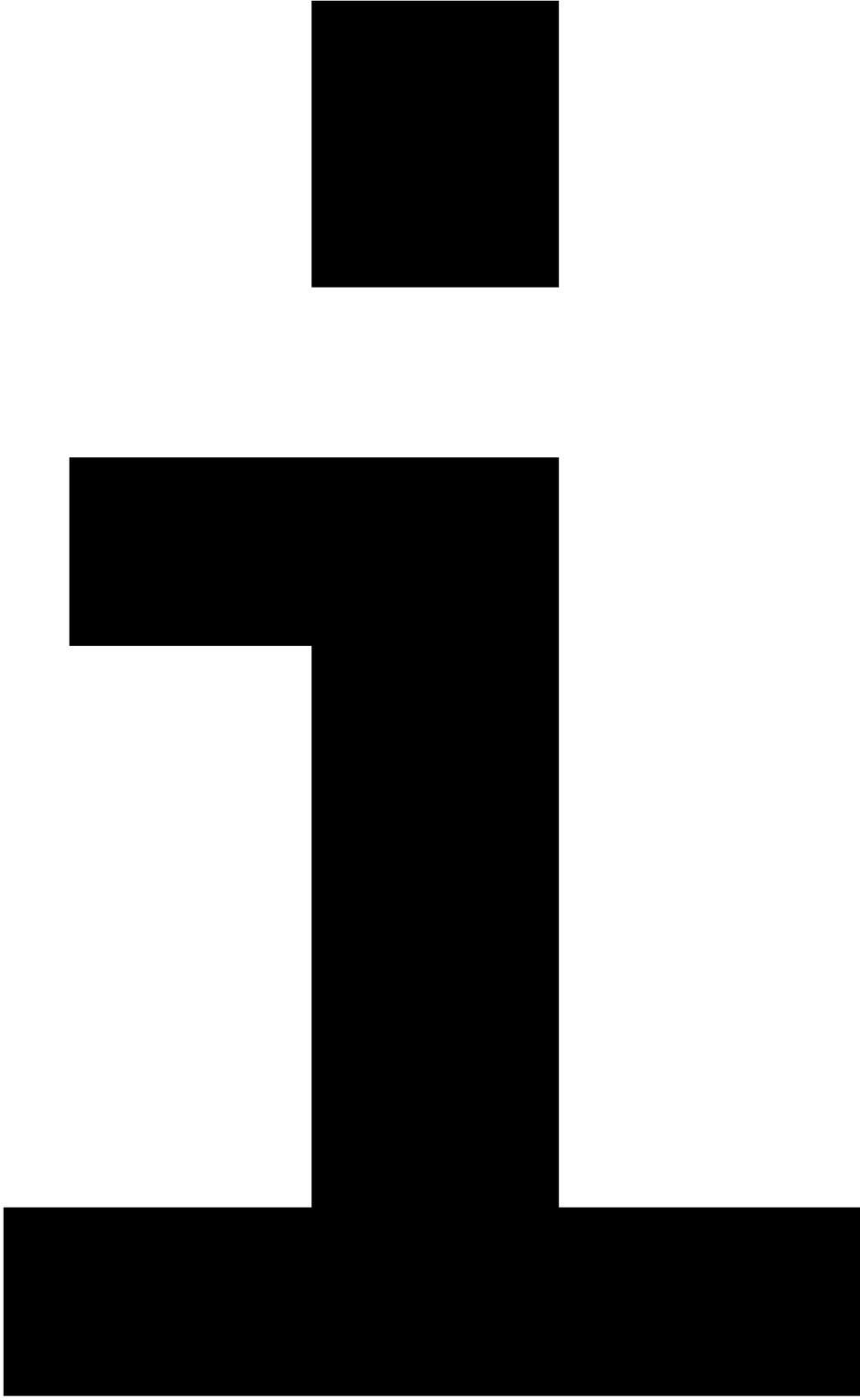
n

S



u

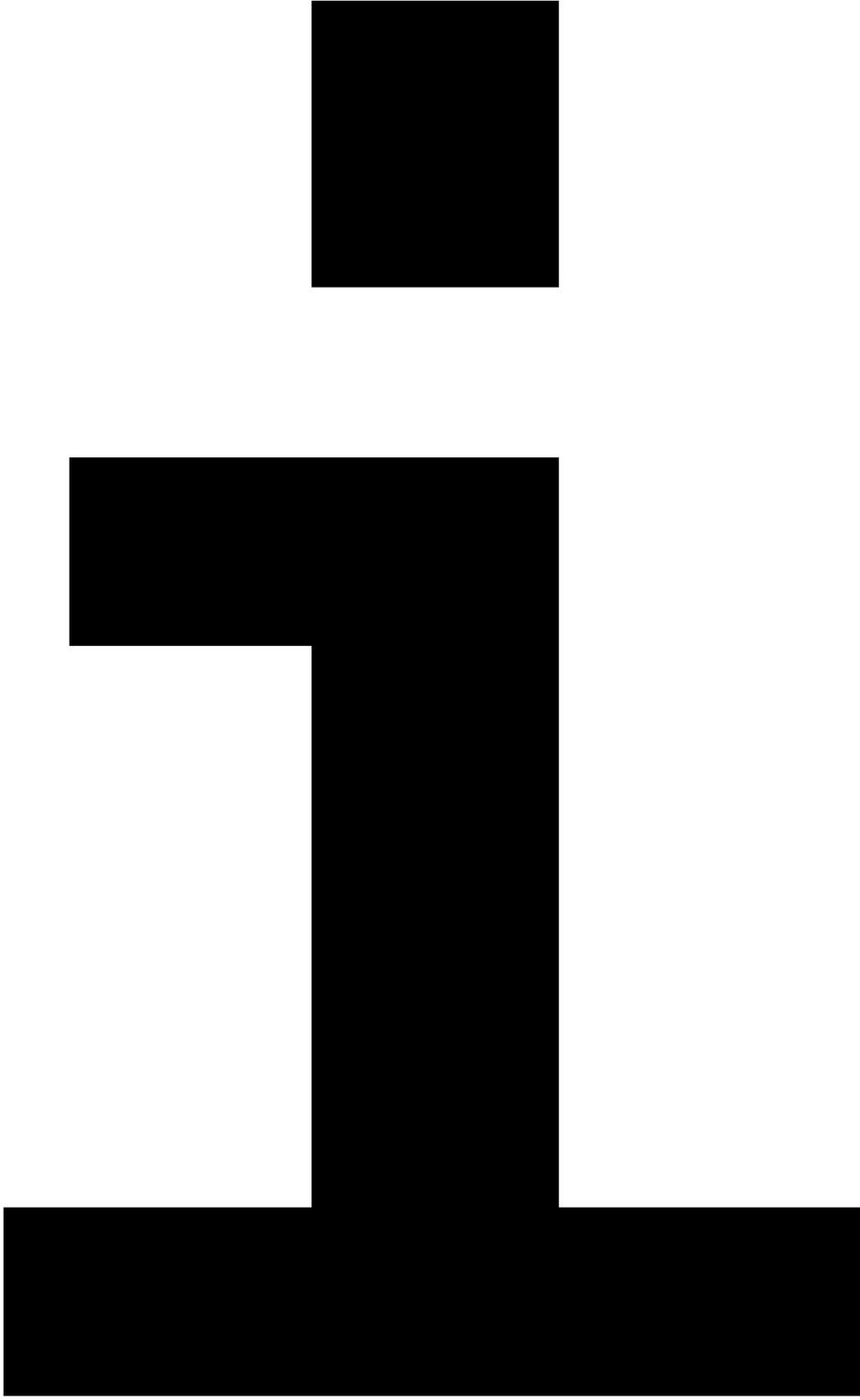
Q



e

n

e



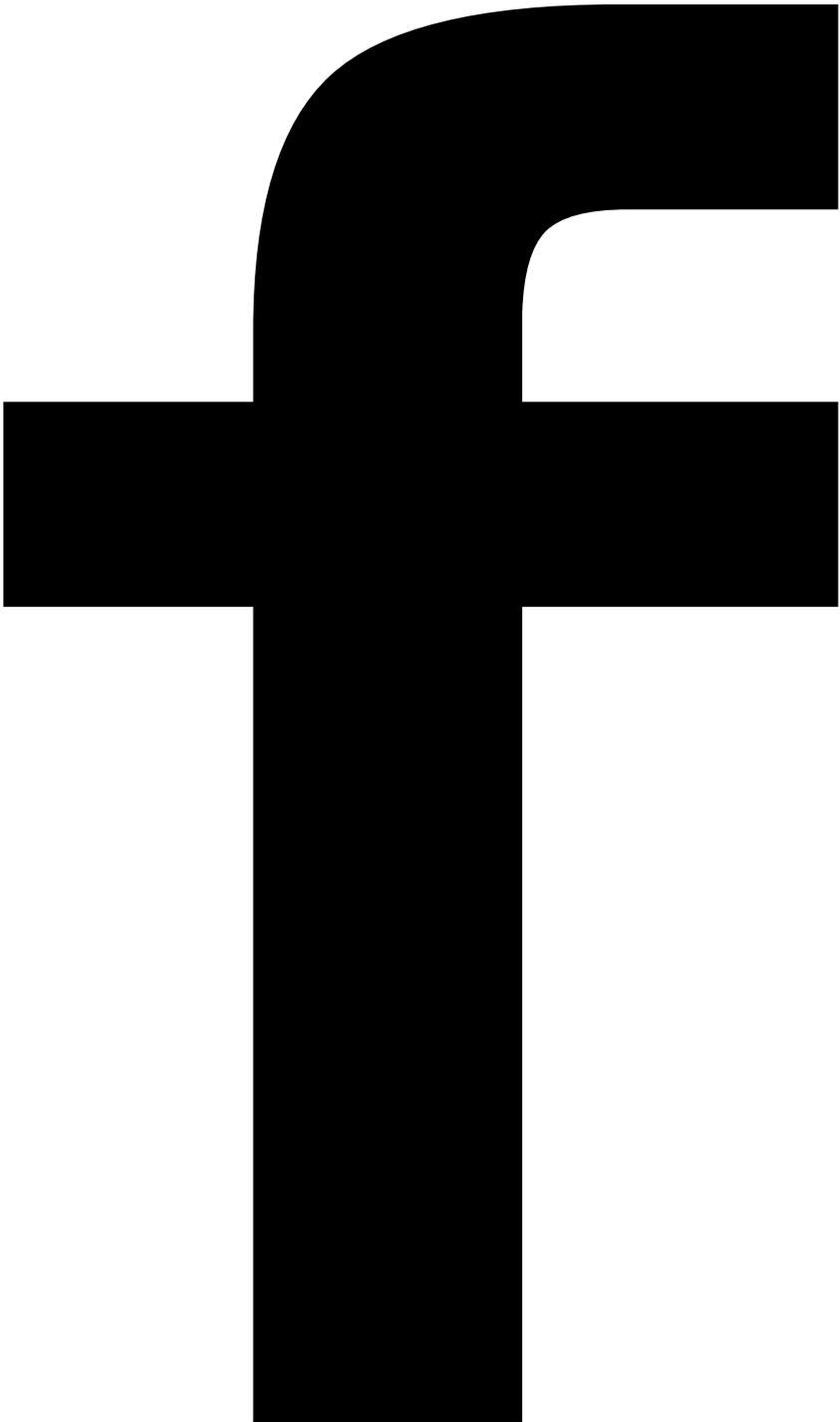
n

e

A

u

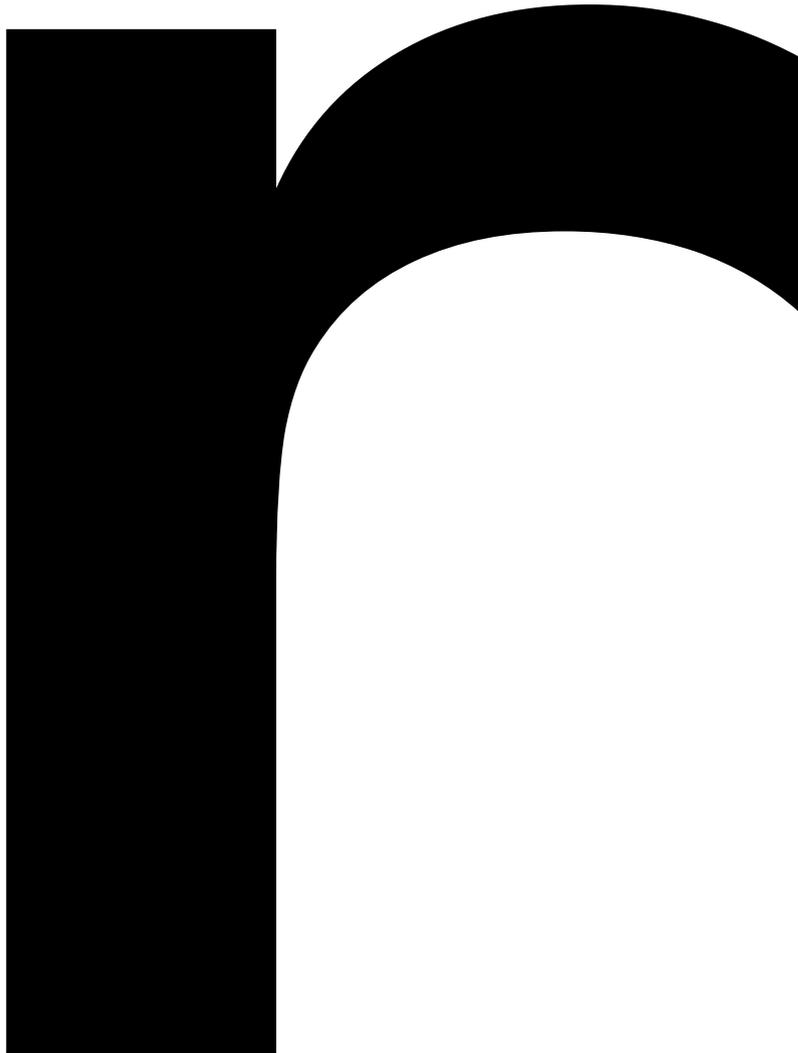
S



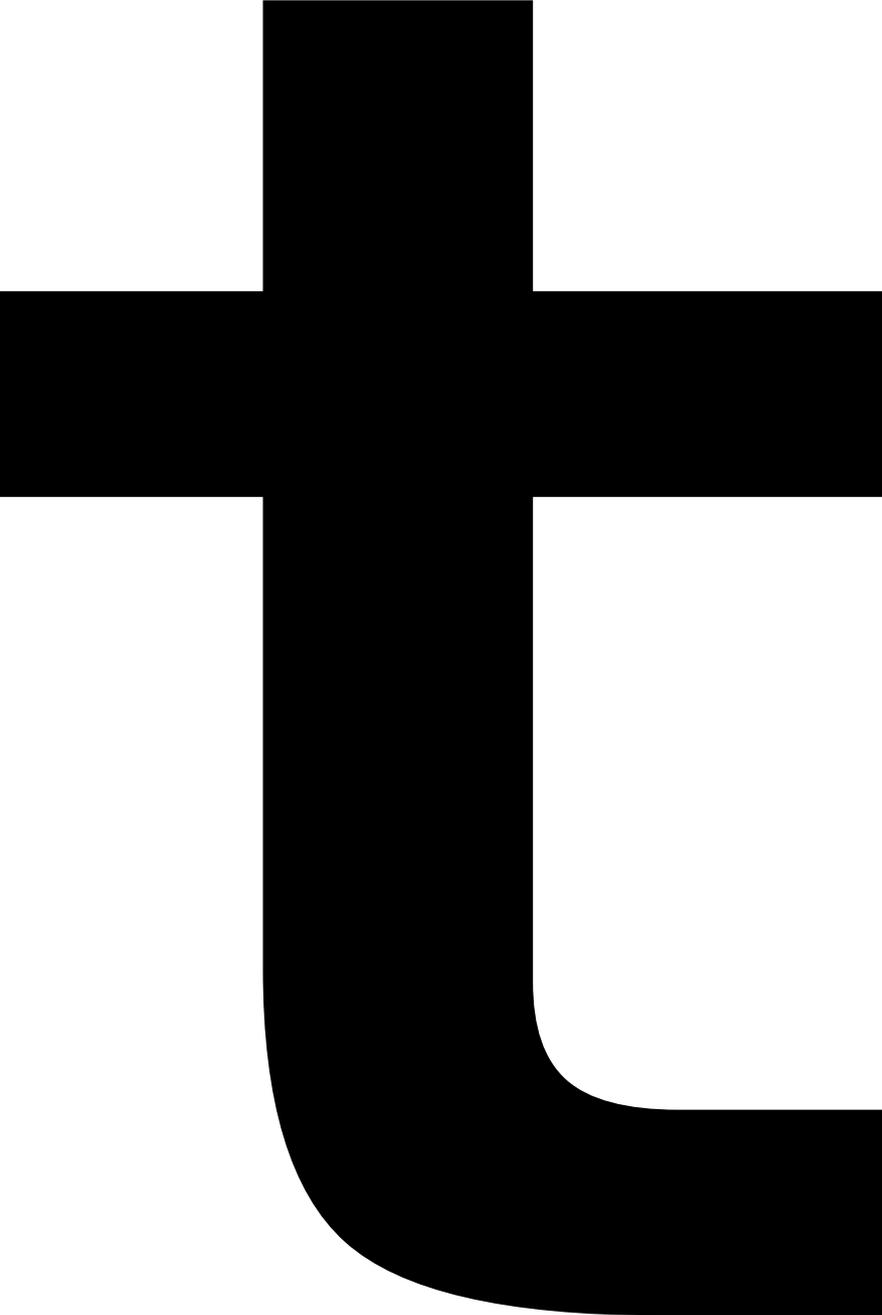
sa

J

J

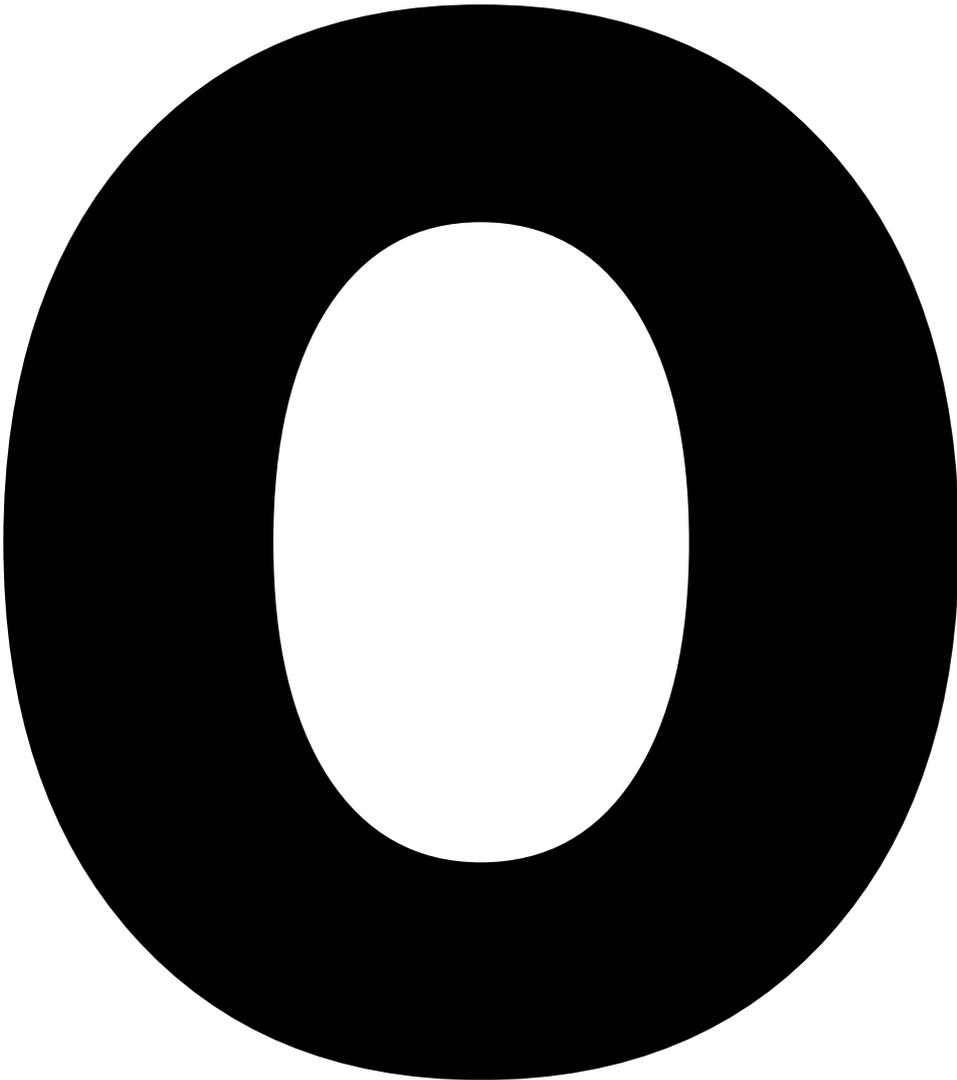


sa

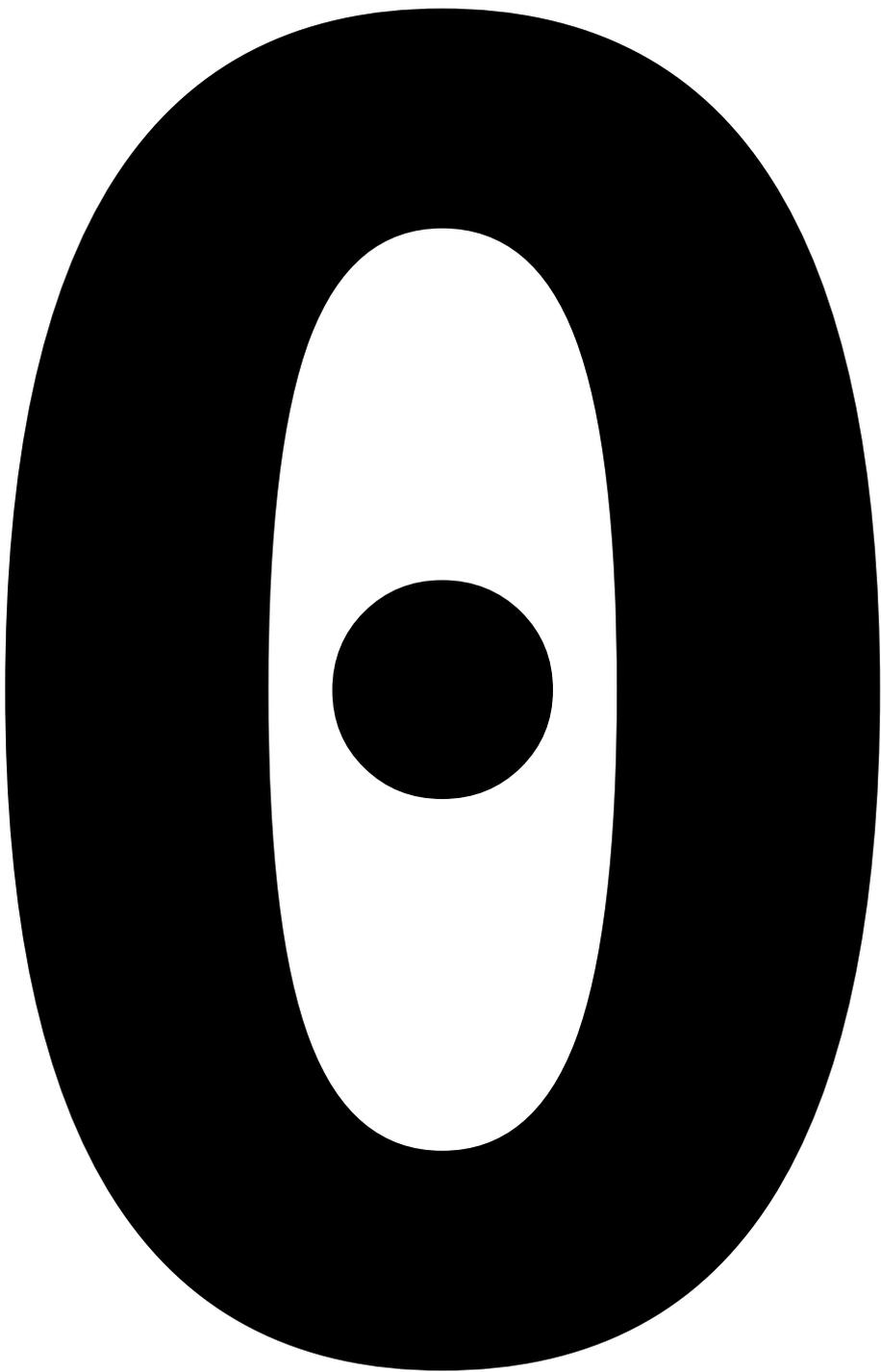


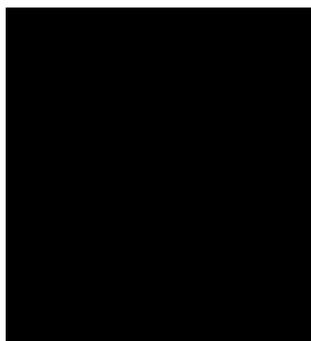
e

V

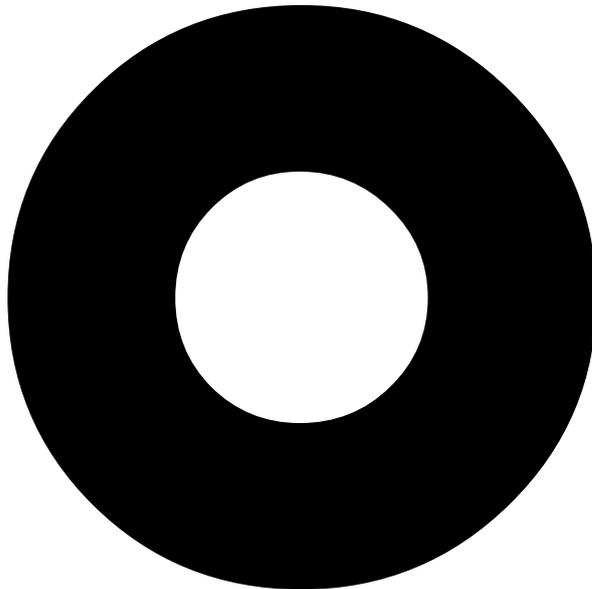
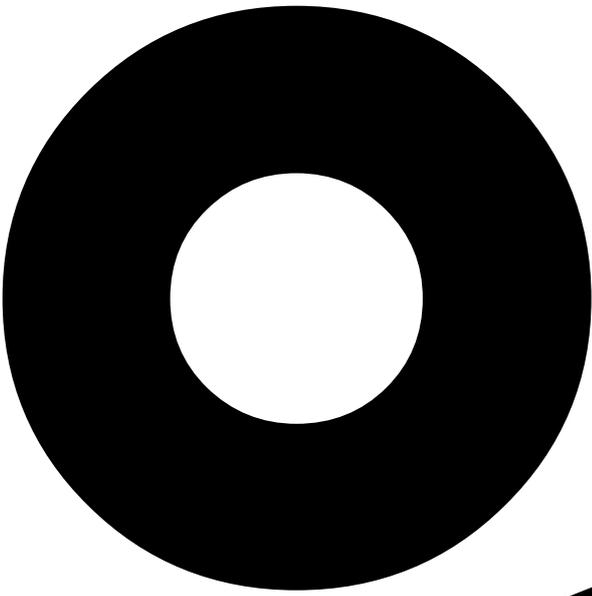


n

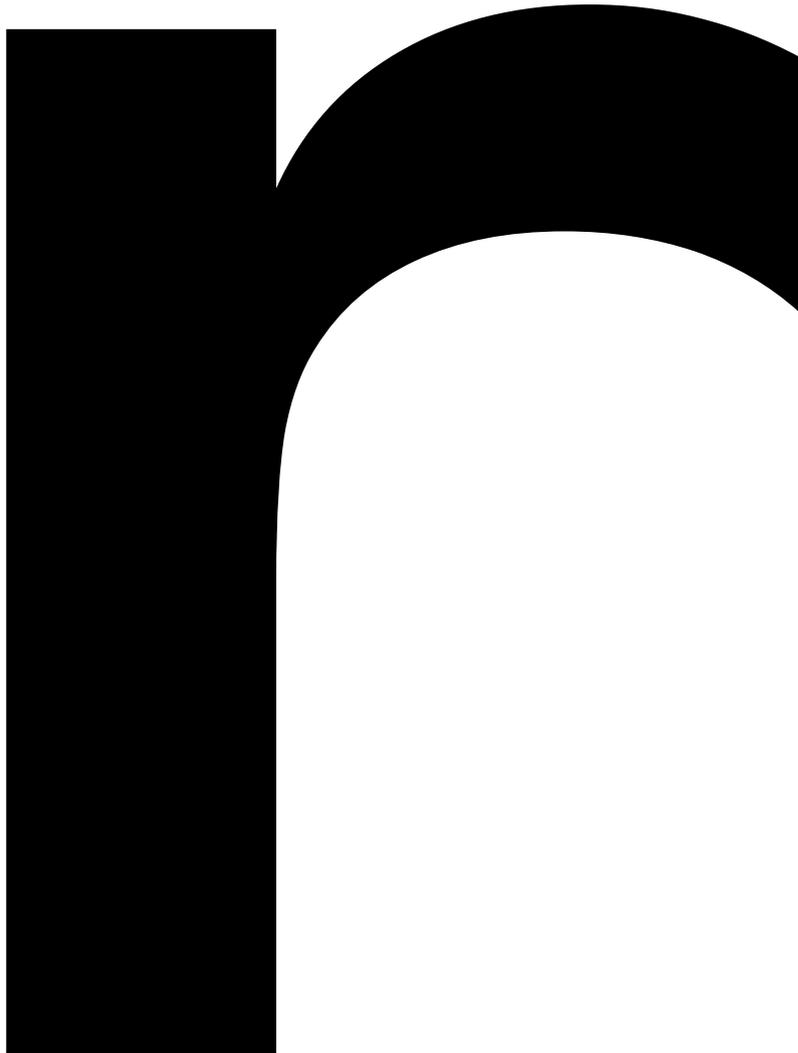


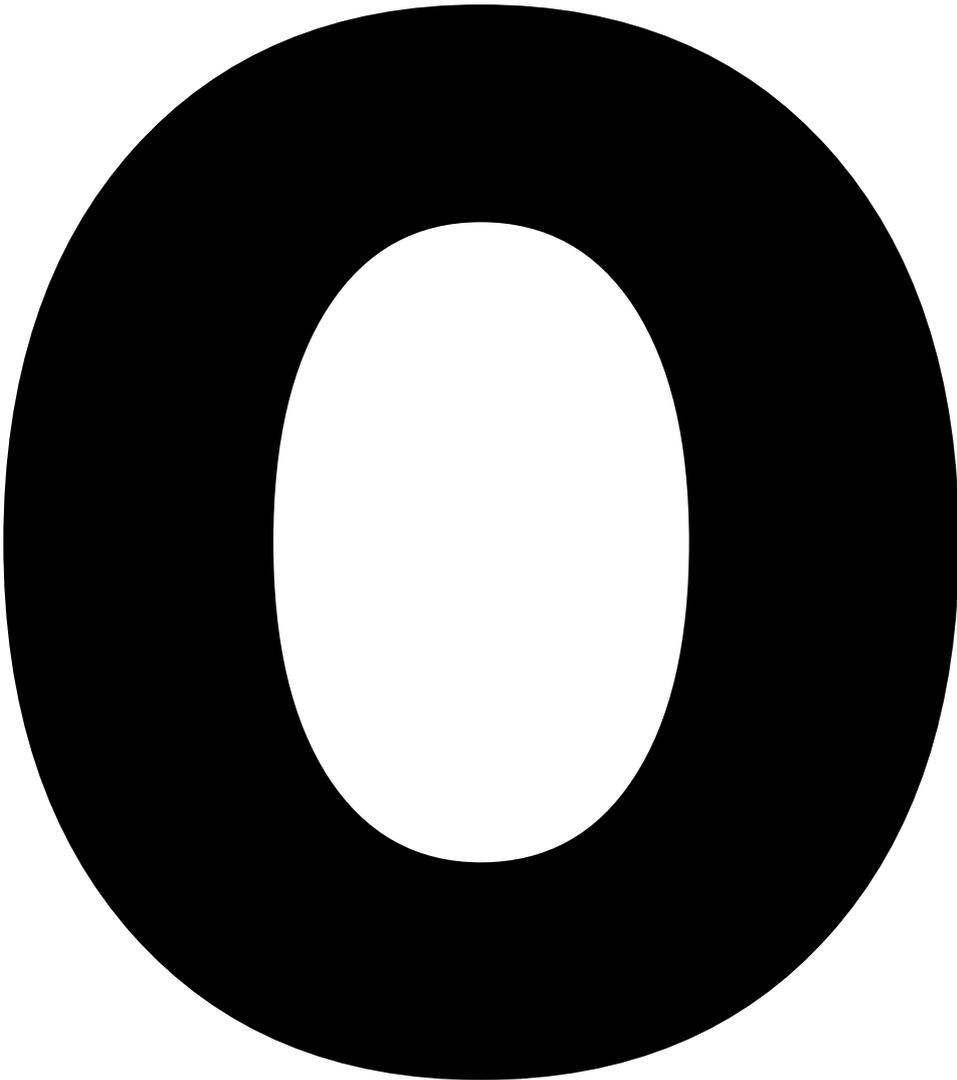


5



o

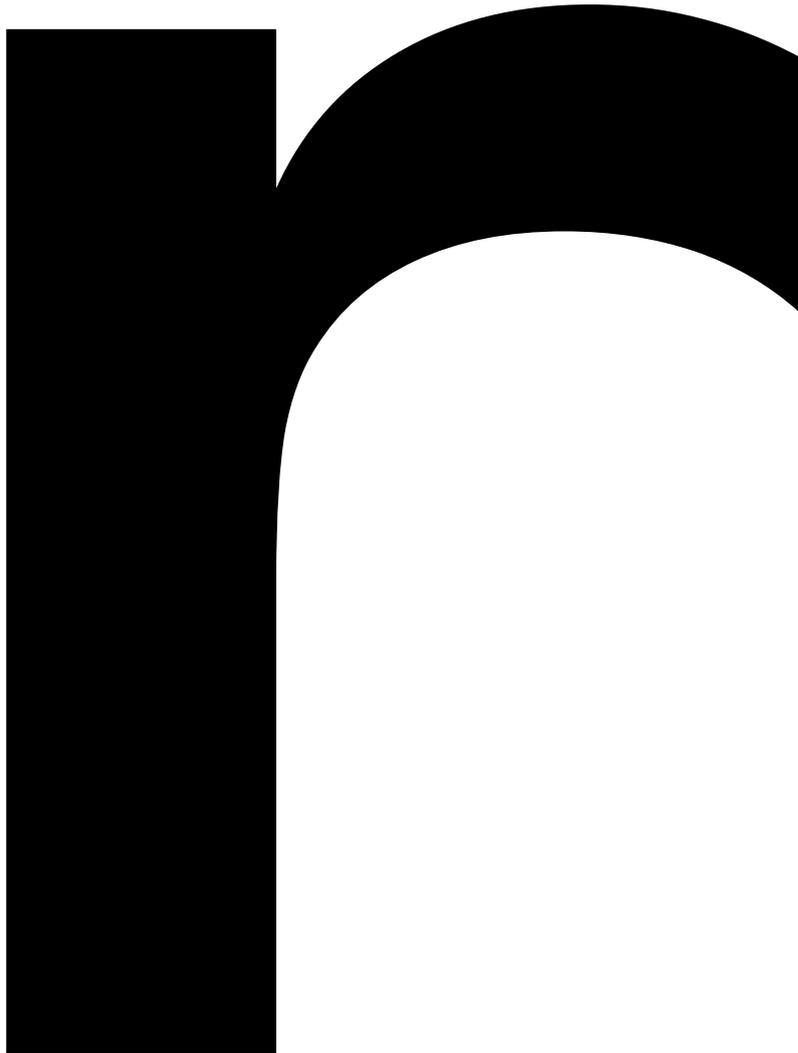




J

sa

h



sa

n

Q

e

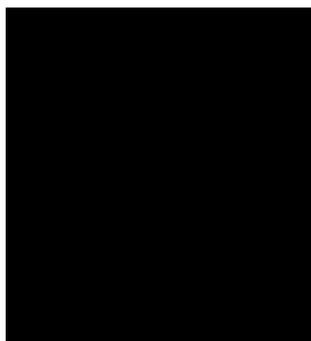
Q

e

10

e

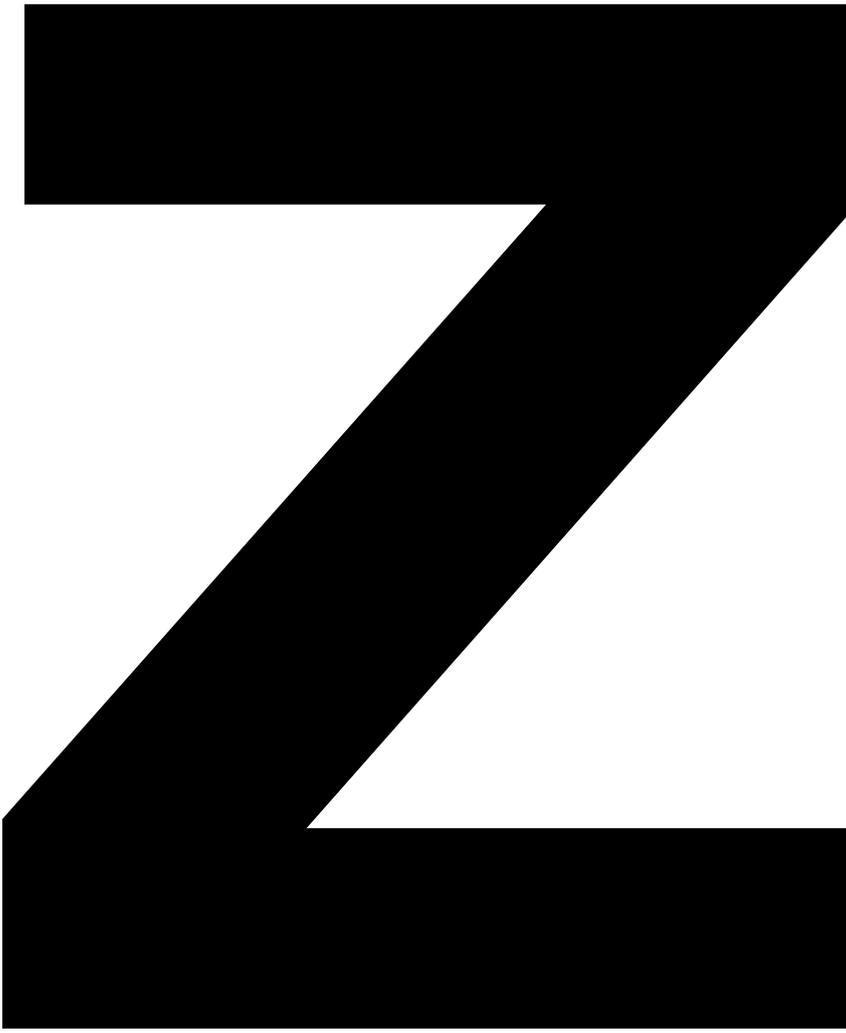
n



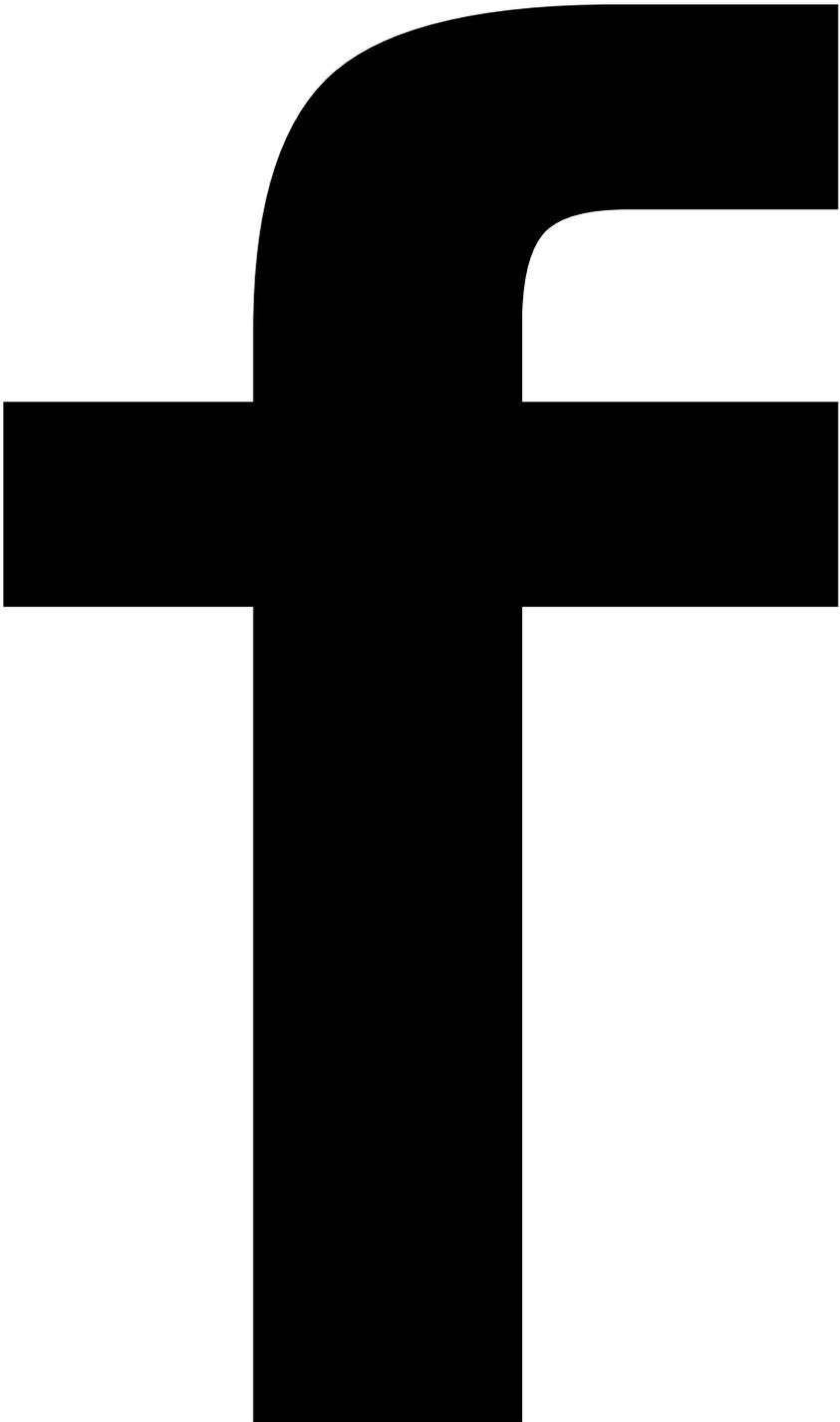
D

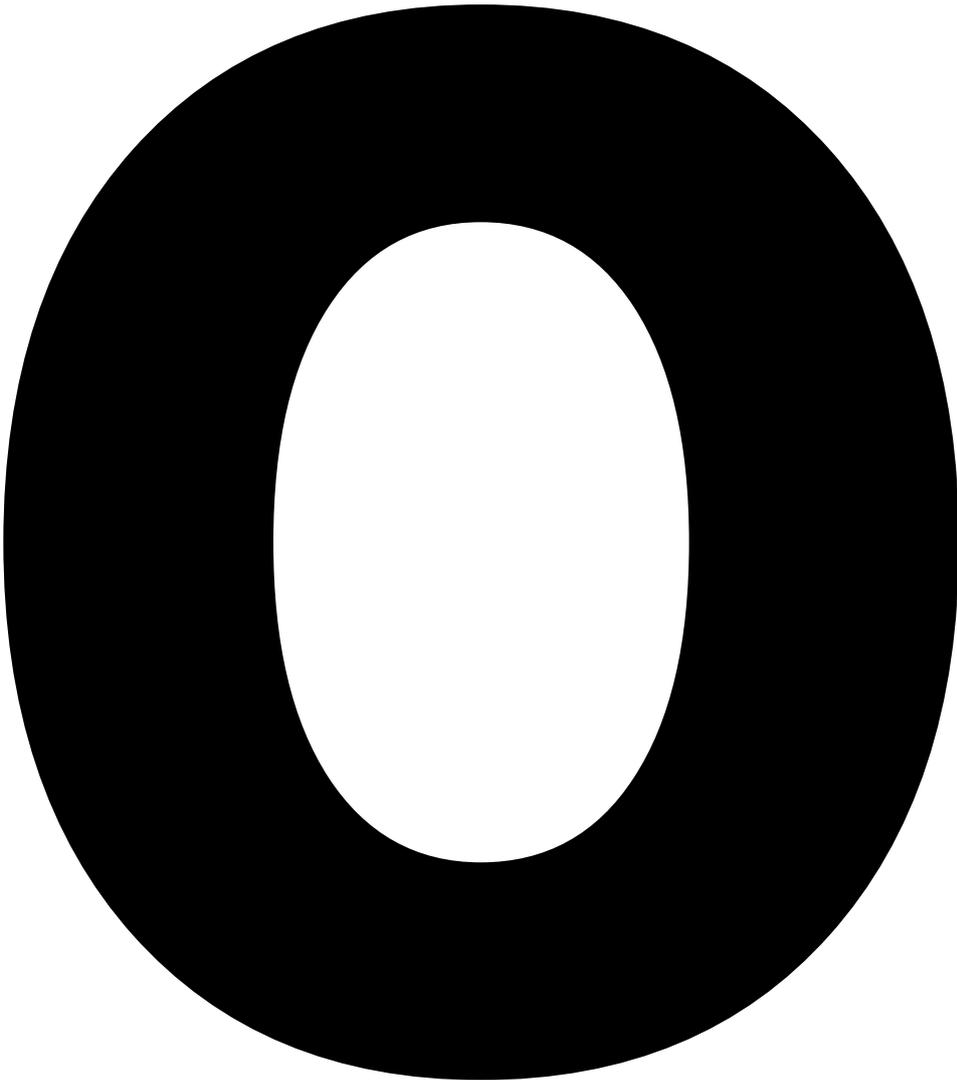
e

m



u





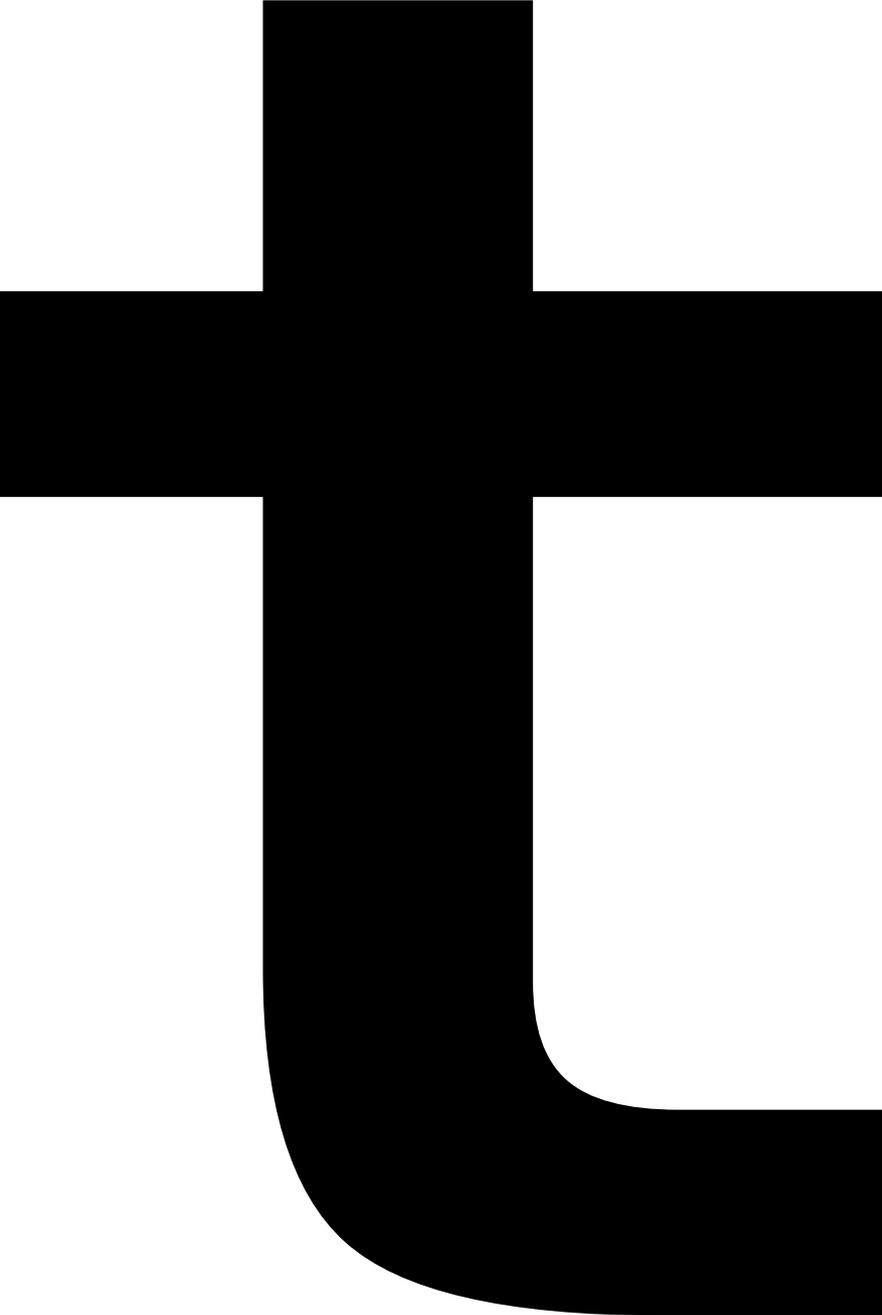
J

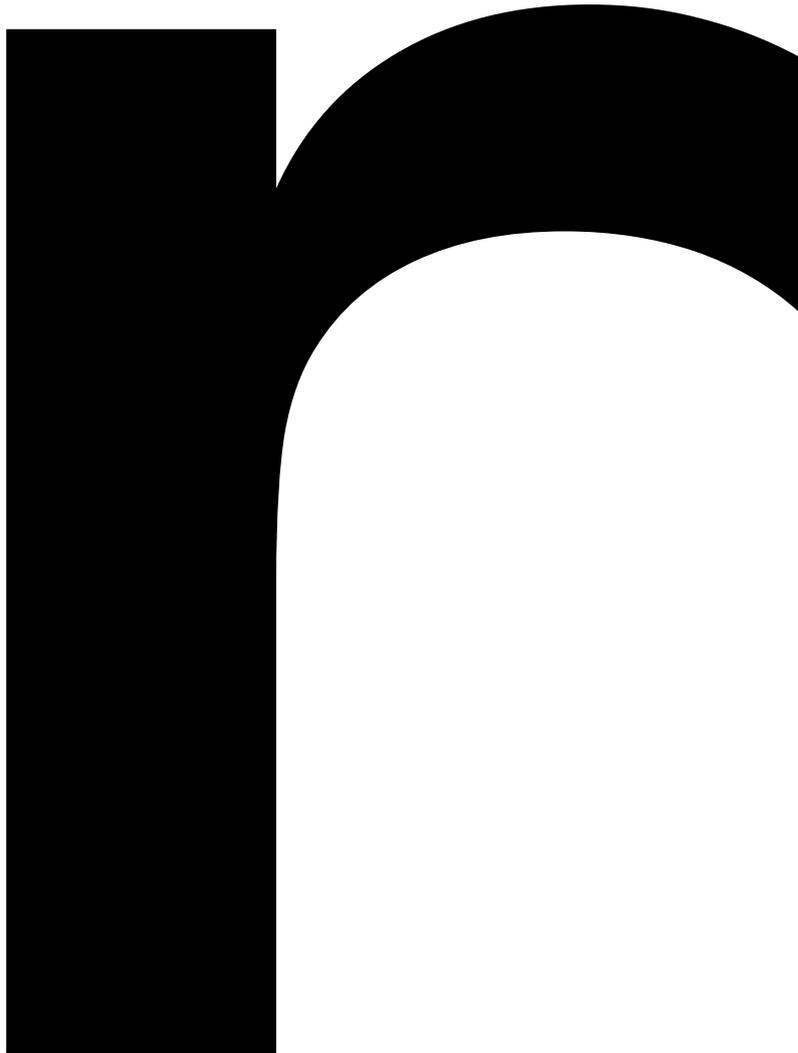
Q

e

10

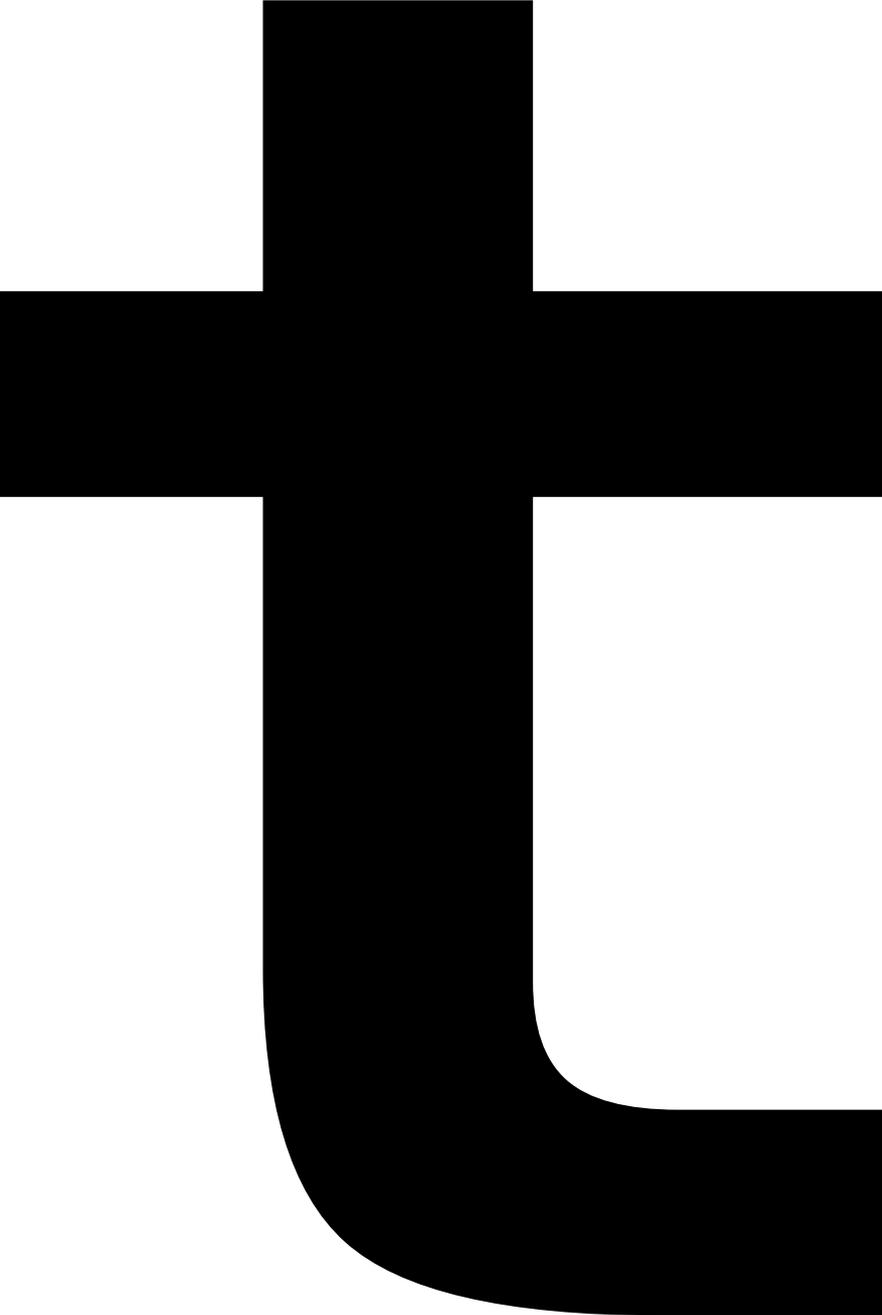
e



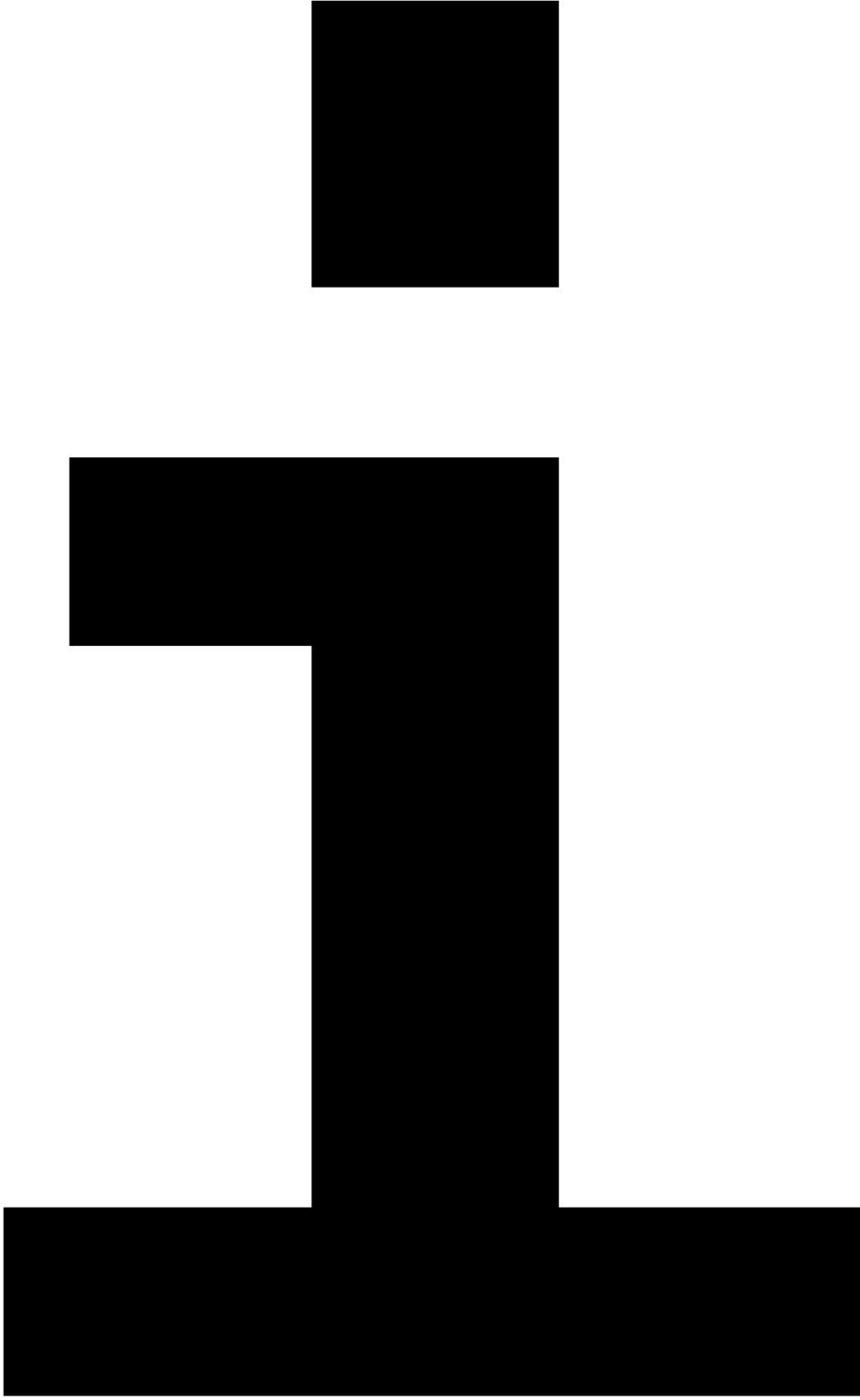




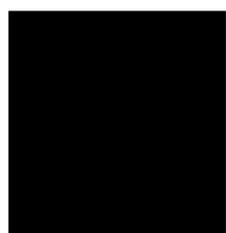
Q



Q



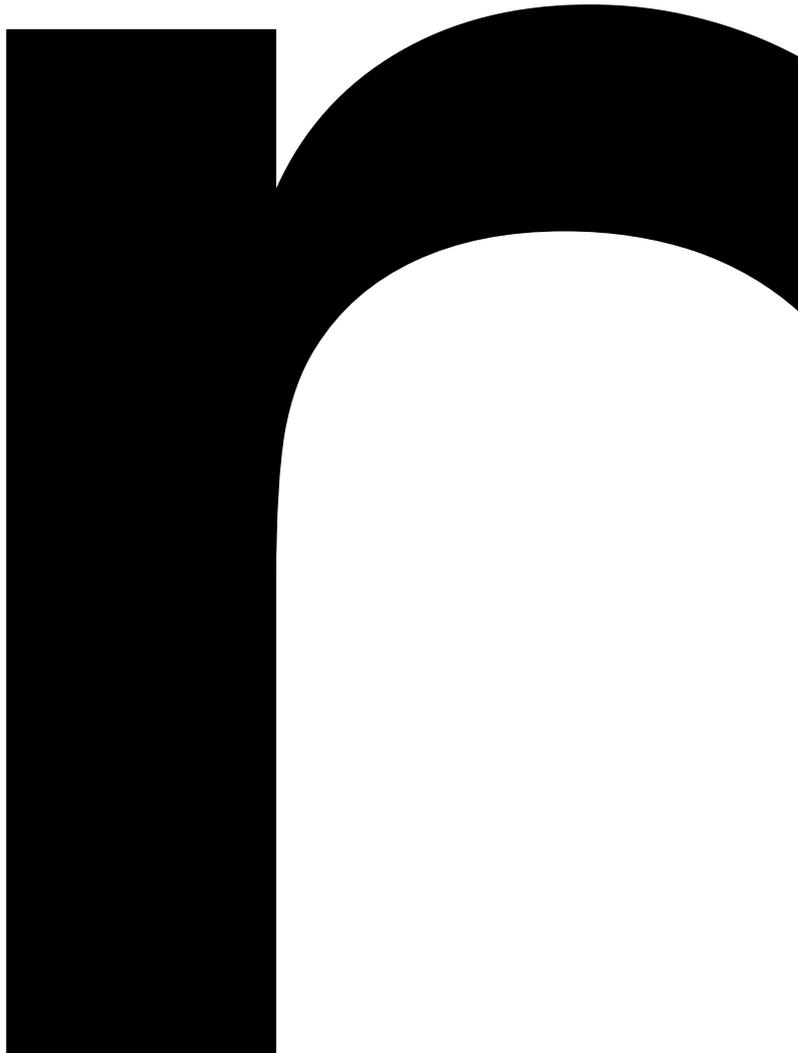
e



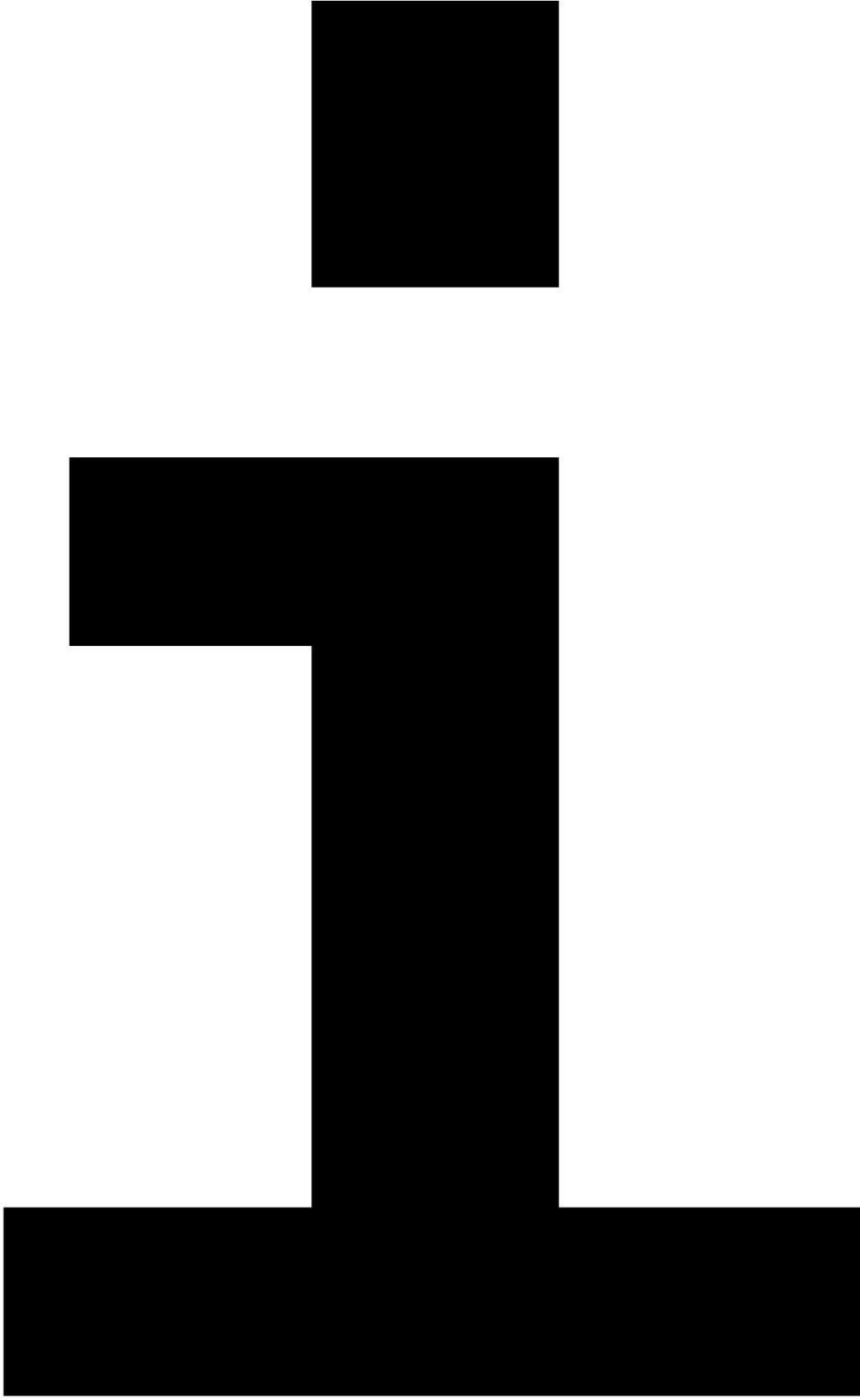
u

10

e



Q



e



e

10

e

n

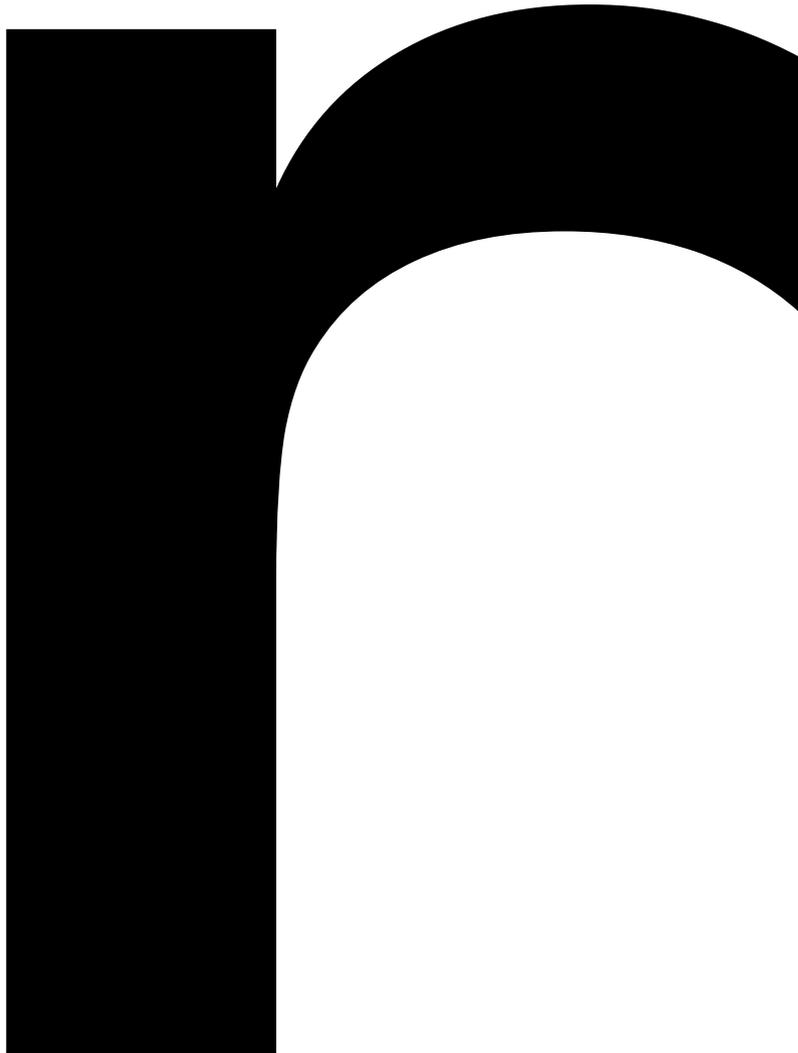
S

Q

sa

u

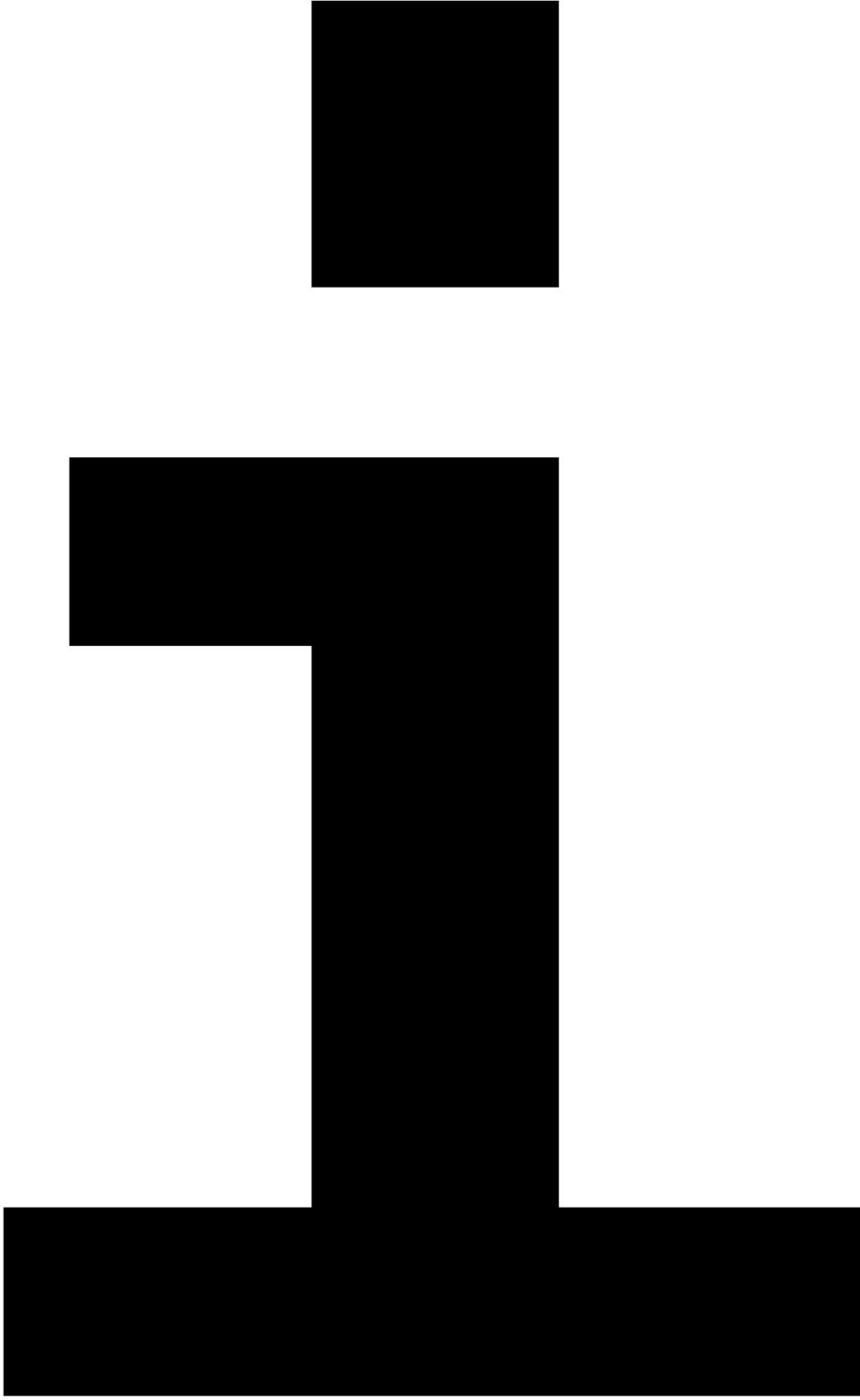
e

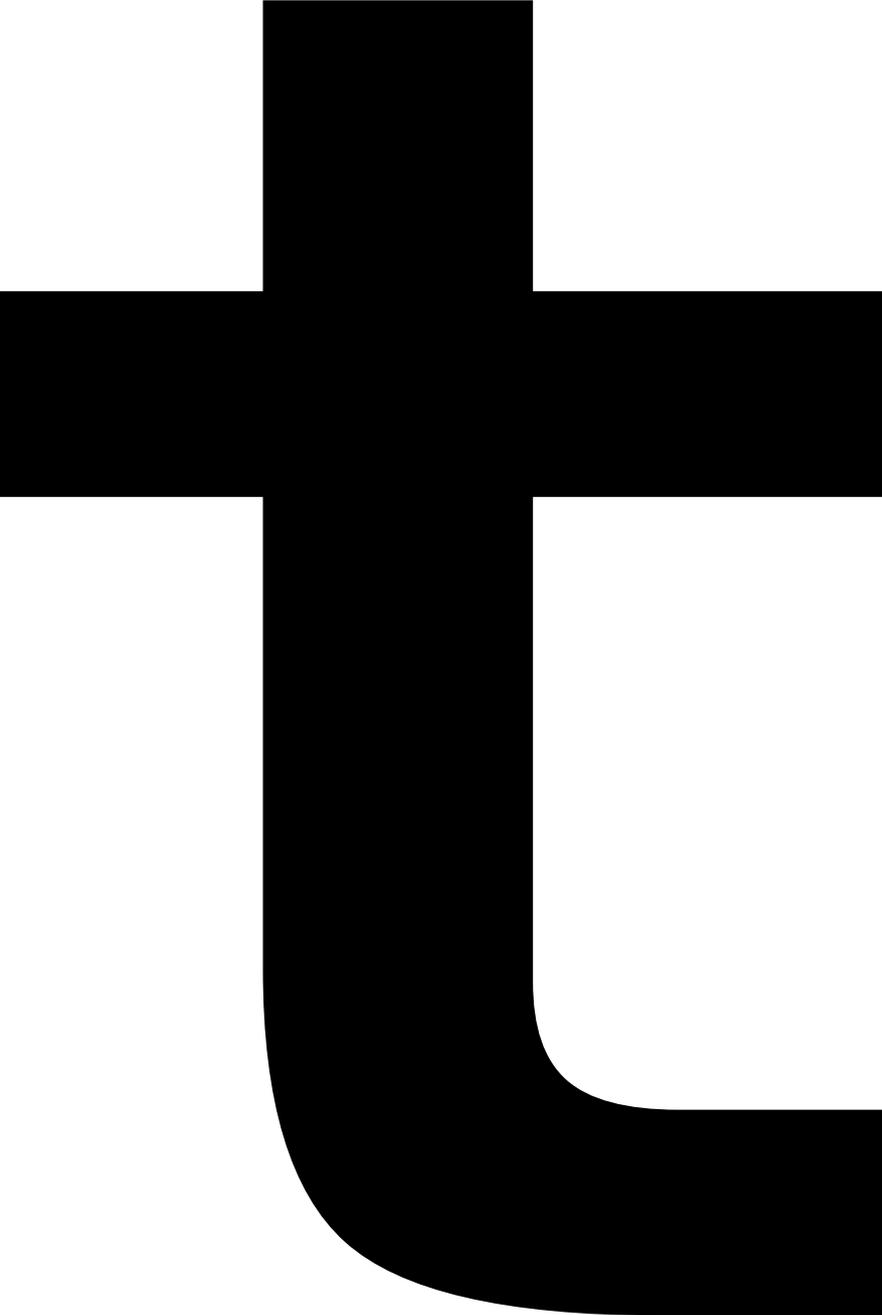


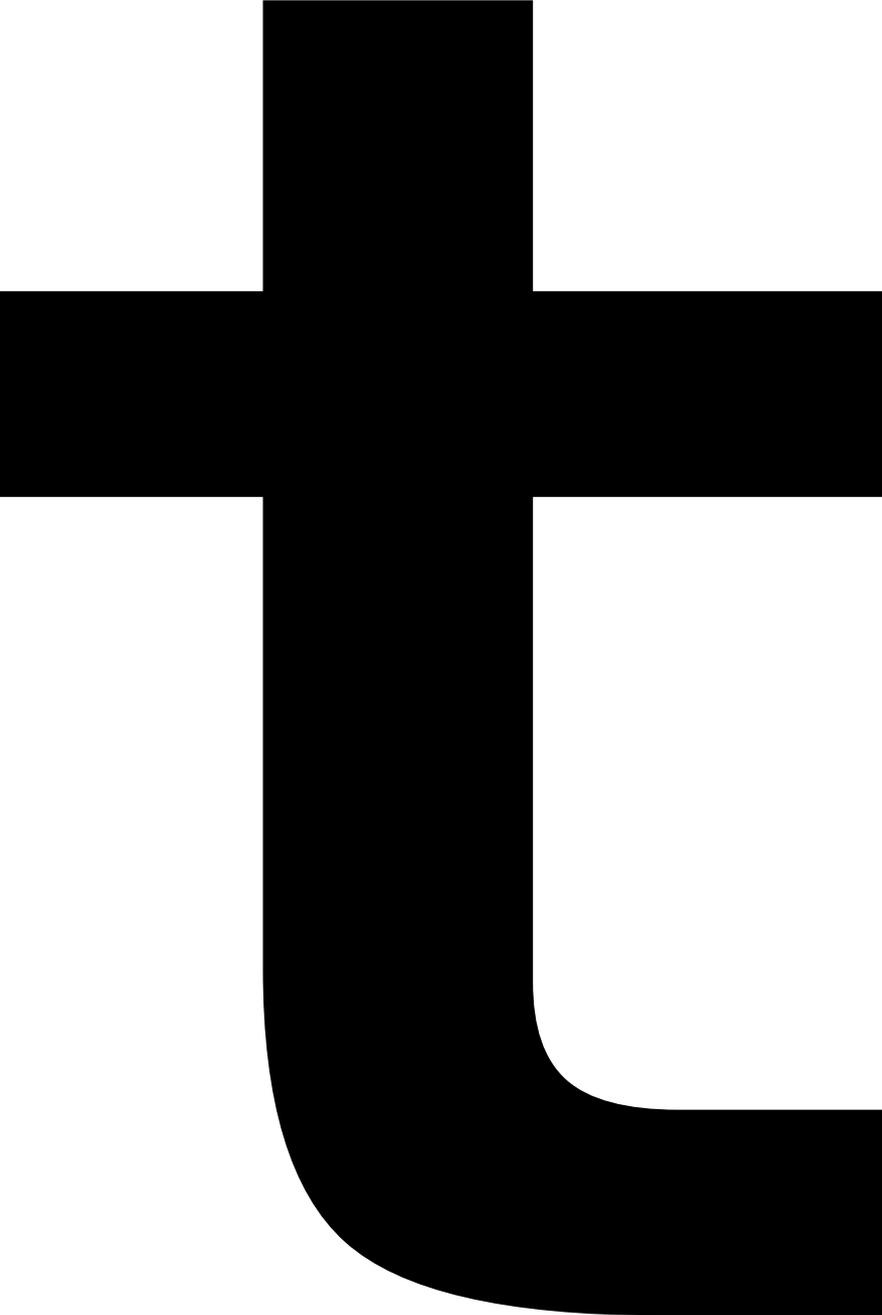
Q

e

m

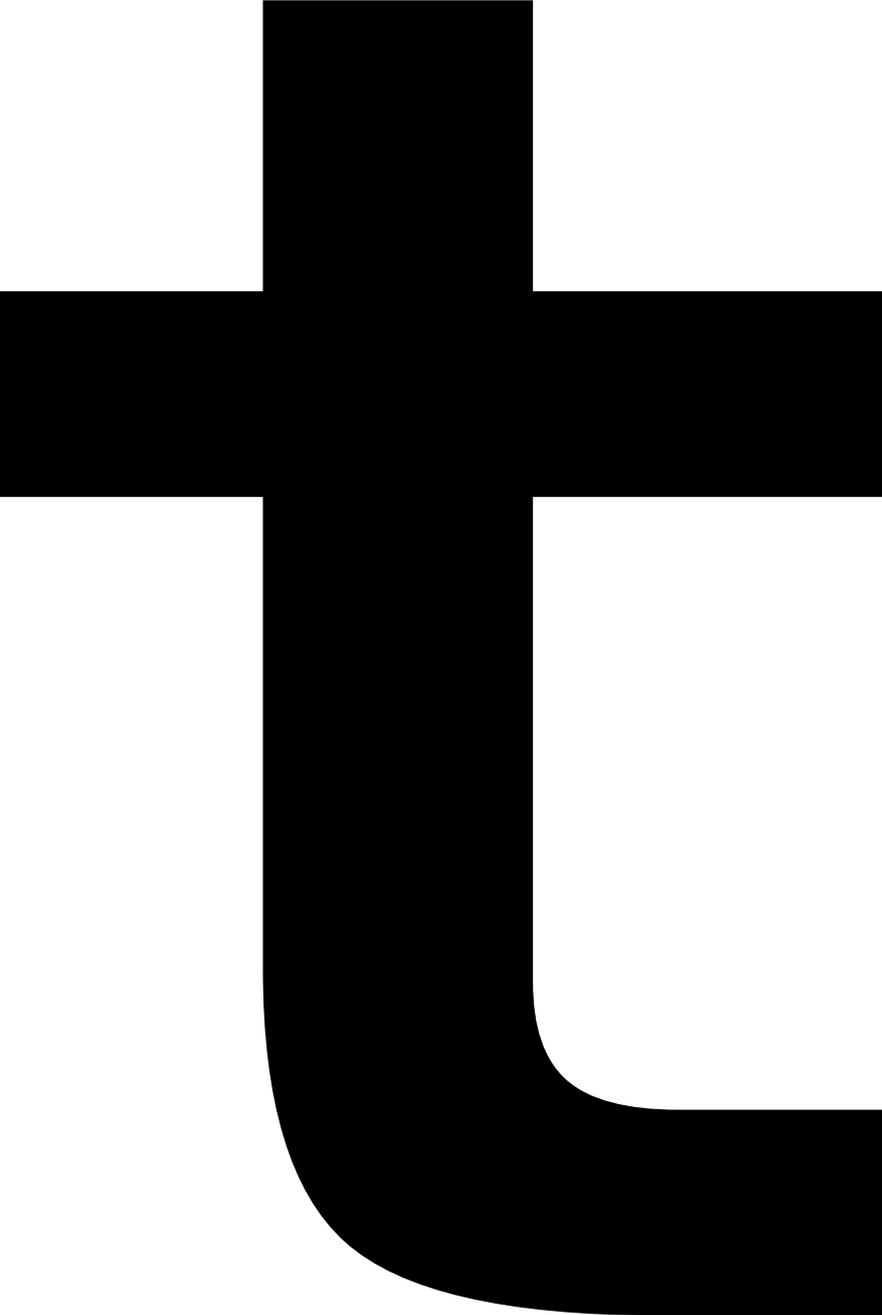






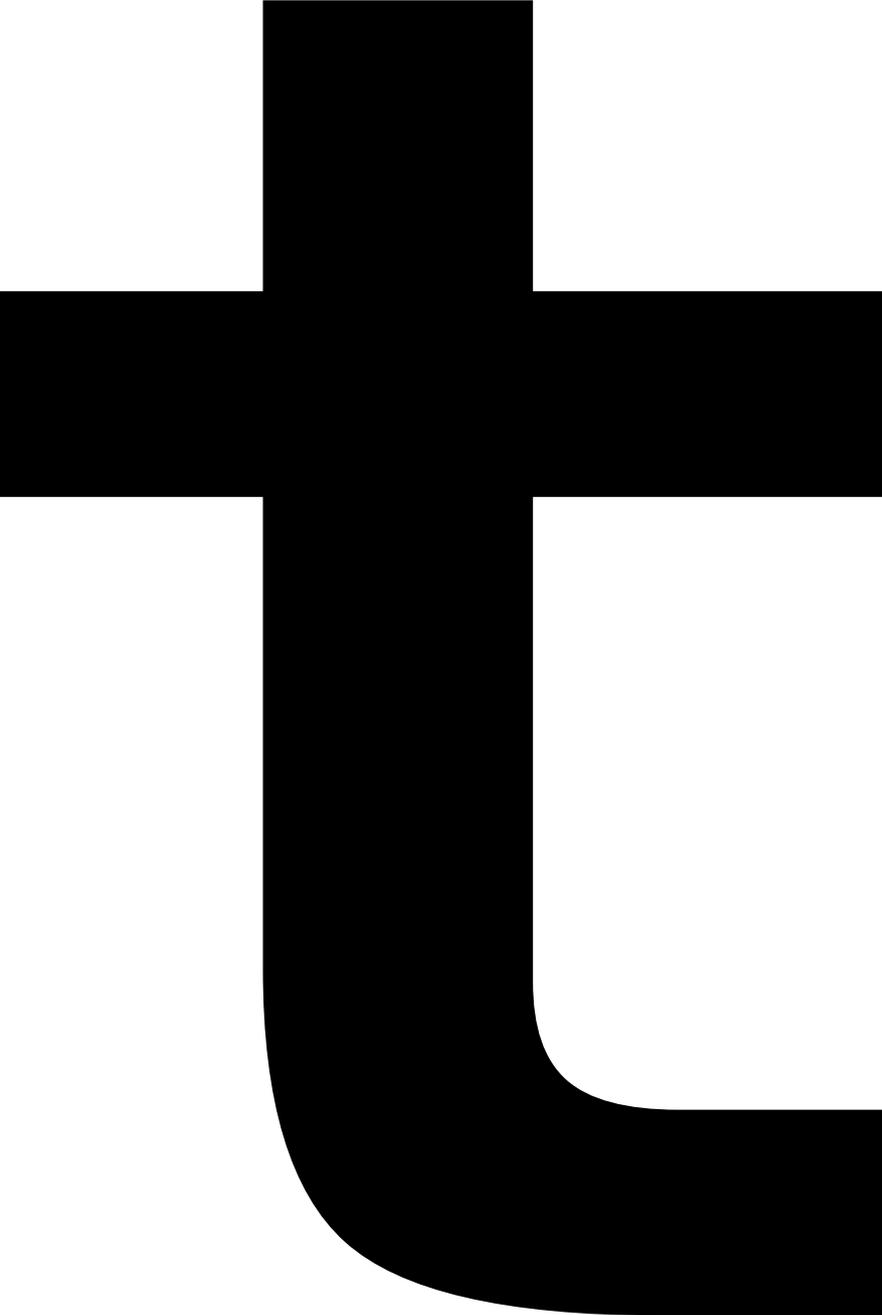
e

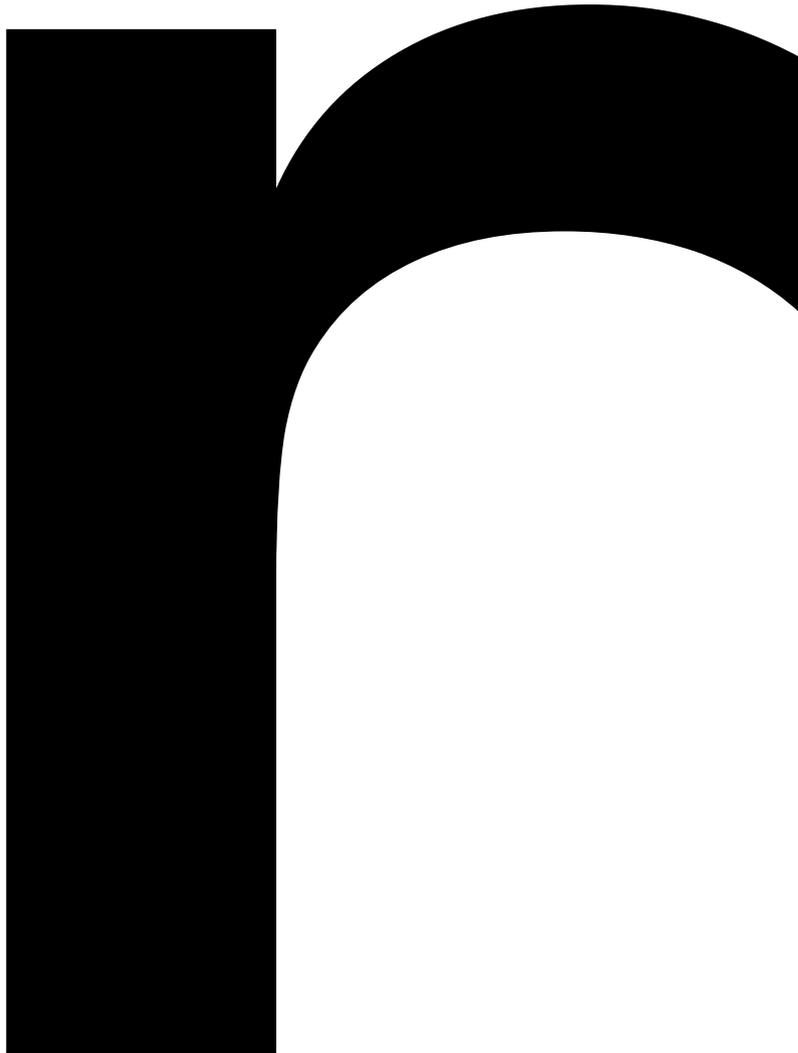
J

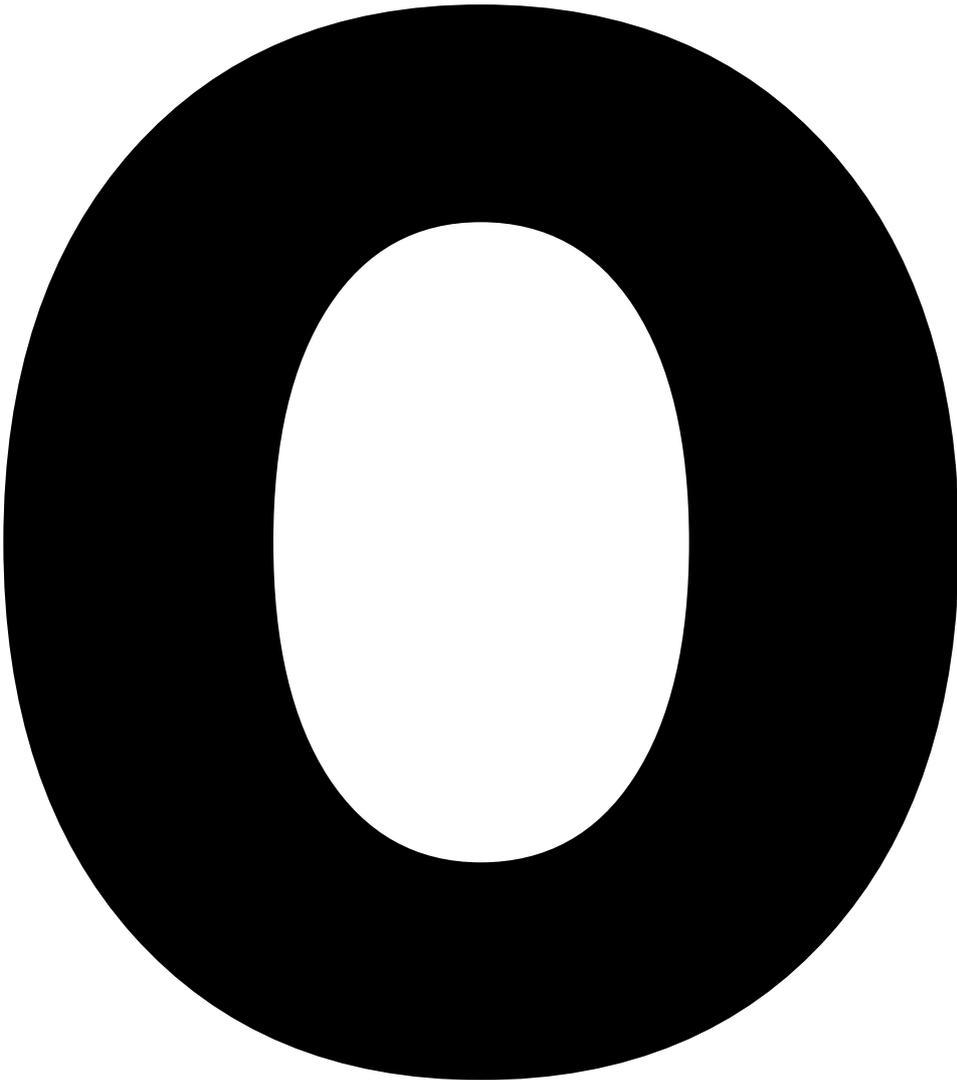


e

S







m

sa

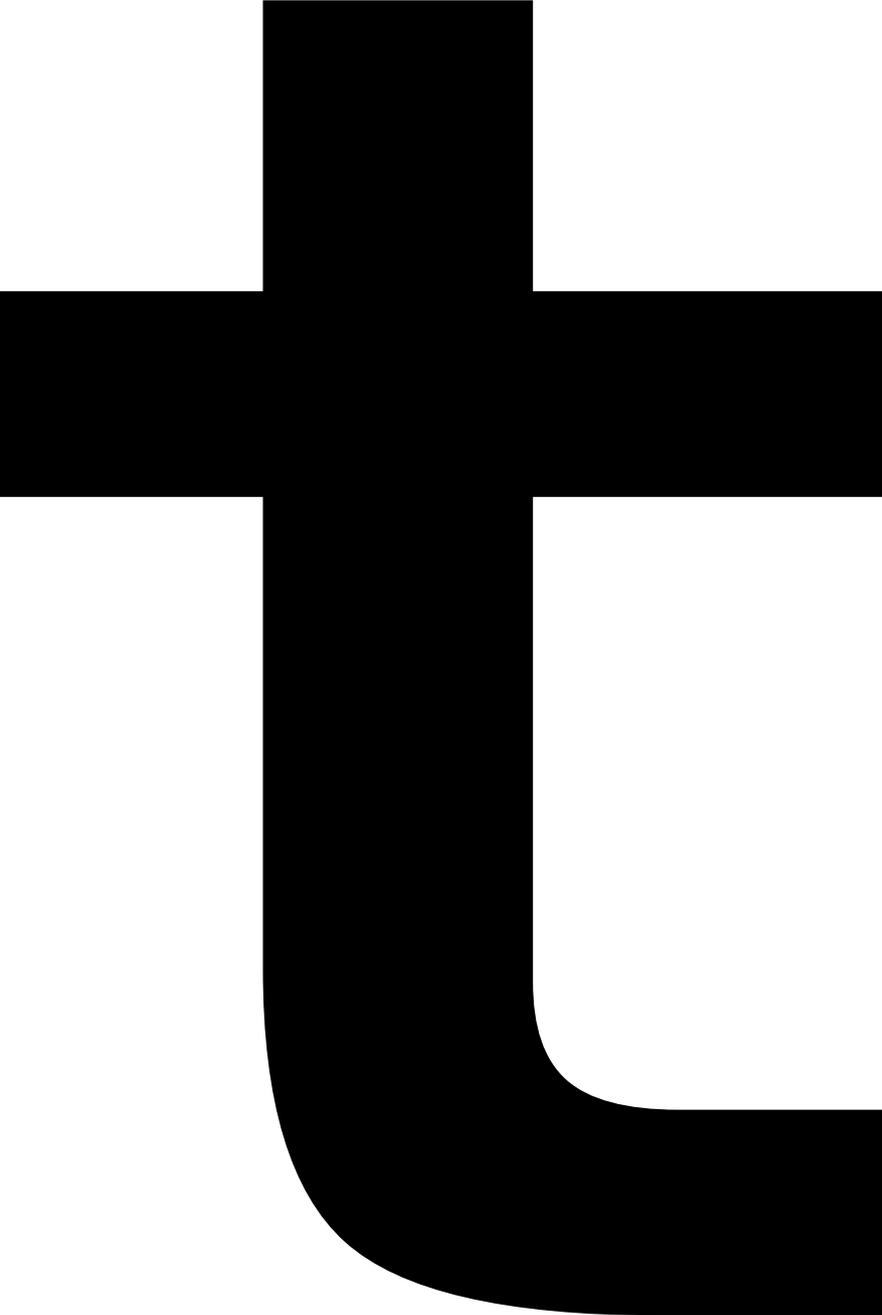
u

S

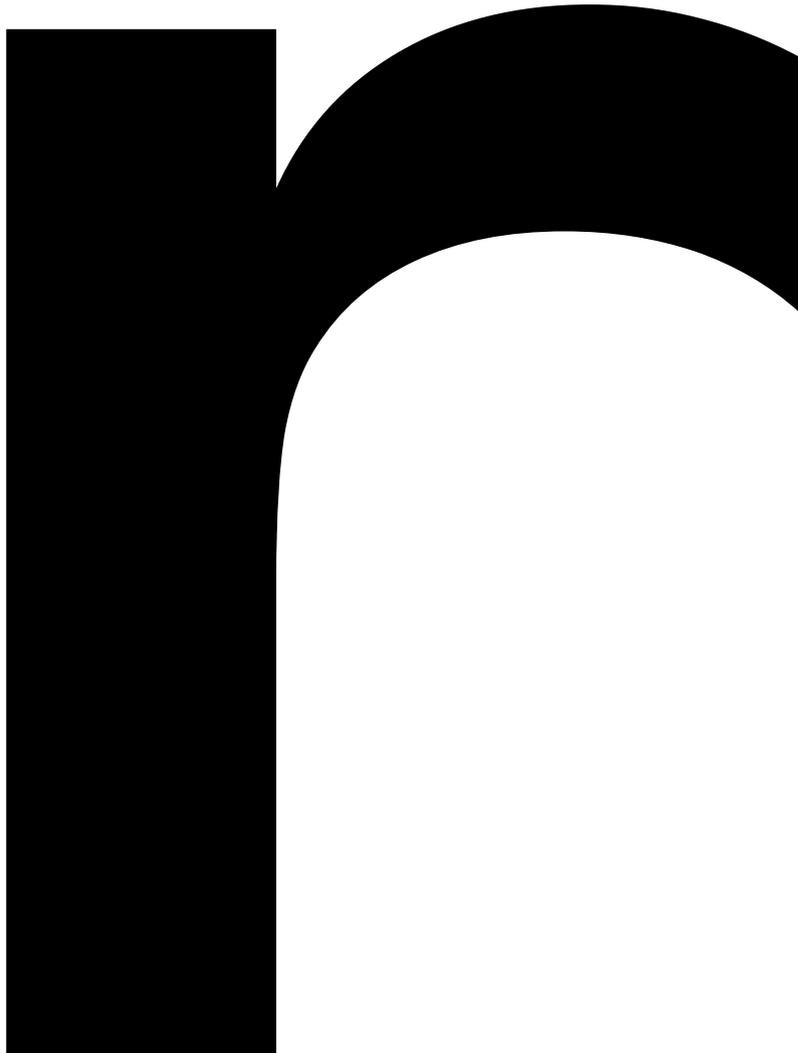
10

e

u



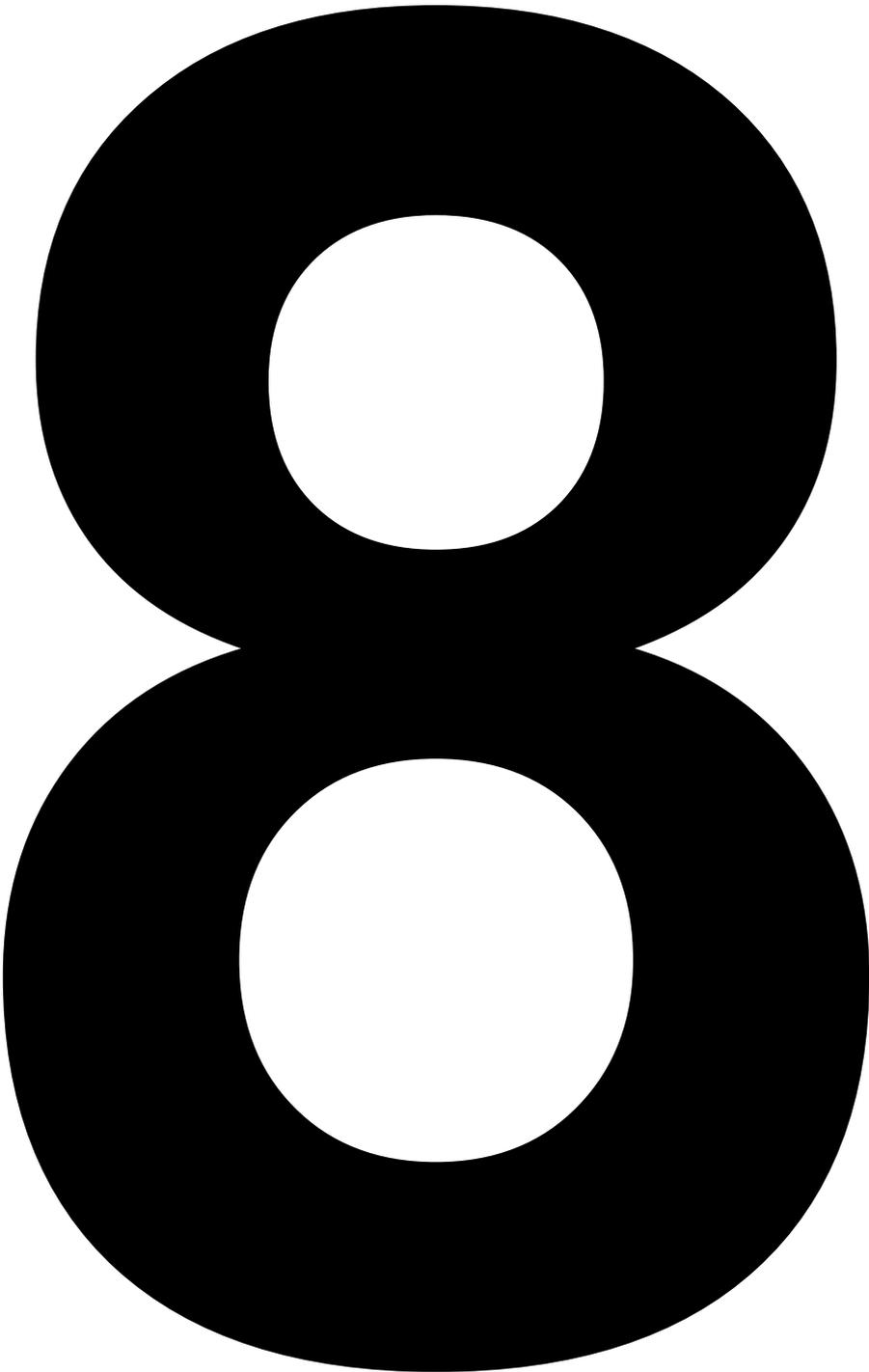
e

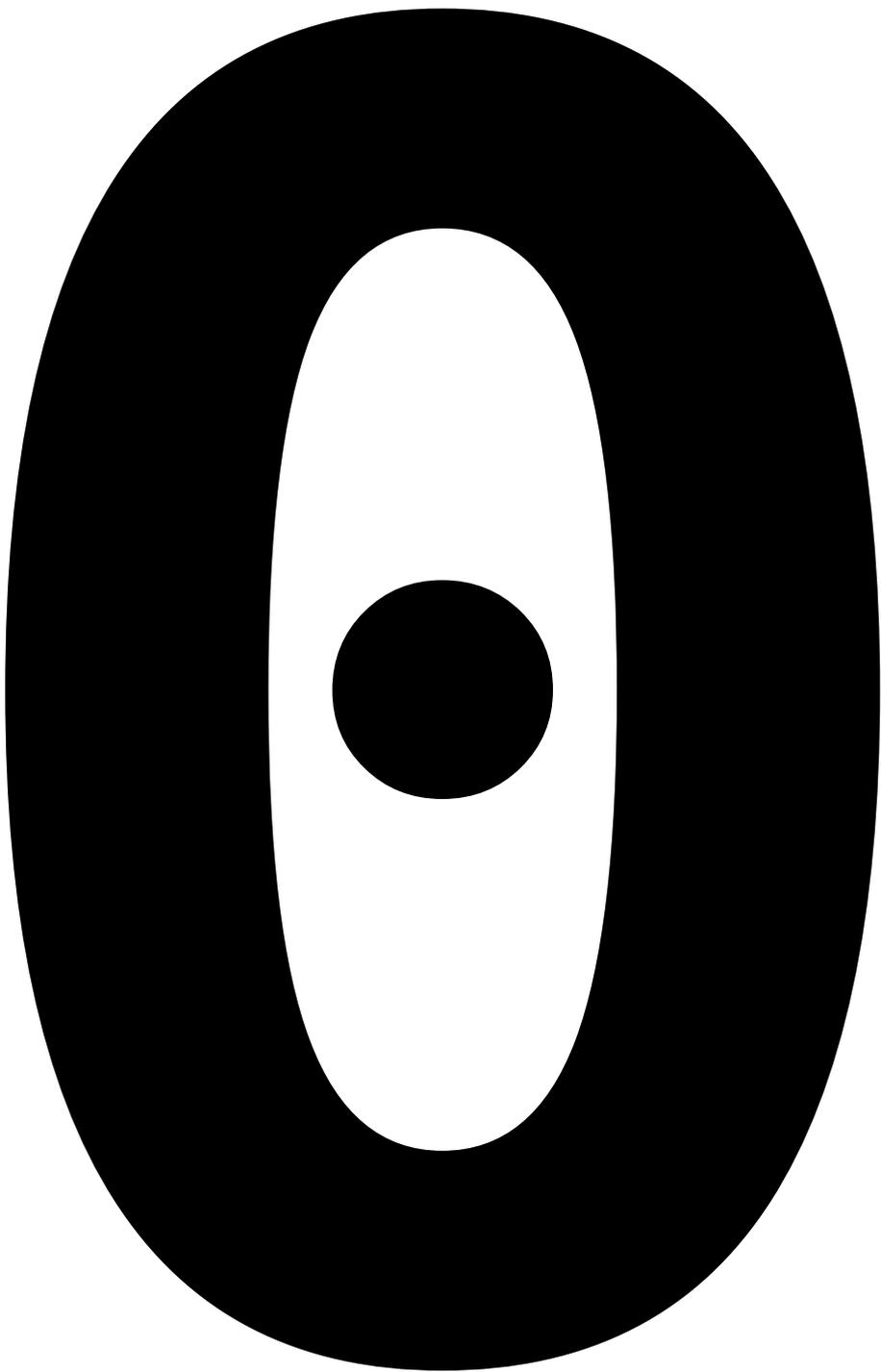


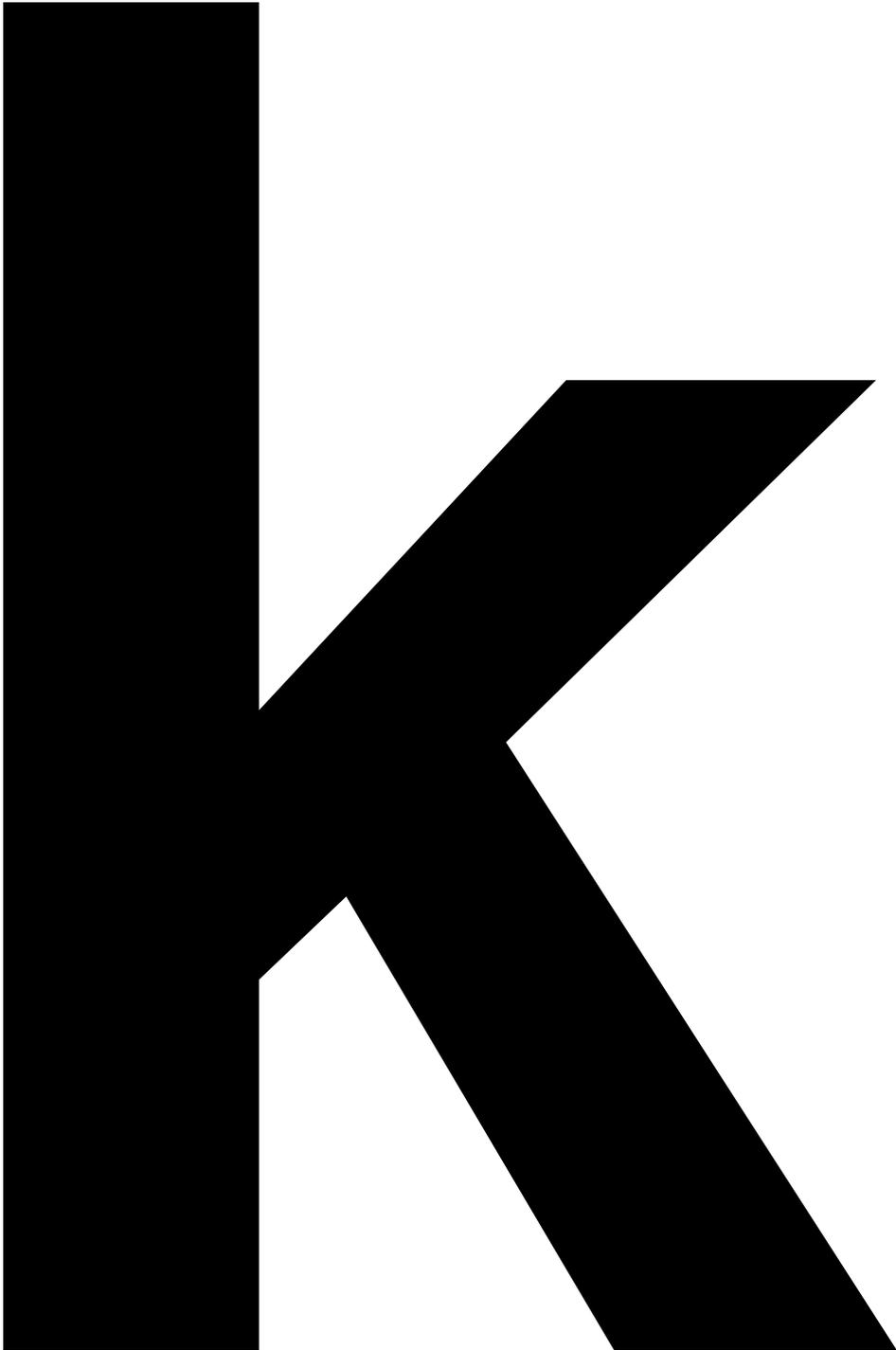
u

n

Q



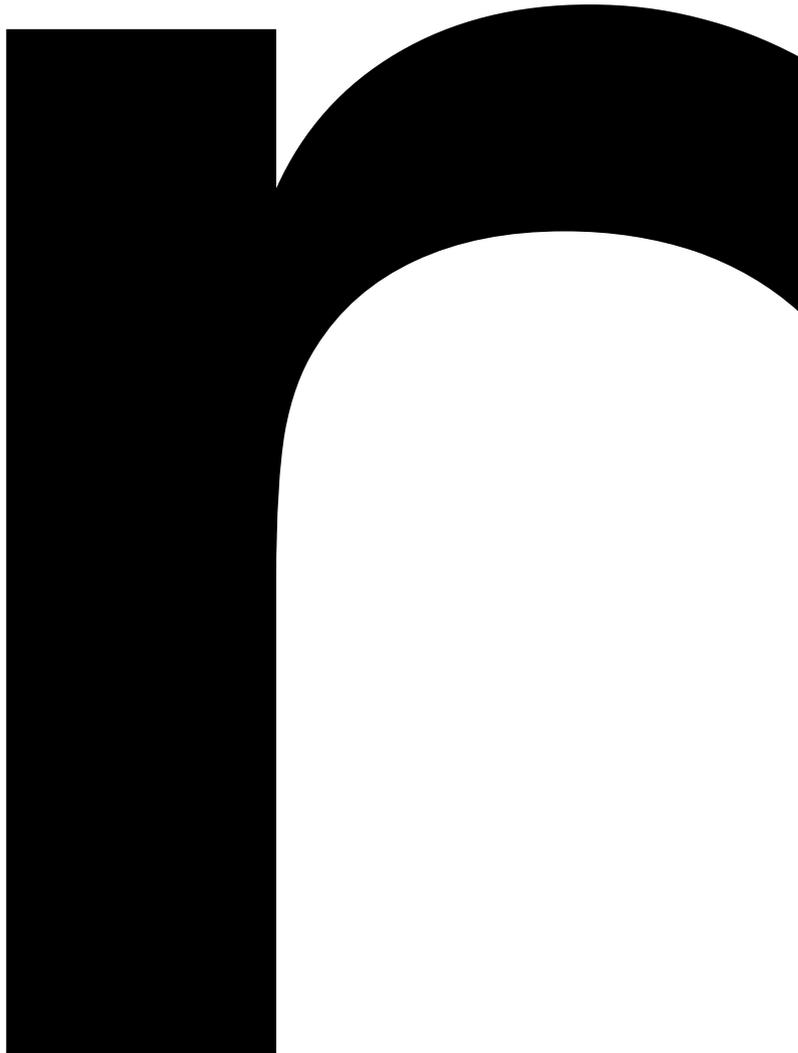


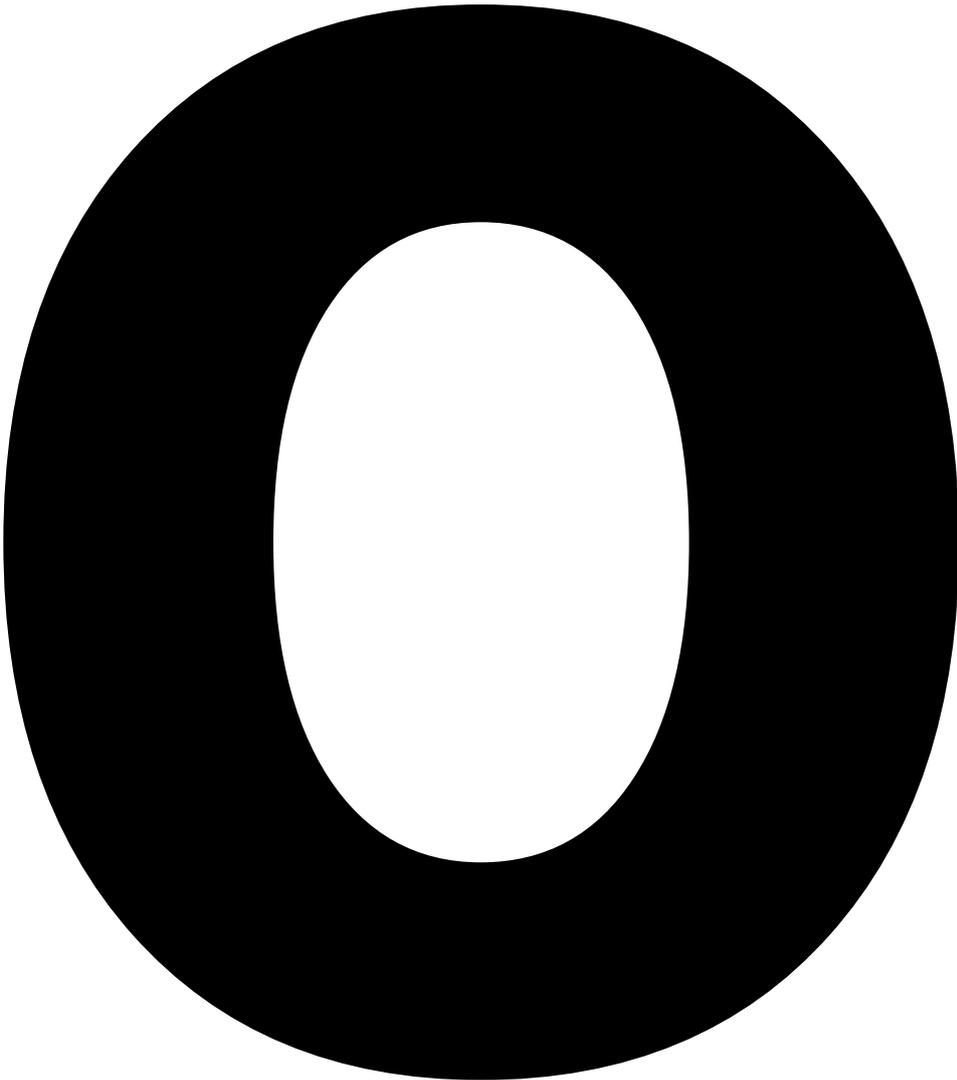


w

h

o





m

2

u

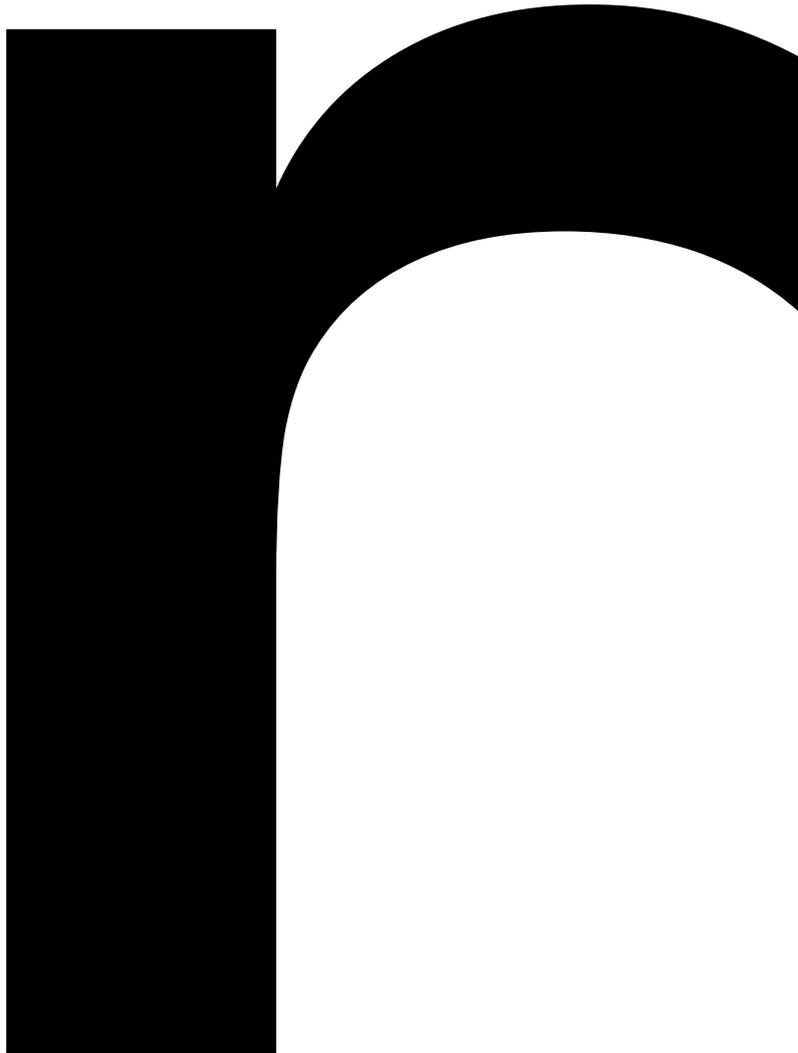
n

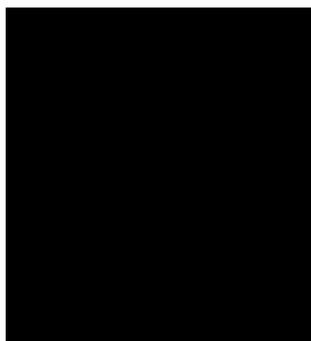
Q

J

sa

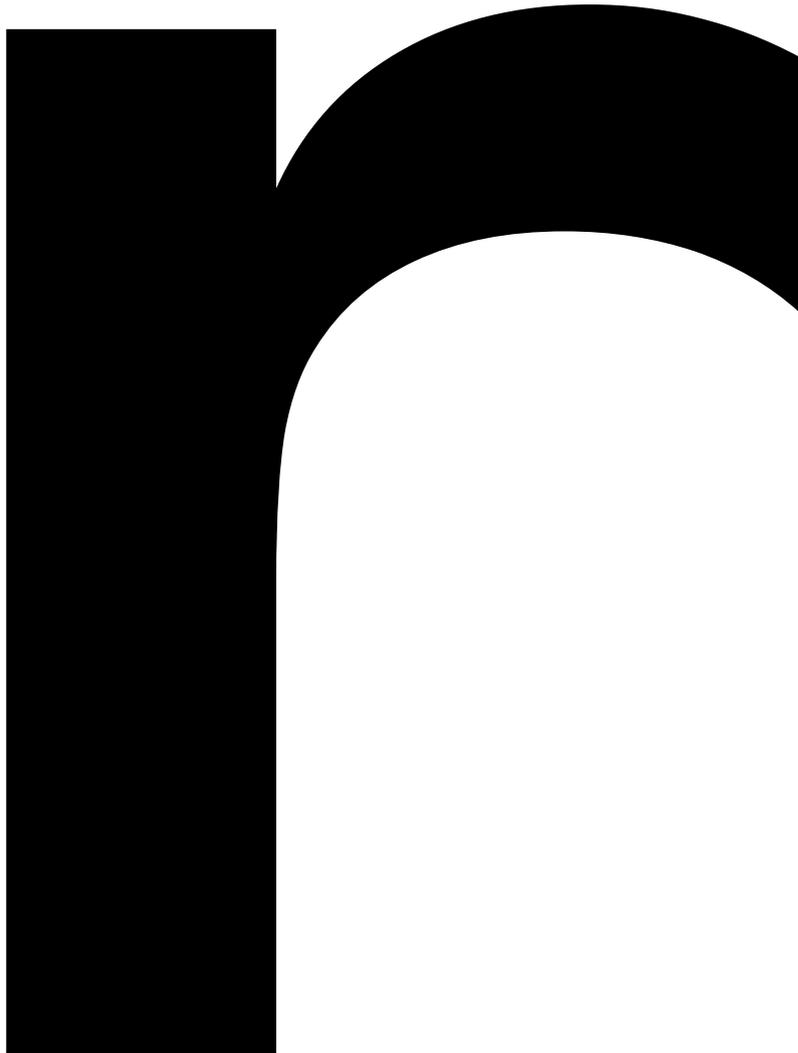
h





D

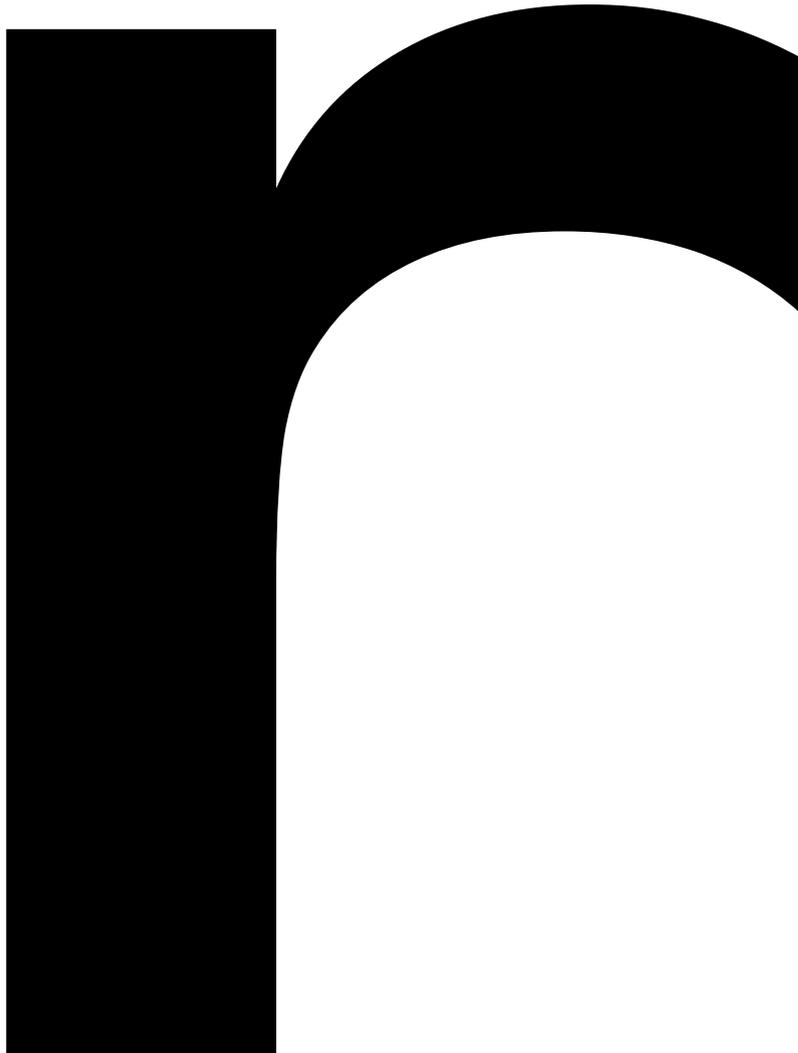
sa



5a

u

S

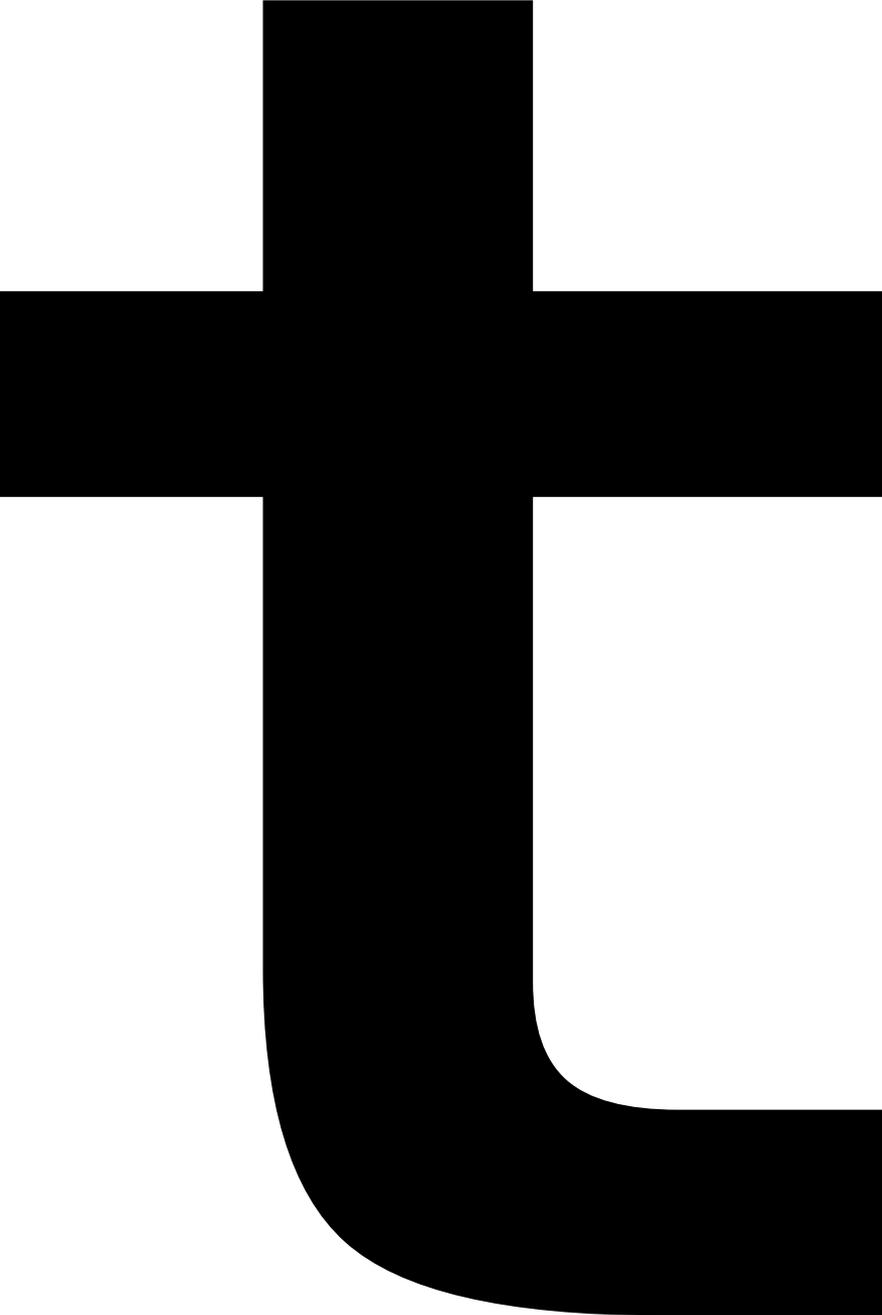


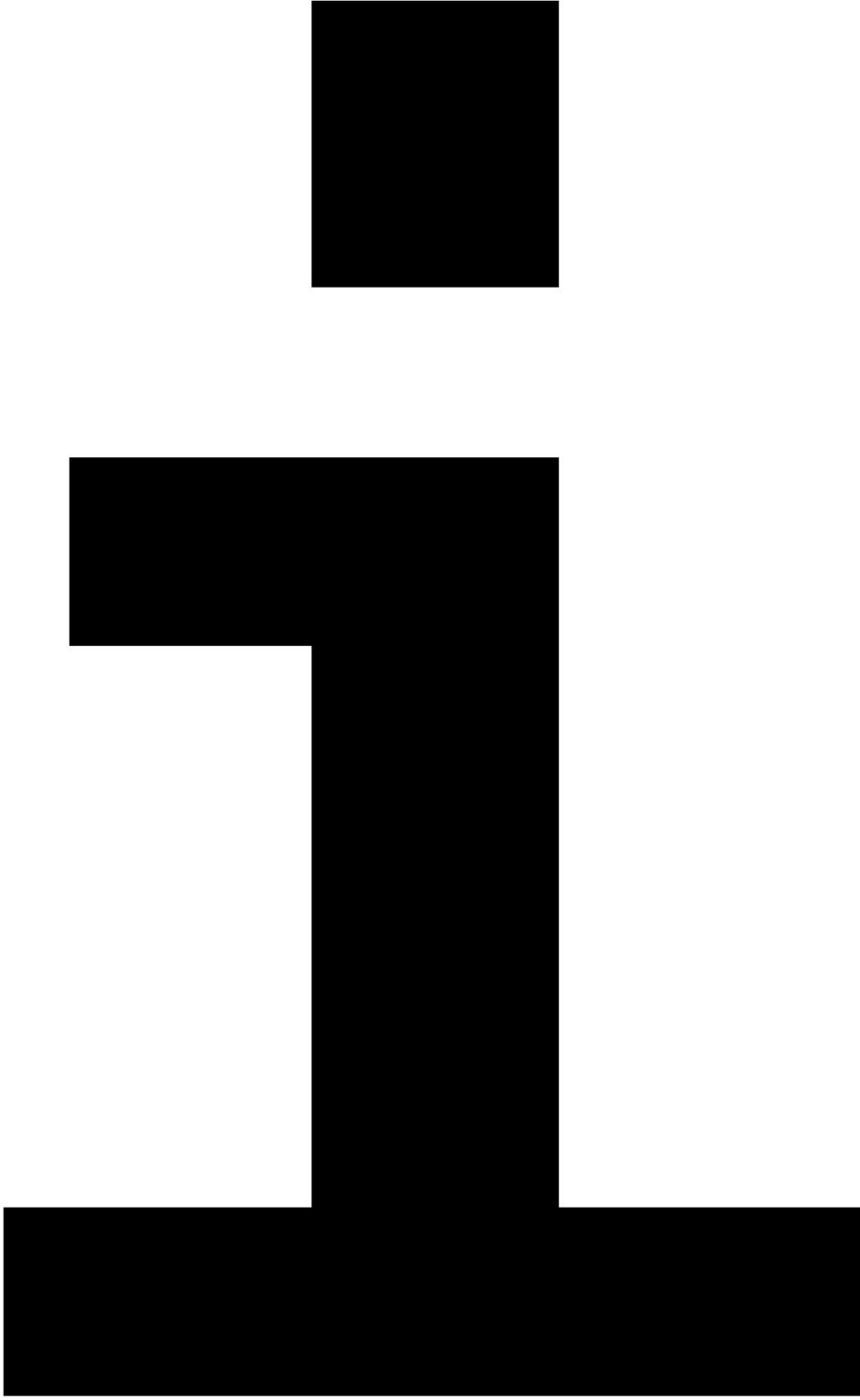
e

S

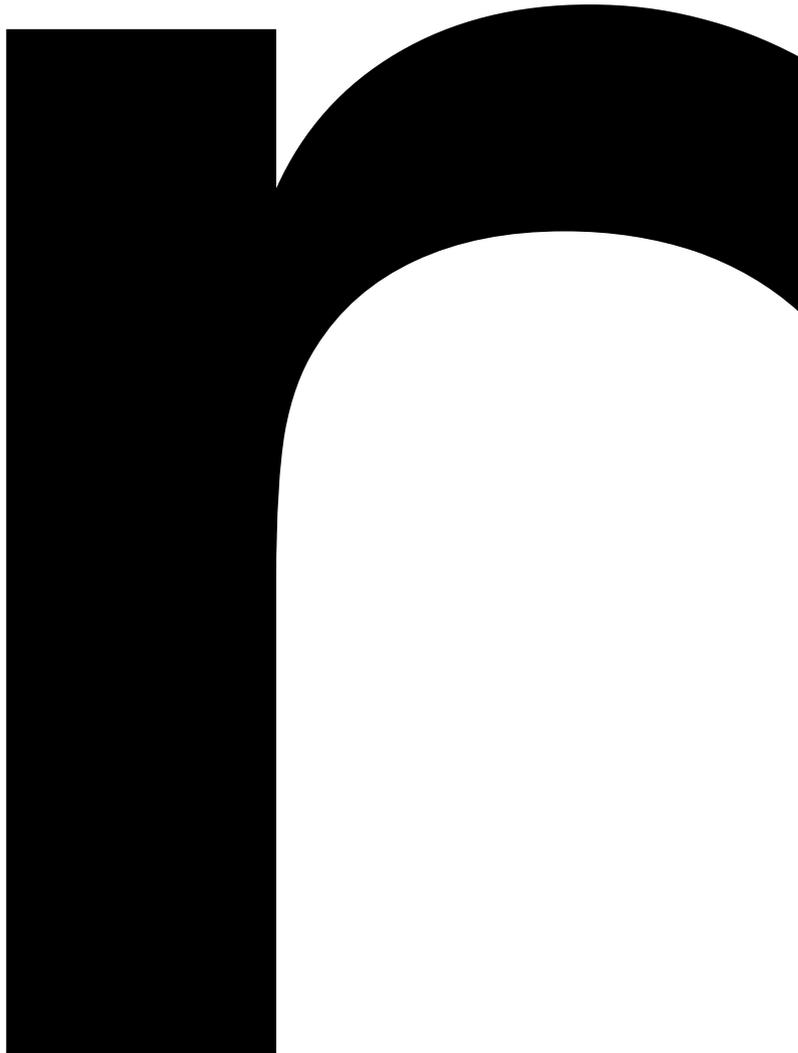
u

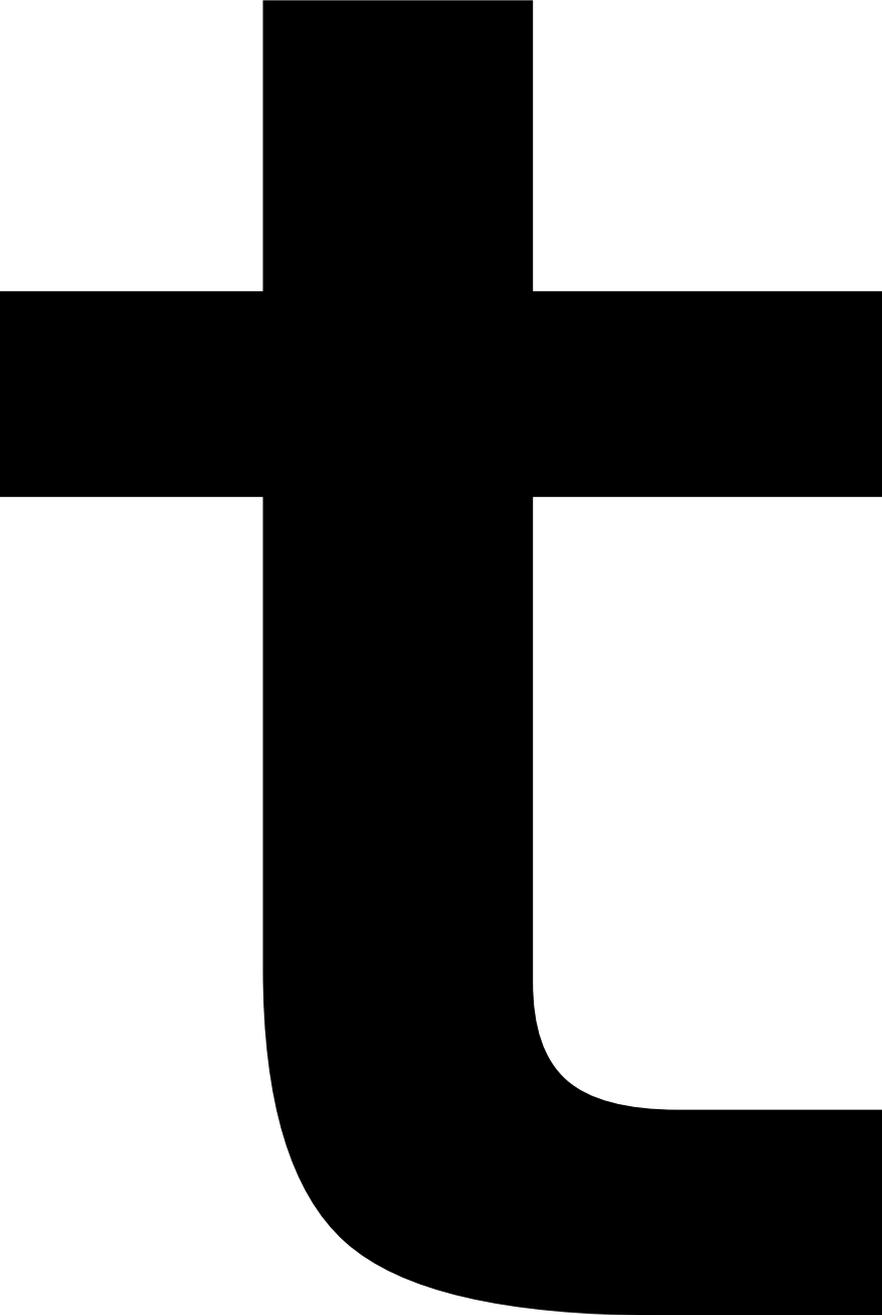
J

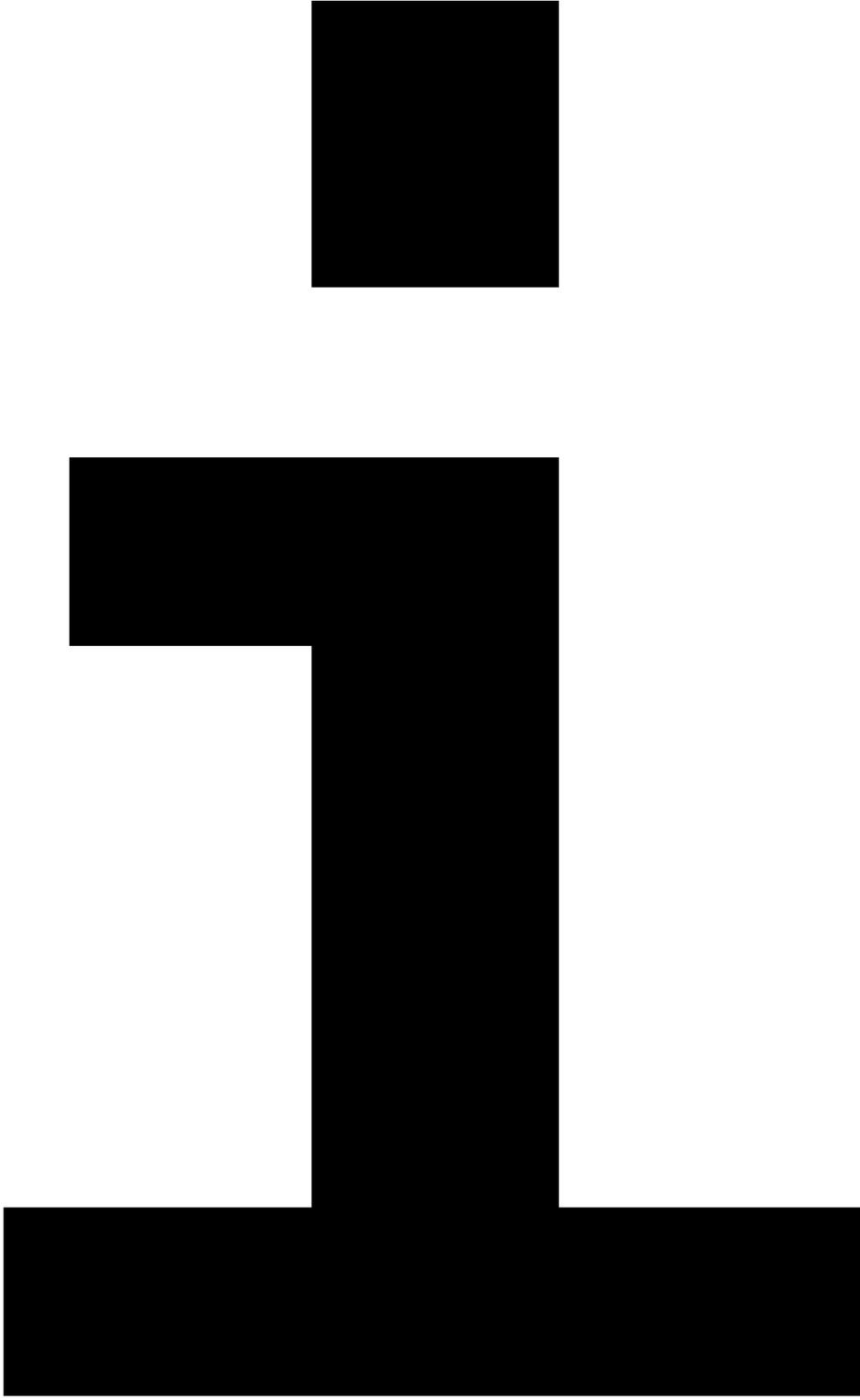




e







n

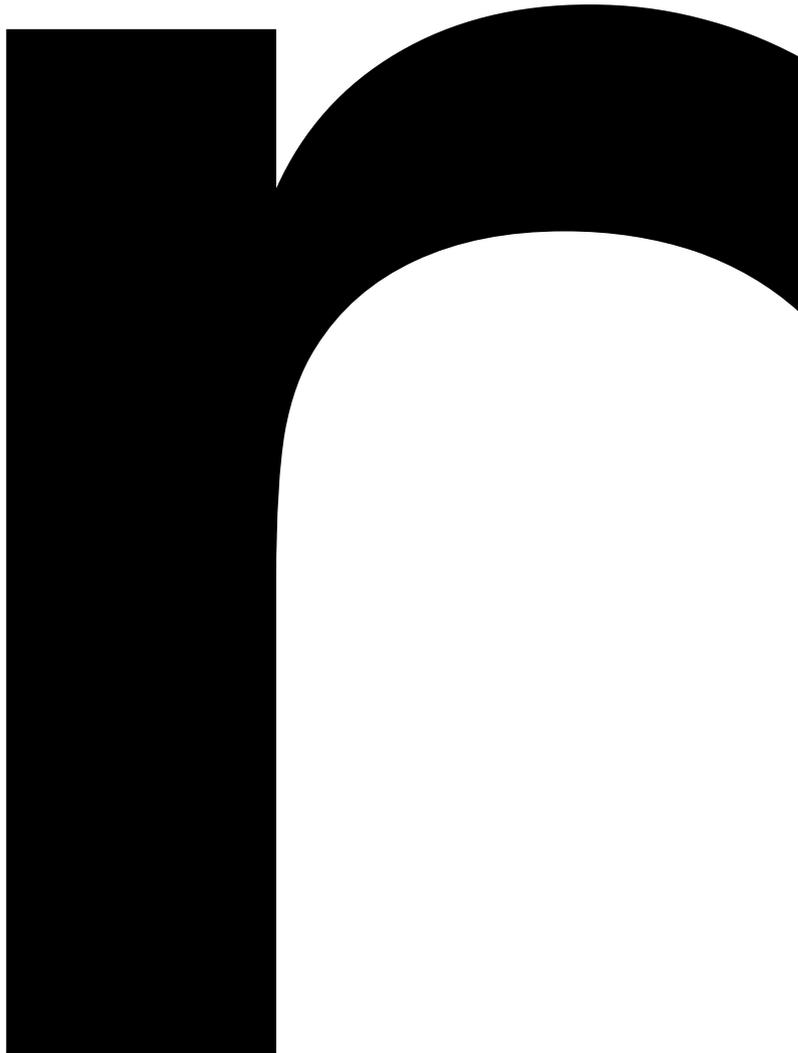
2

5

J

sa

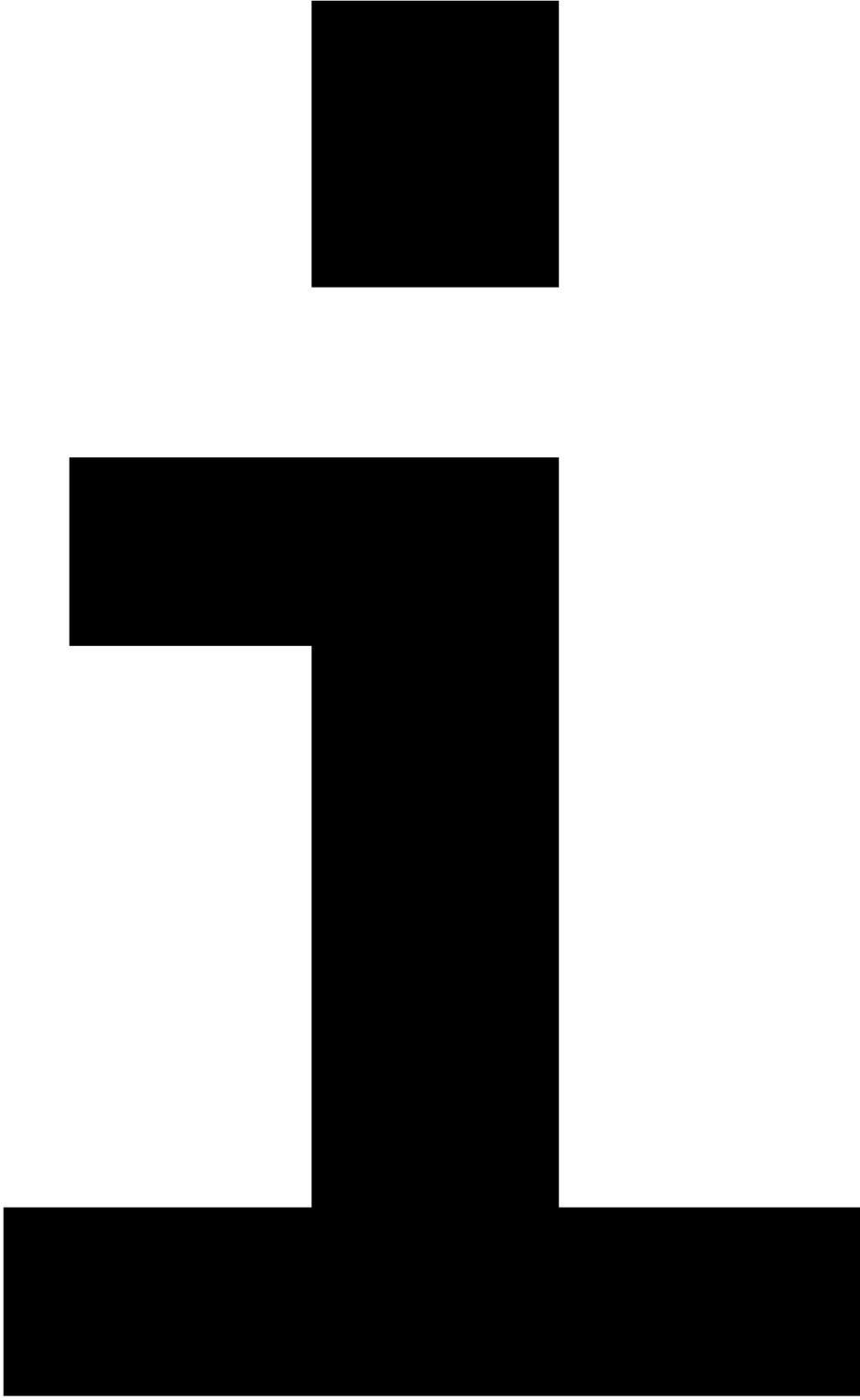
h



e

n

e



n

e

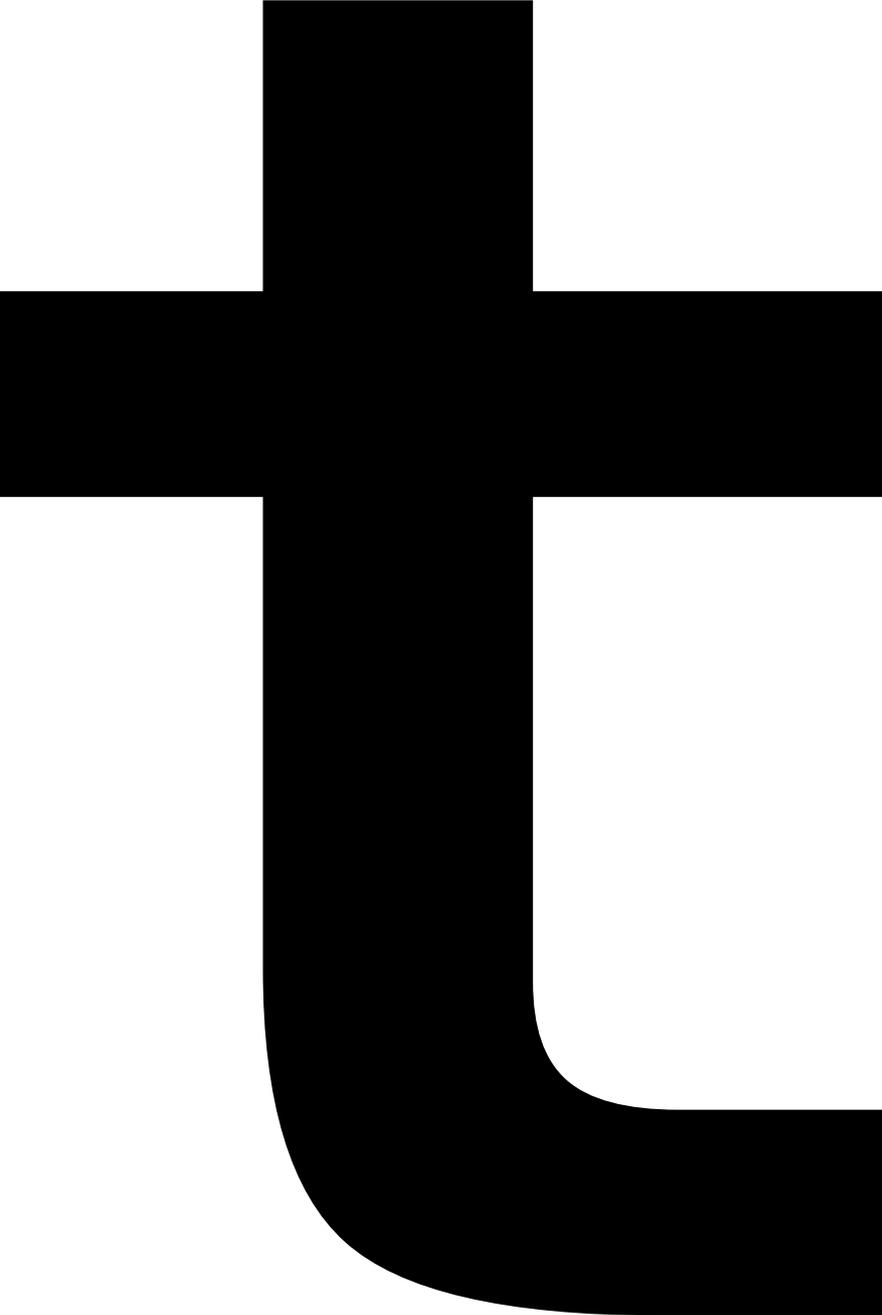
G

e

S

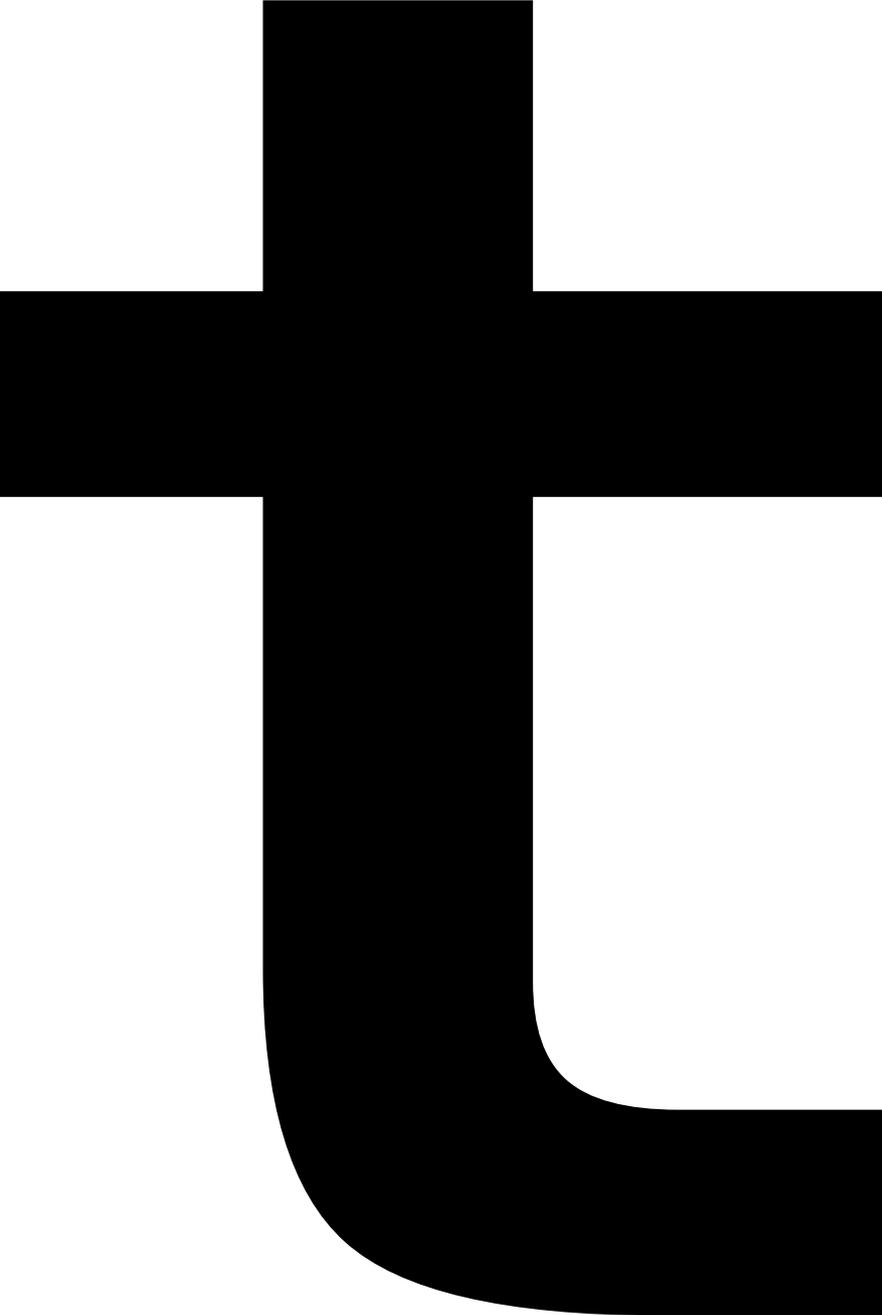
sa

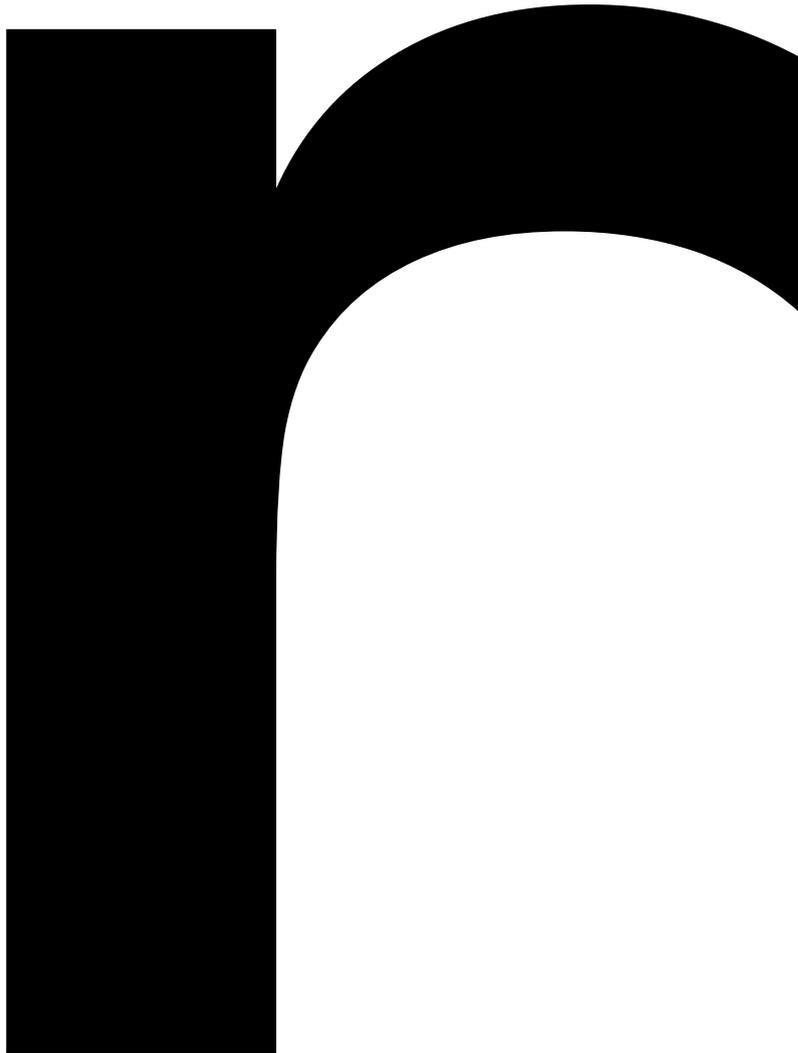
m

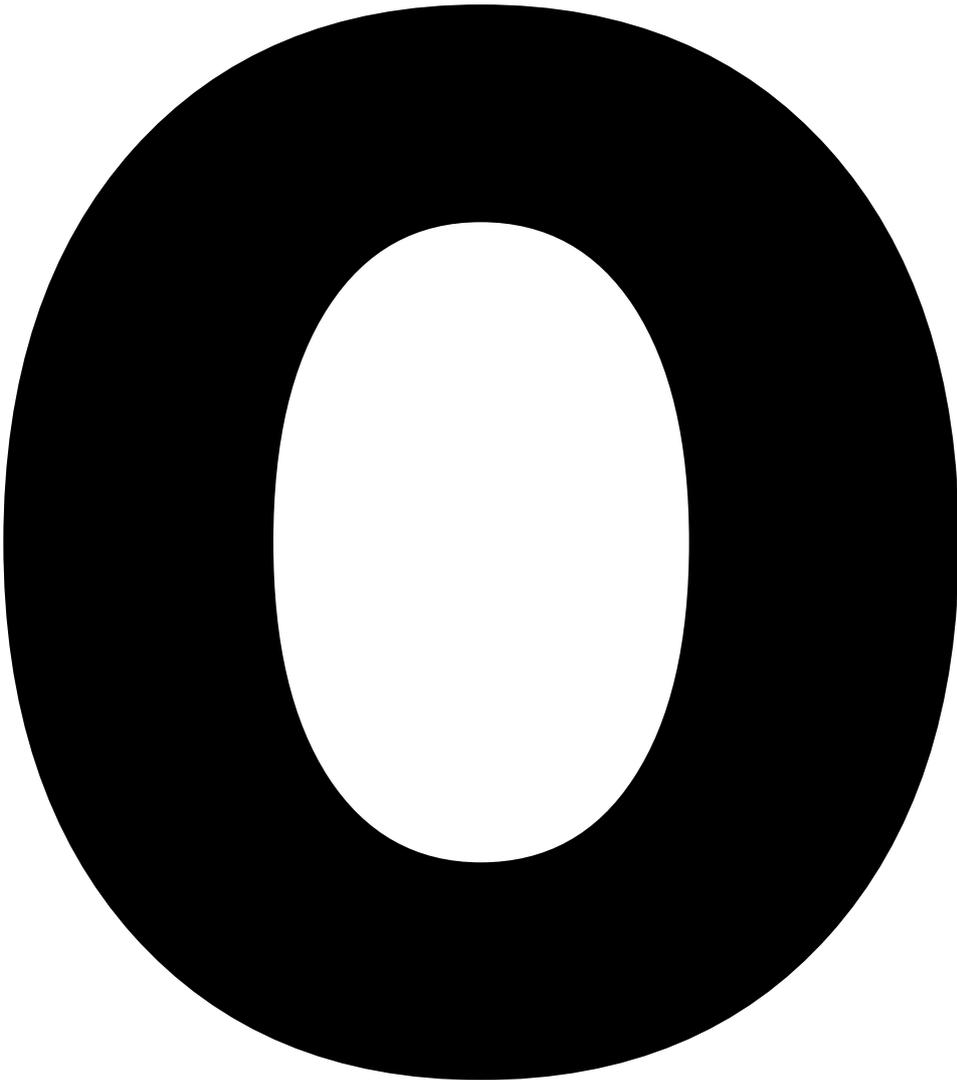




S

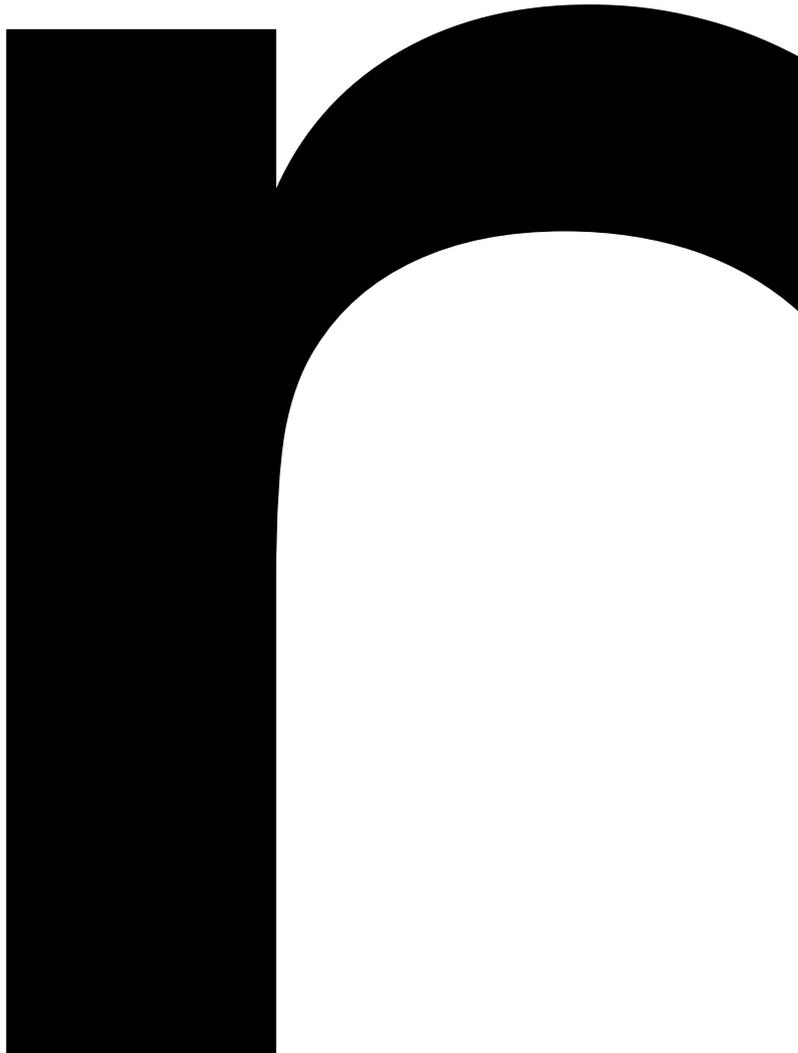


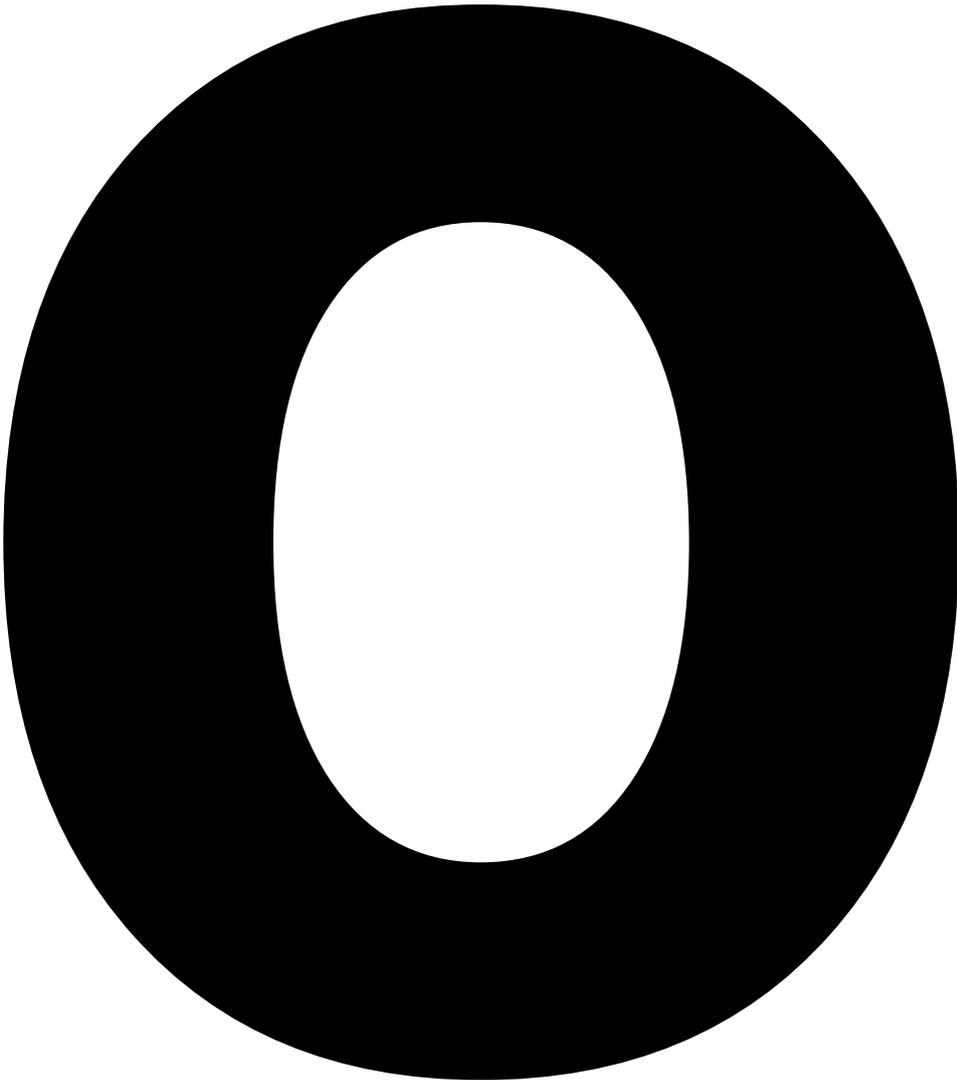




m

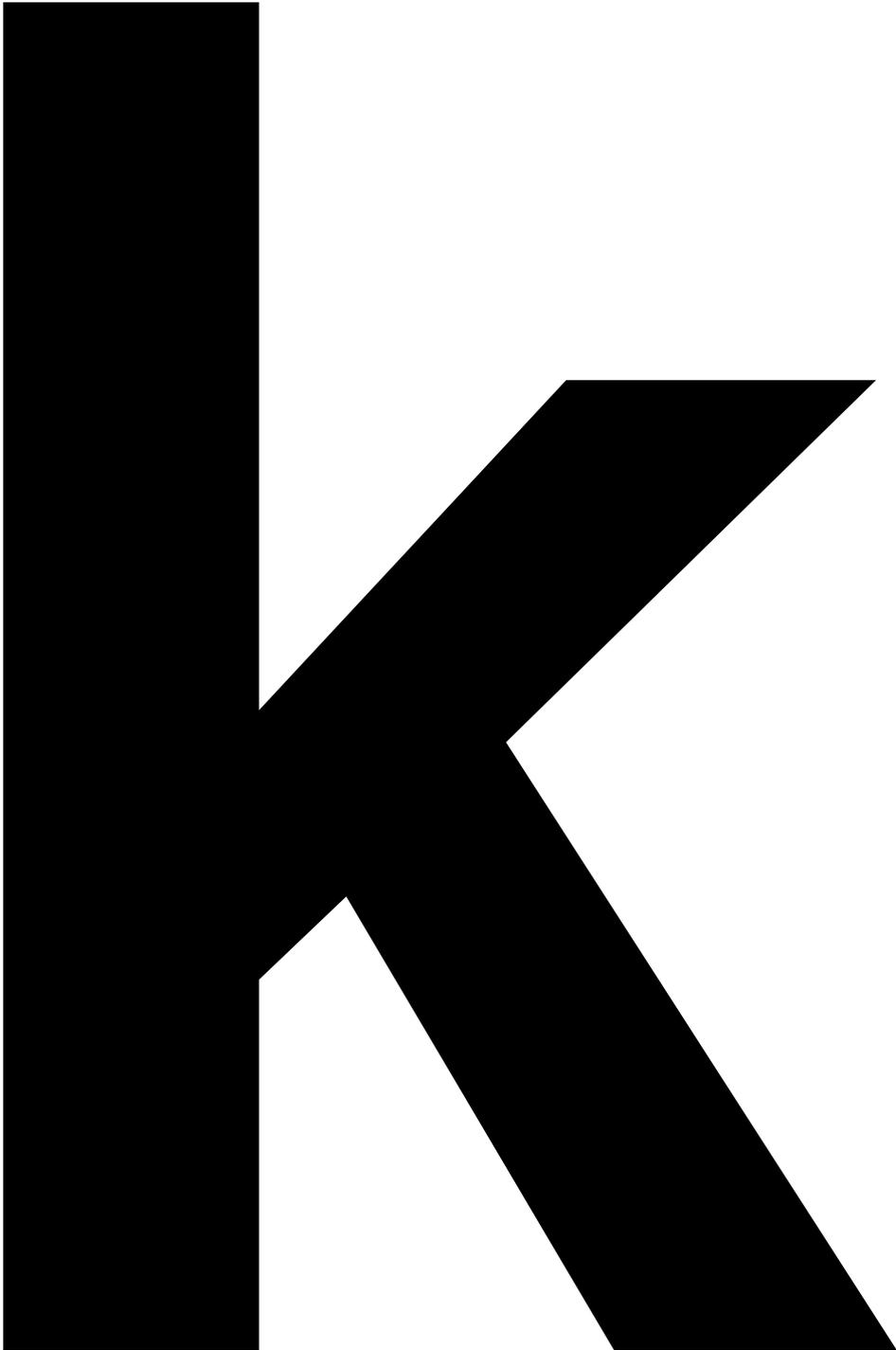
o

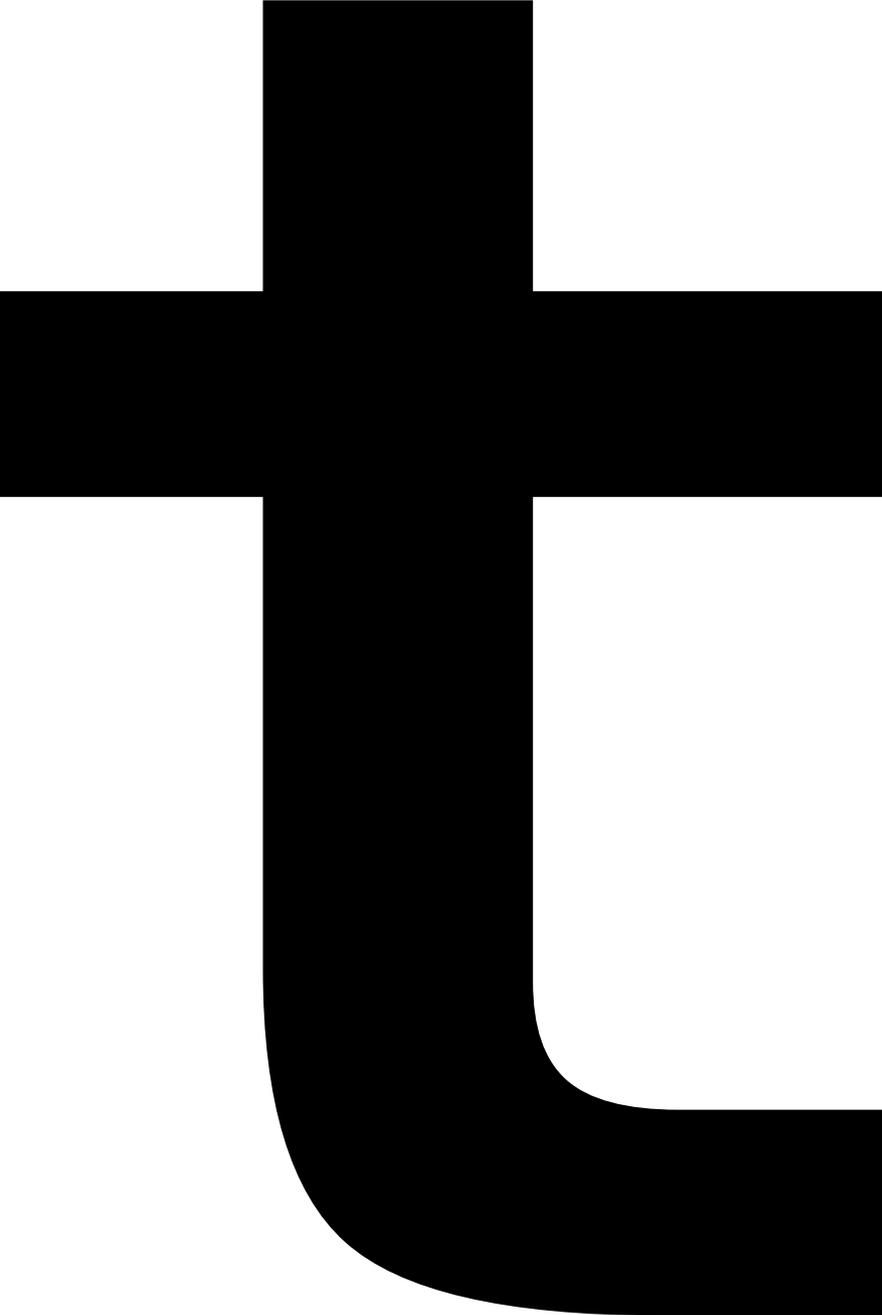


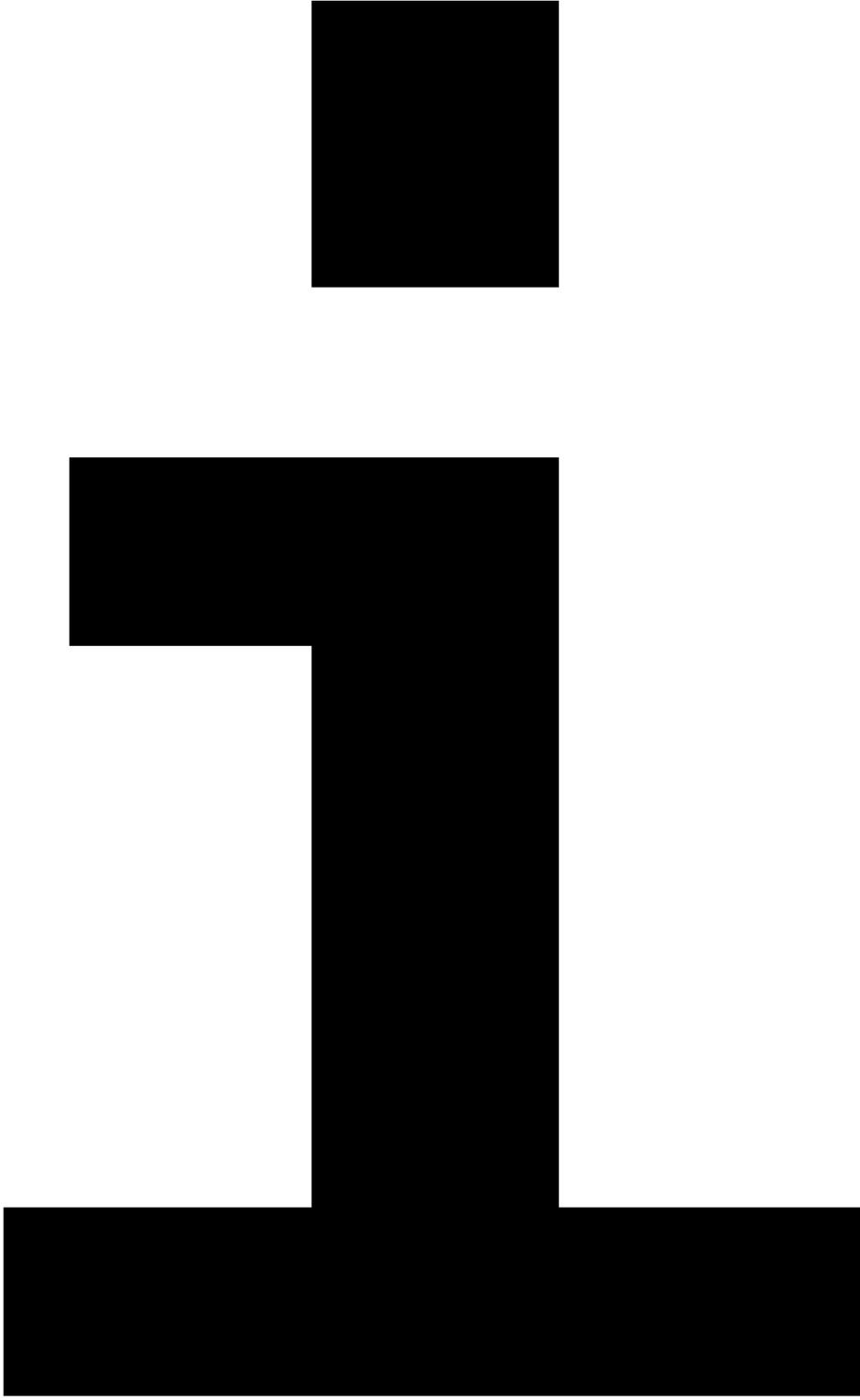


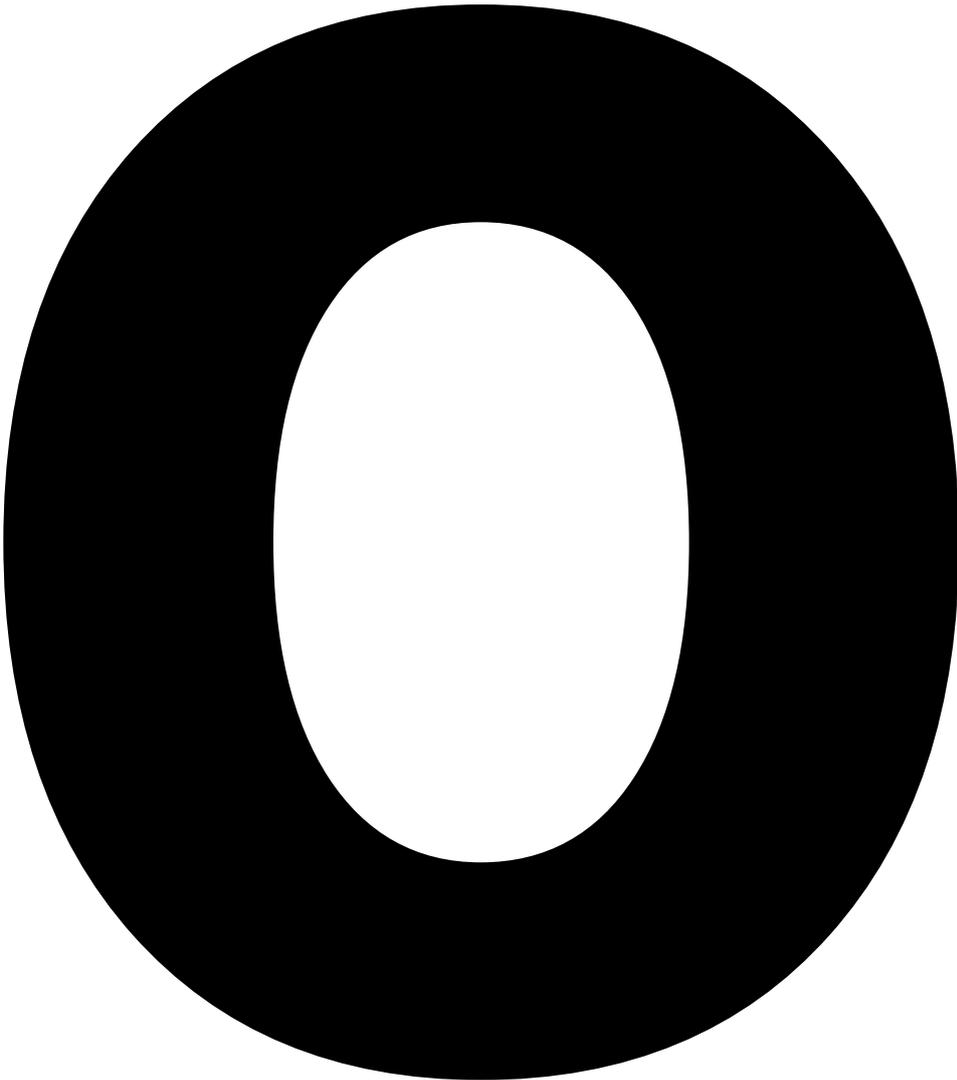
Q

u



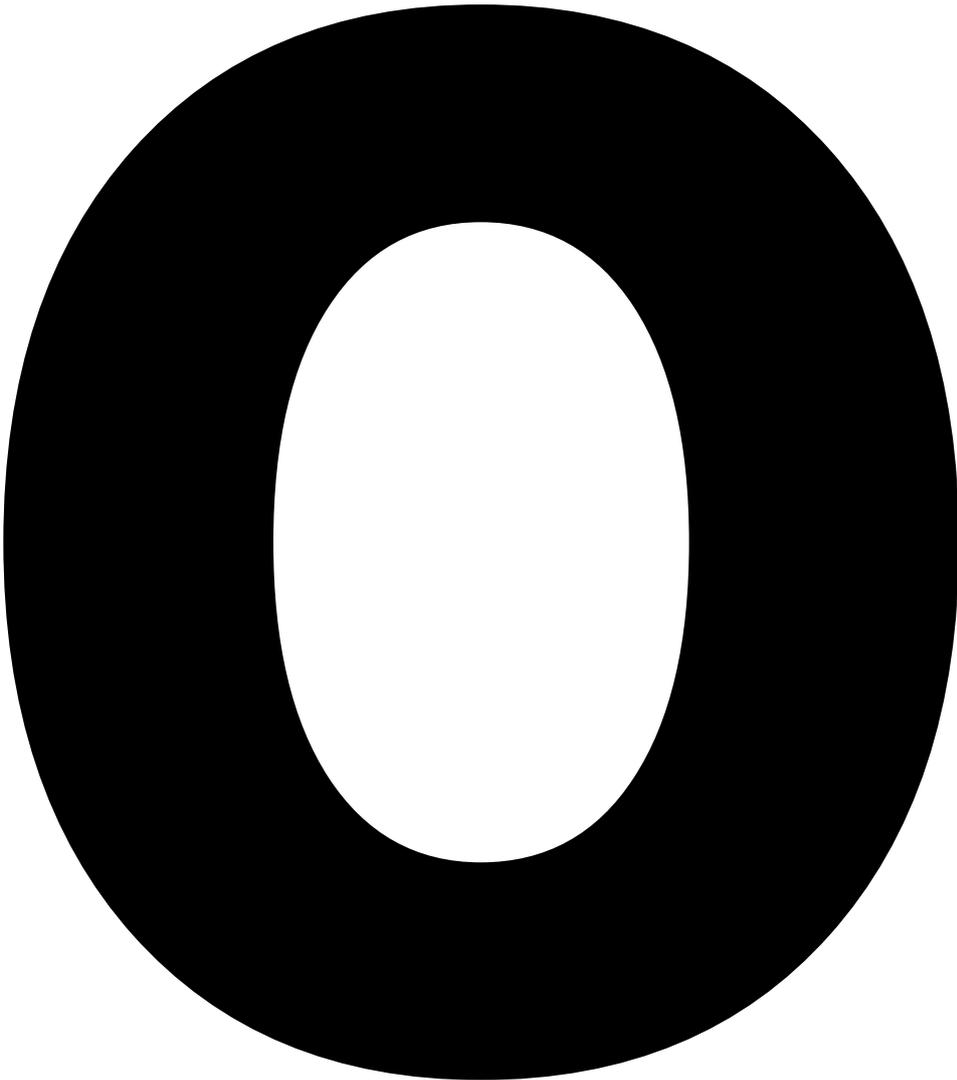






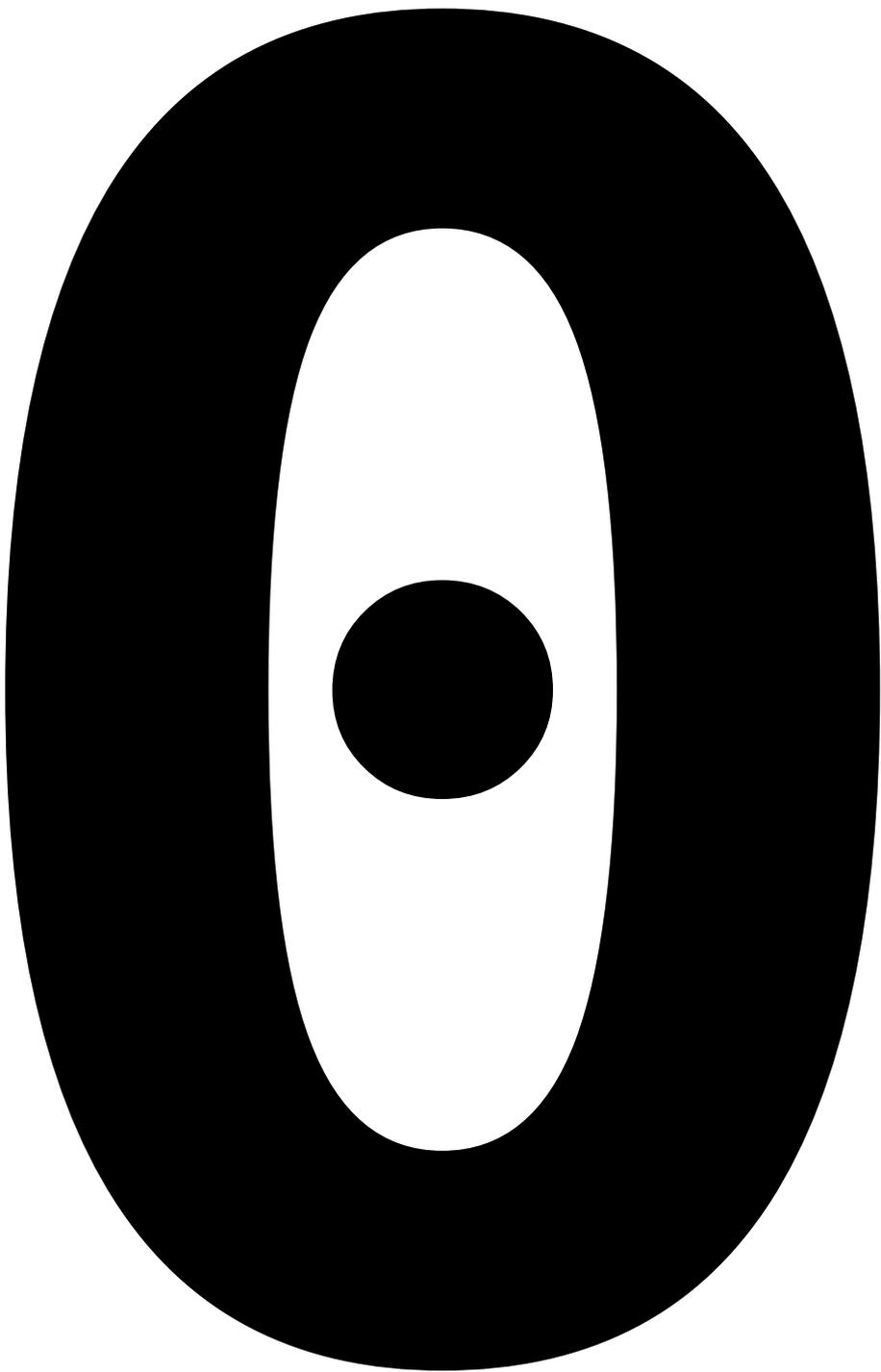
n

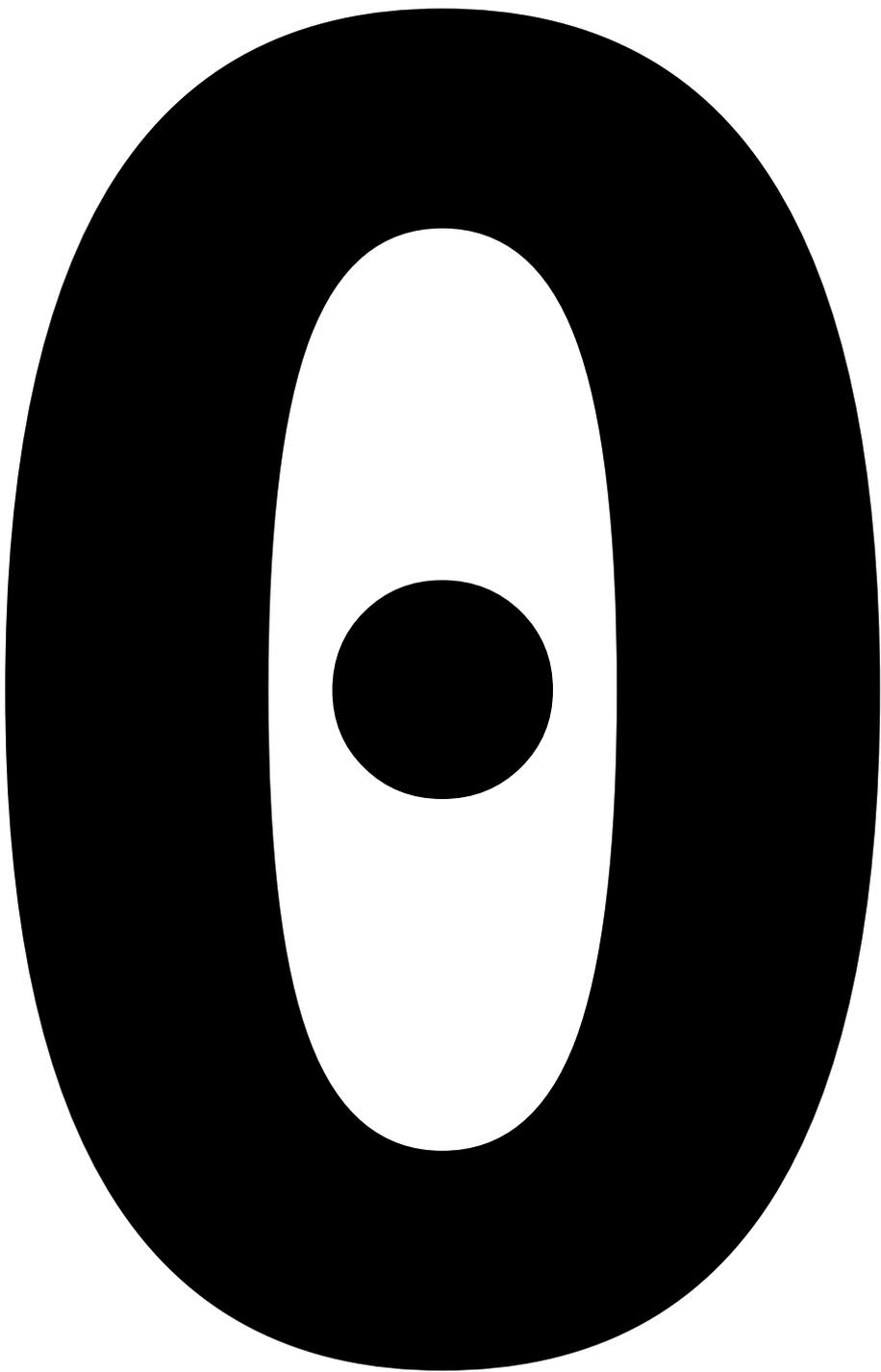
V

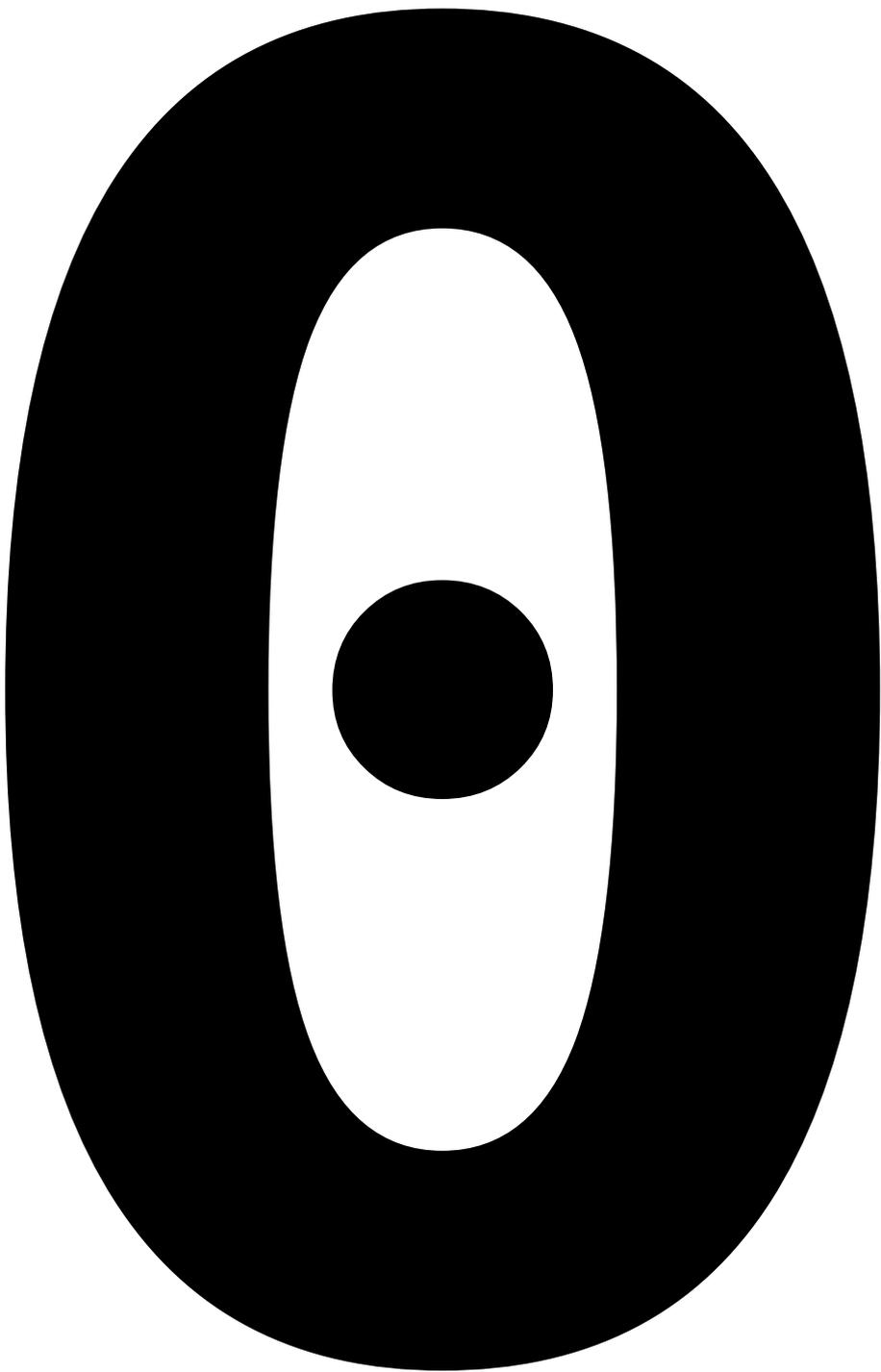


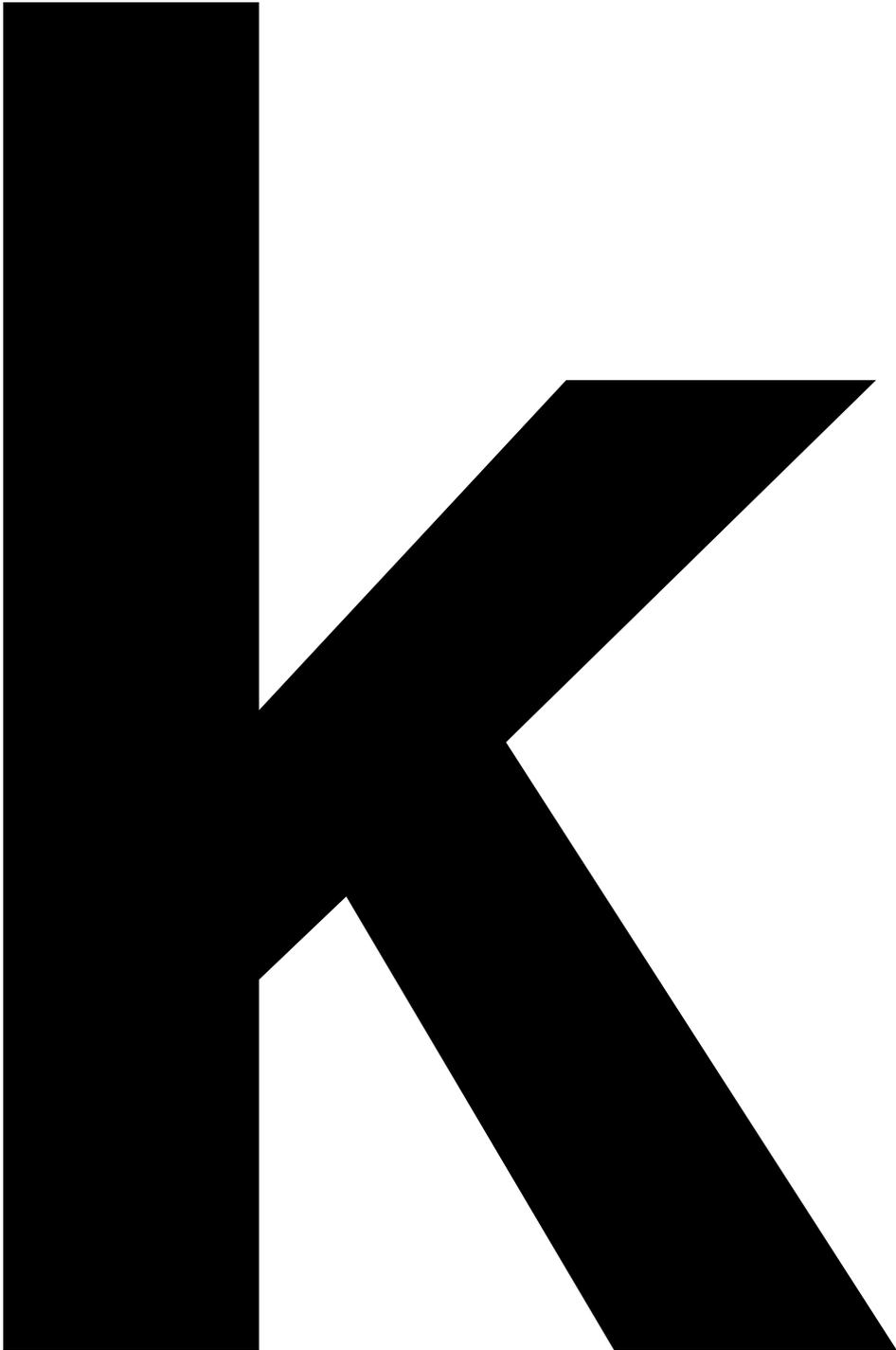
n

2





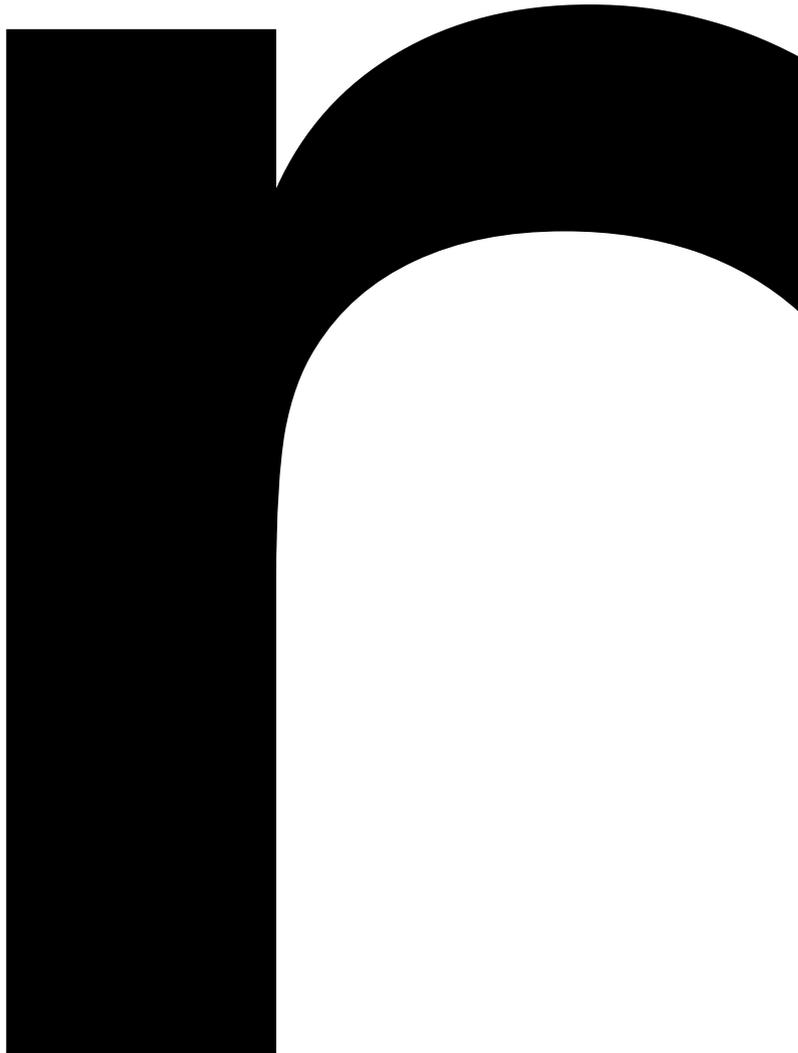


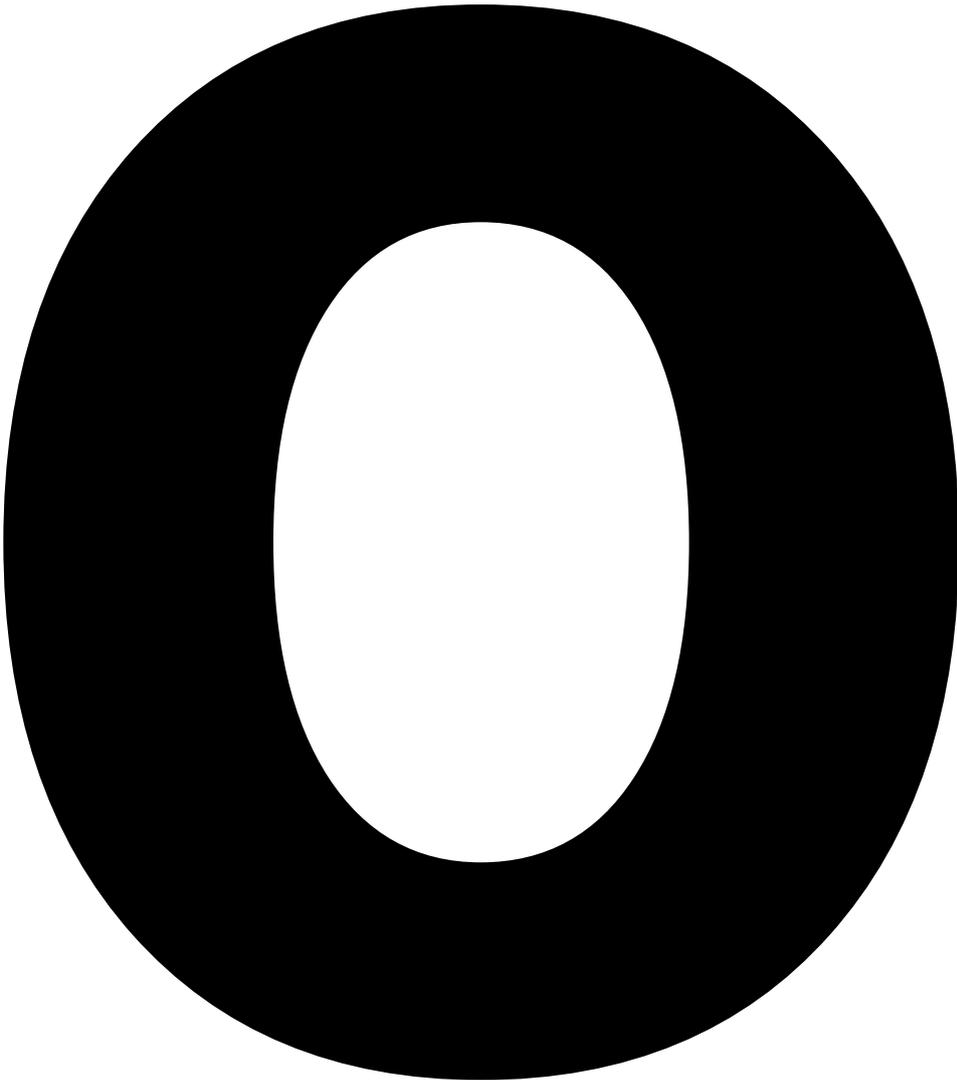


w

h

o

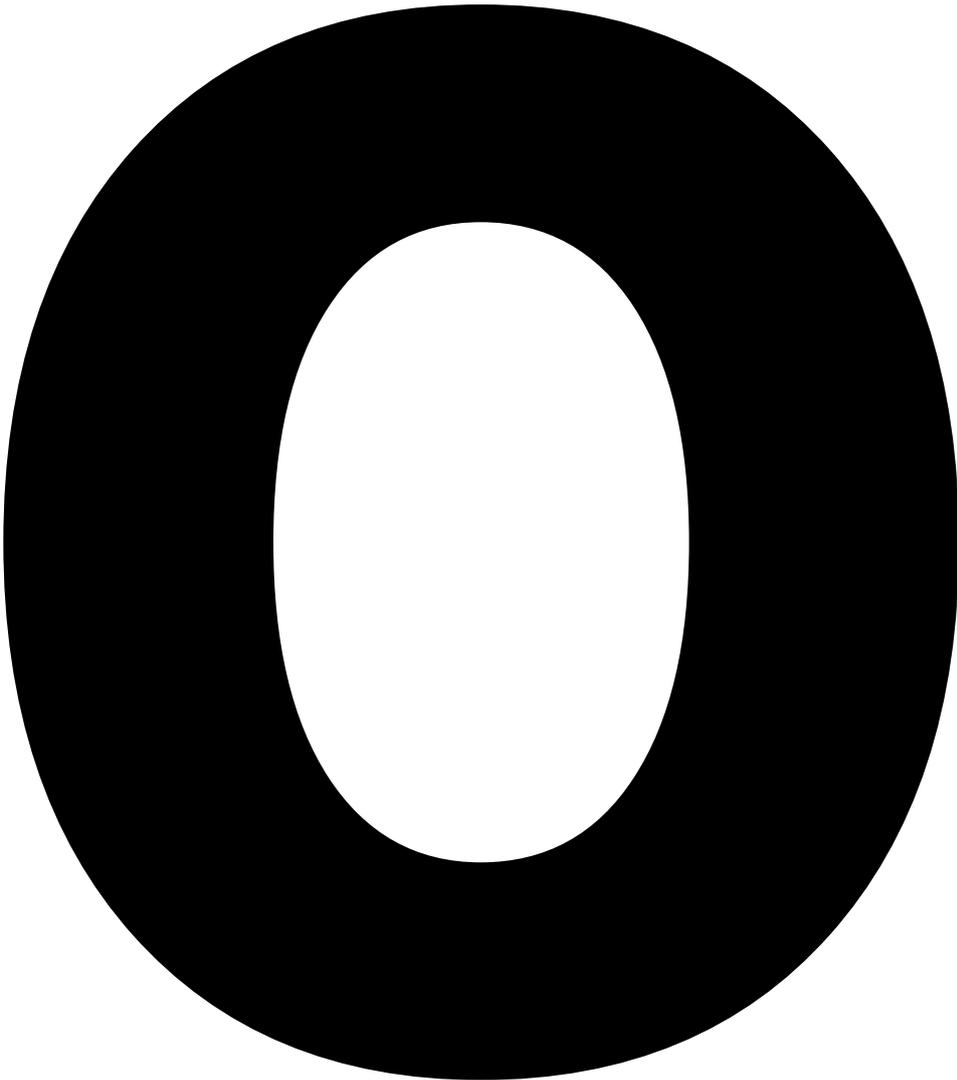




m

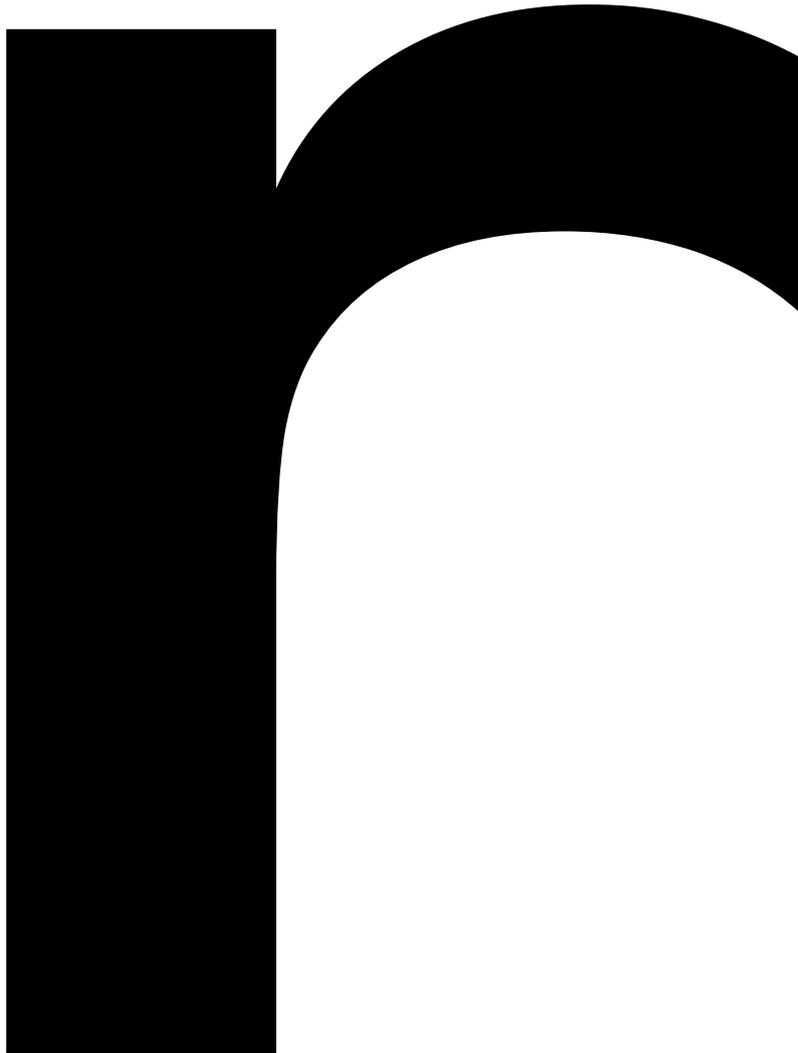
2

S



J

sa



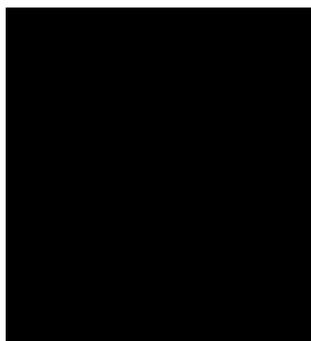
o

sa

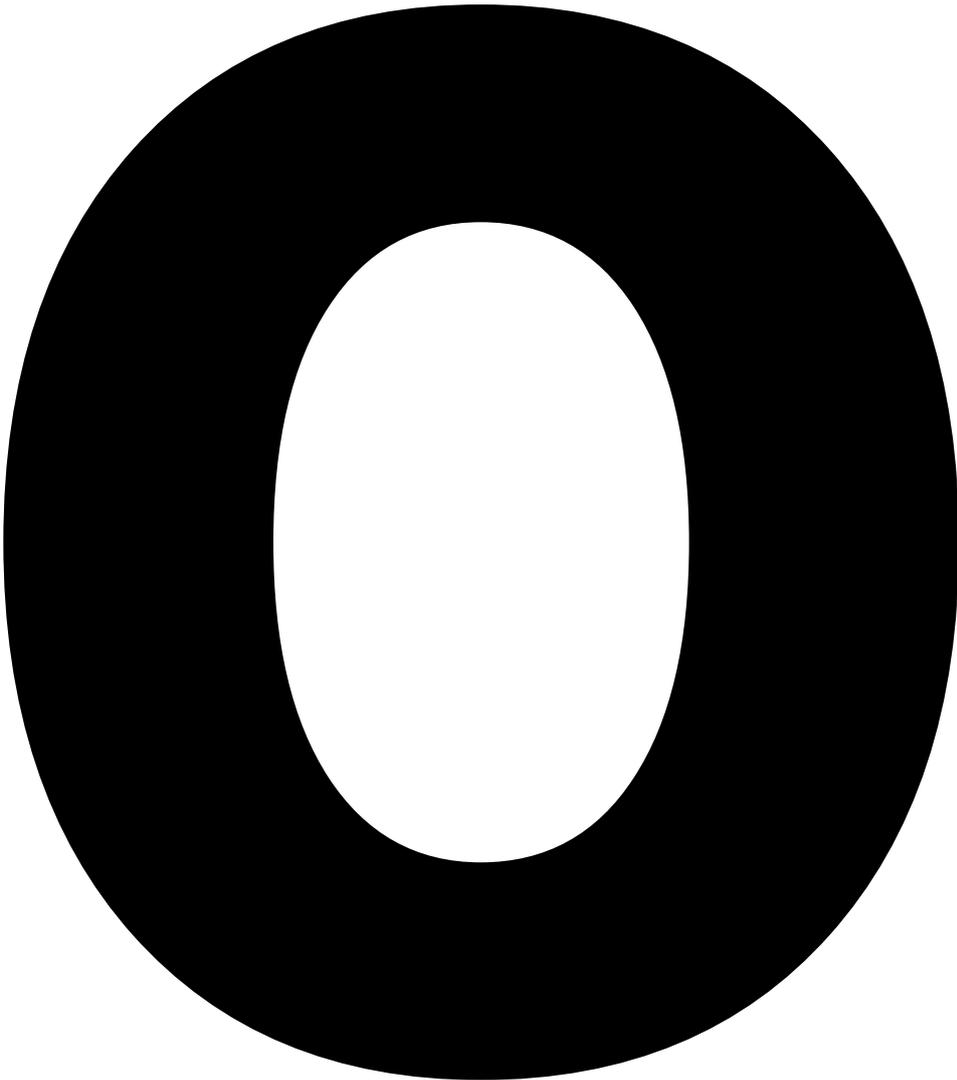
n

e

J

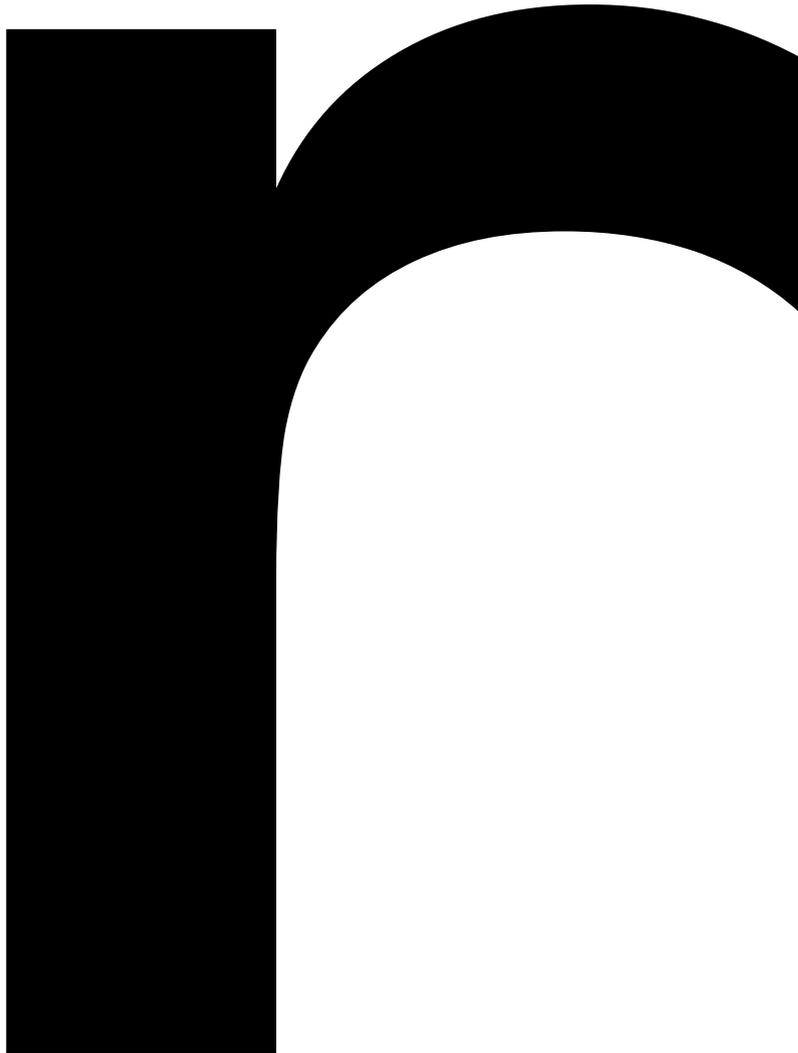


S

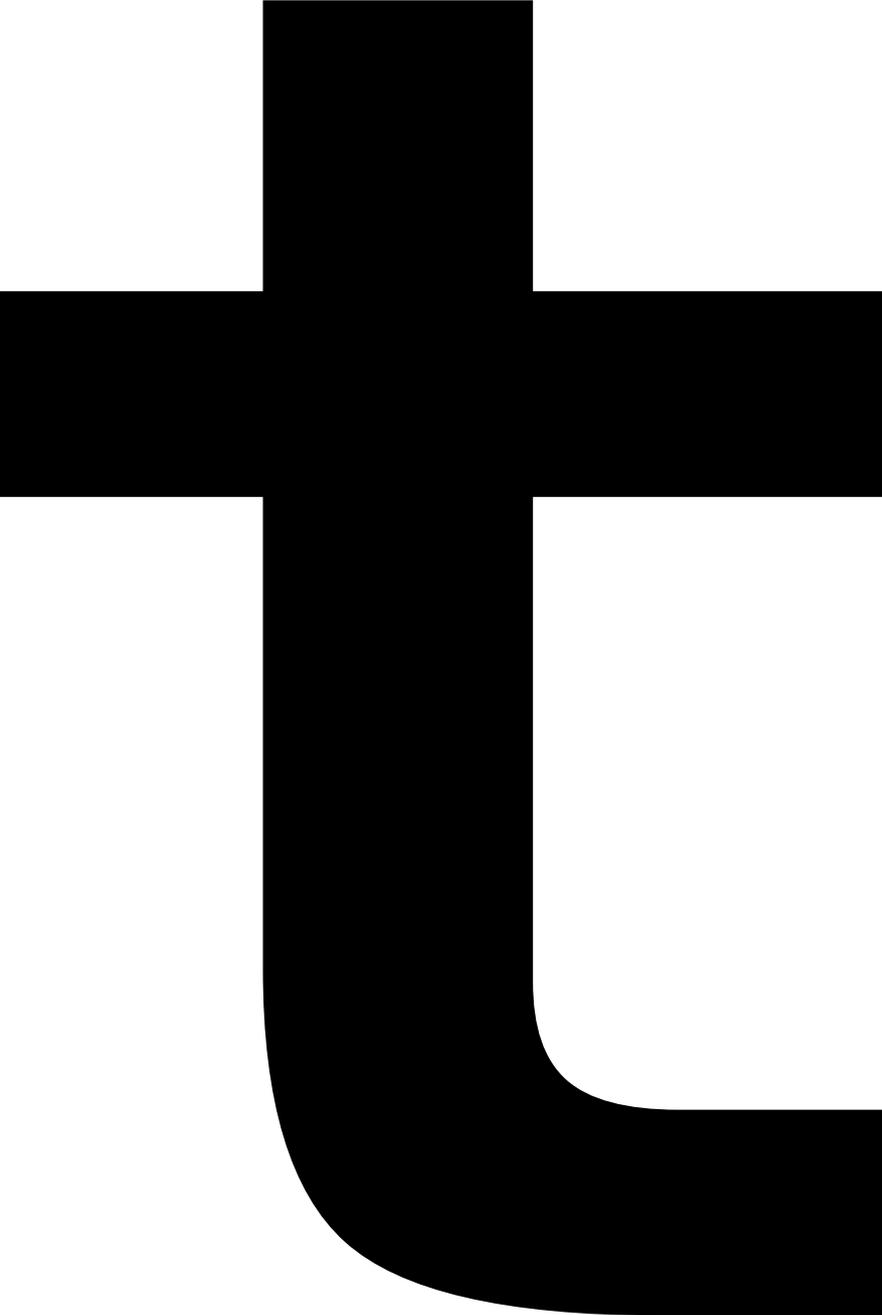


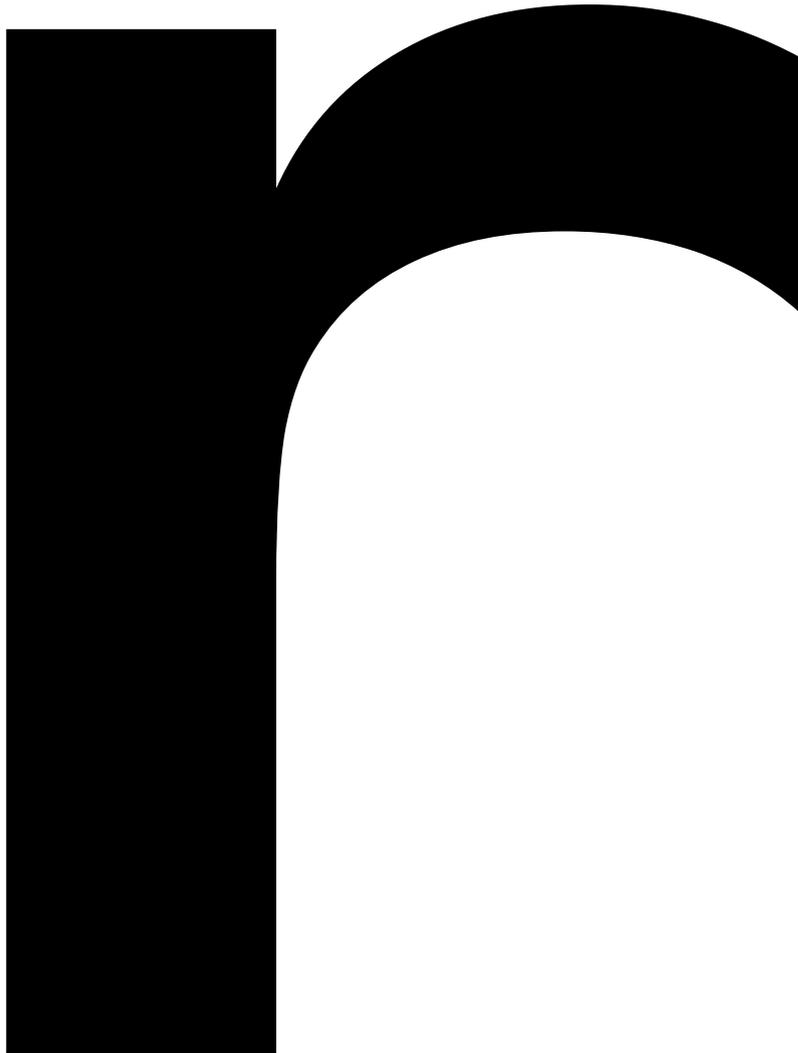
J

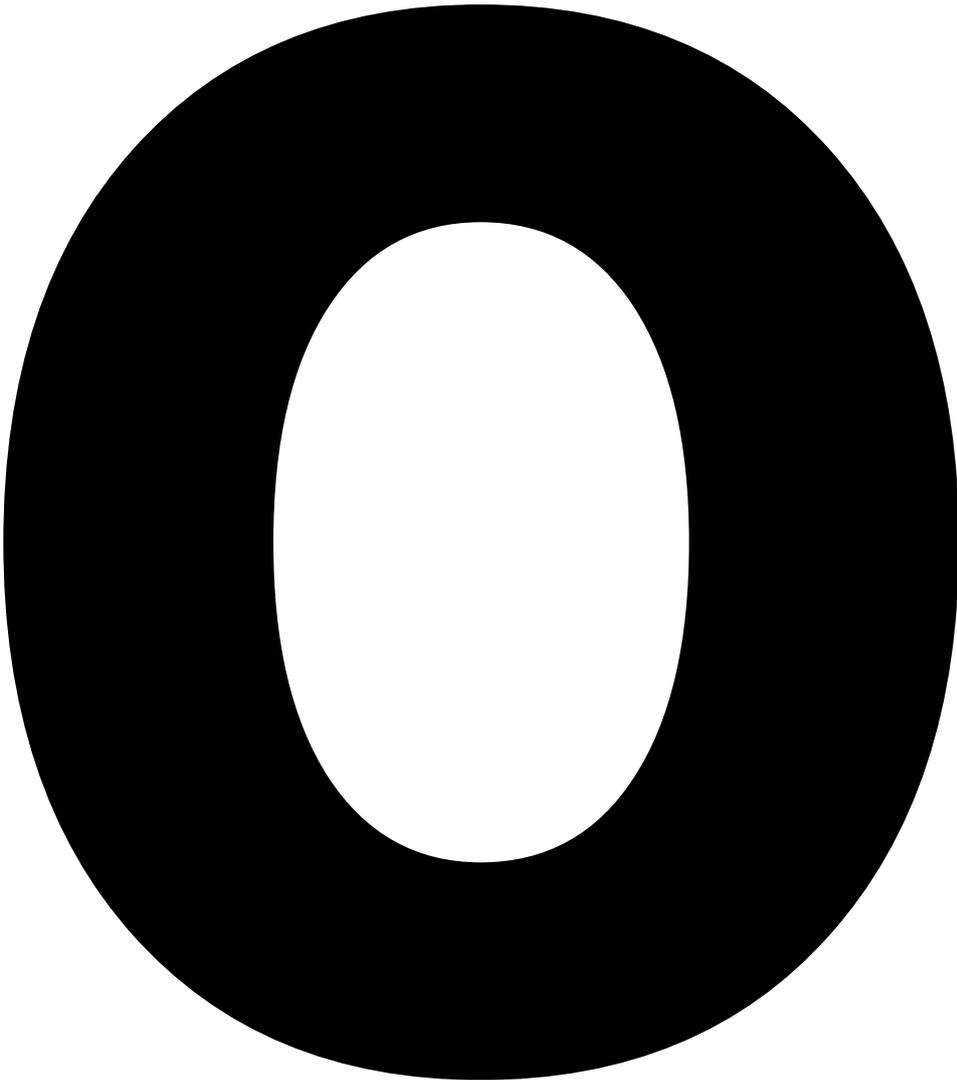
sa



S

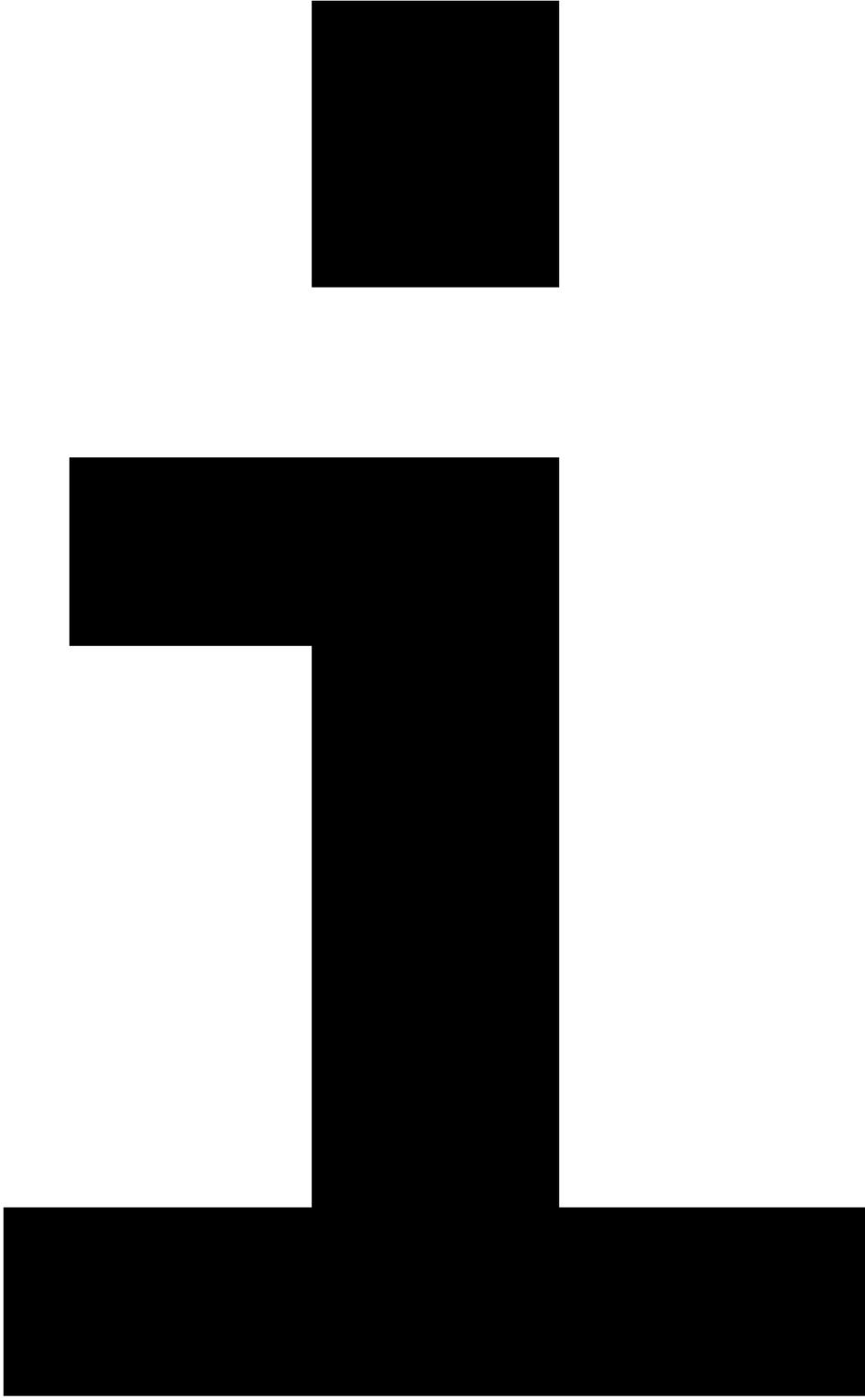


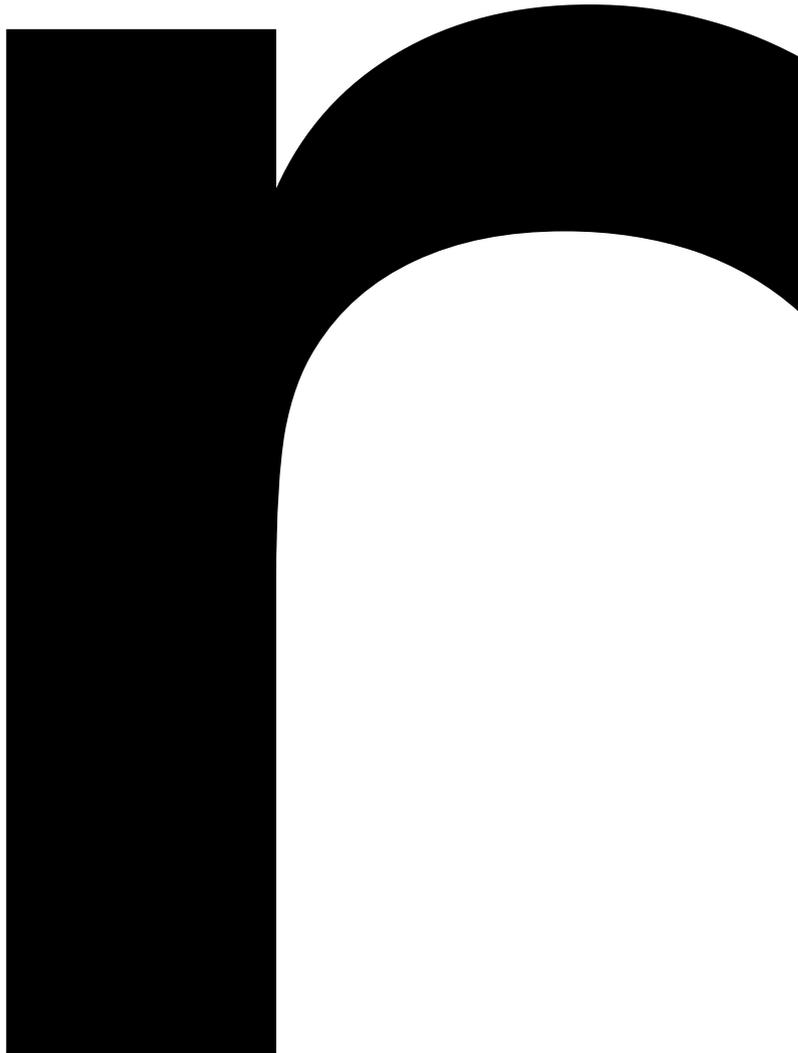




m

w



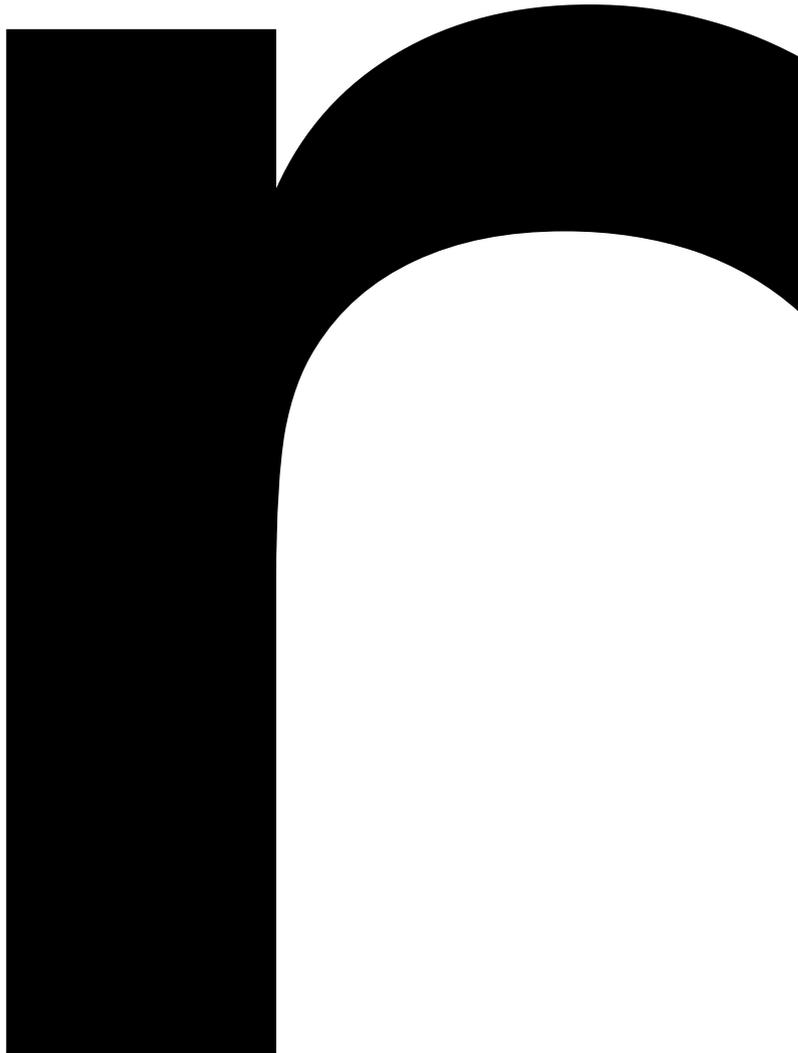


Q

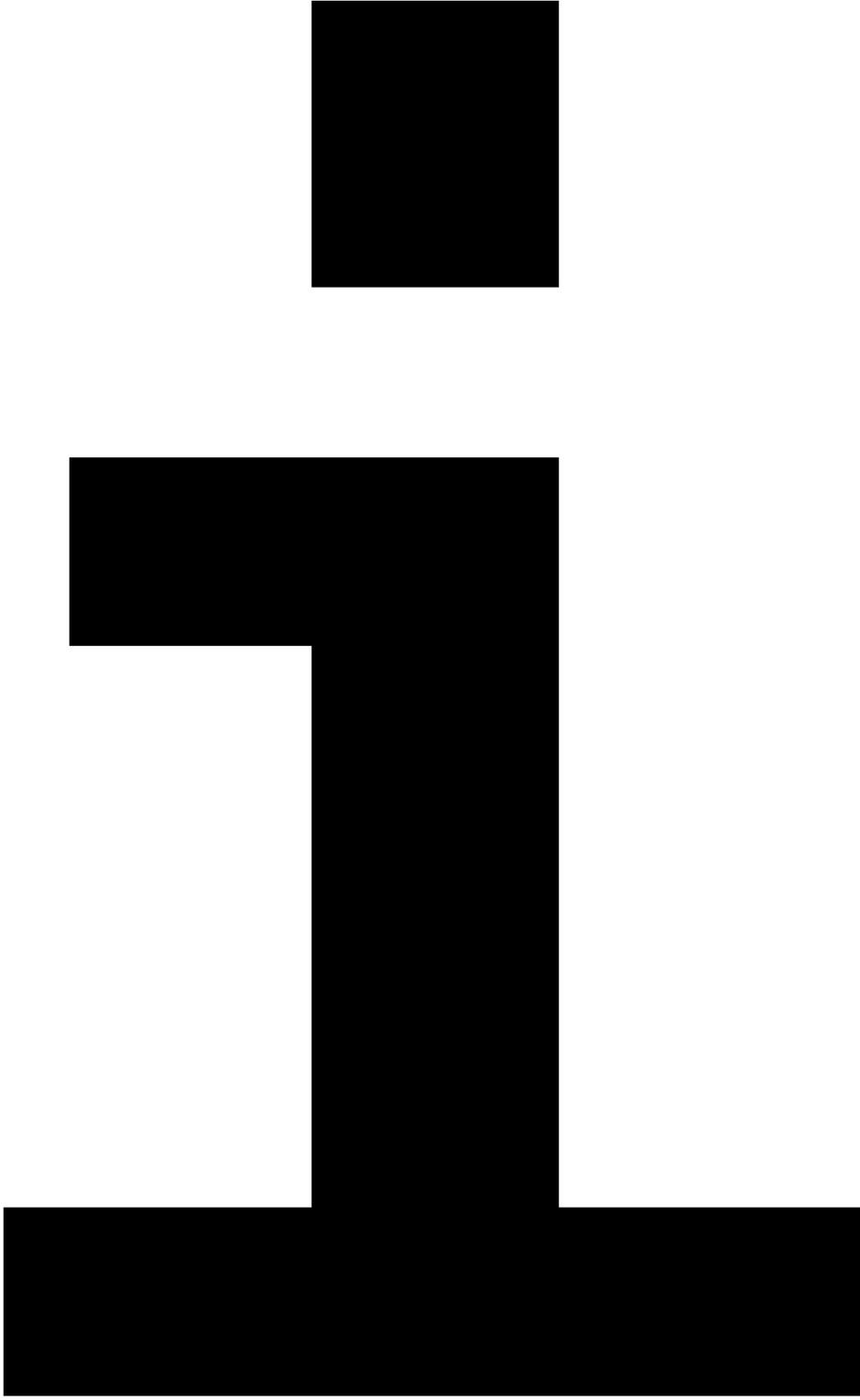
sa

10

e

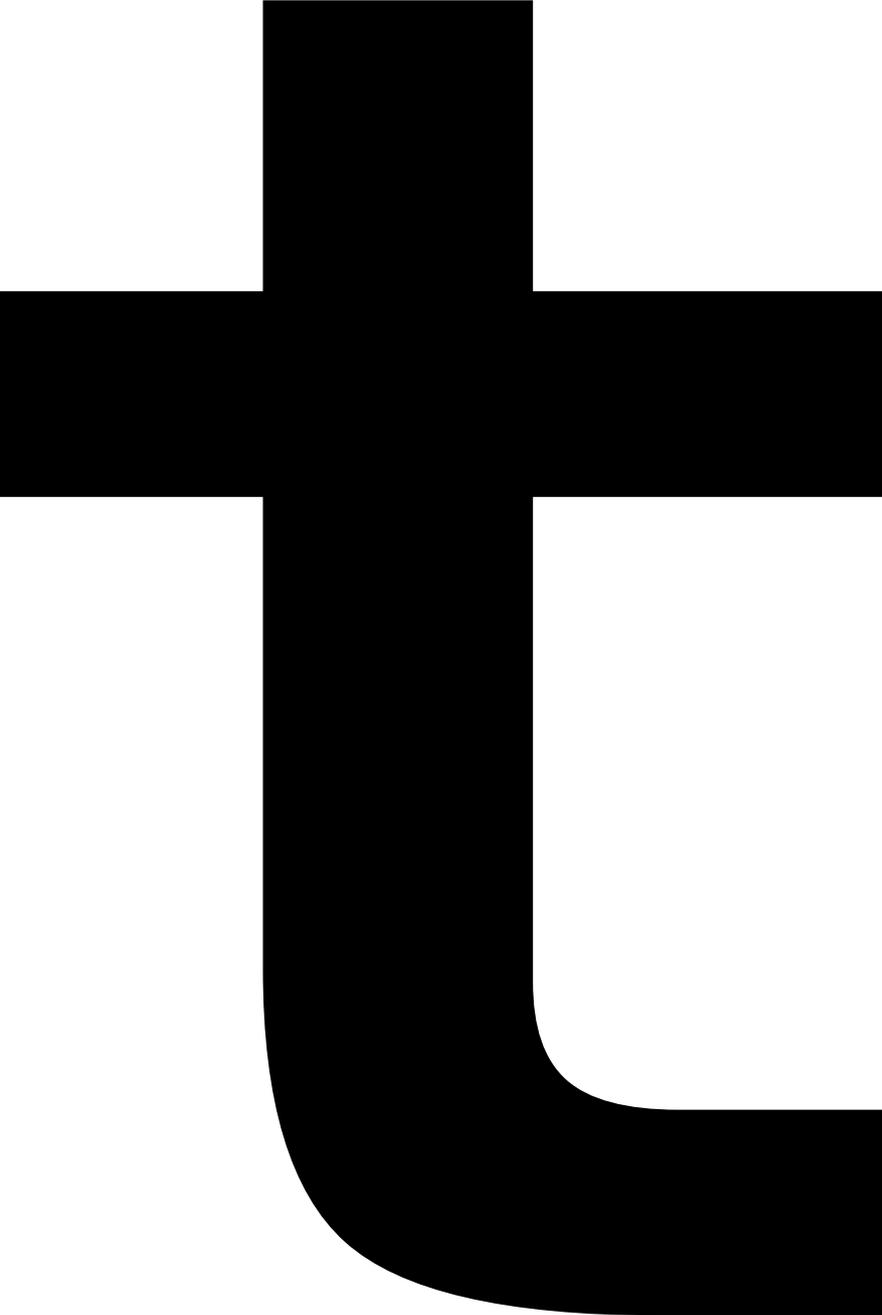


n



C

h

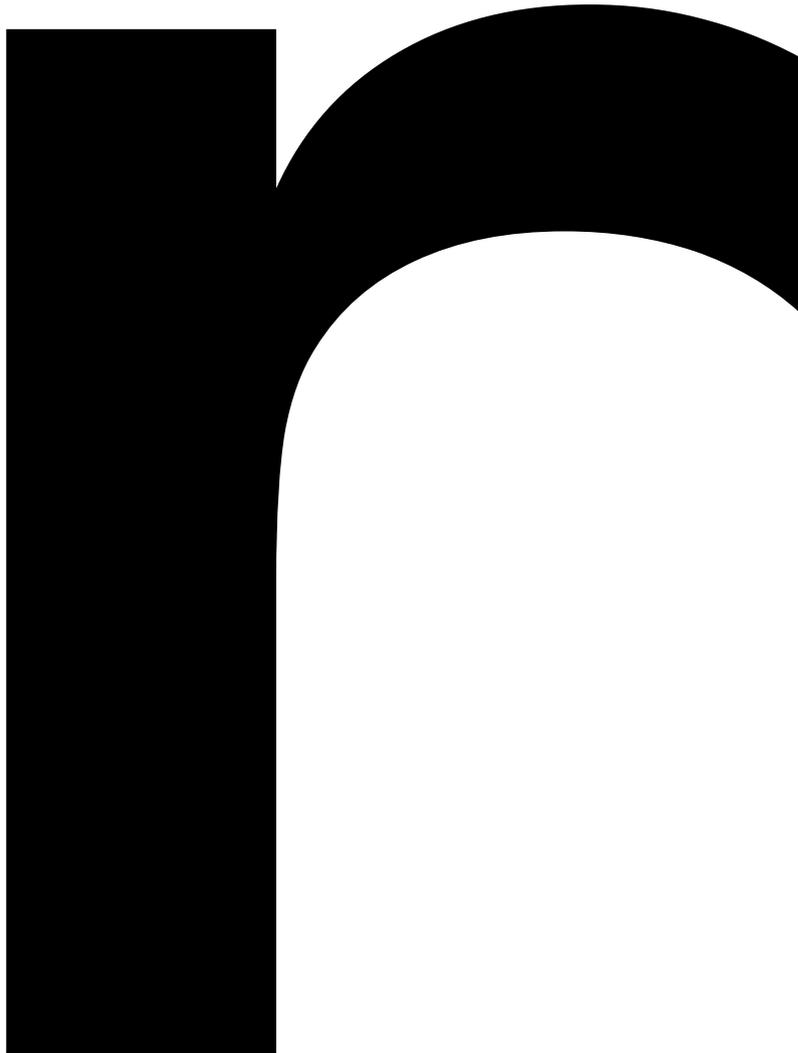


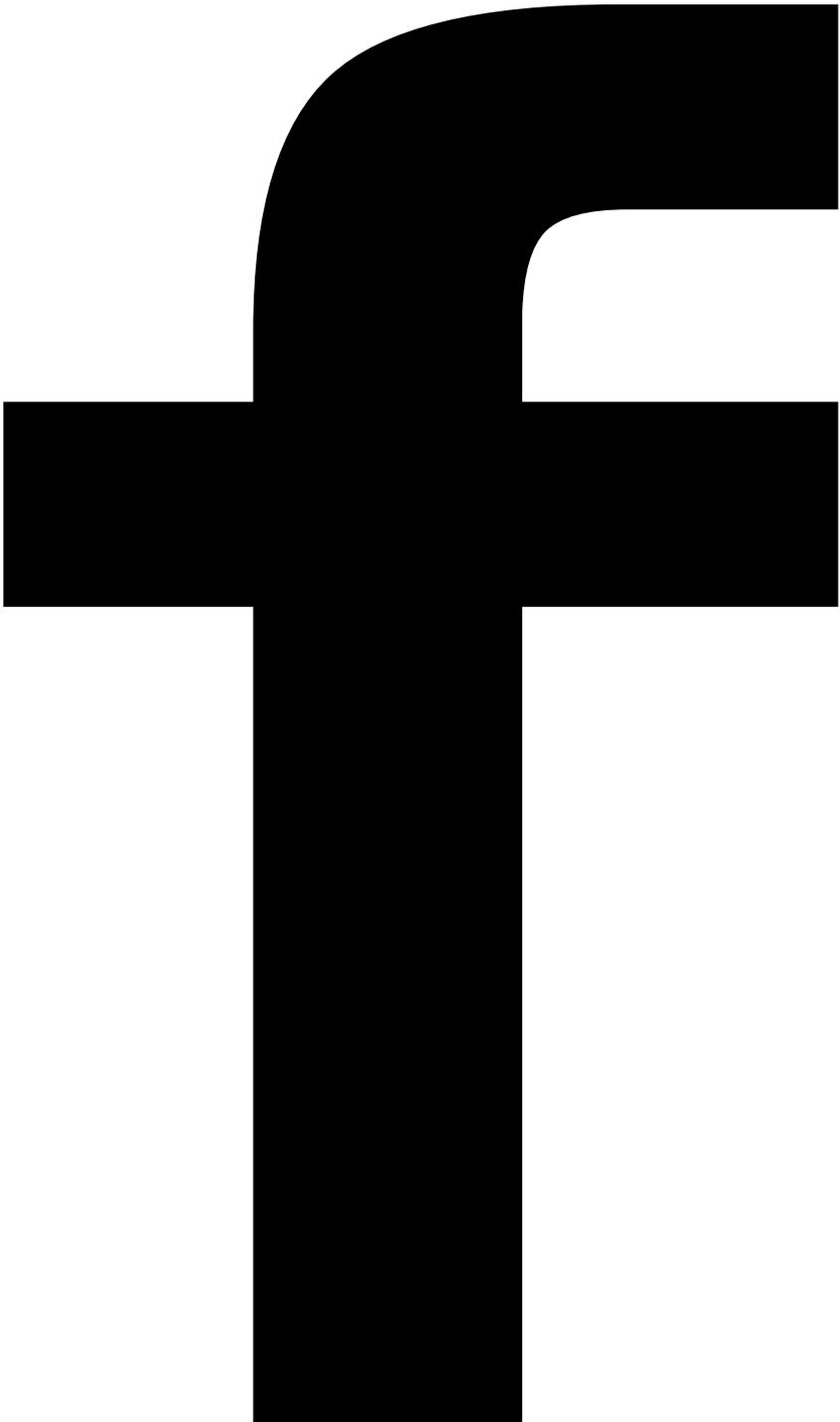
10

e

Q

sa

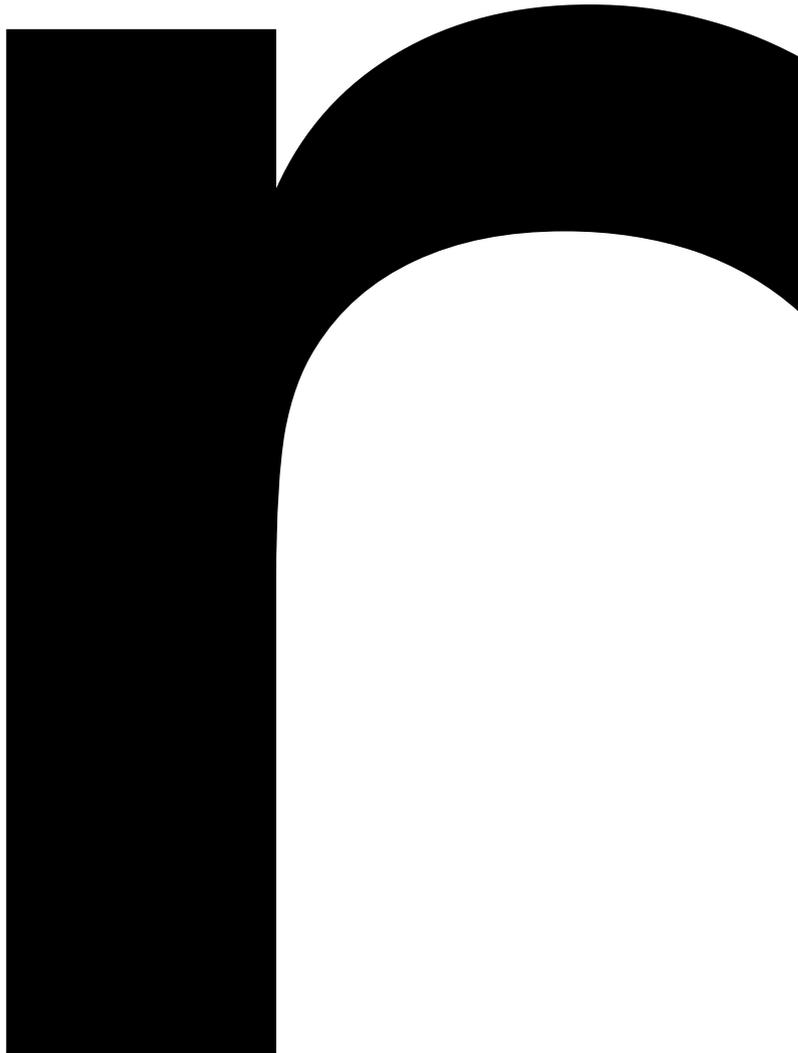




S

Q

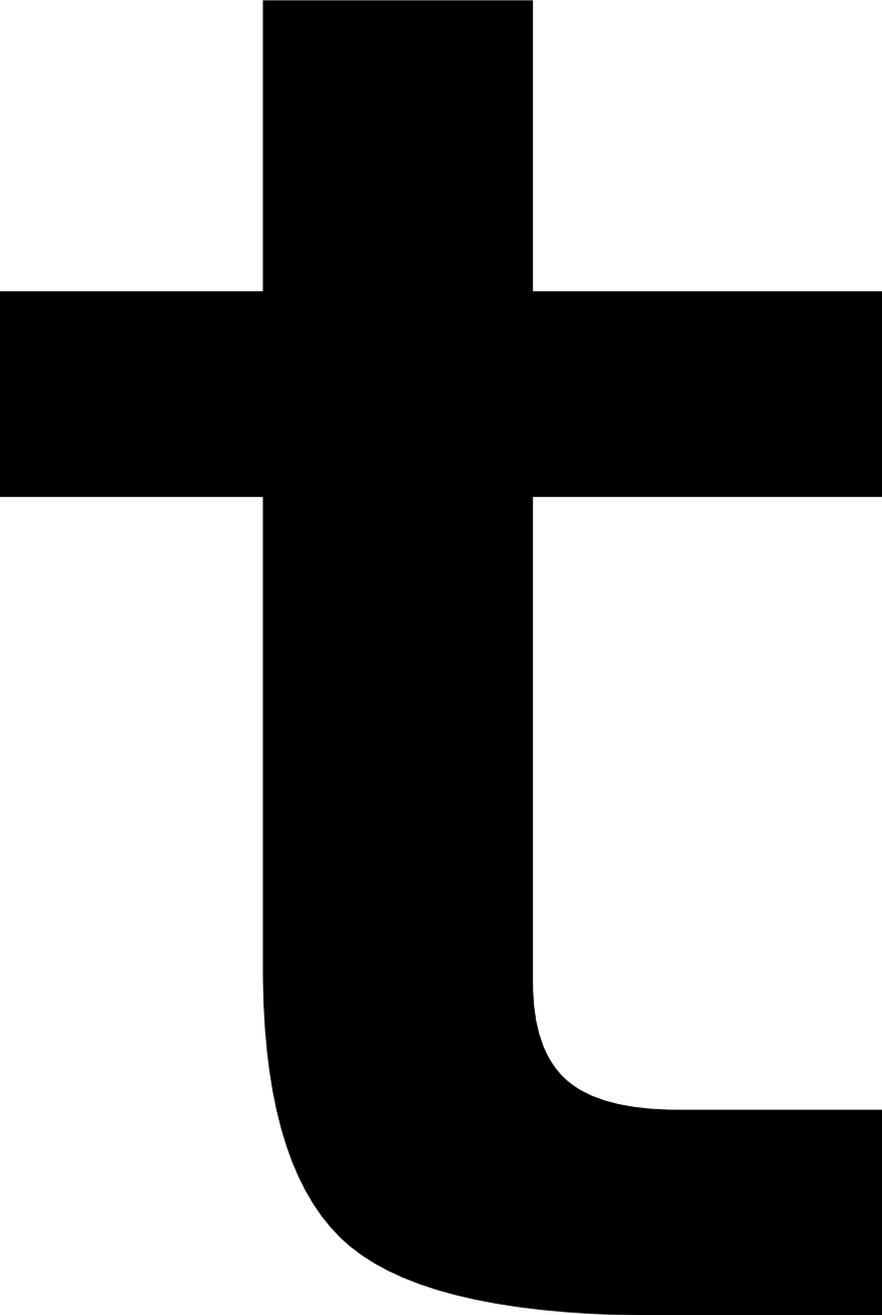
e



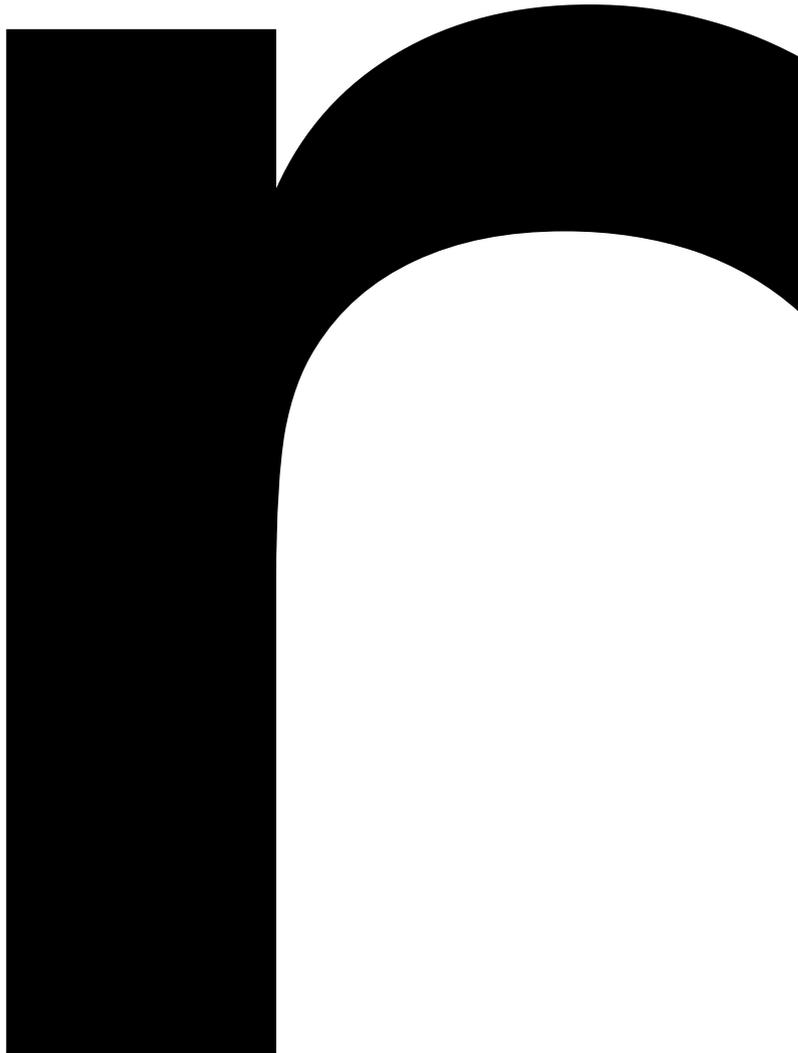
e

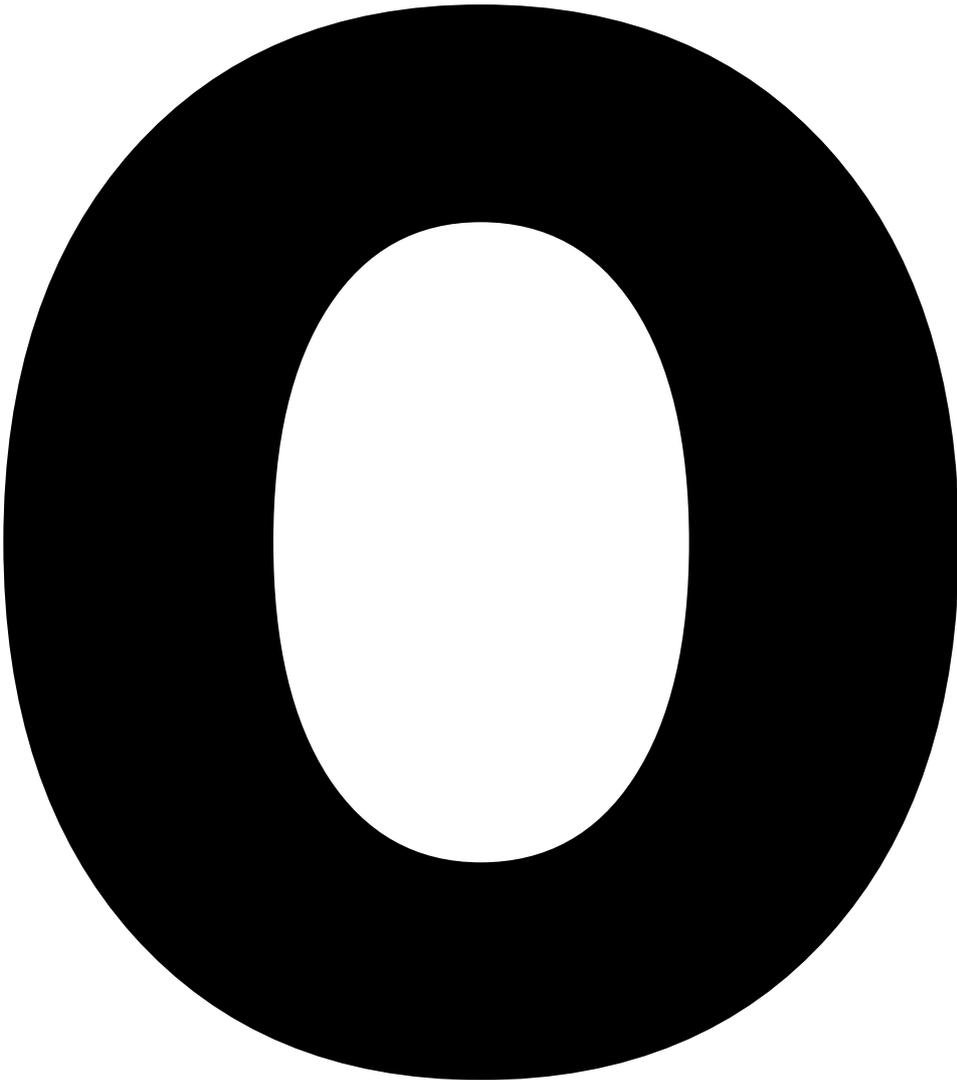
C

h



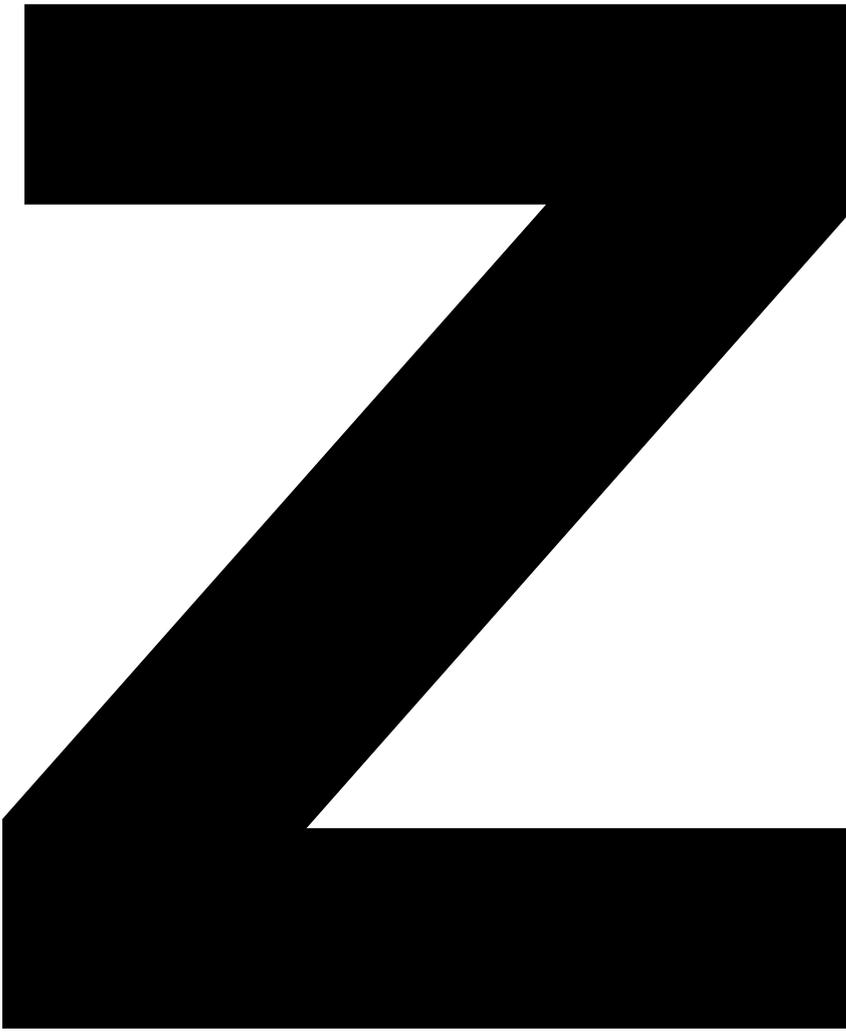
o

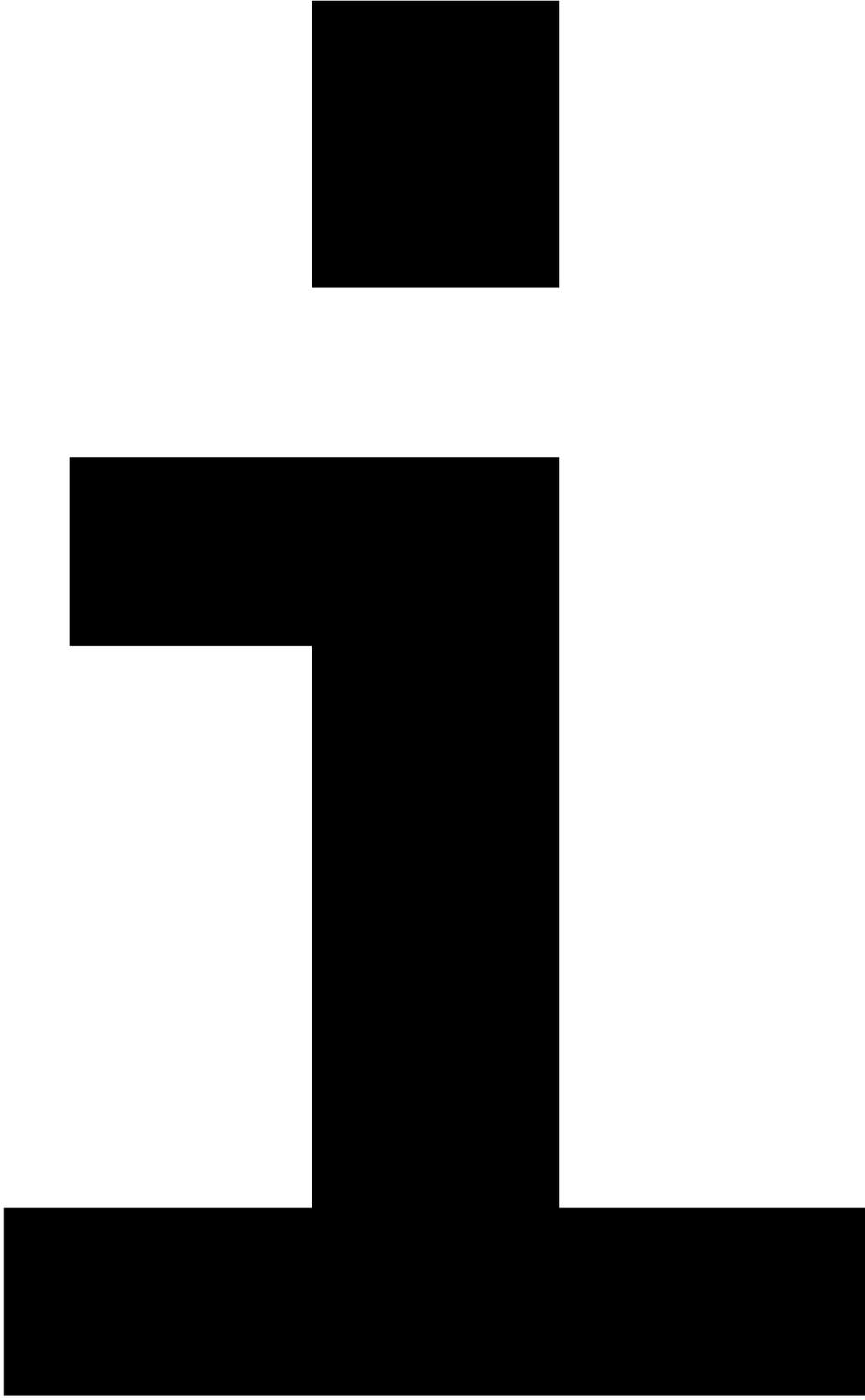




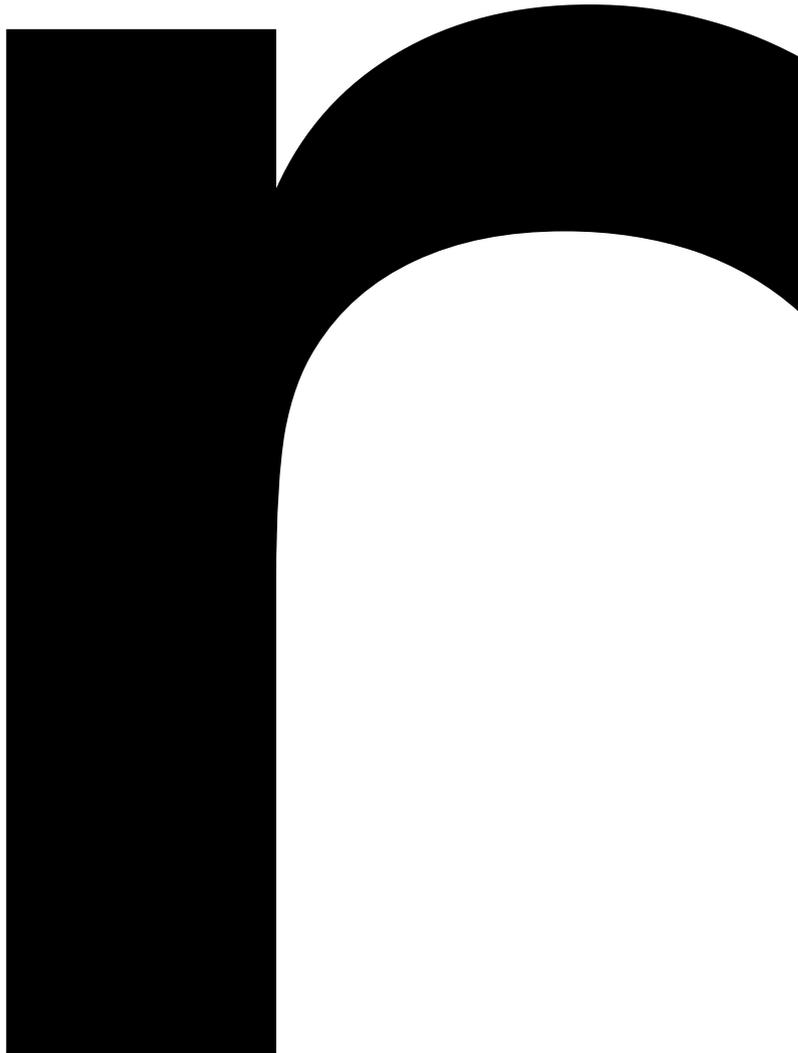
Q

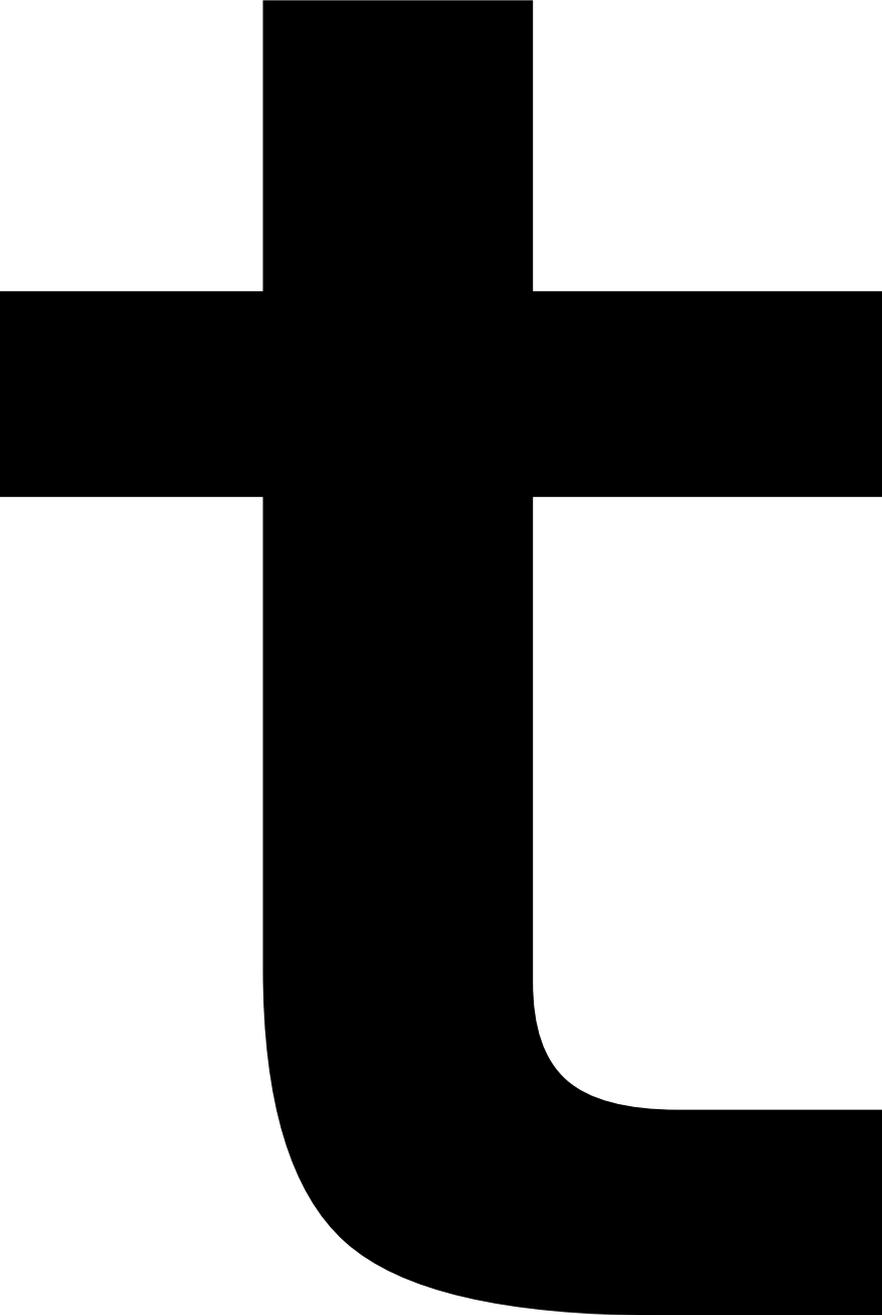
u





e





u

n

Q

Q

e

S

w

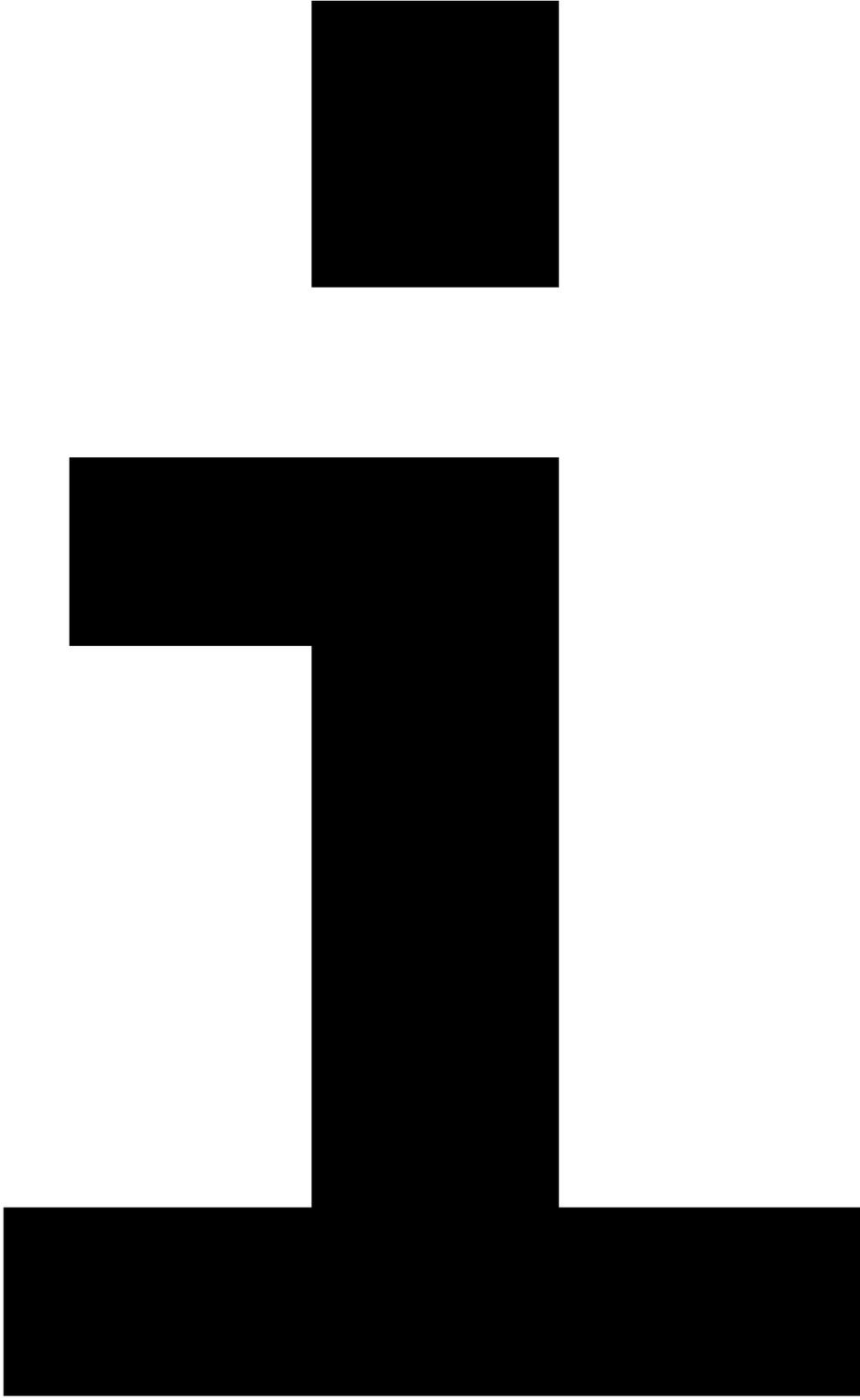
e

Q

e

n

S



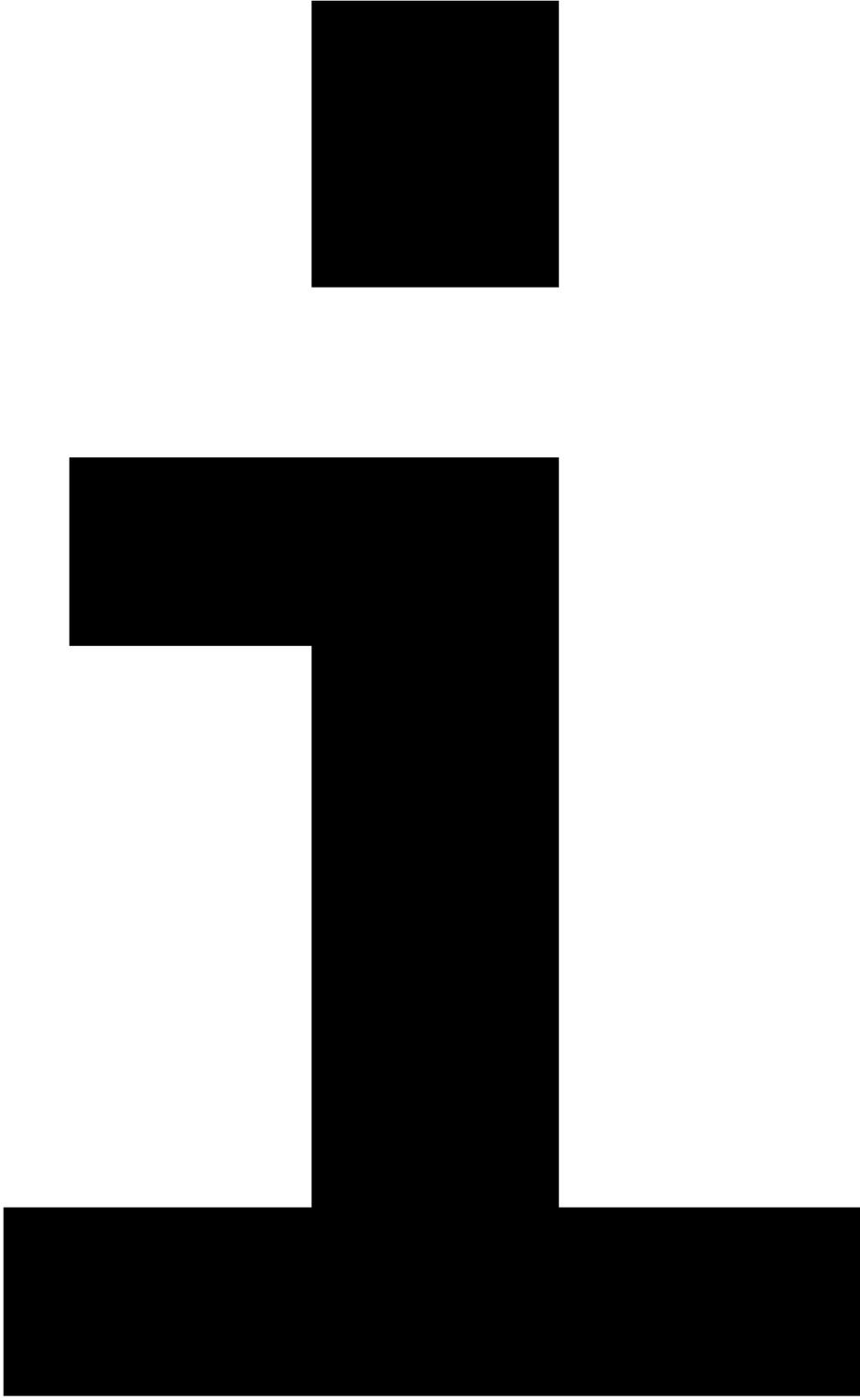
n

Q

S

o

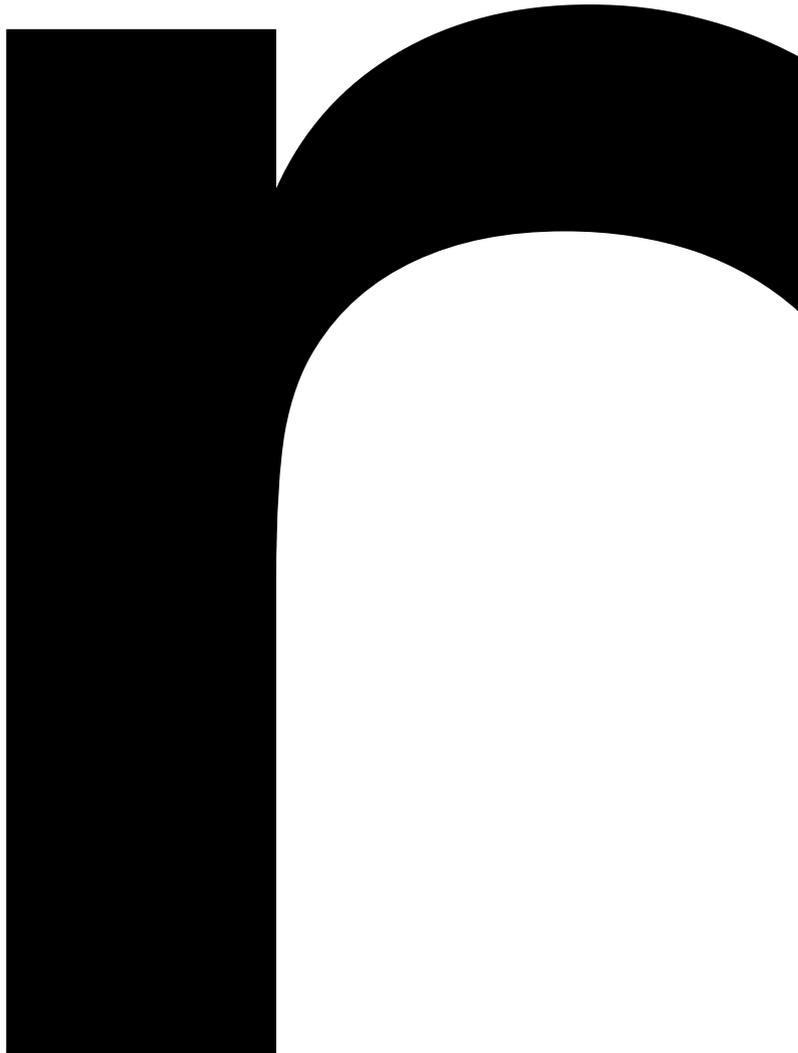
e



C

h

e



sa

n

J

sa

Q

e

n

u

n

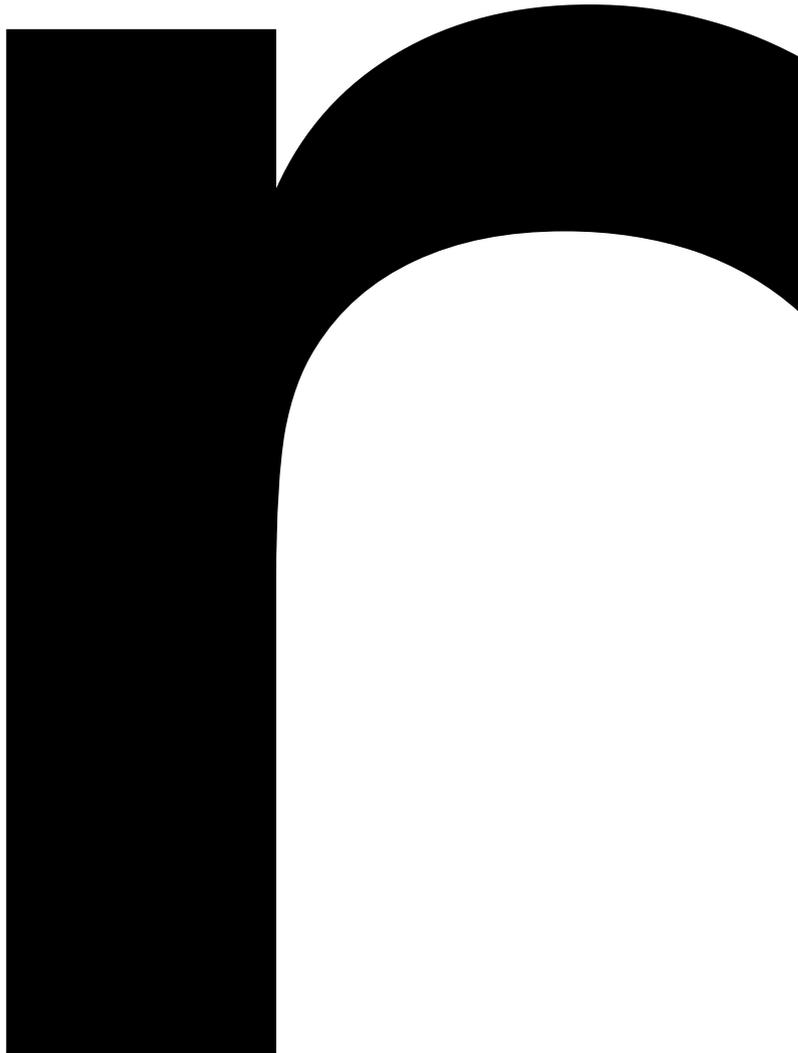
Q

R

e

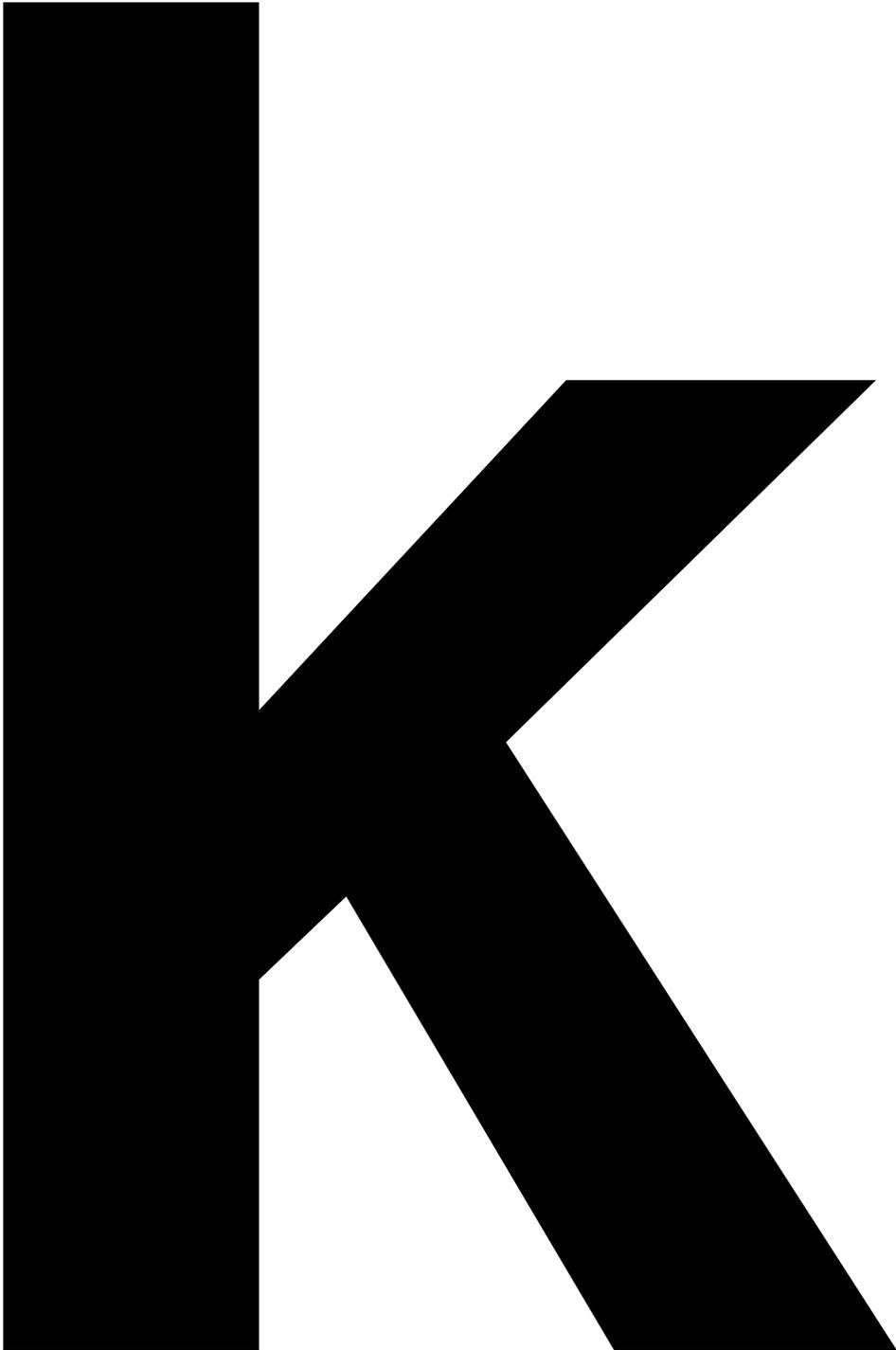
S

e



V

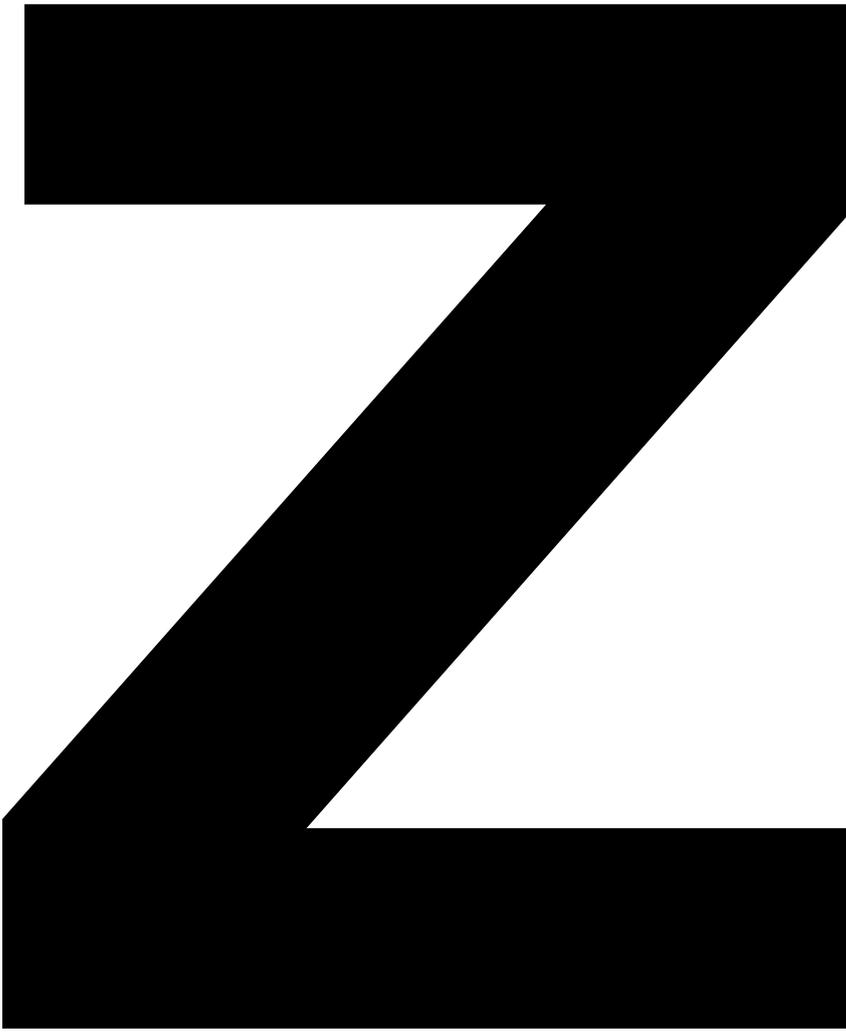
e

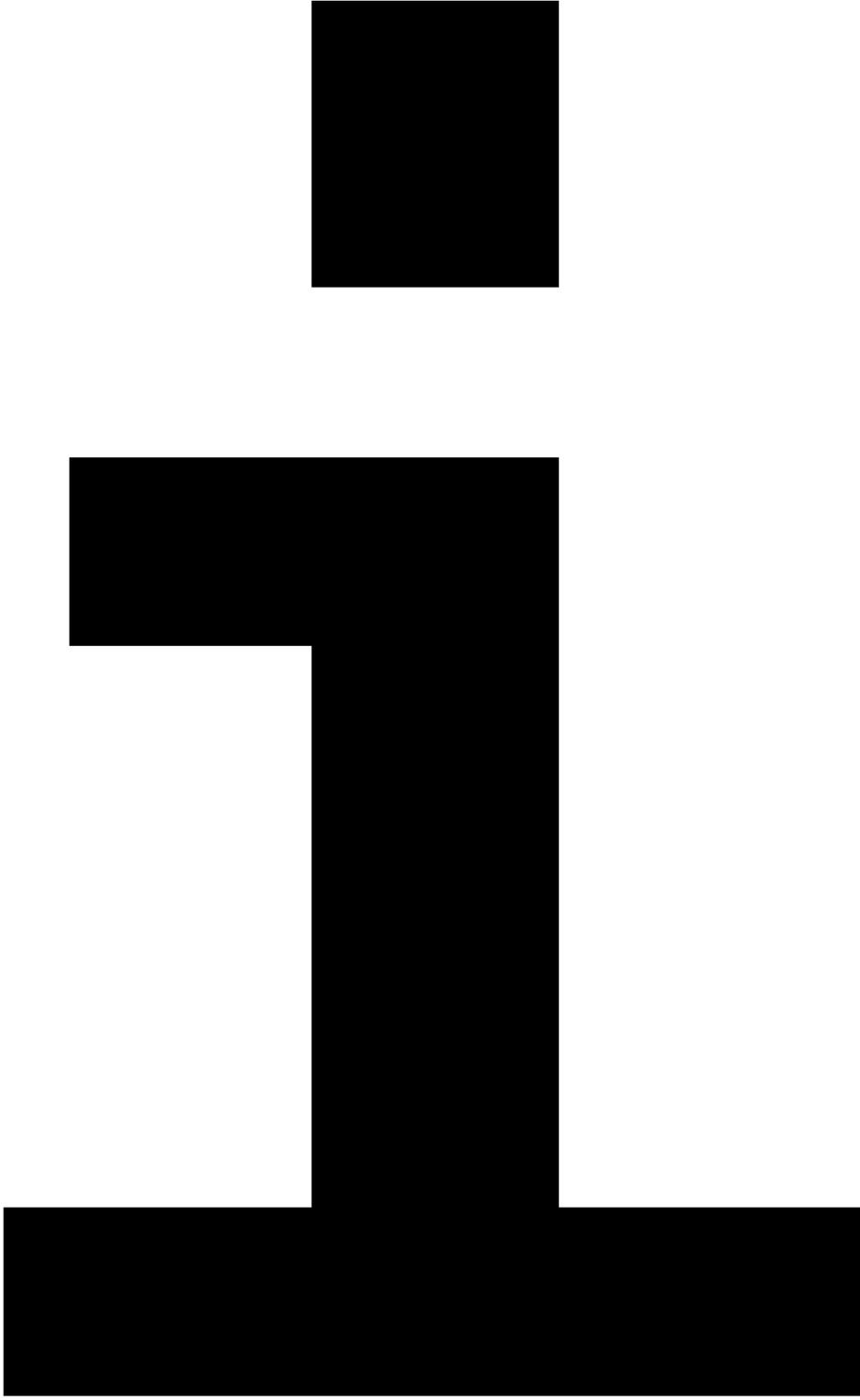


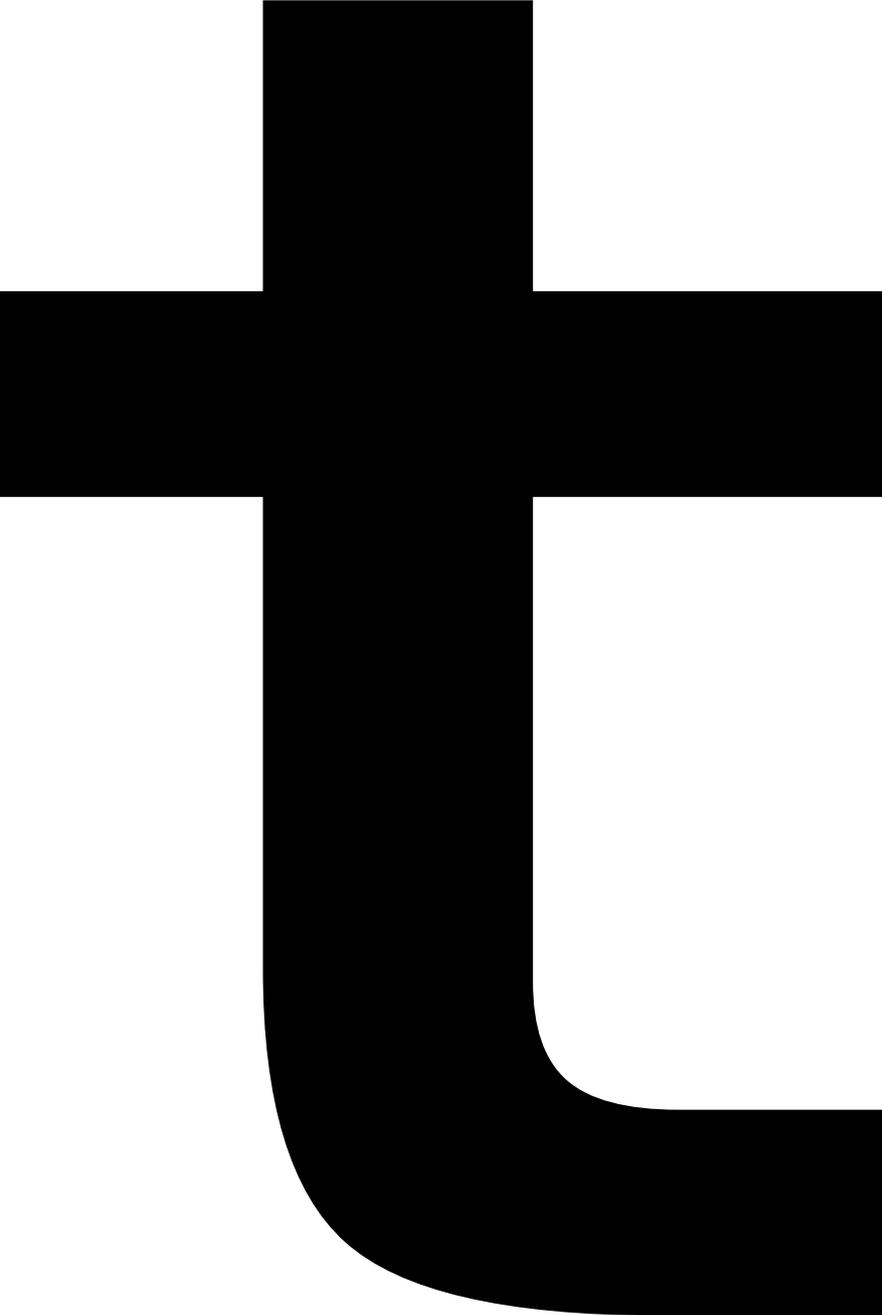
sa

o

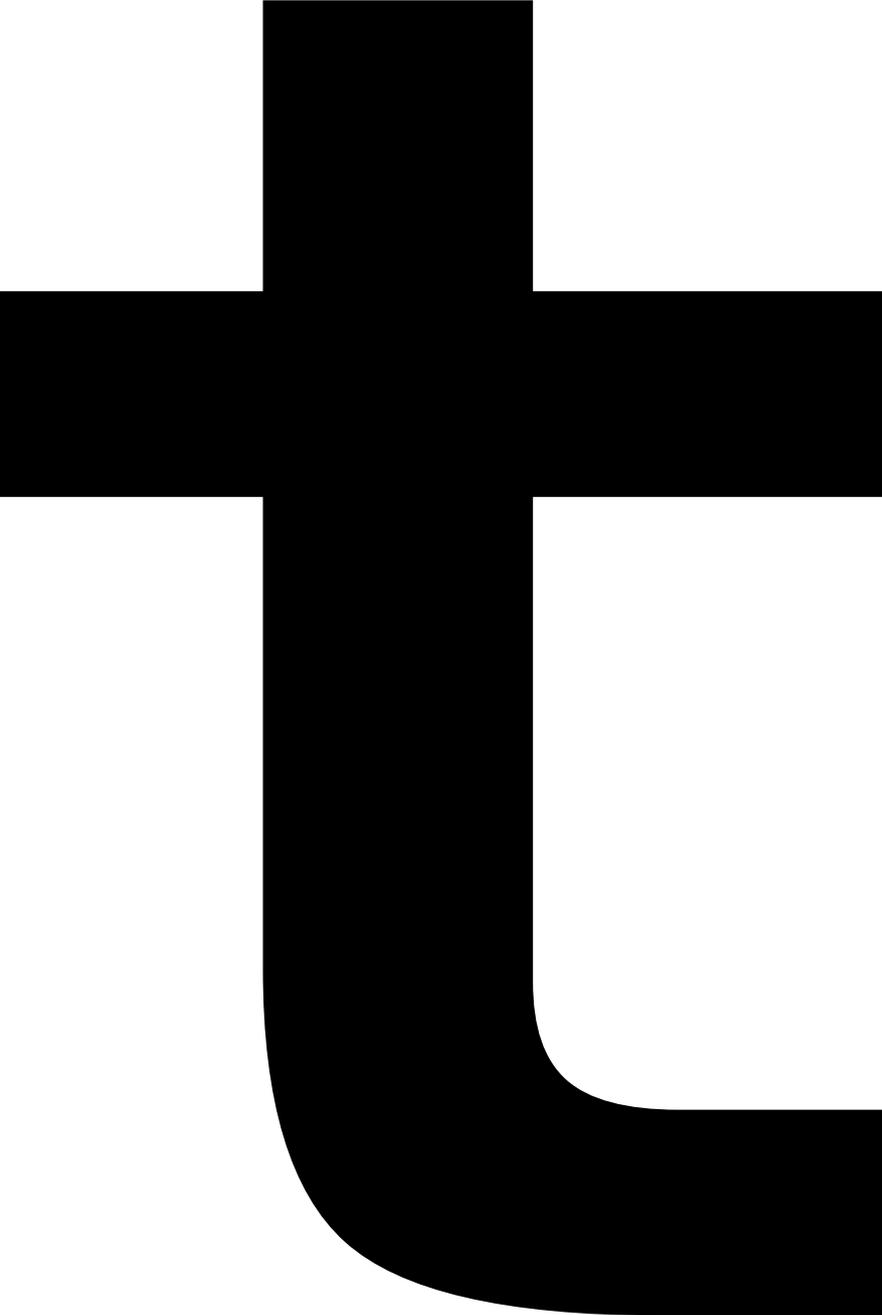
5a







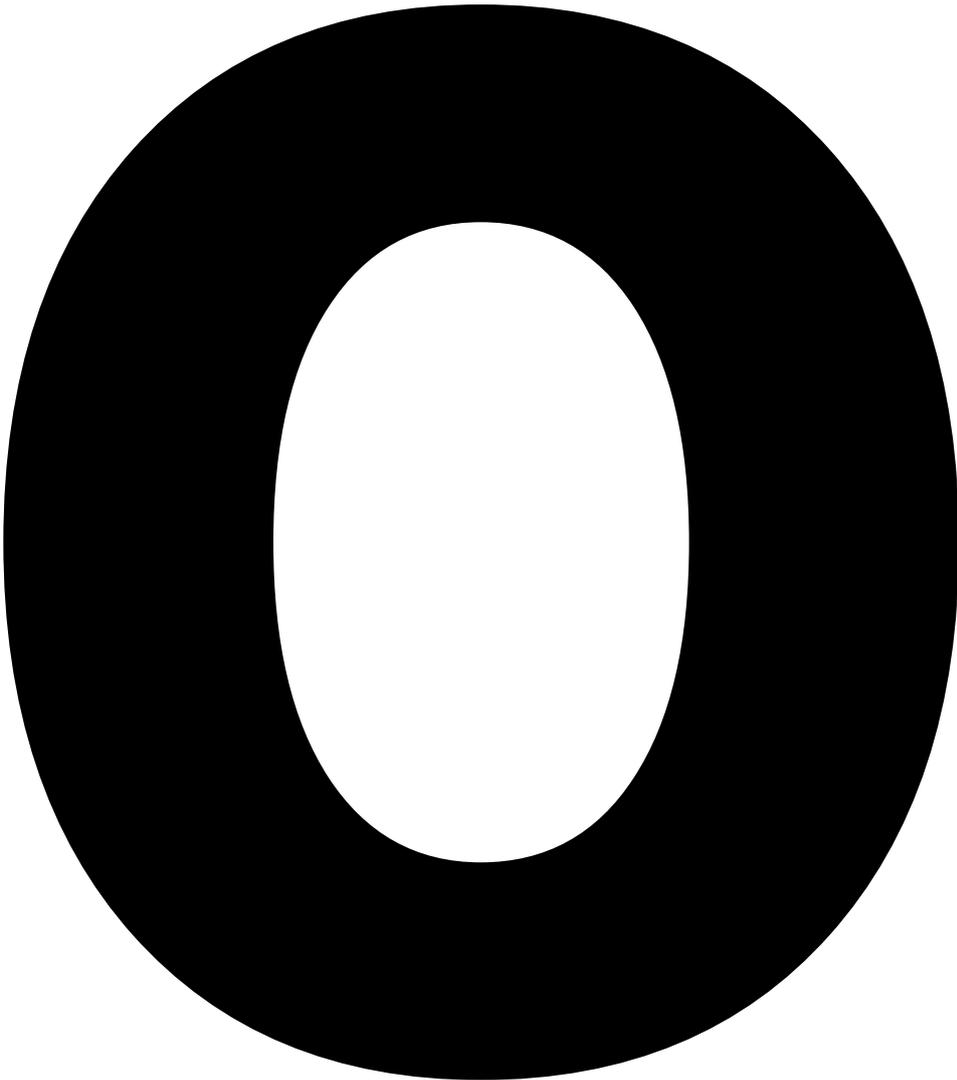


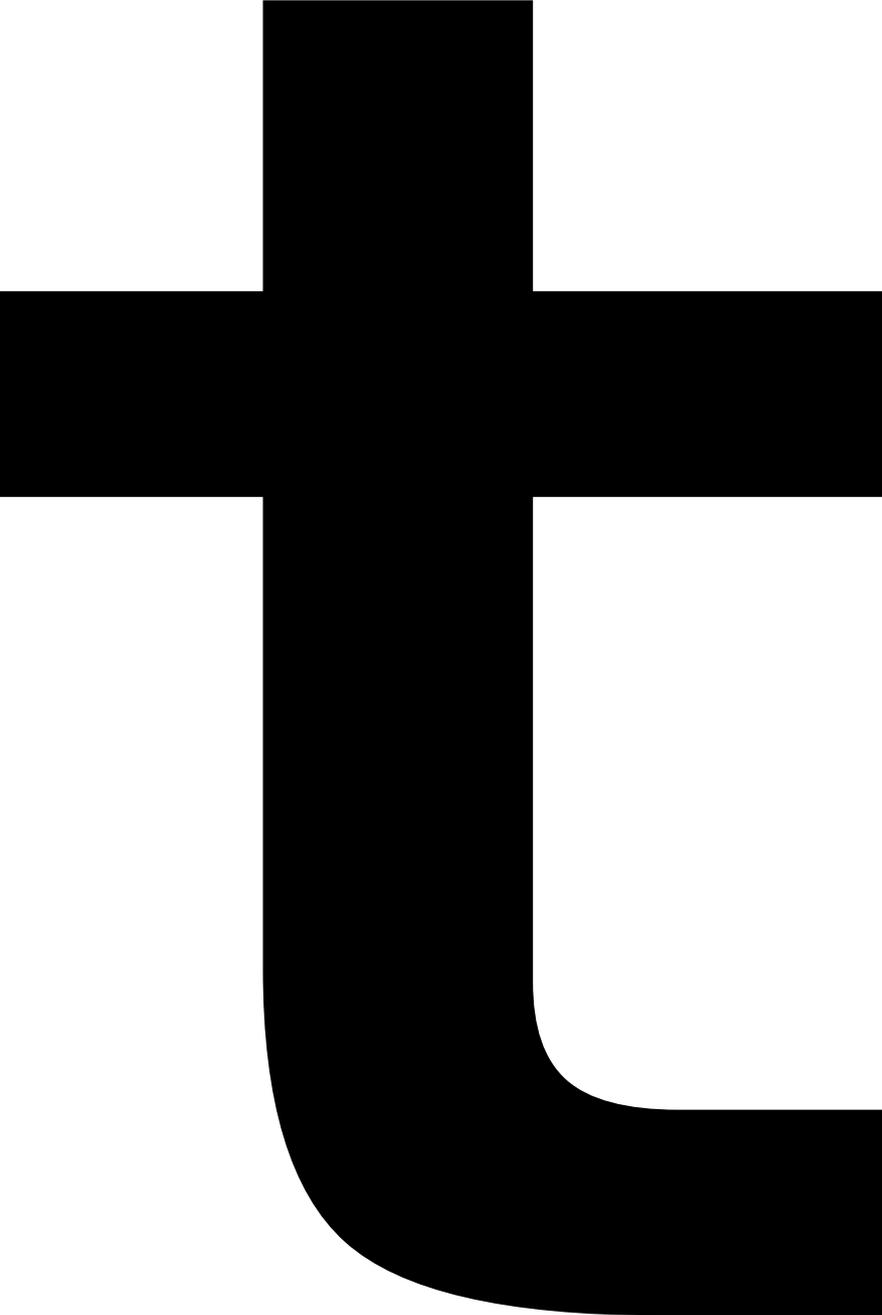


e

n

n



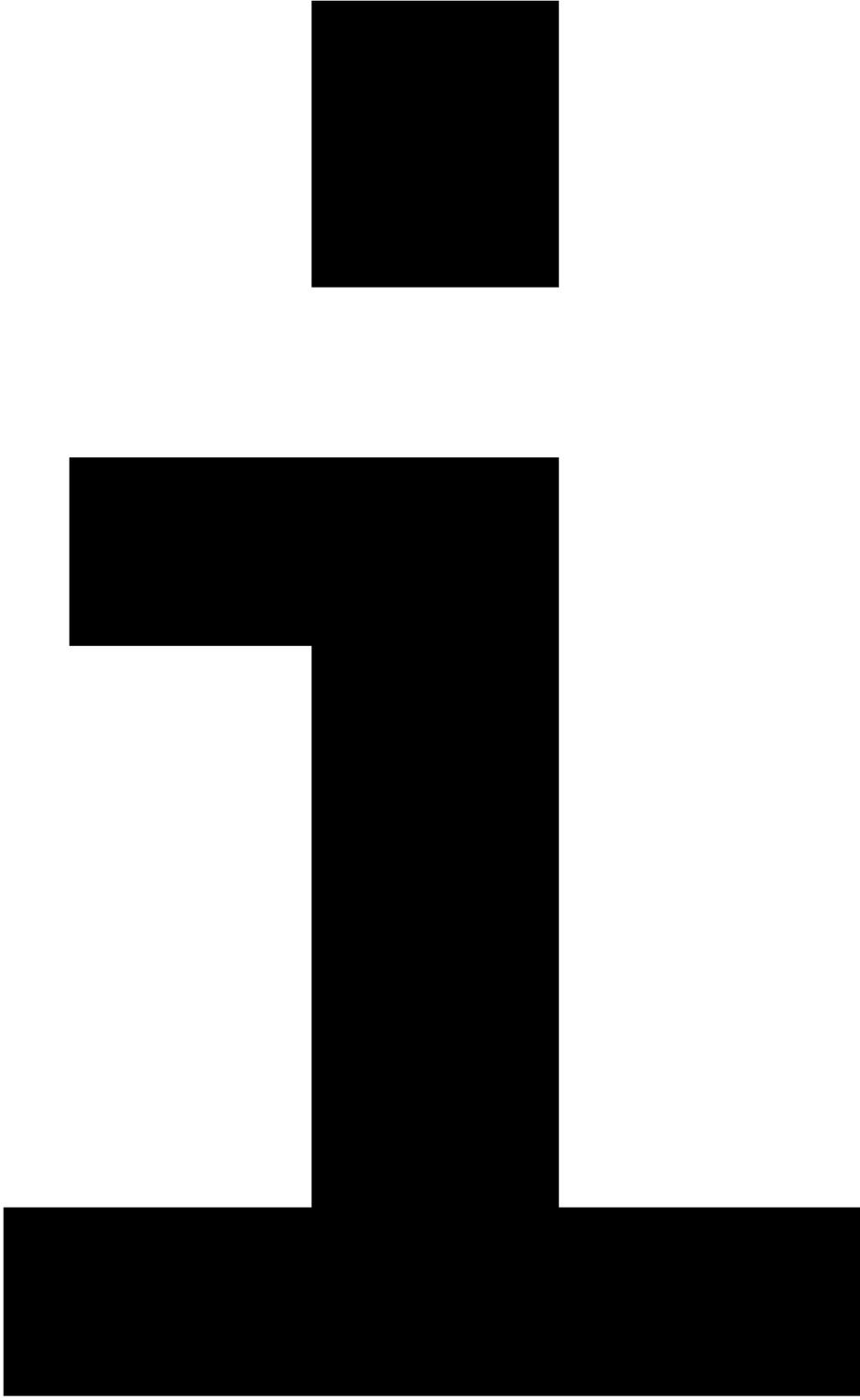


w

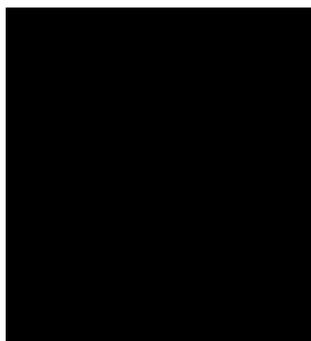
e

n

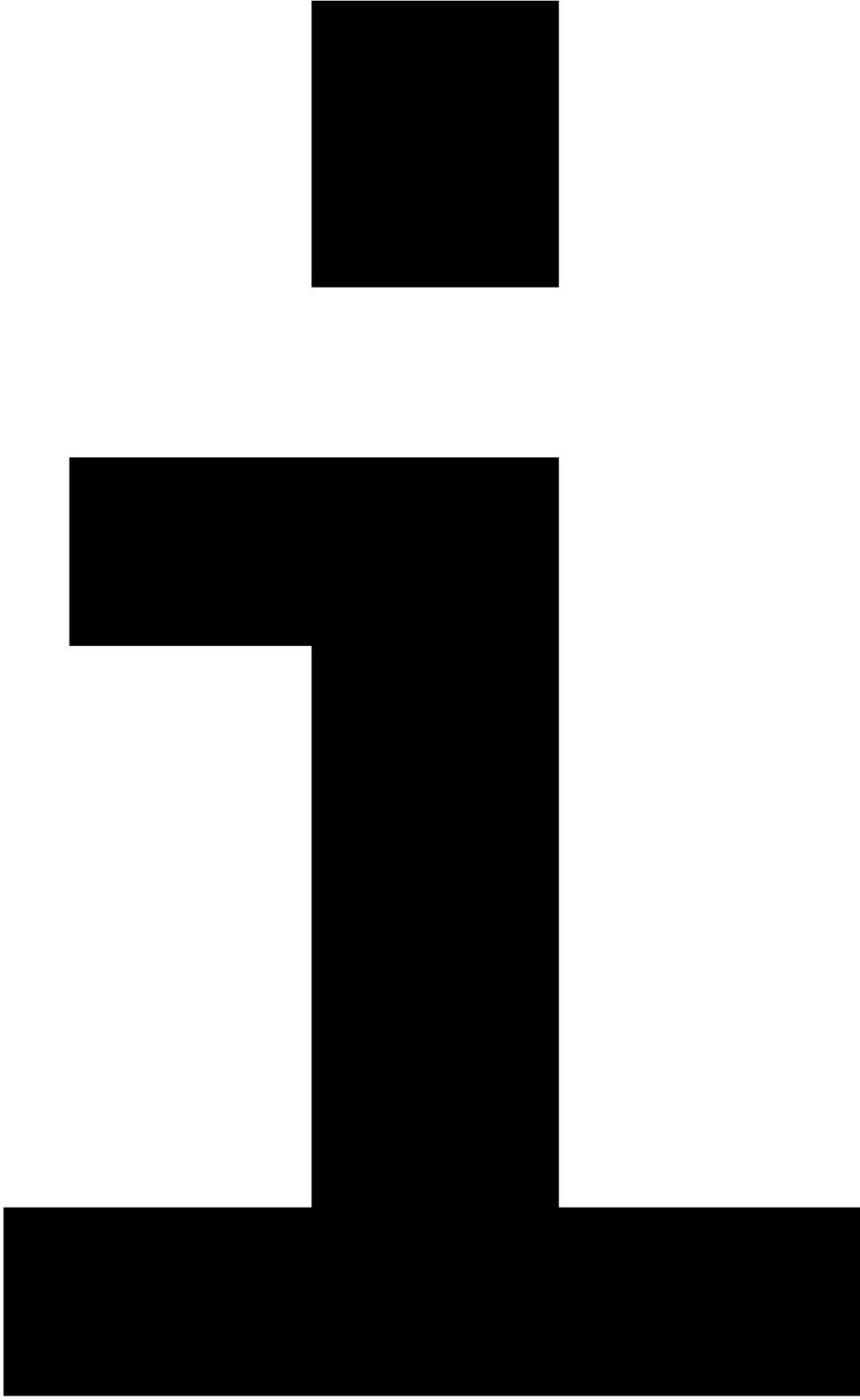
Q



Q

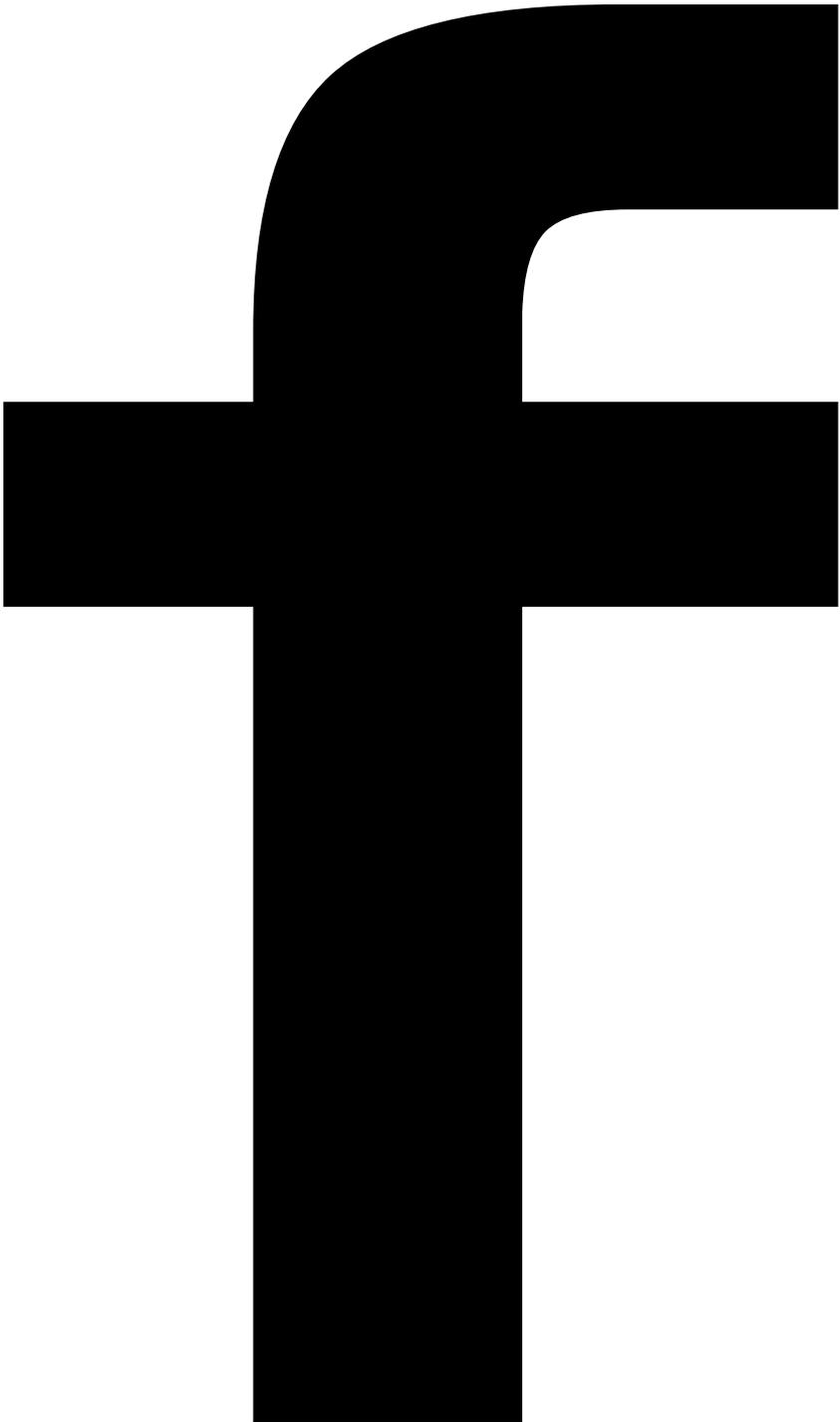


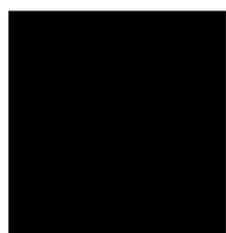
D



e

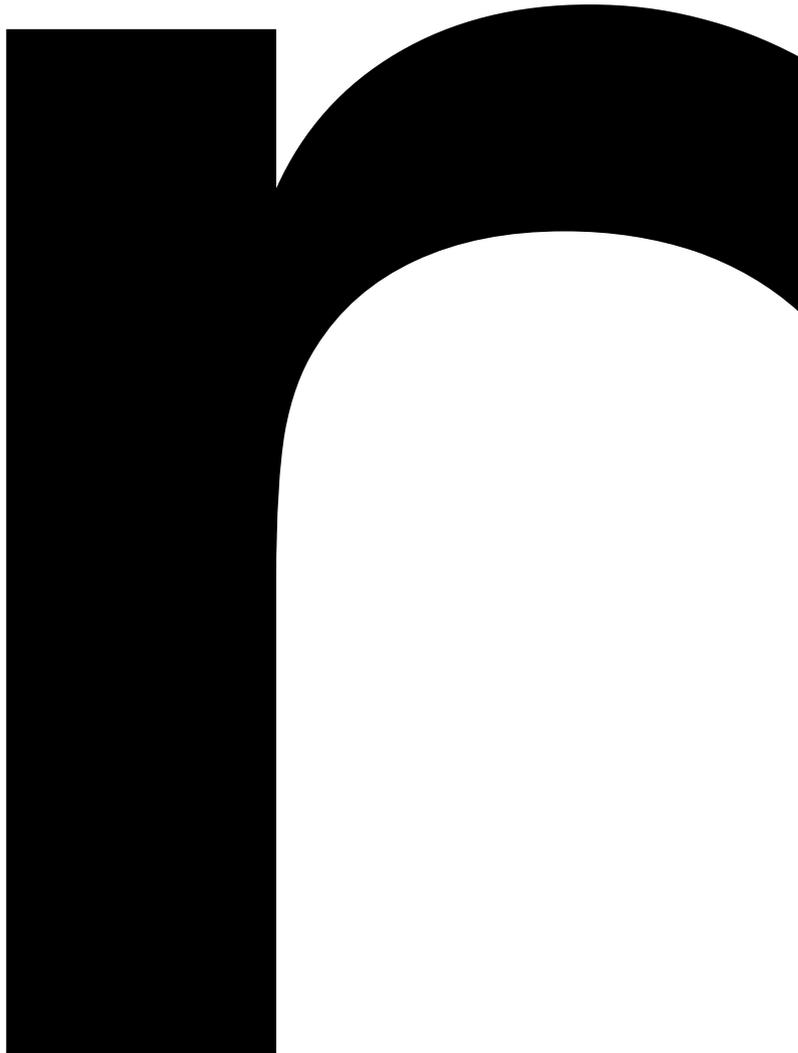
S

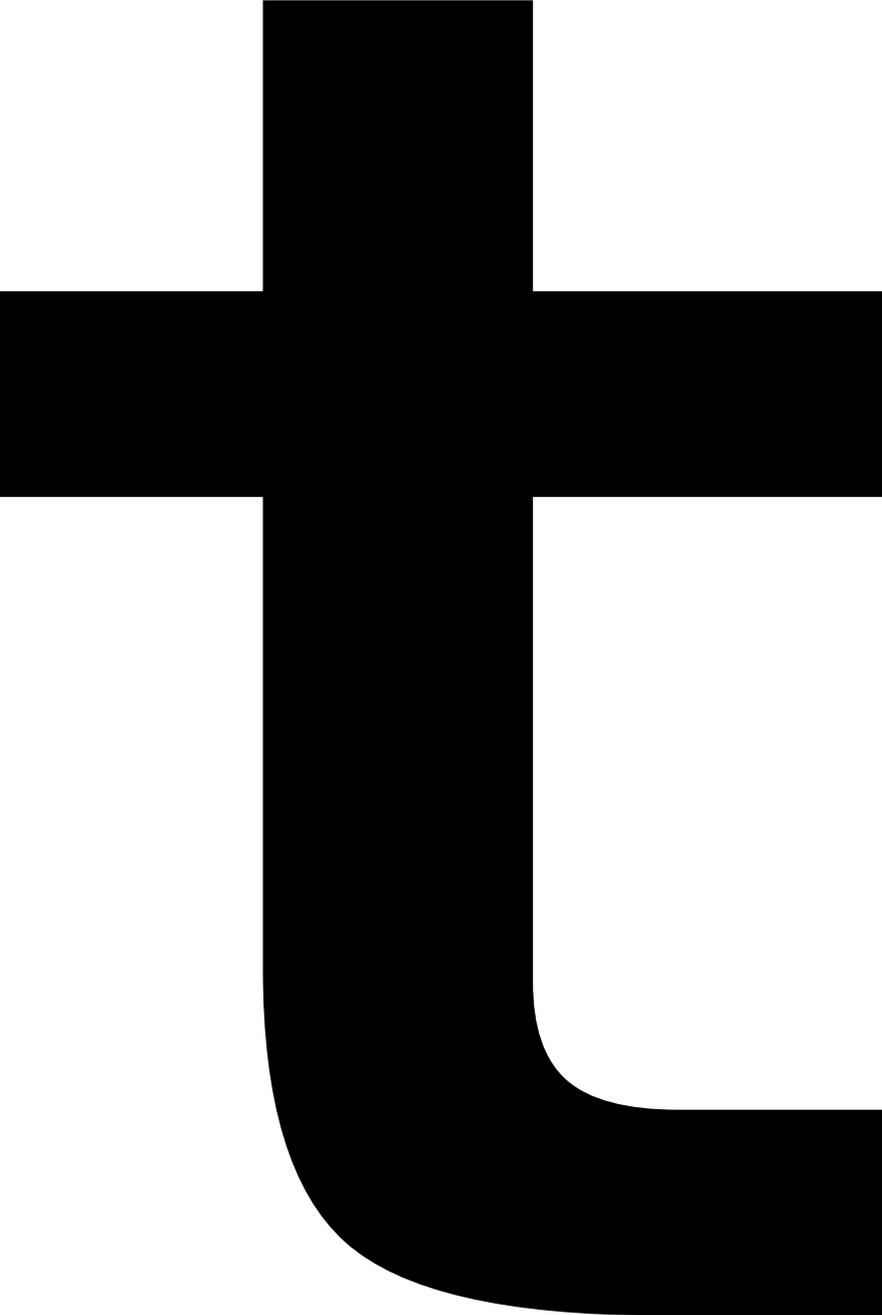


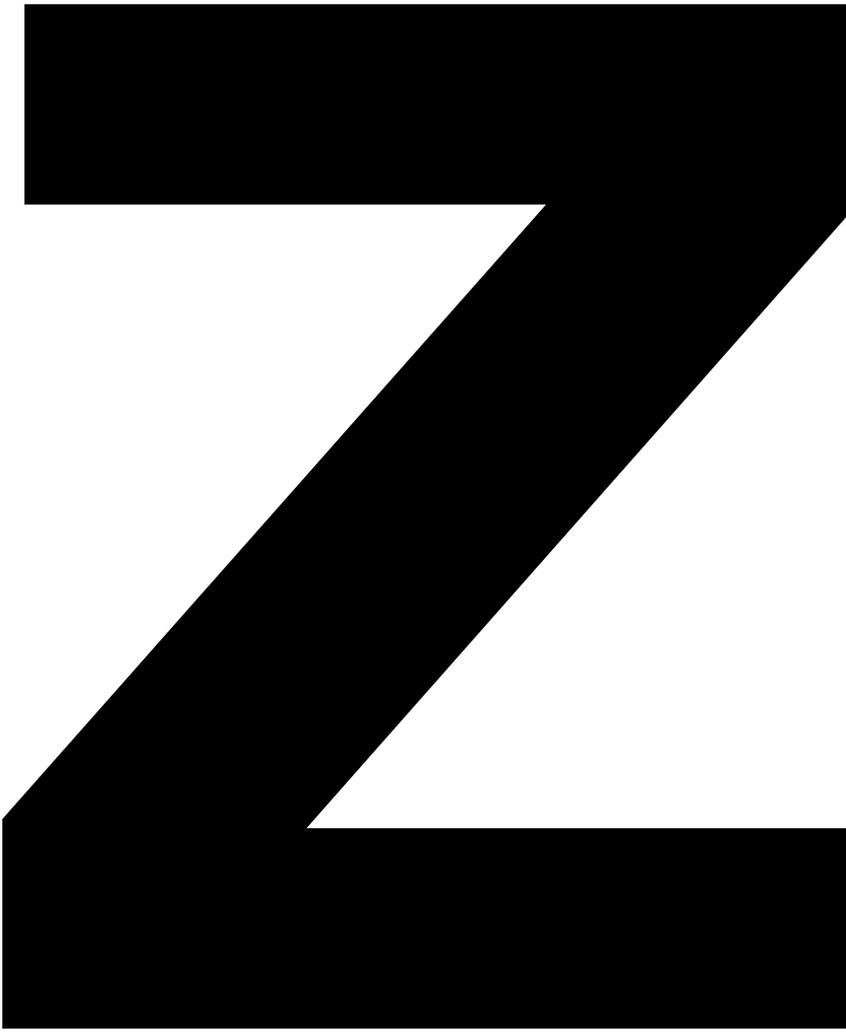


u

h







u

U

m

w

sa

n

Q

J

u

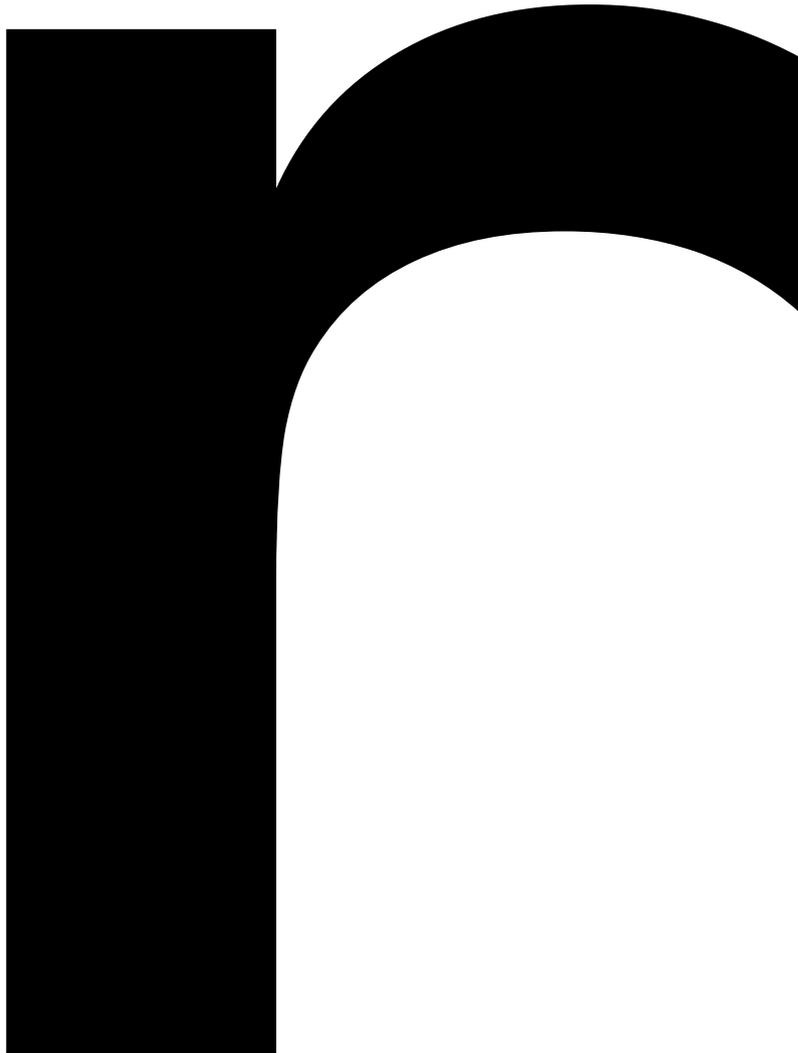
n

Q

S

V

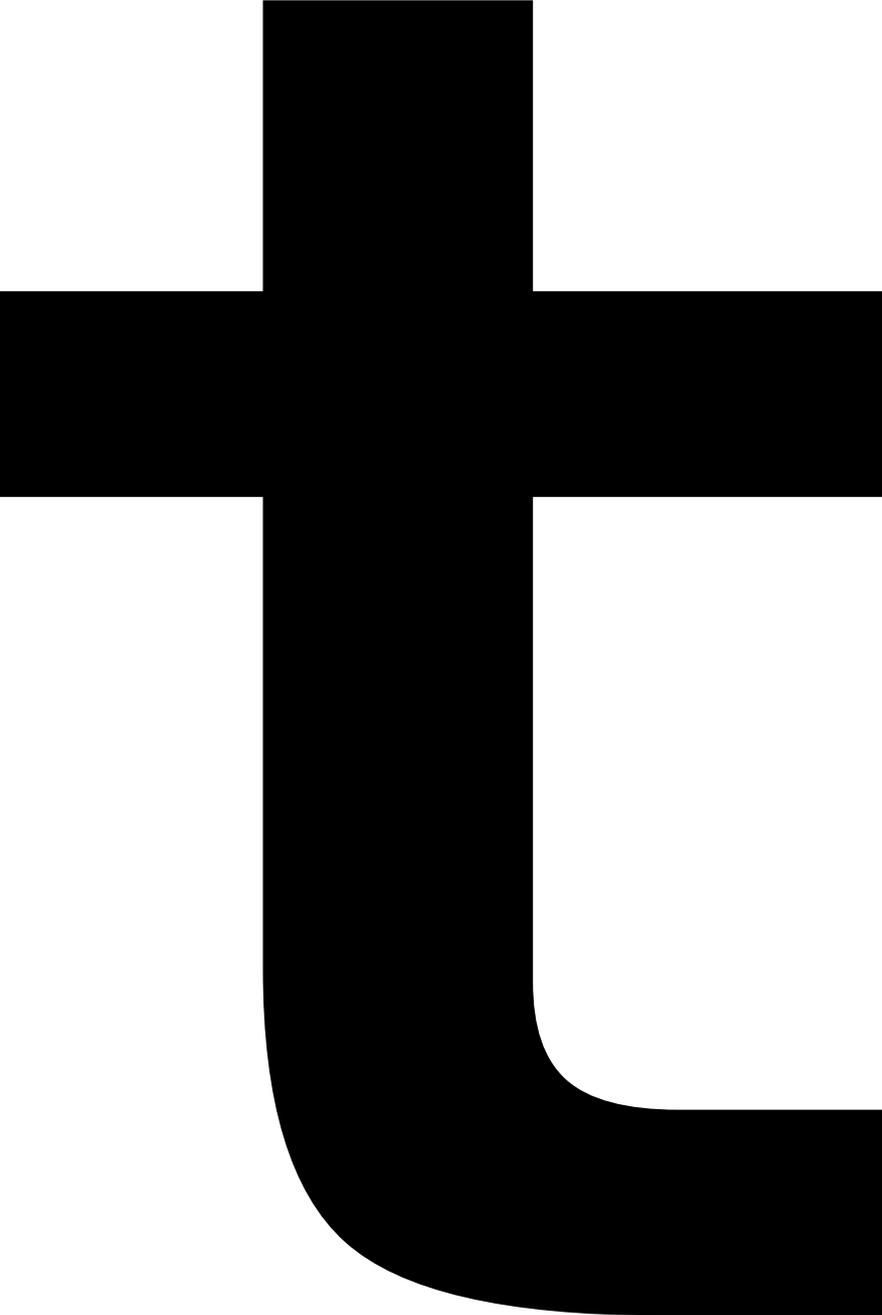
e



J

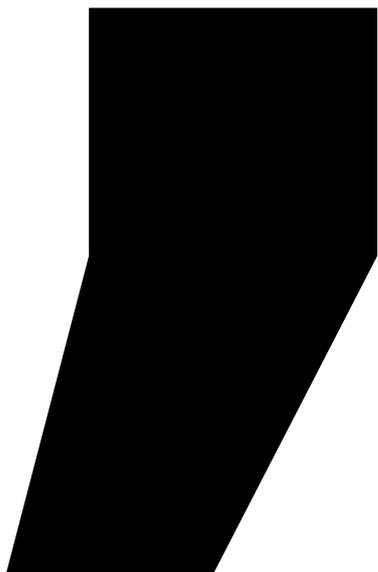
u

S

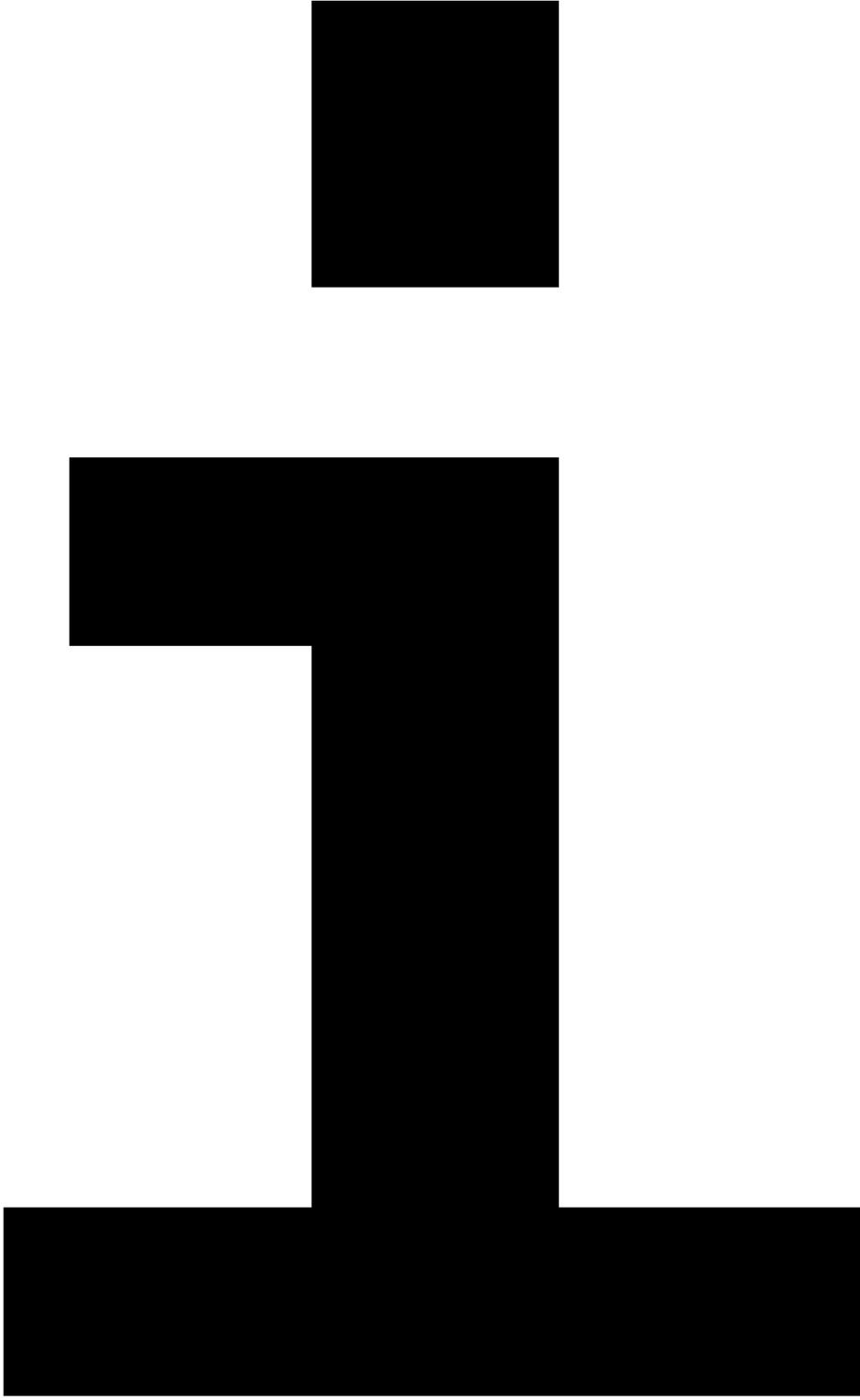


e

n



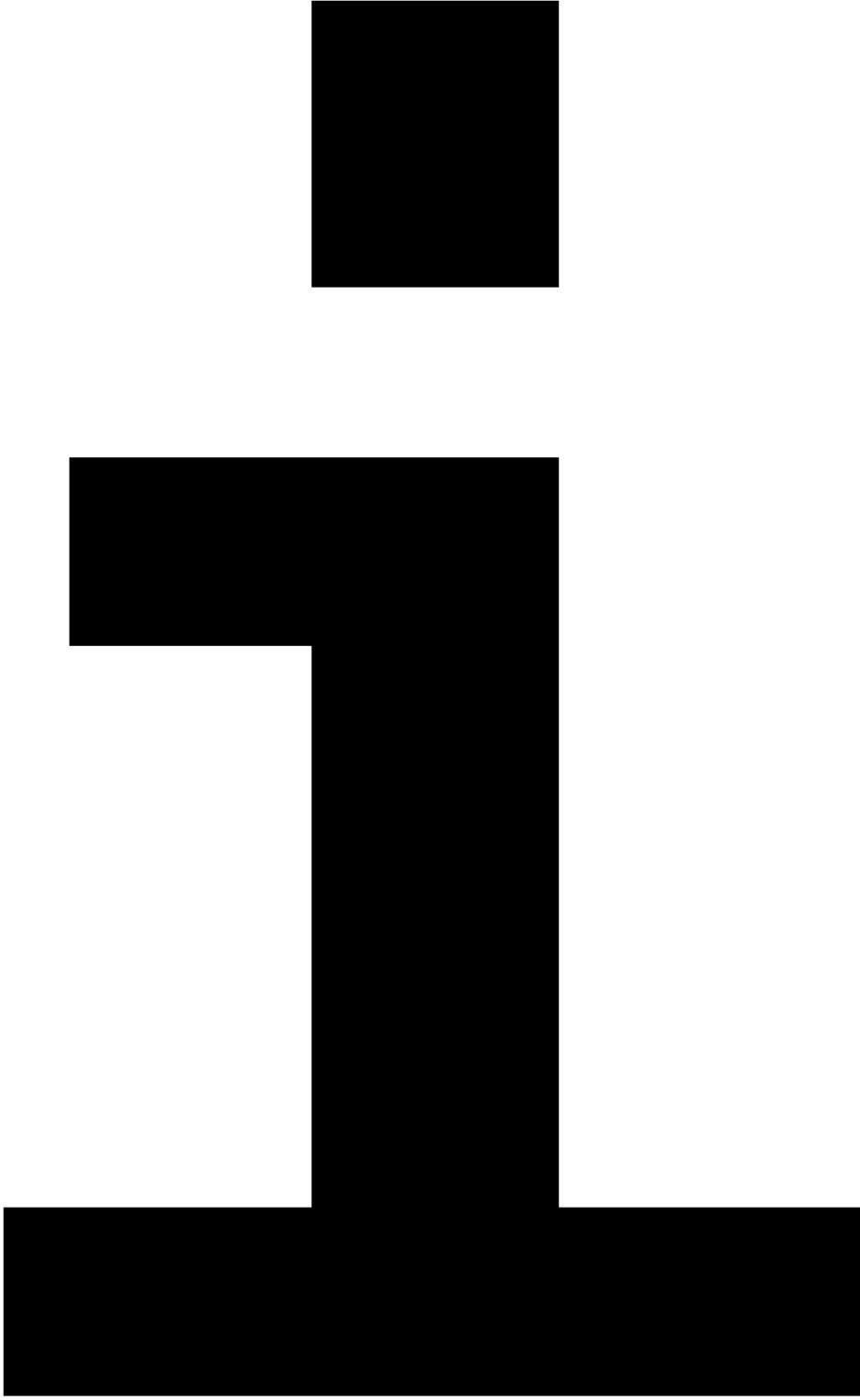
Q



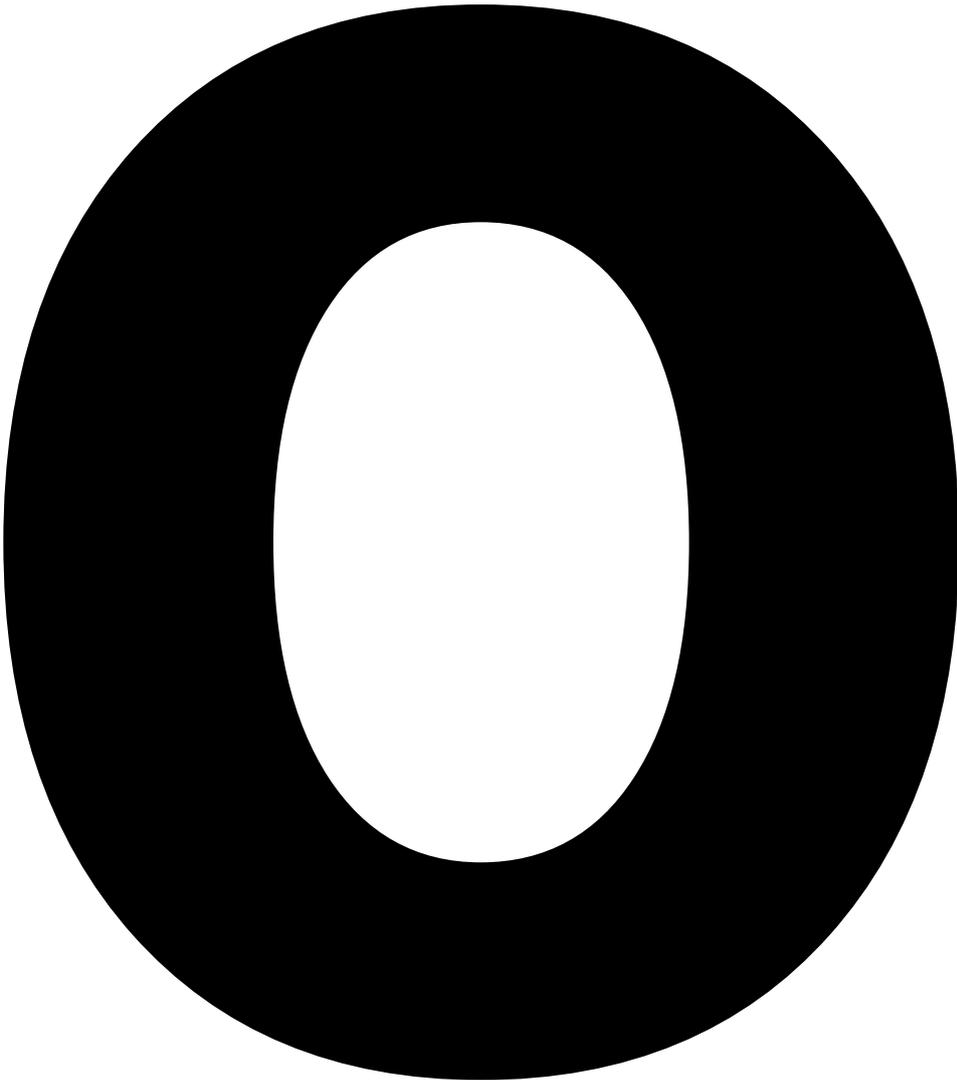
e

10

e



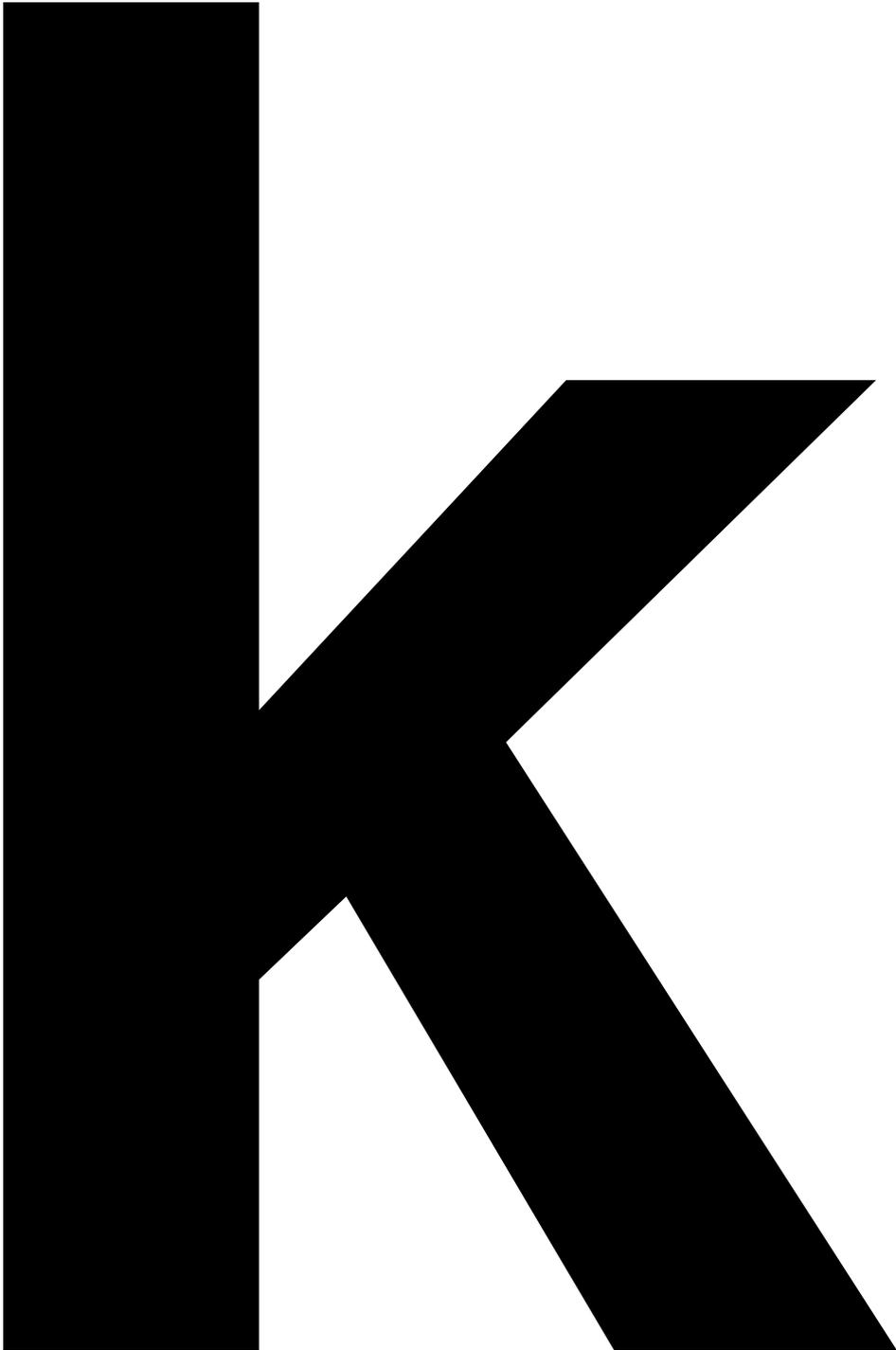
K

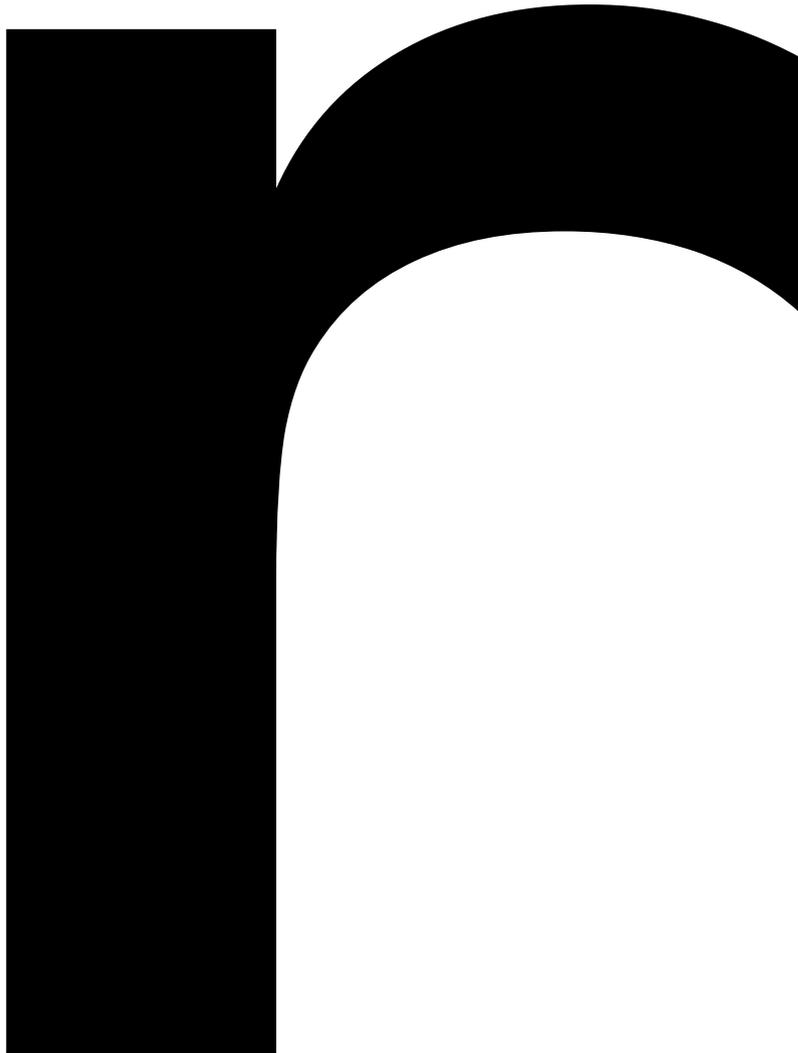


h

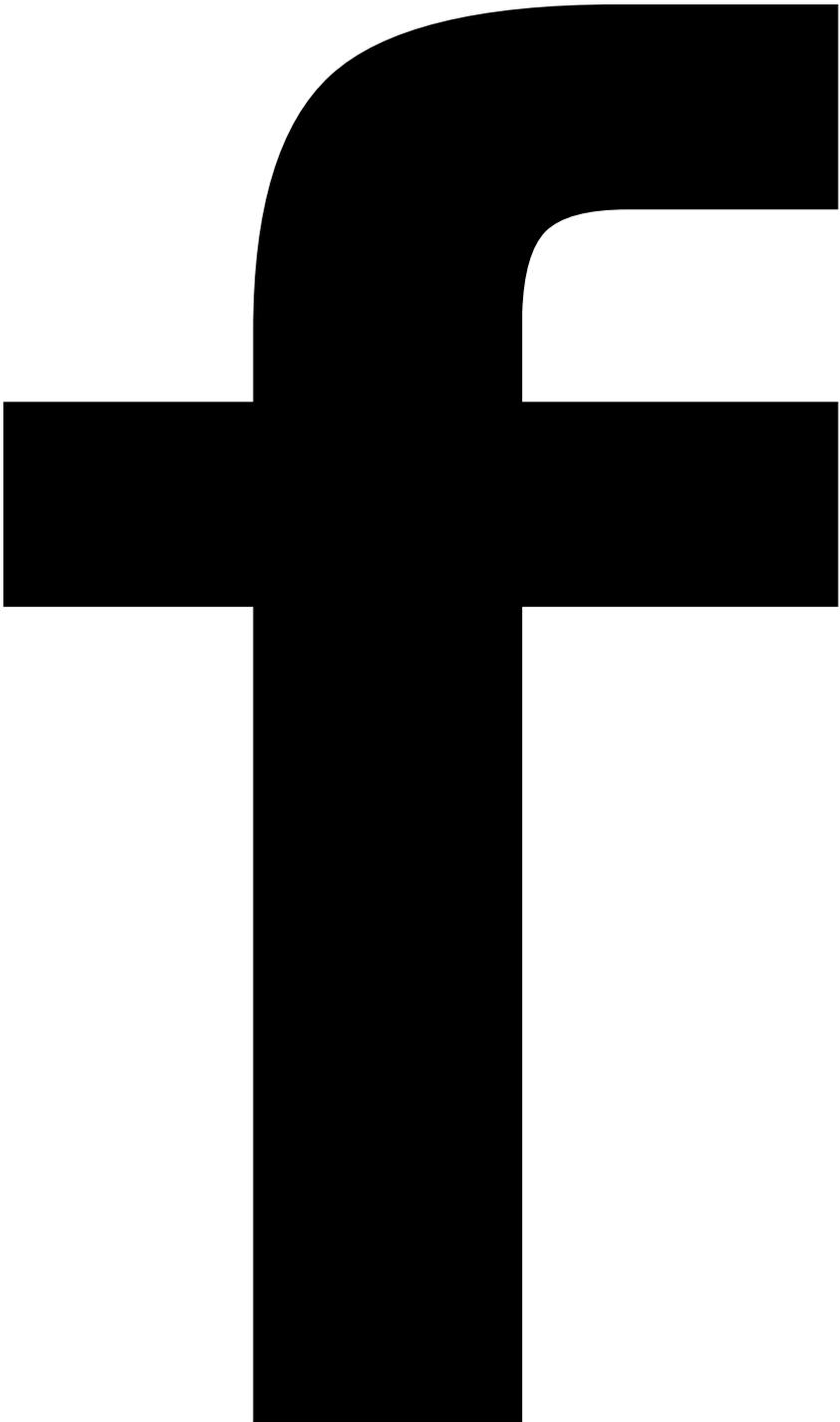
J

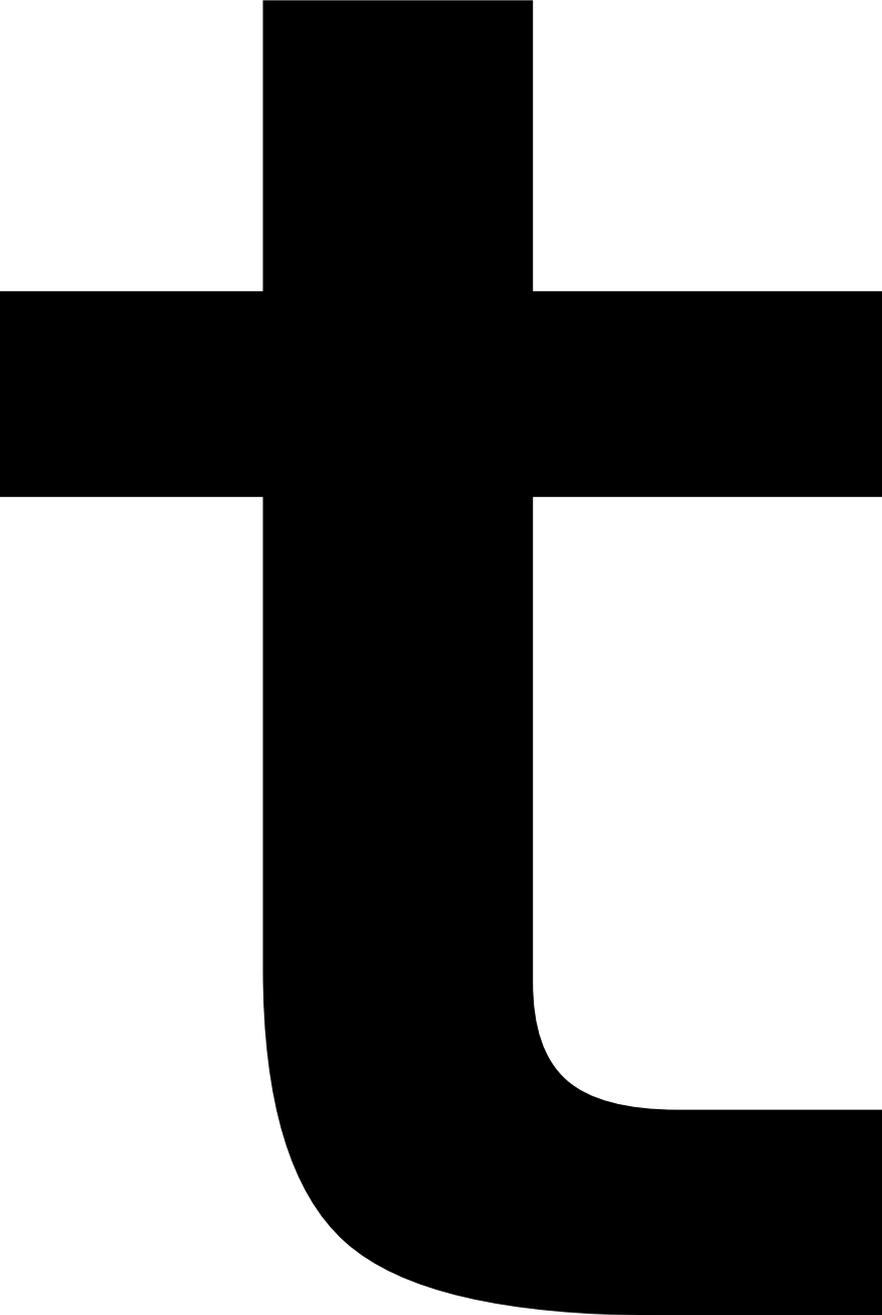
e





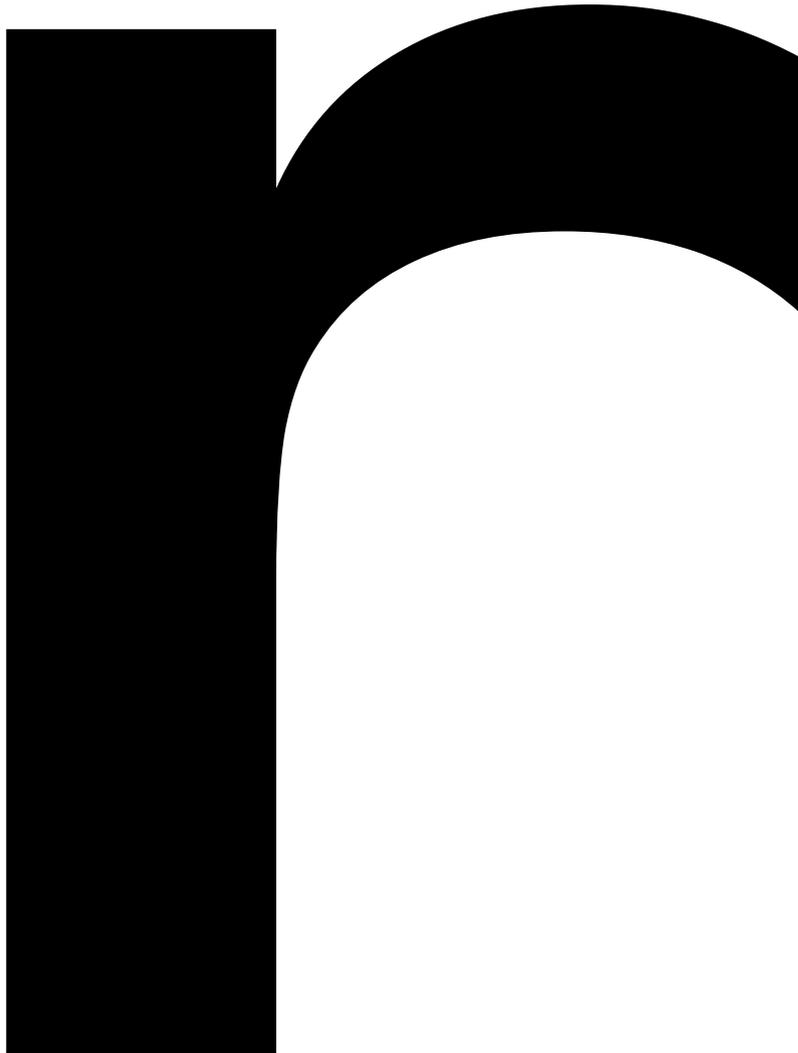
sa

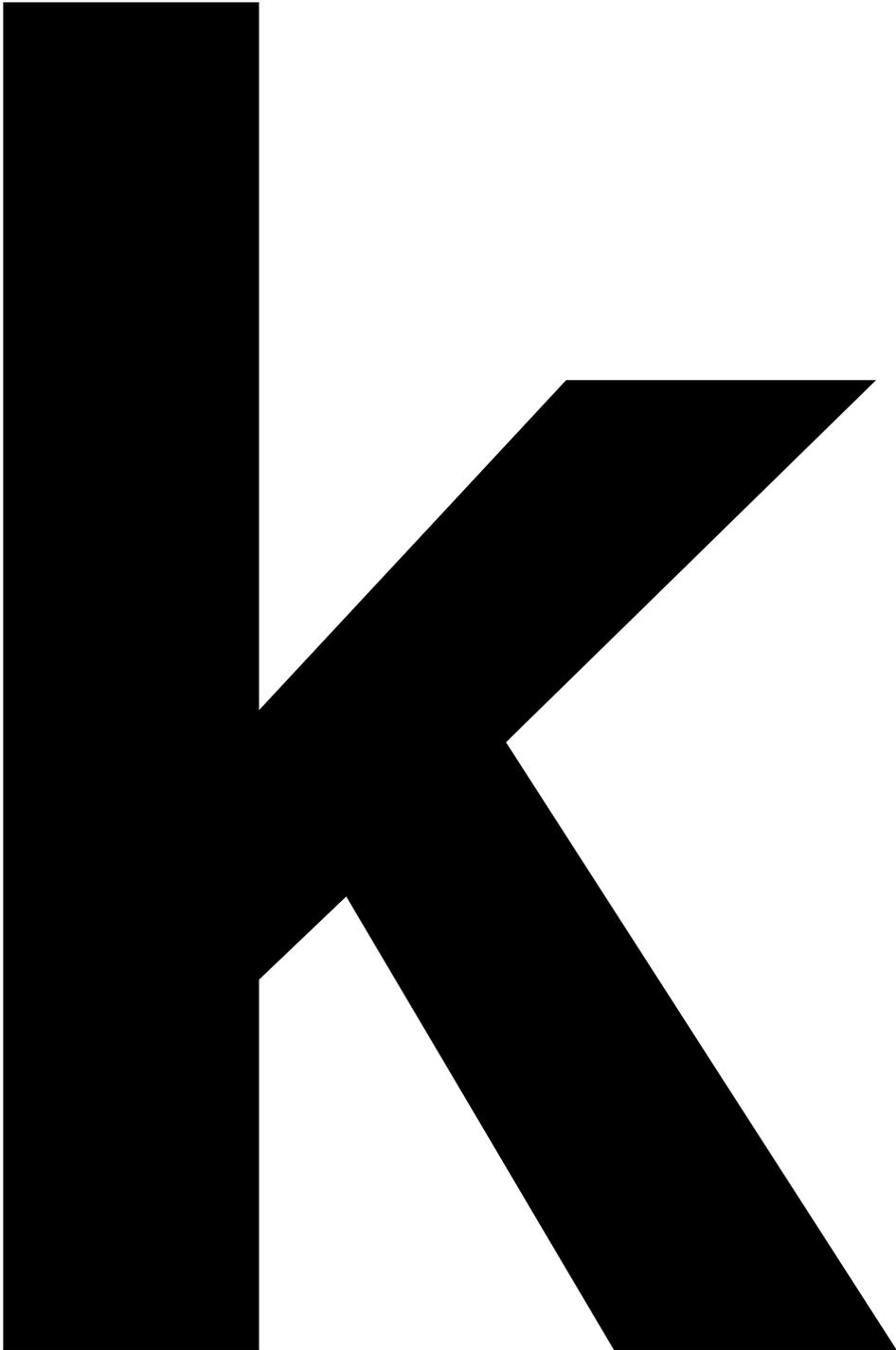




w

e

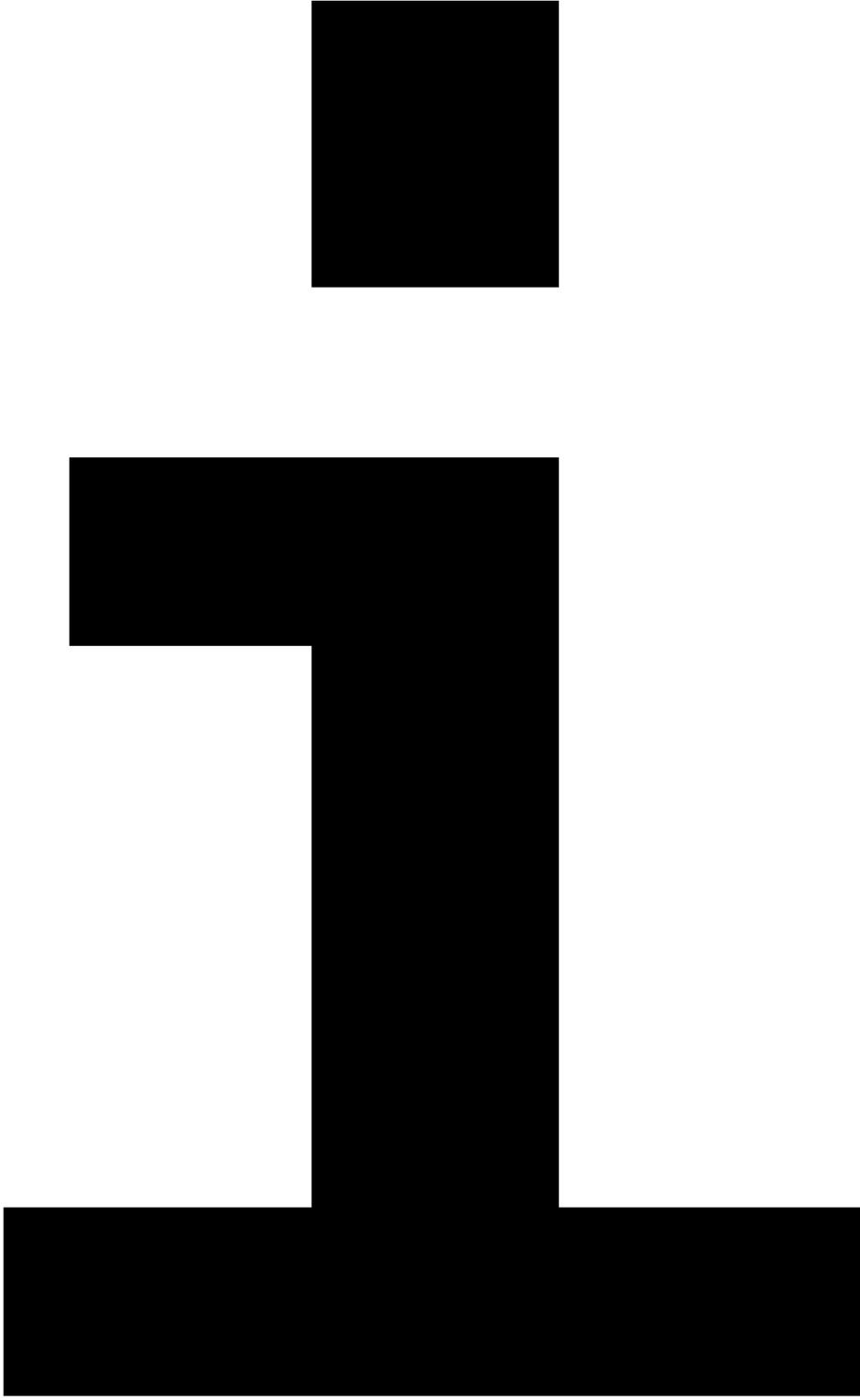




e

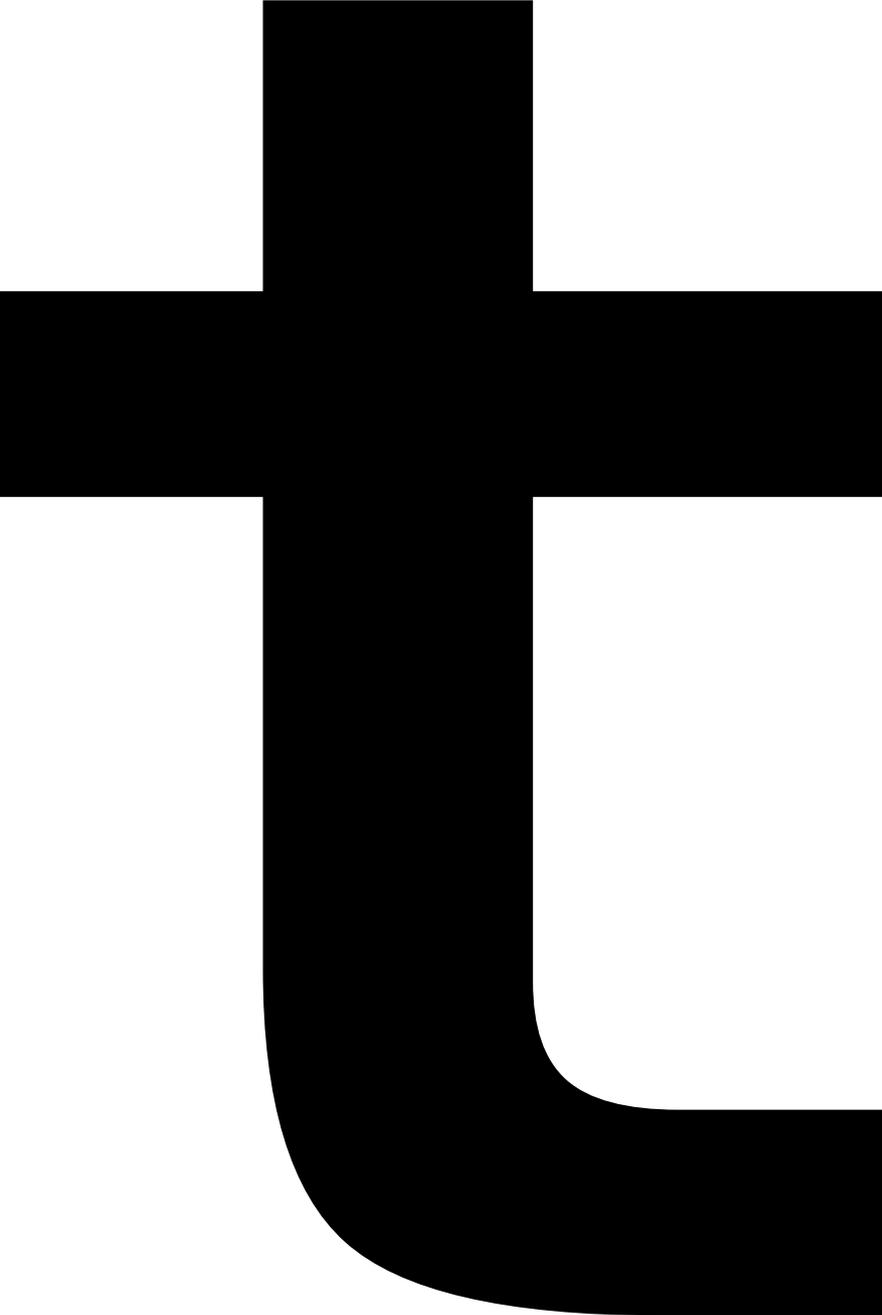
n

n



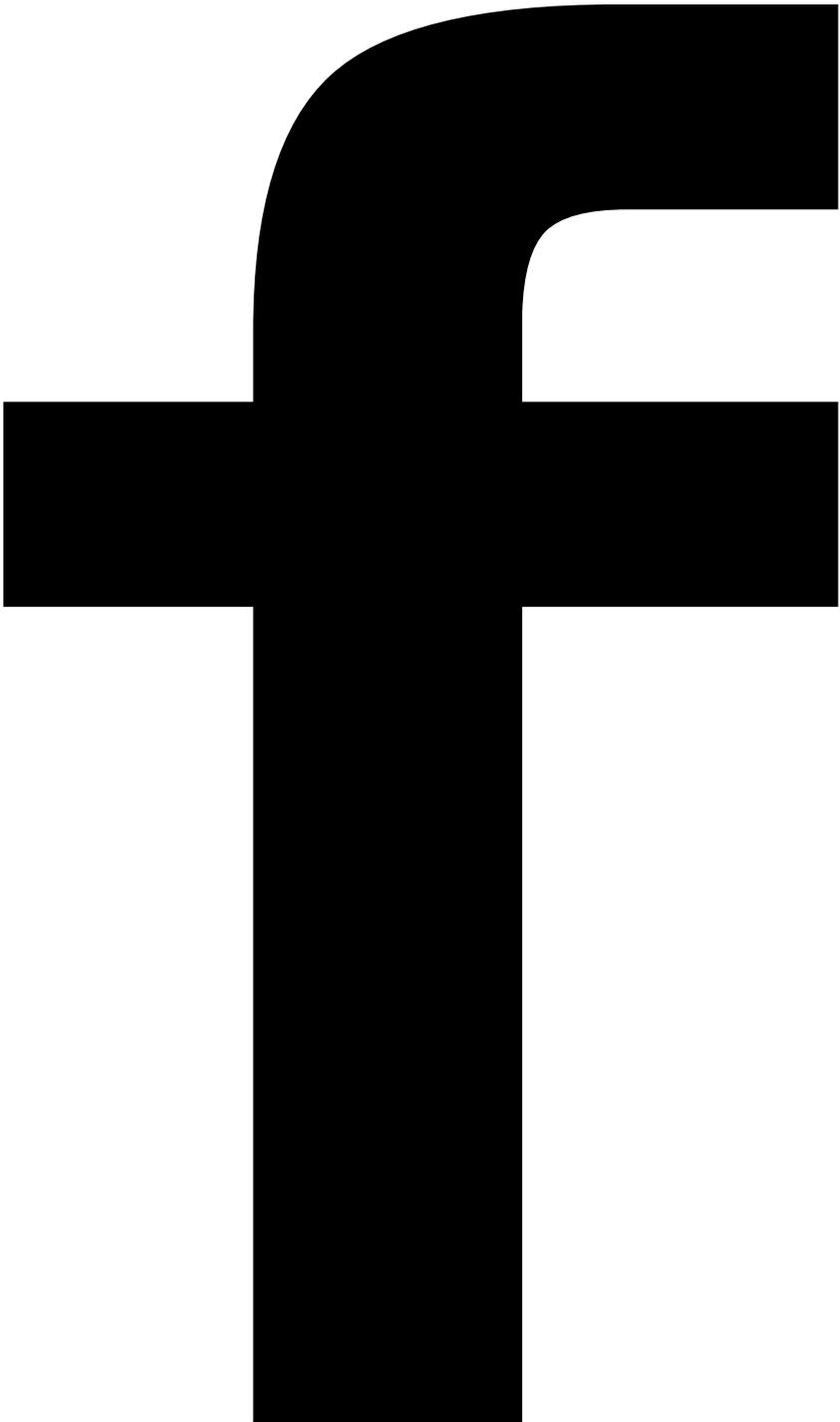
C

h



sa

n



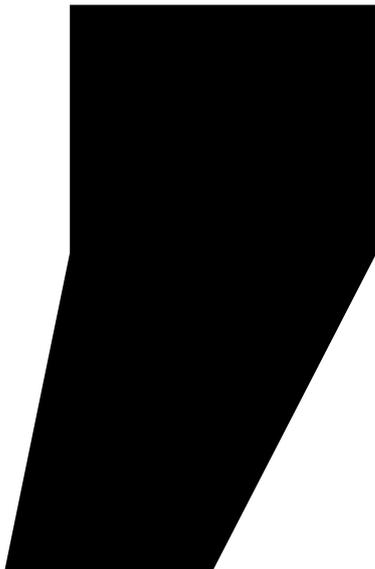
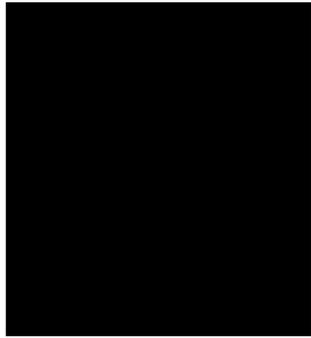
sa

J

J

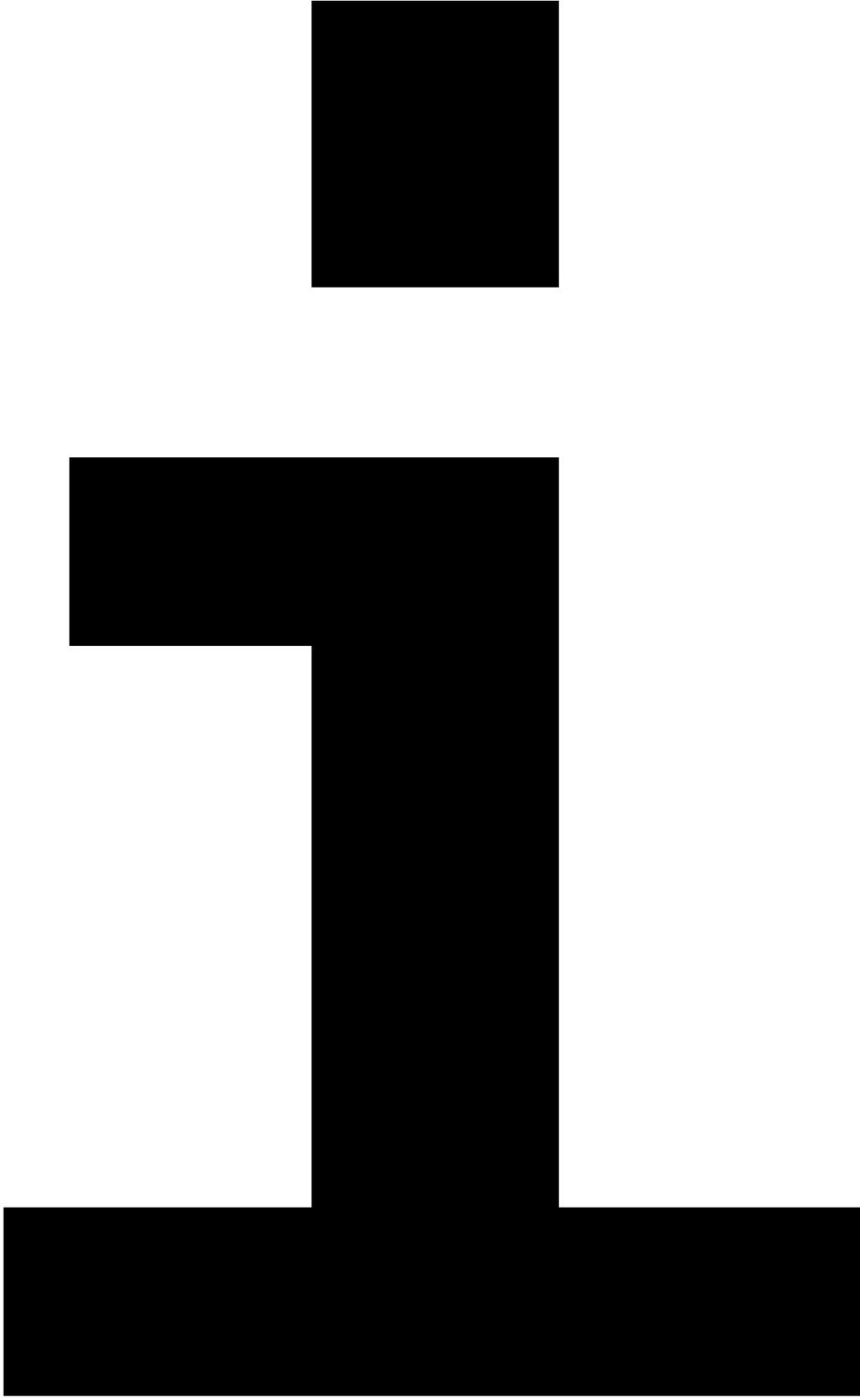
e

n



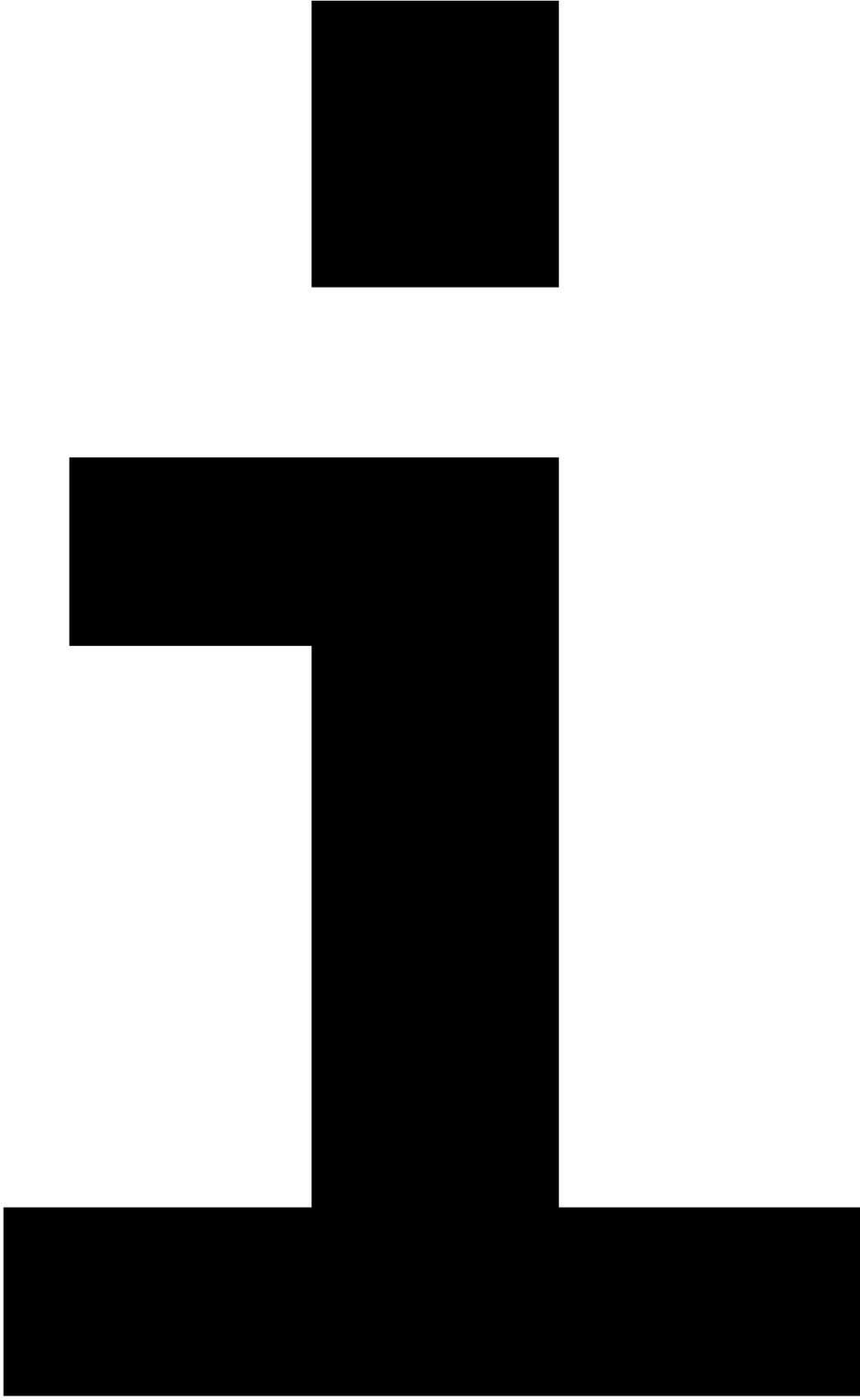
10

e



S

o



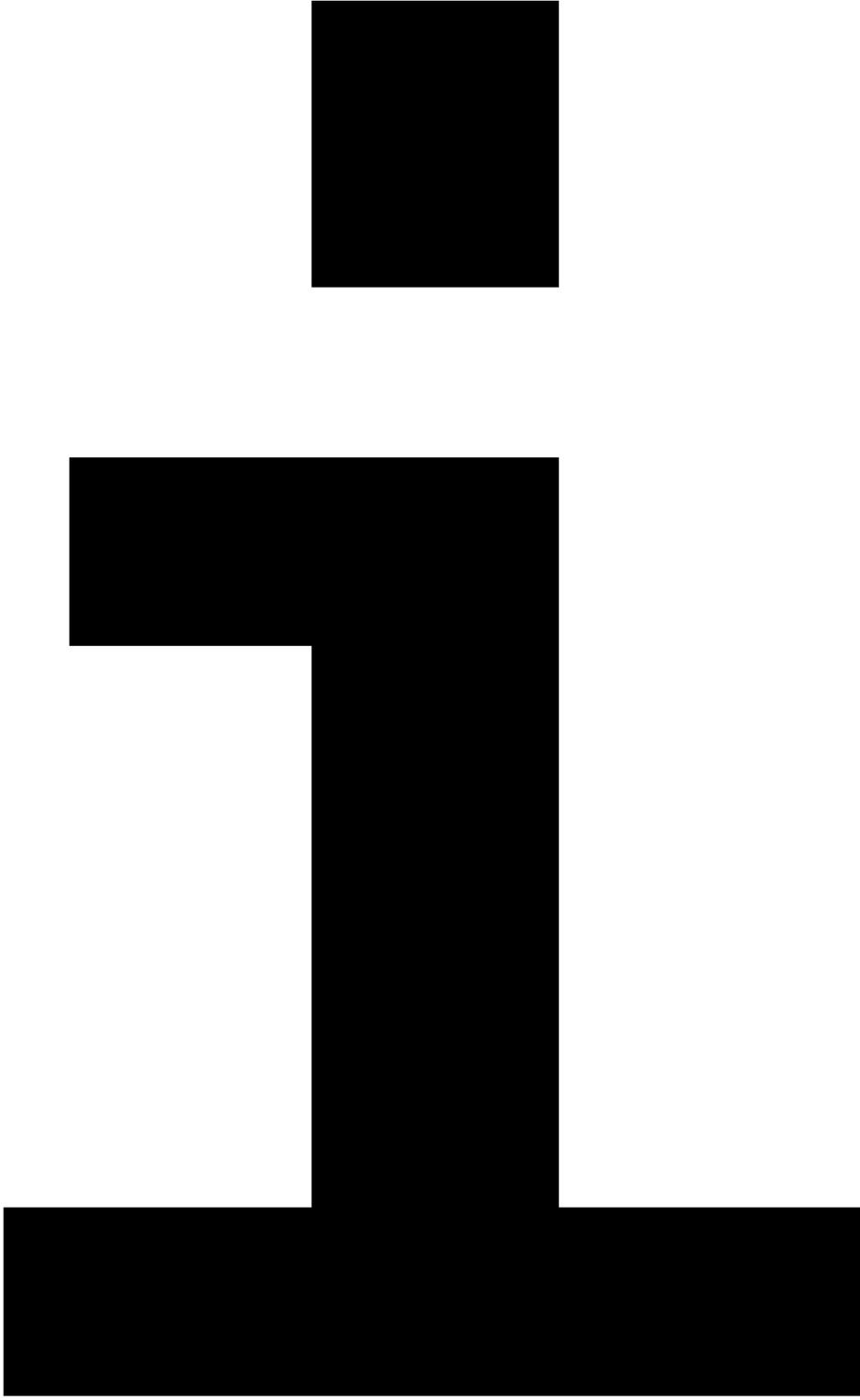
e

J

S

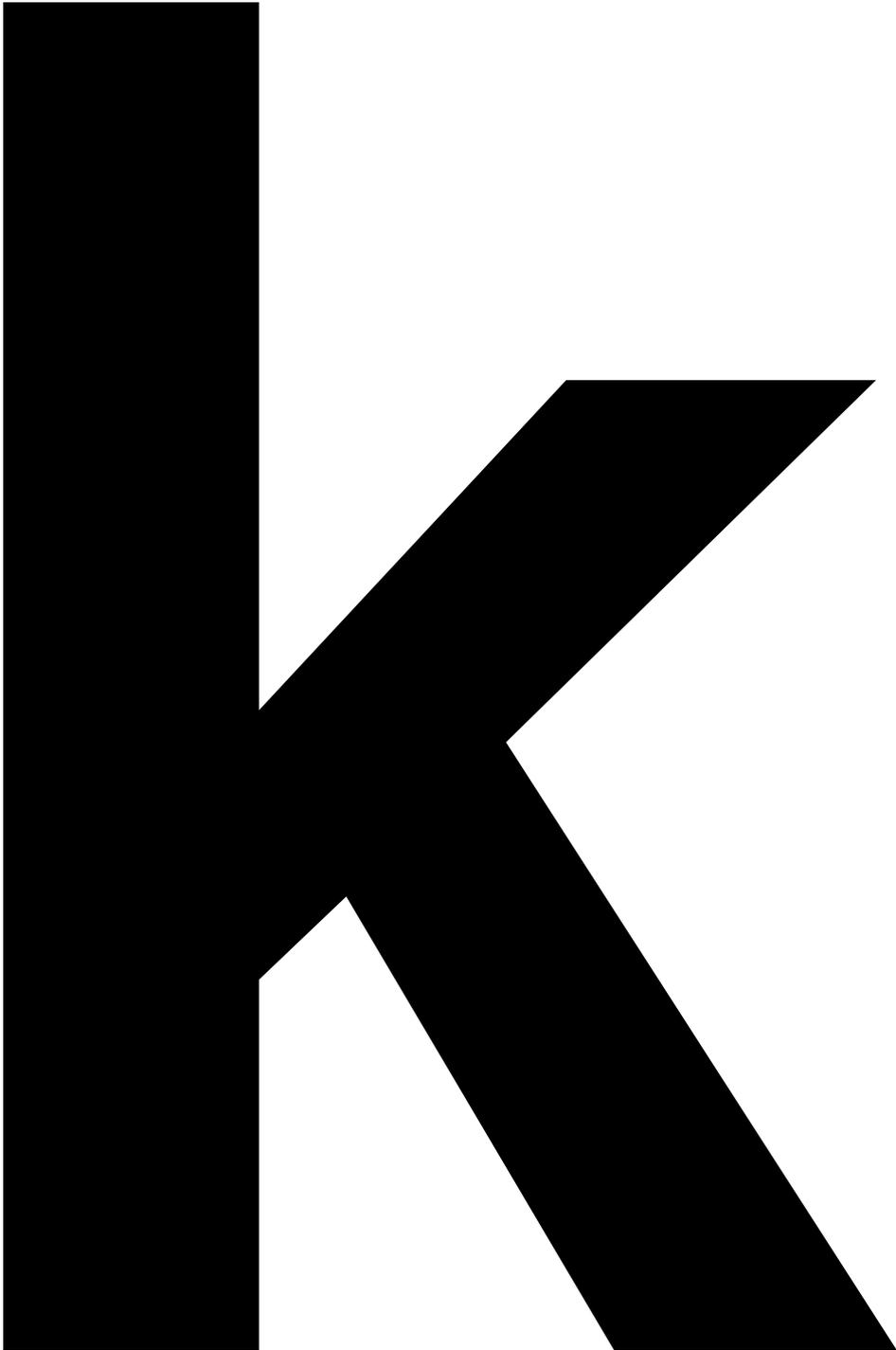
w

e



S

e

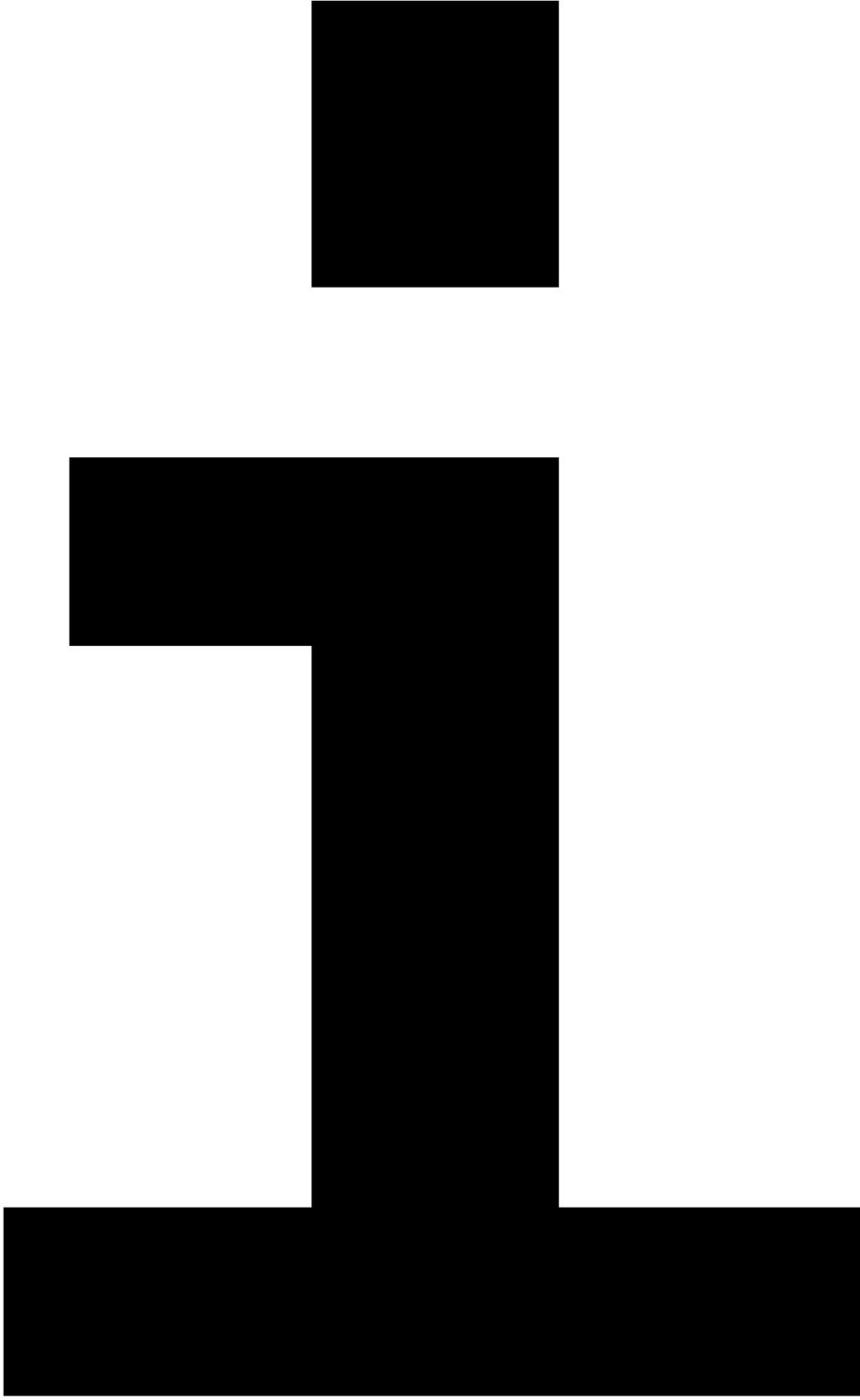


sa

n

n

e



n

P

u

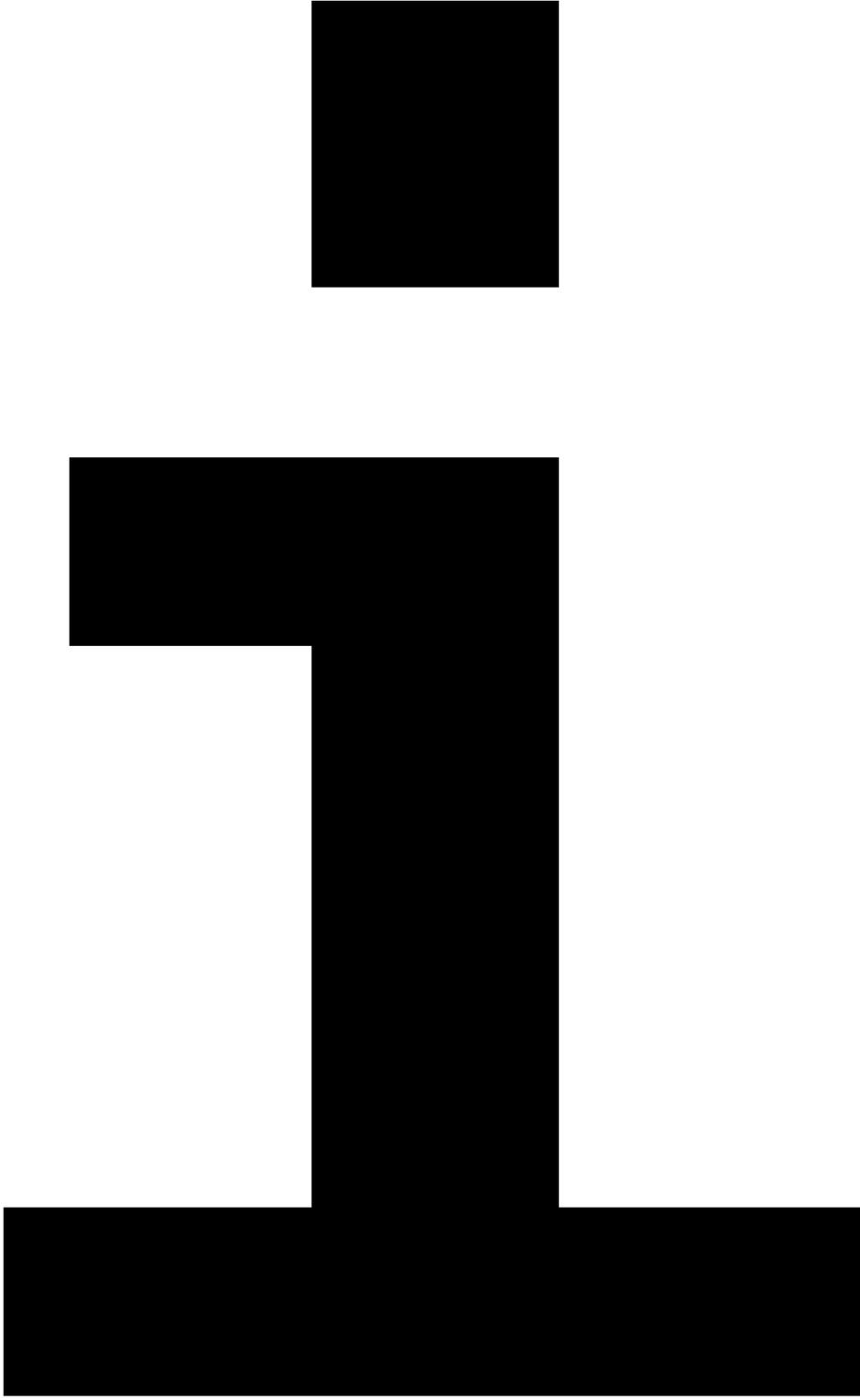
m

o

S

o

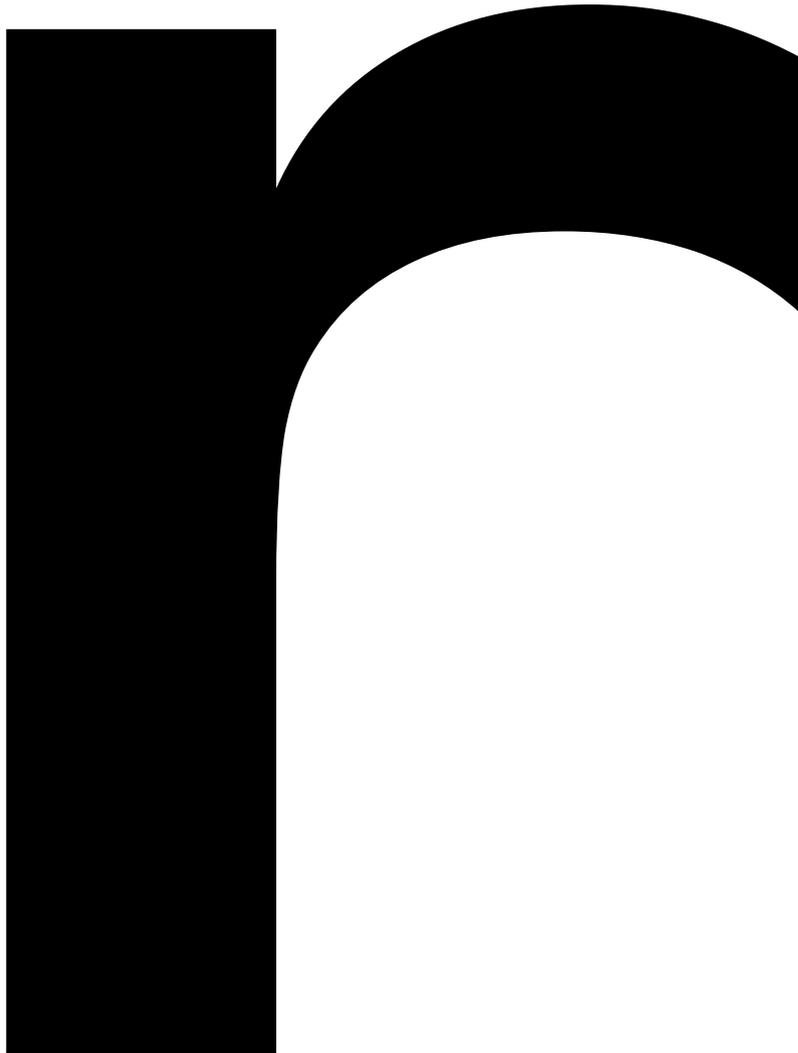
e



C

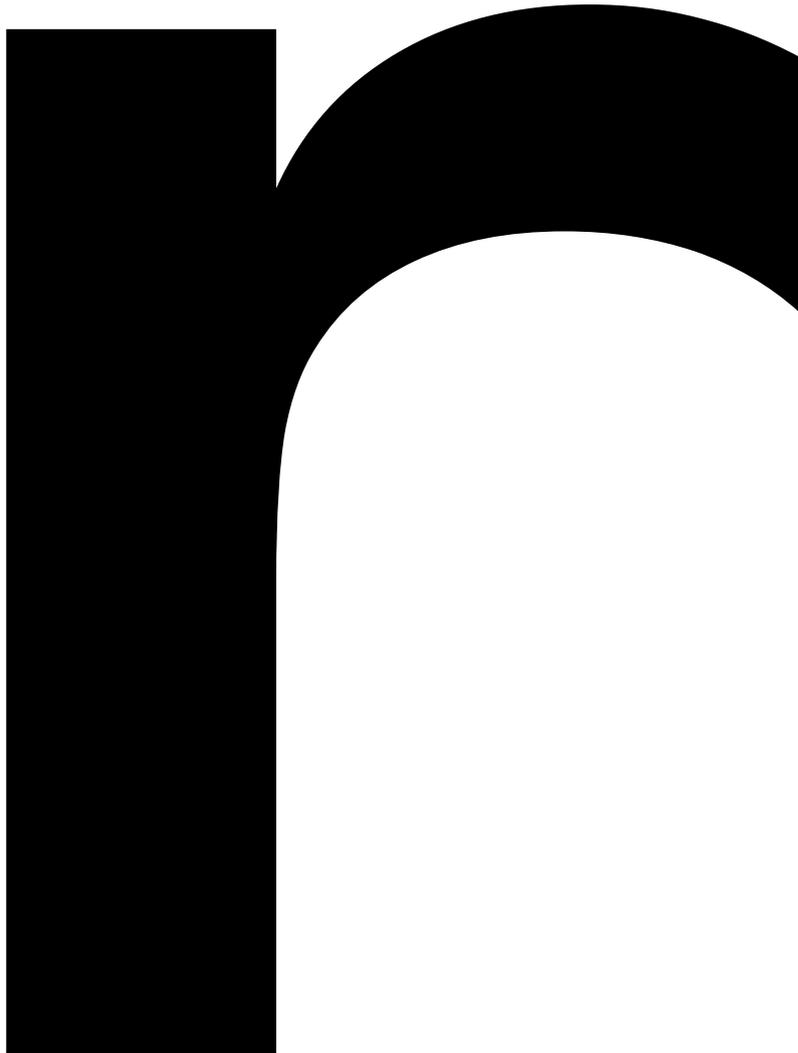
h

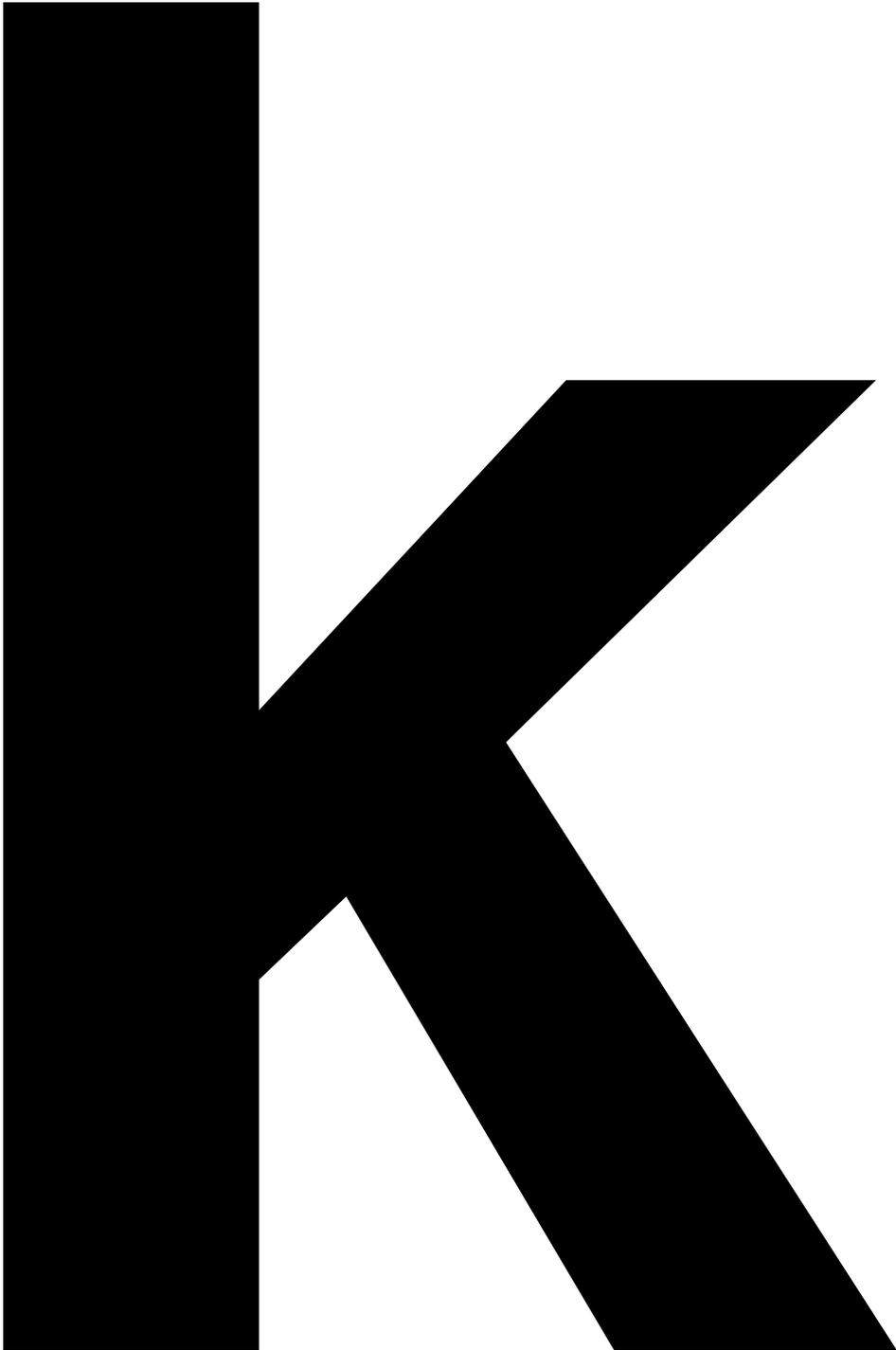
e



w

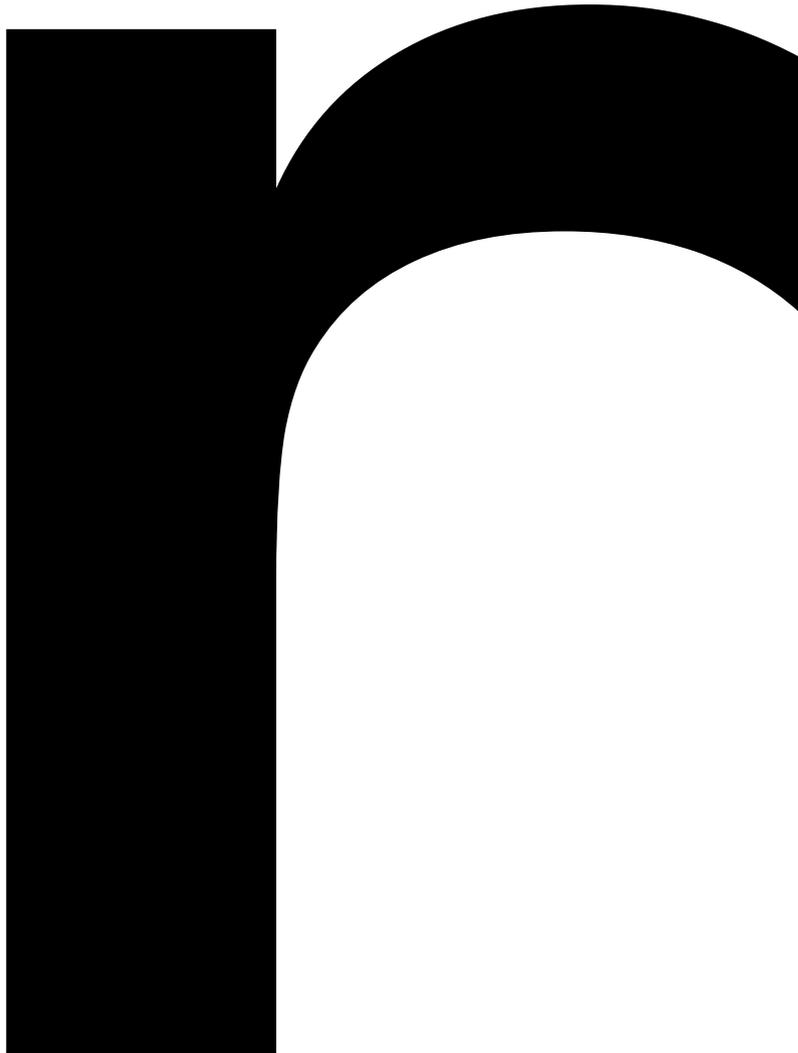
e



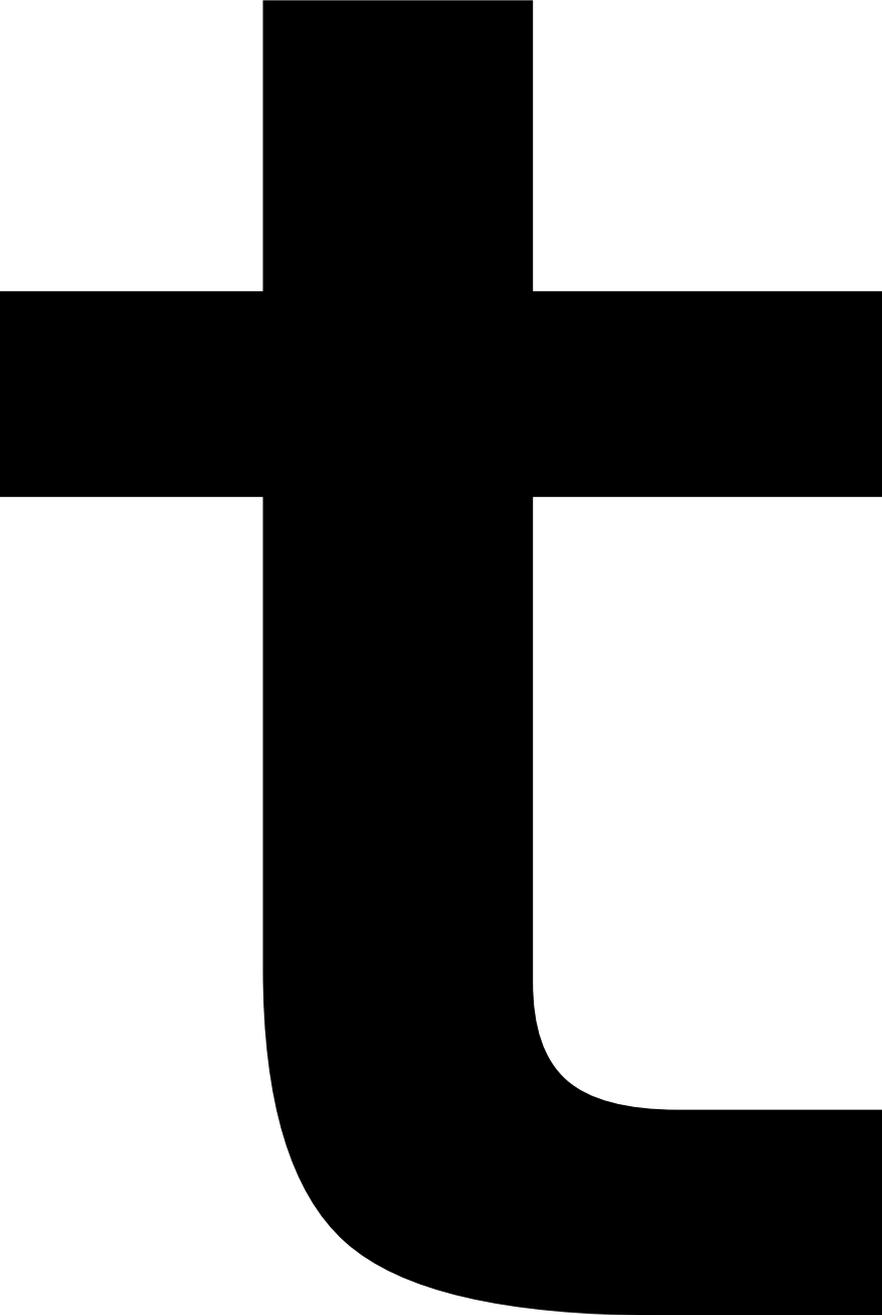


n

u

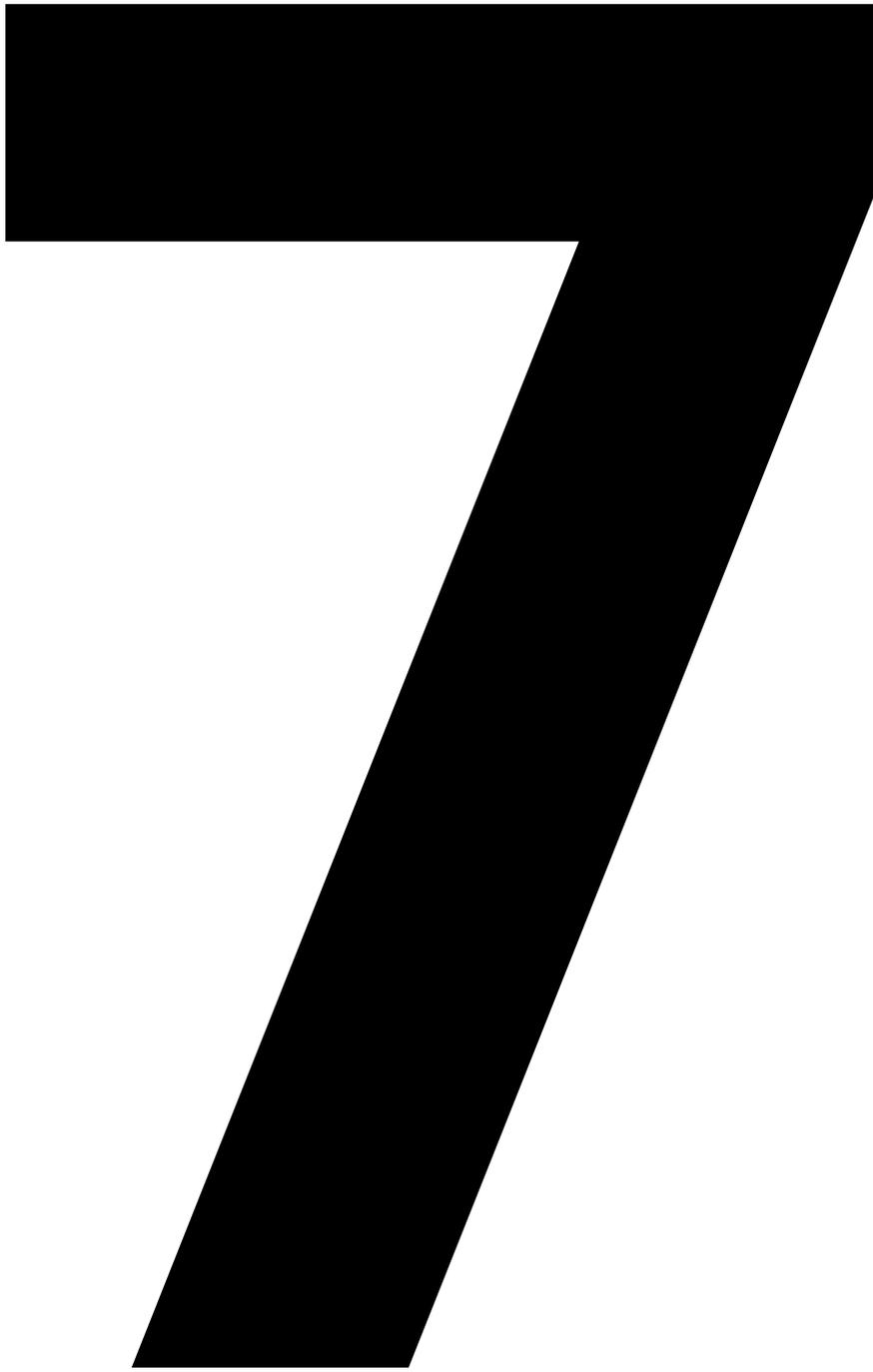


e

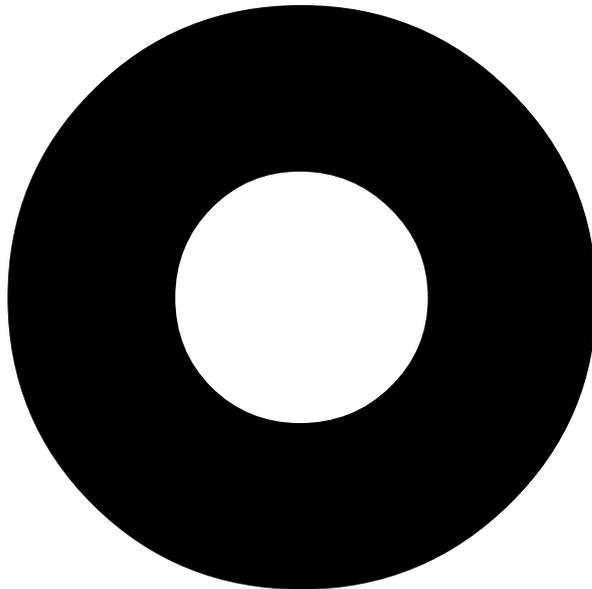
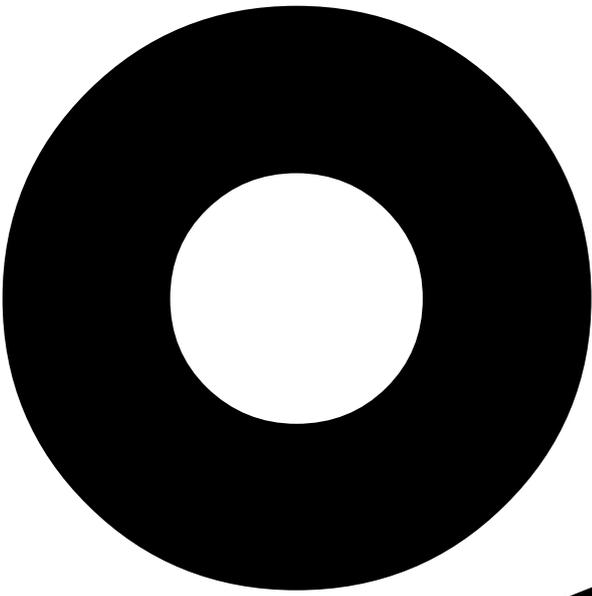


w

sa

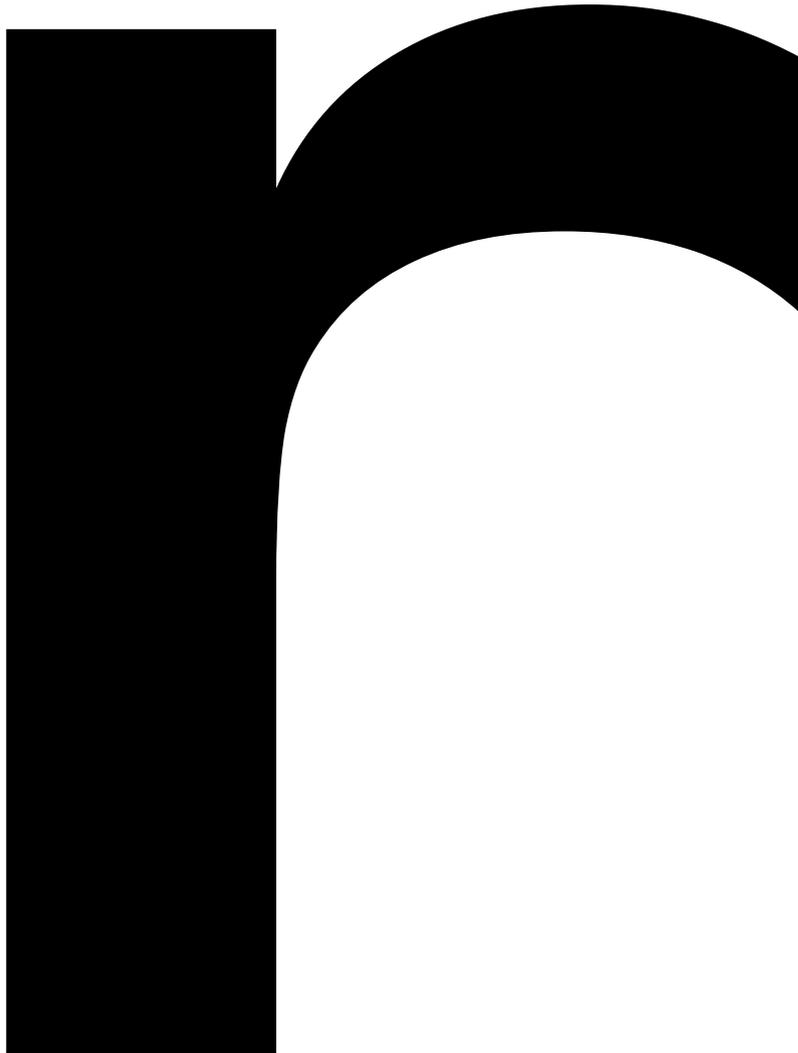


5

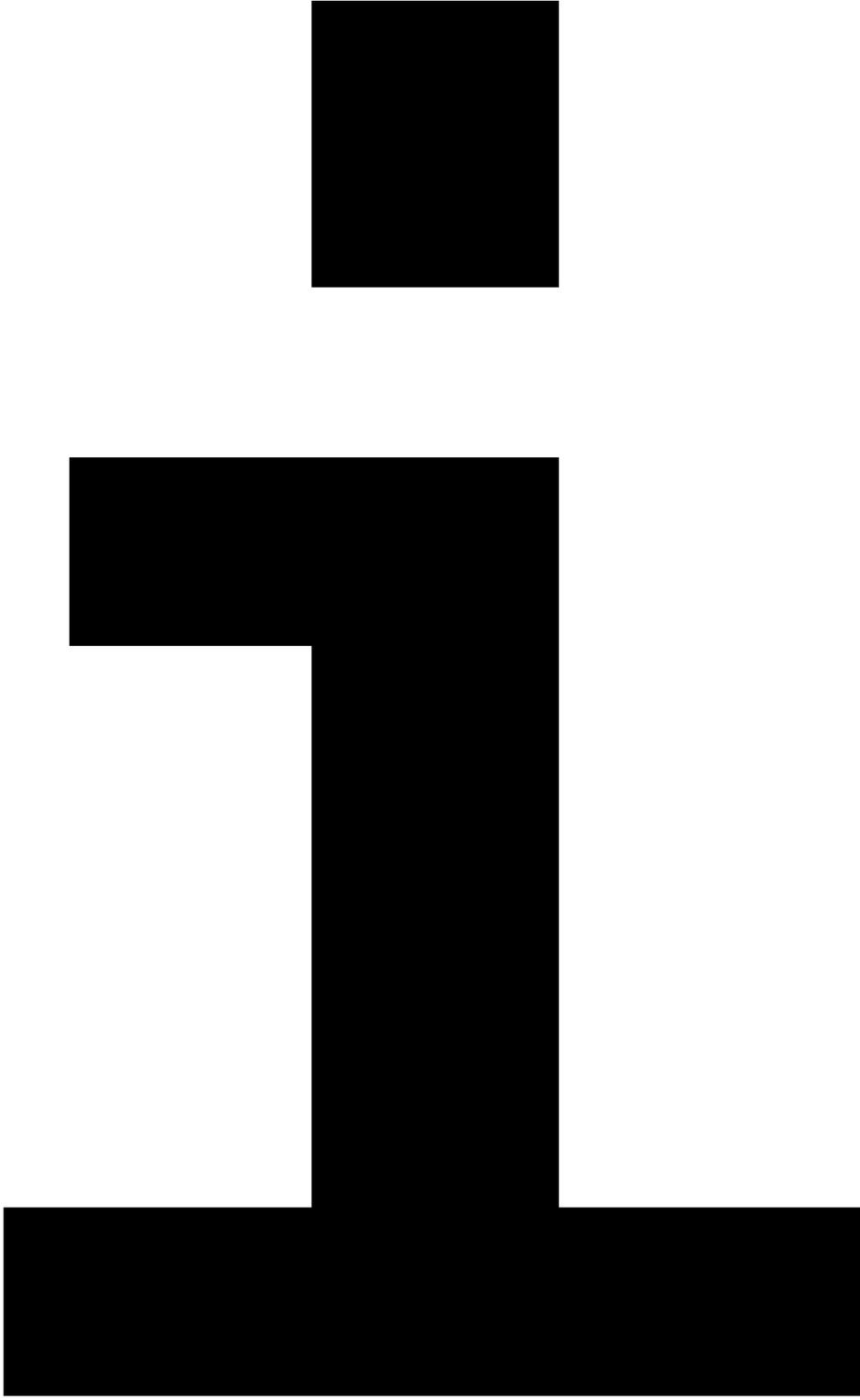


Q

e



e

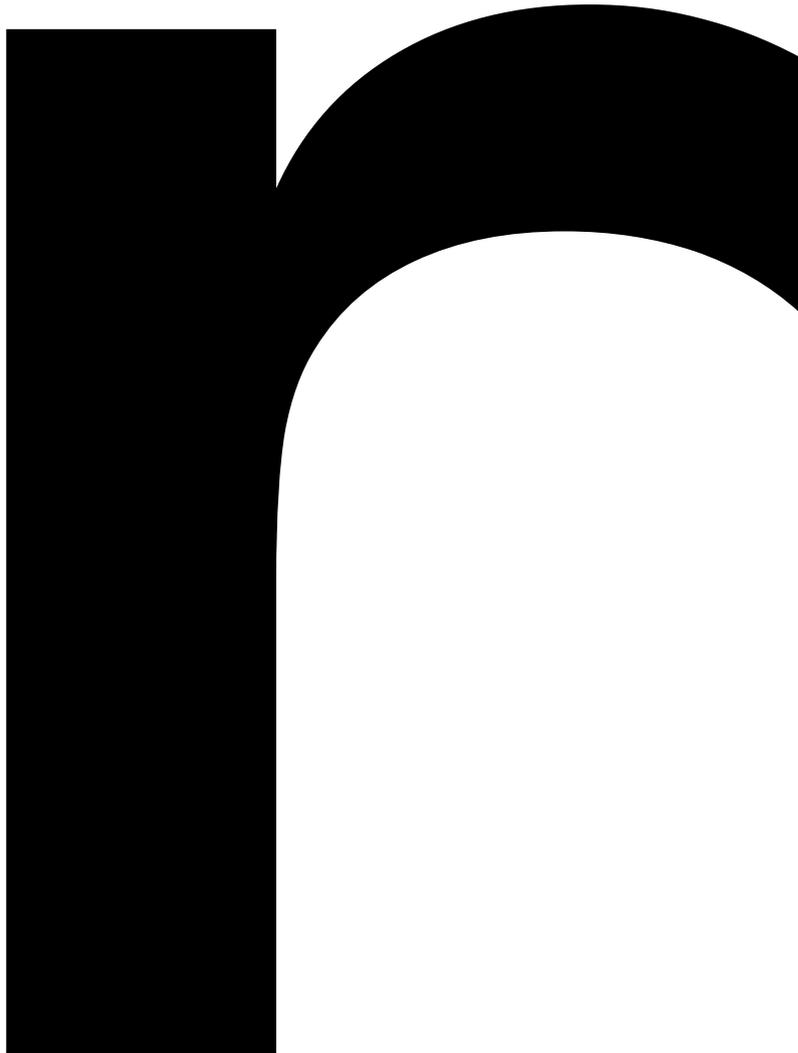


n

Q

e

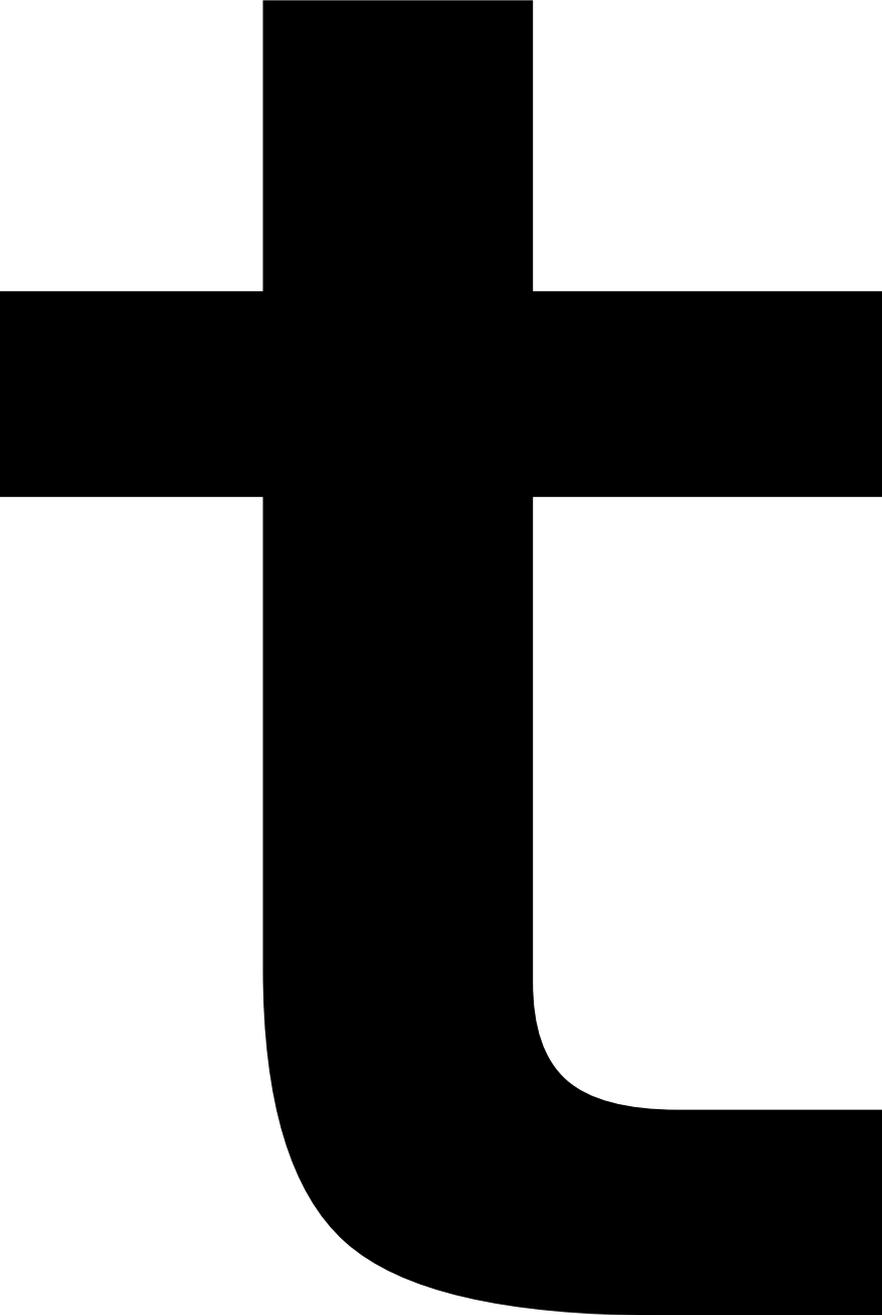
10



sa

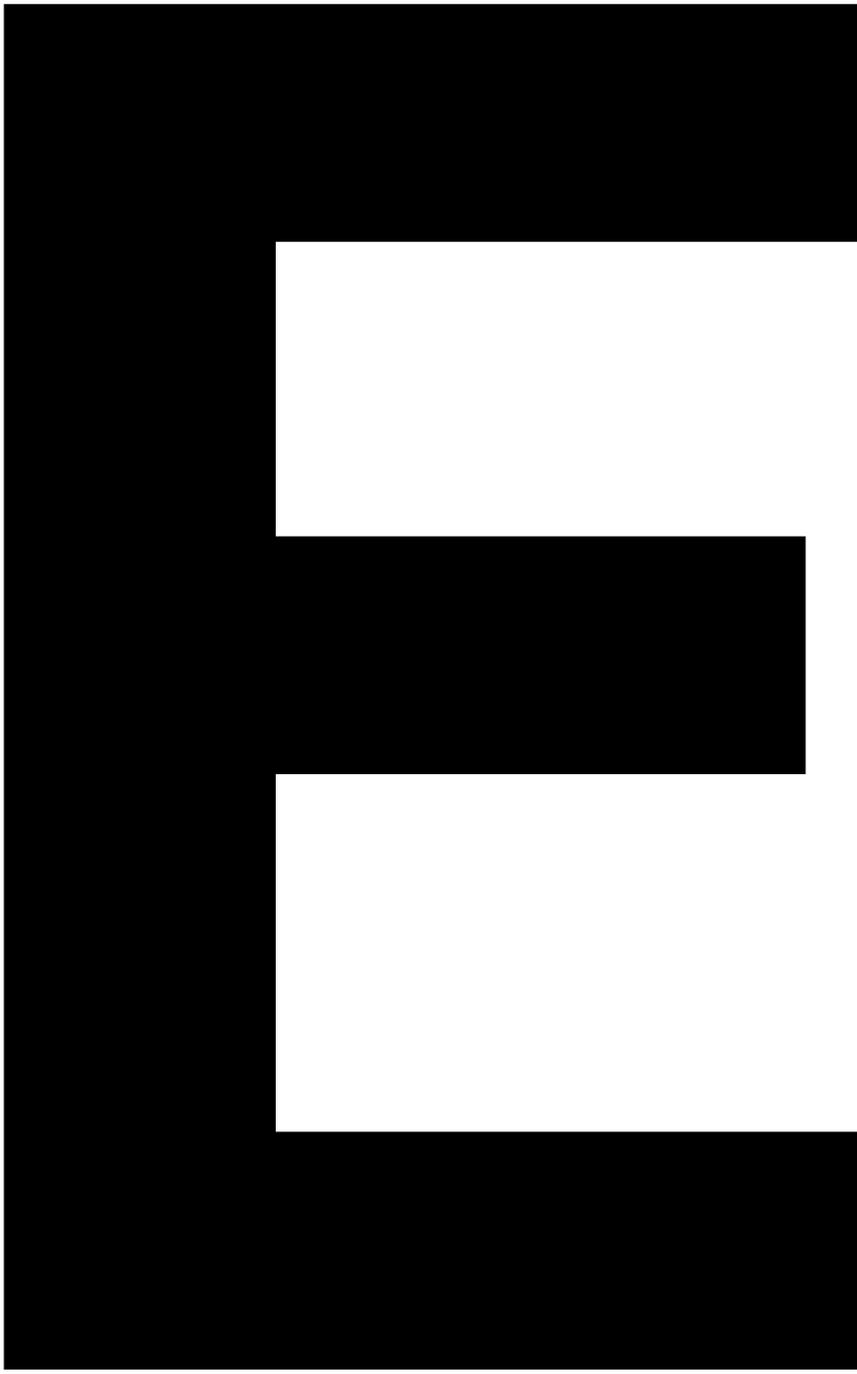
C

h



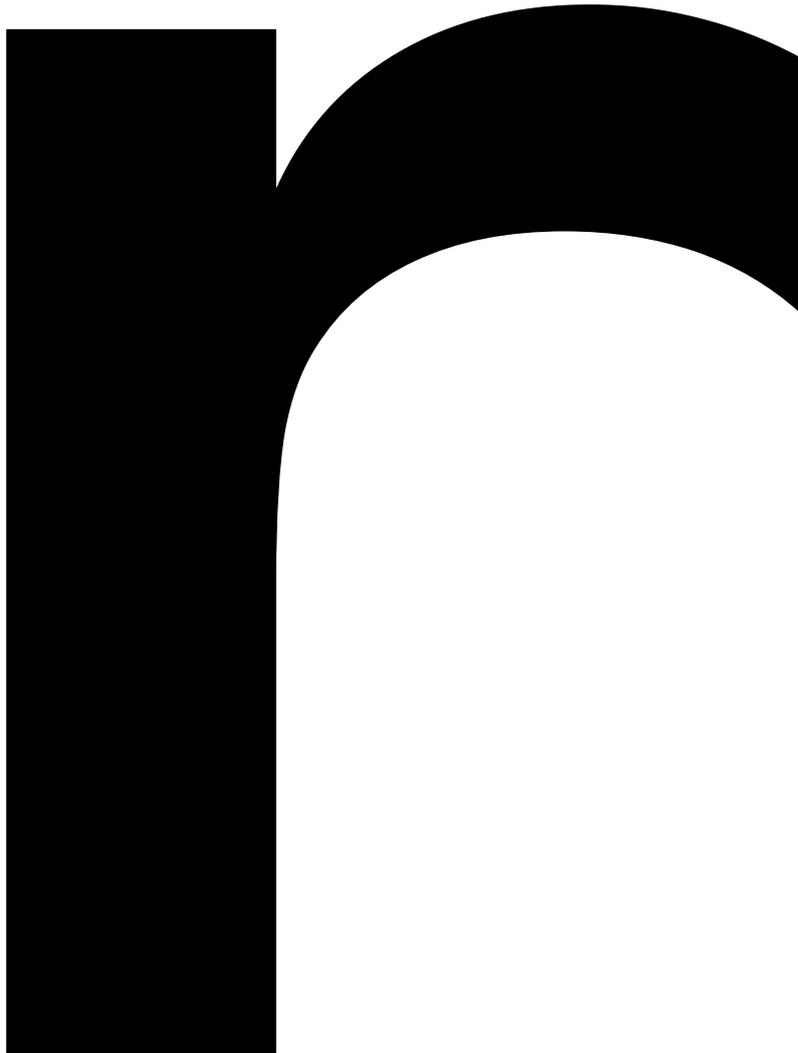
e

n

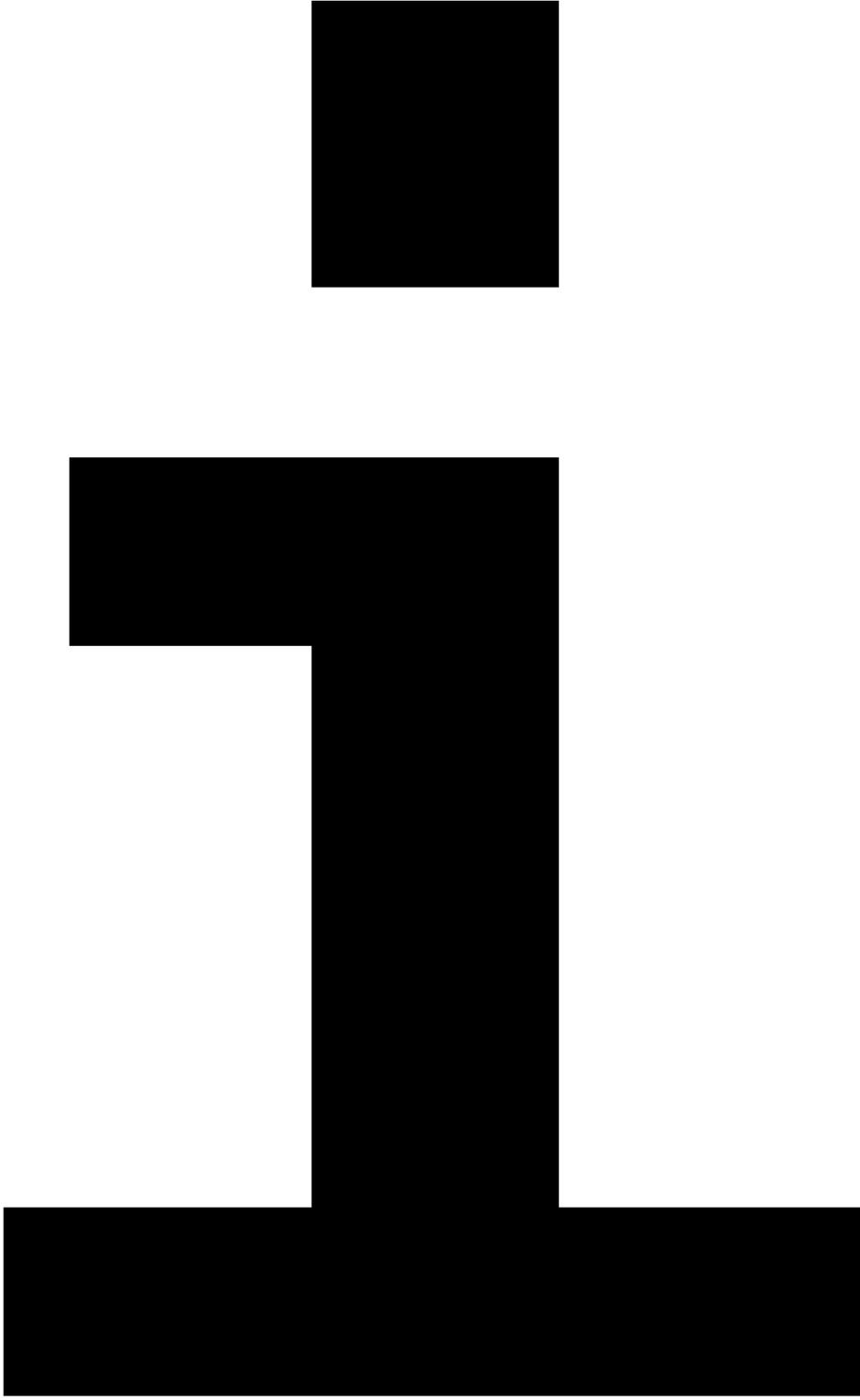


n

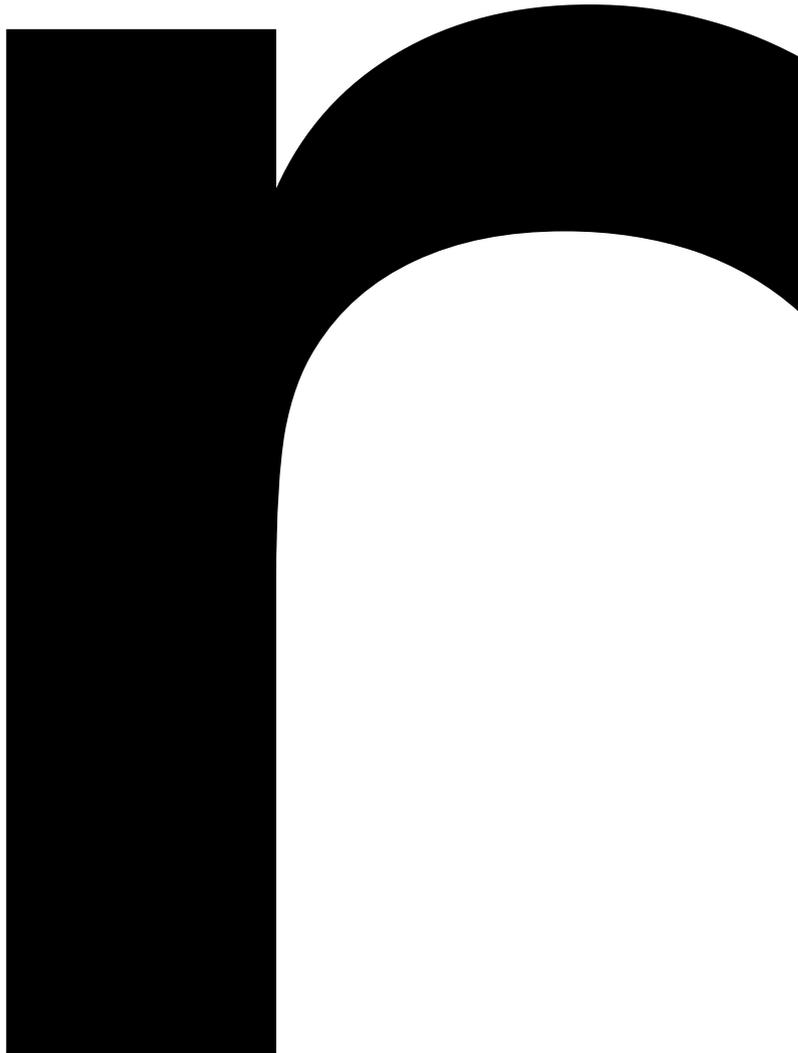
e



Q

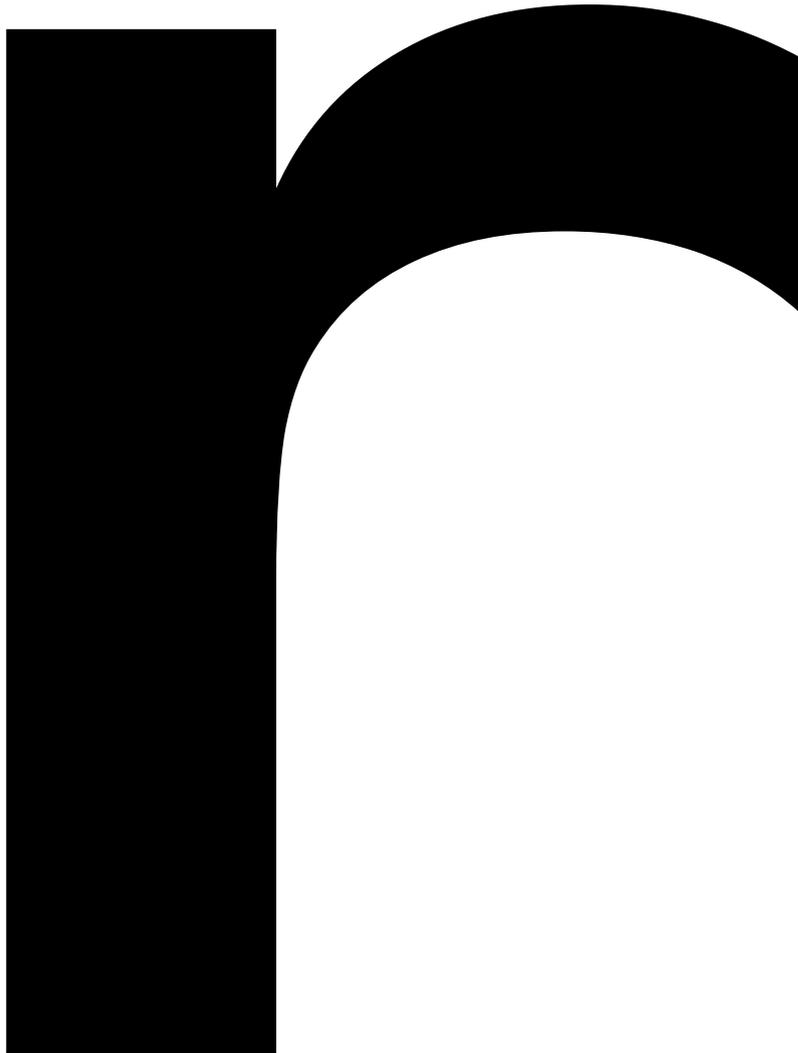


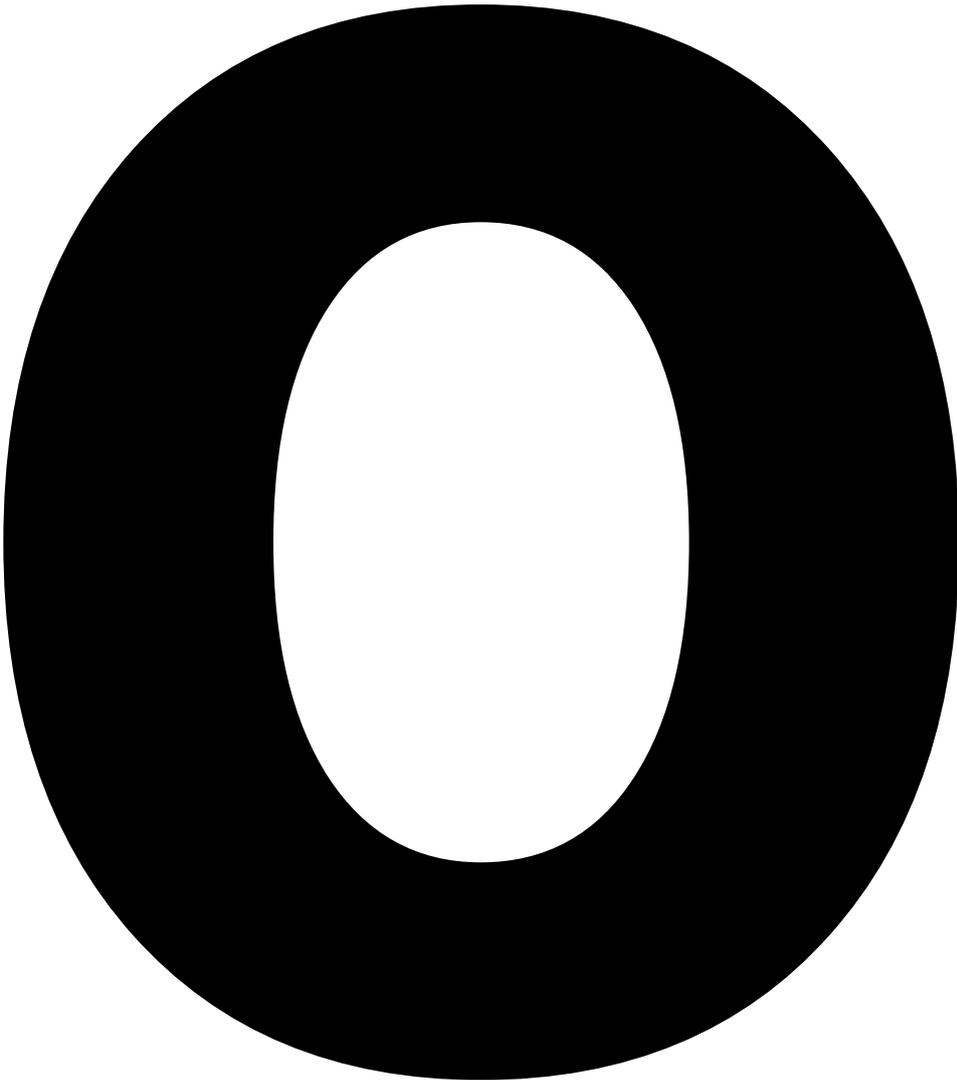
e



e

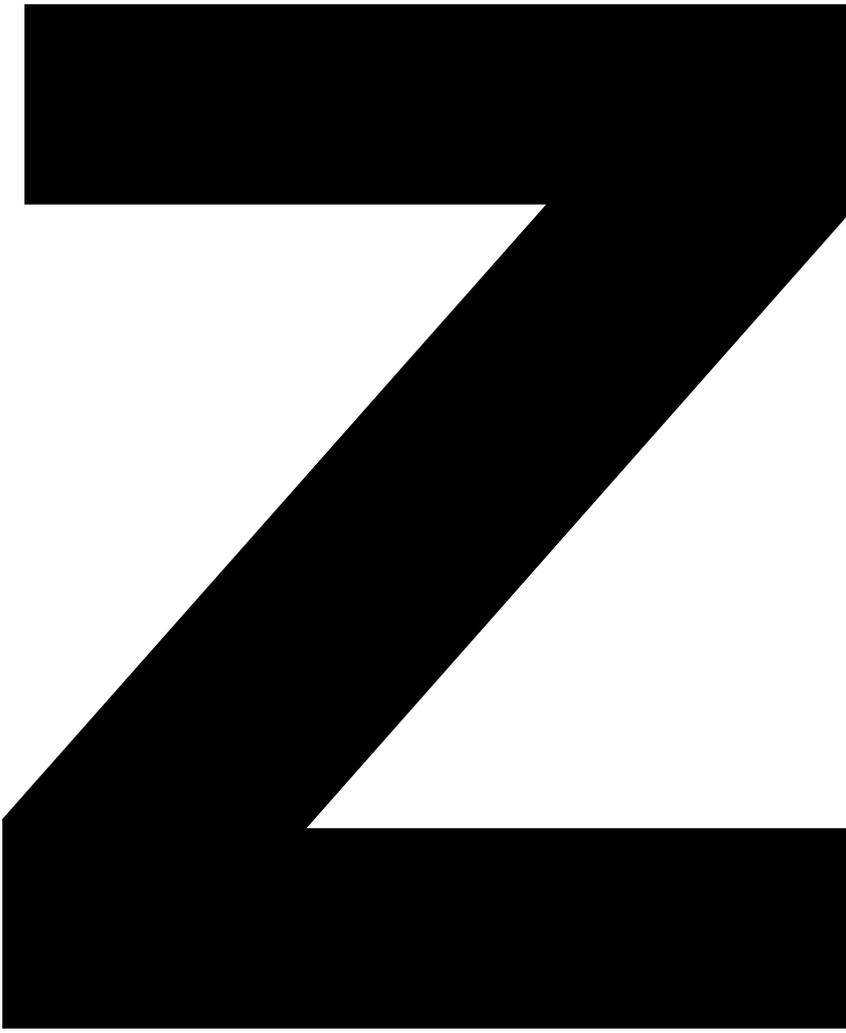
o

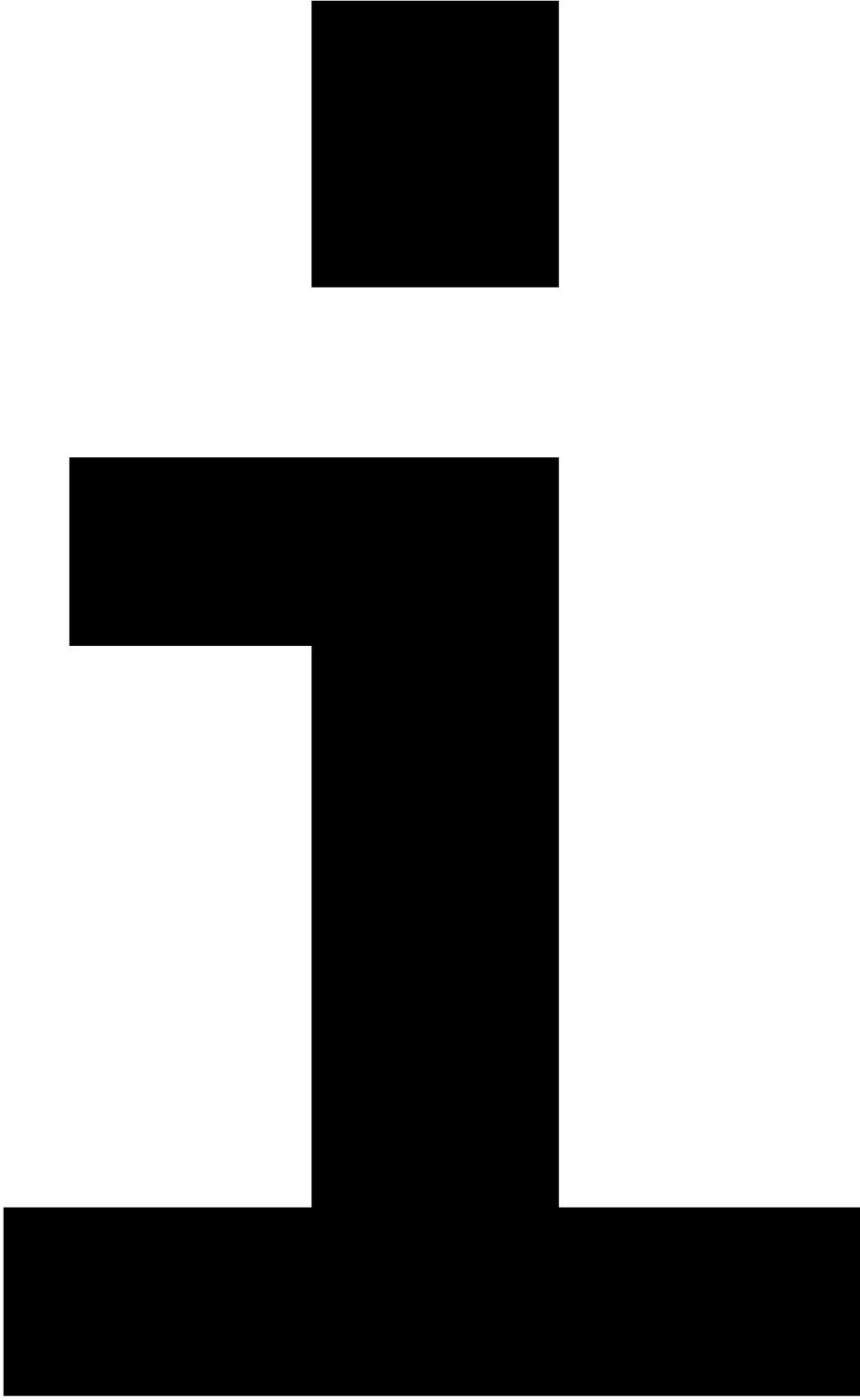




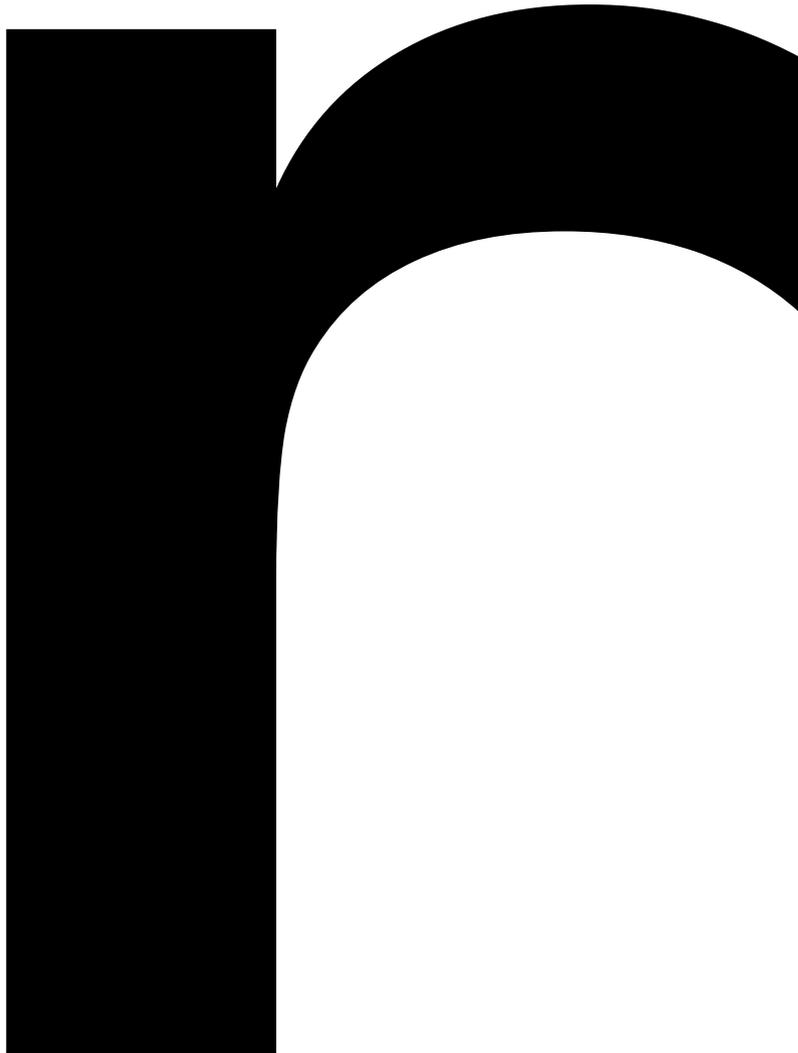
Q

u



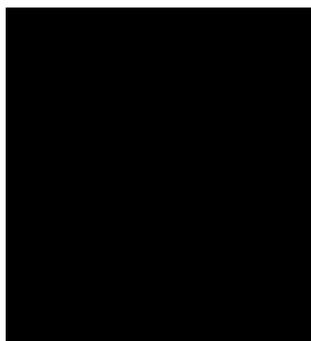


e



e

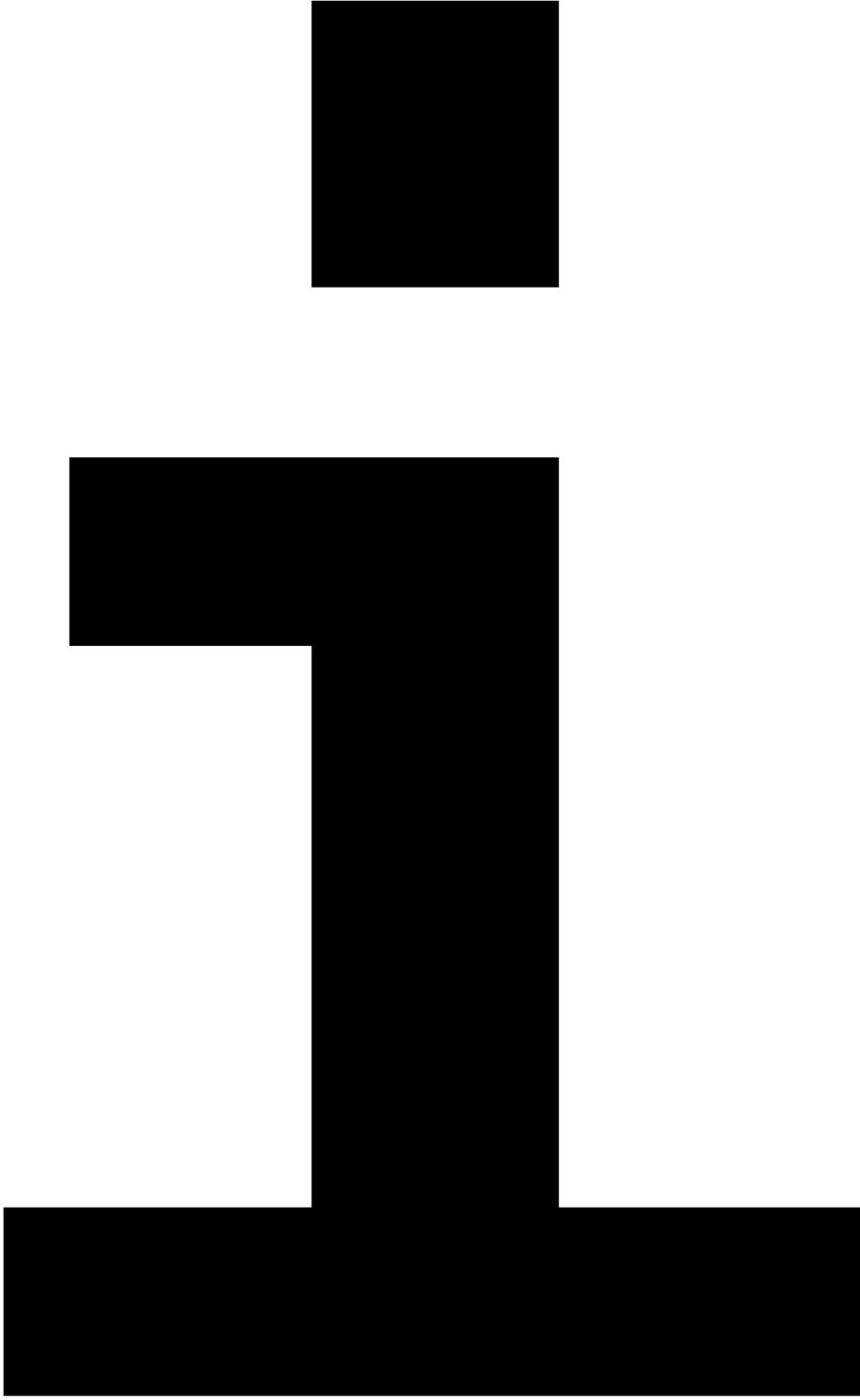
n



U

m

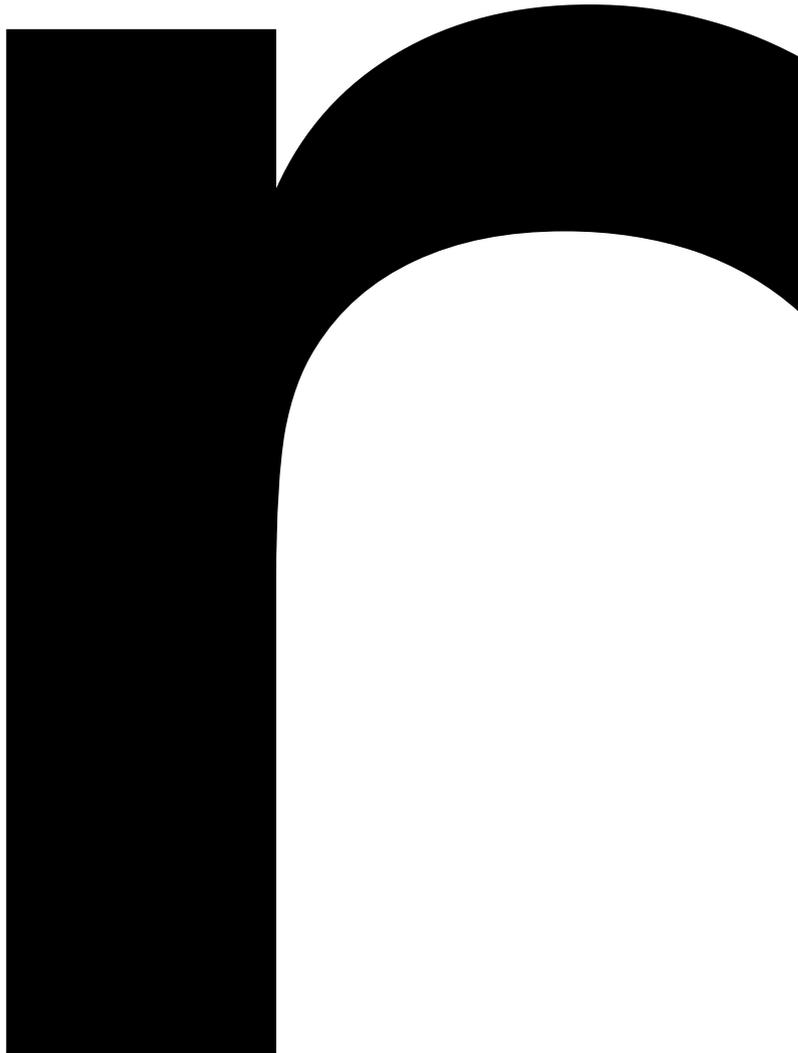
e



n

e

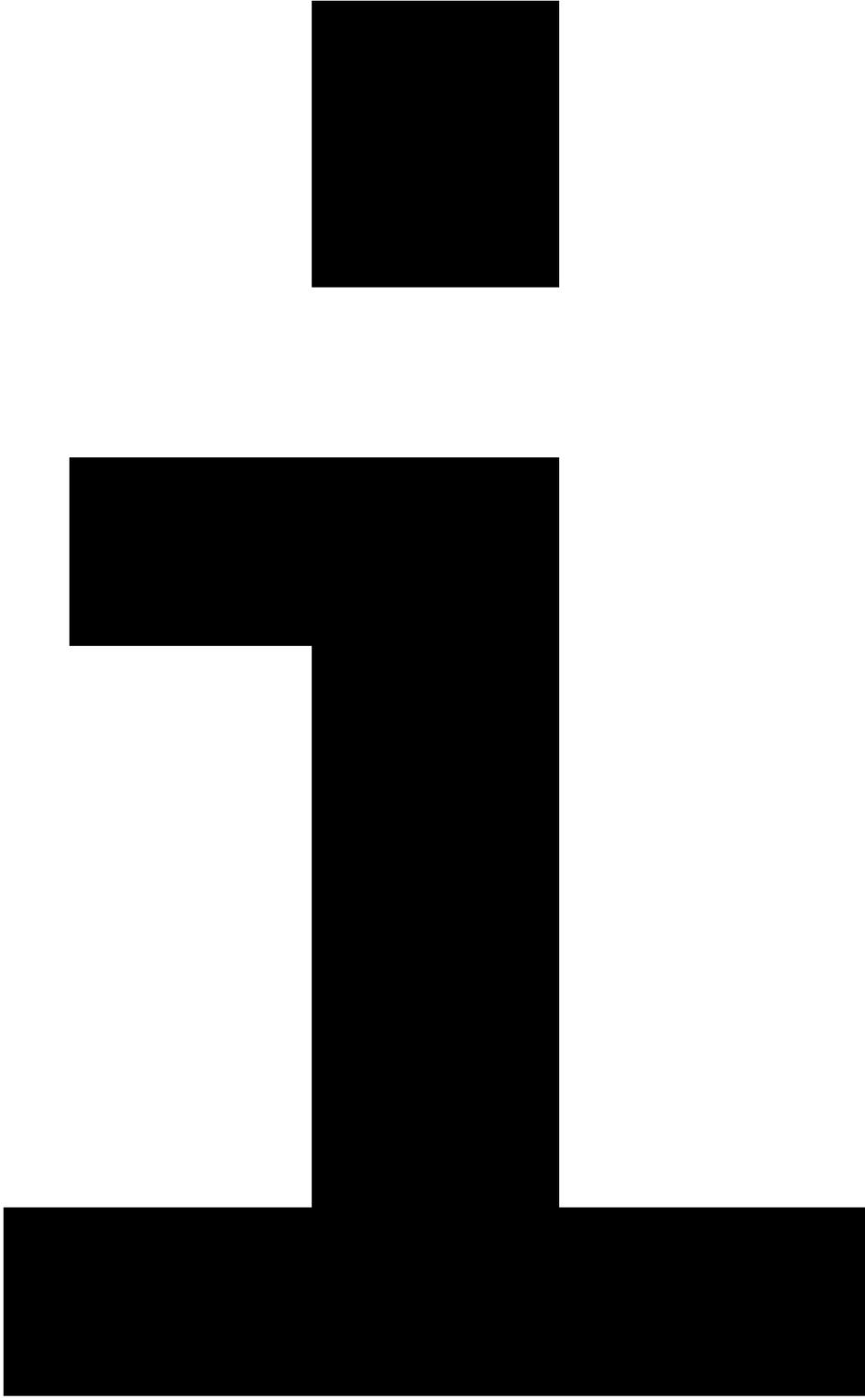
n



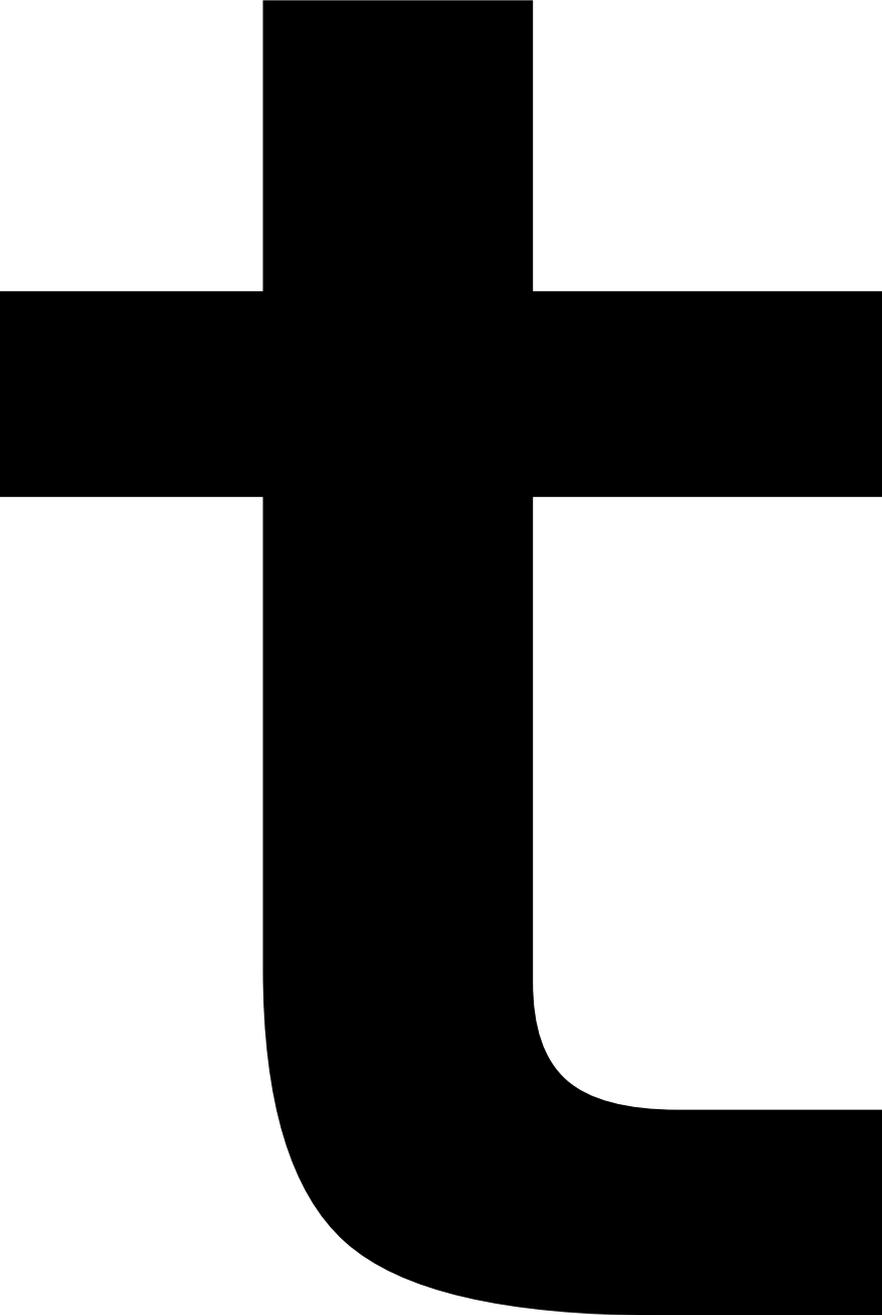
e

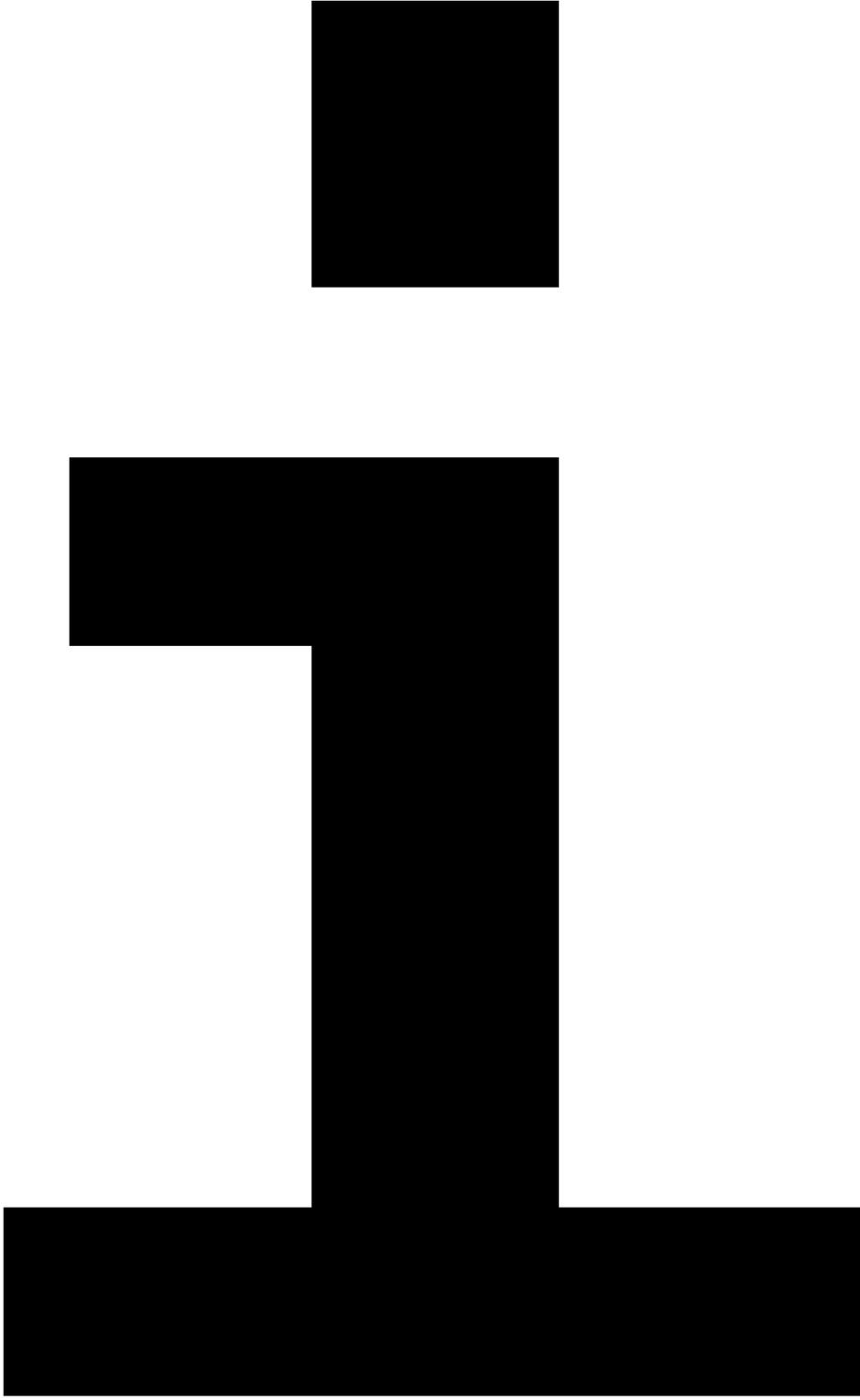
sa

J



S





S

C

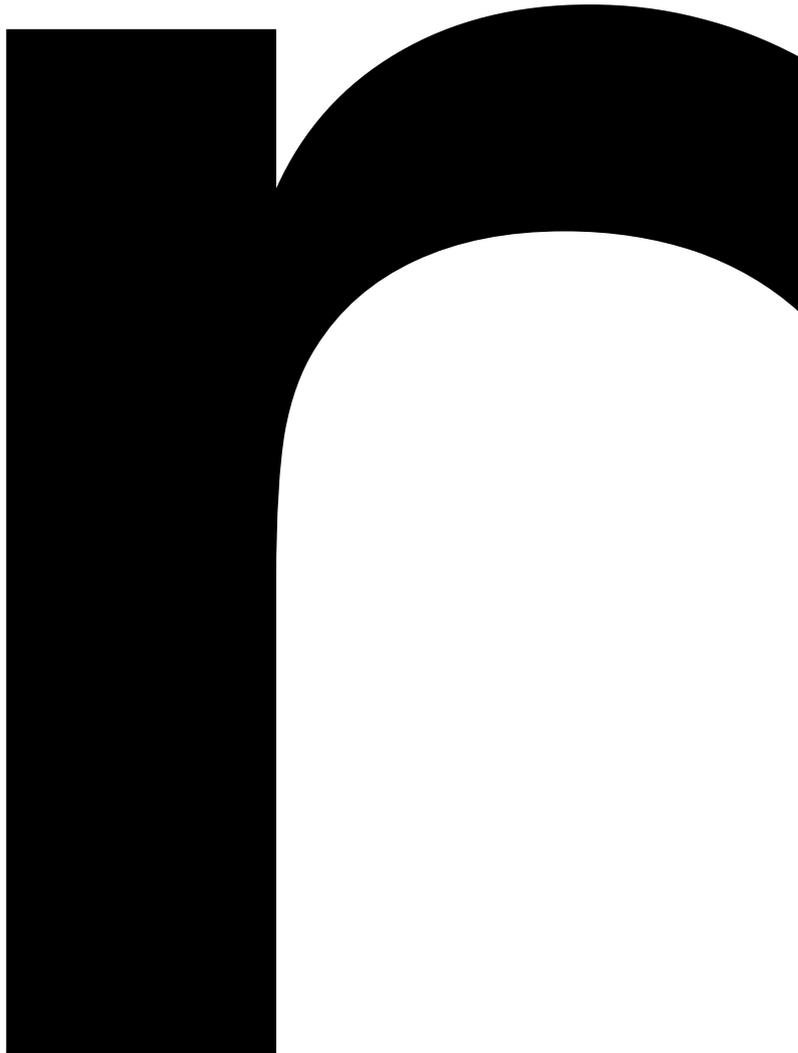
h

e

n

V

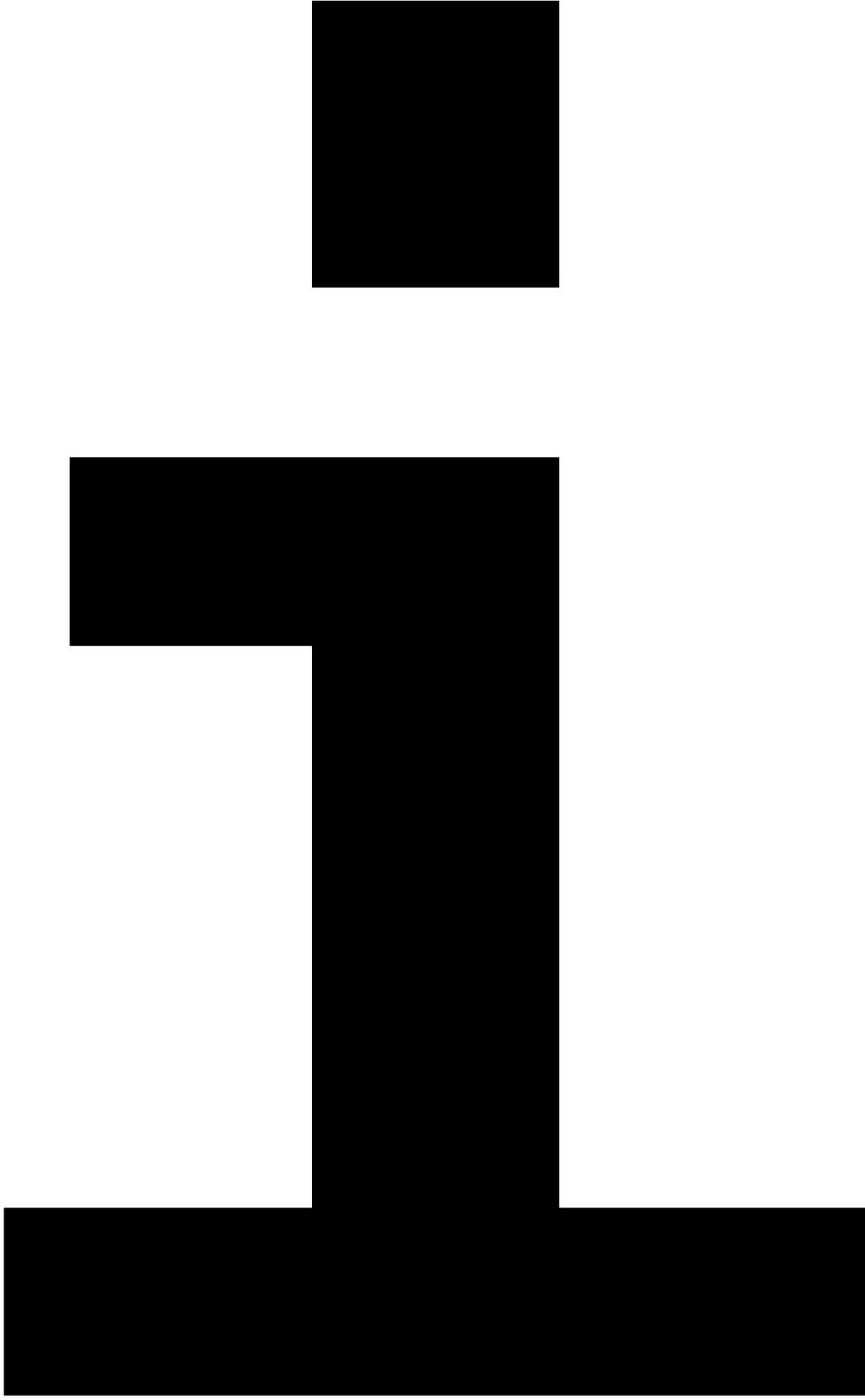
e



Q

J

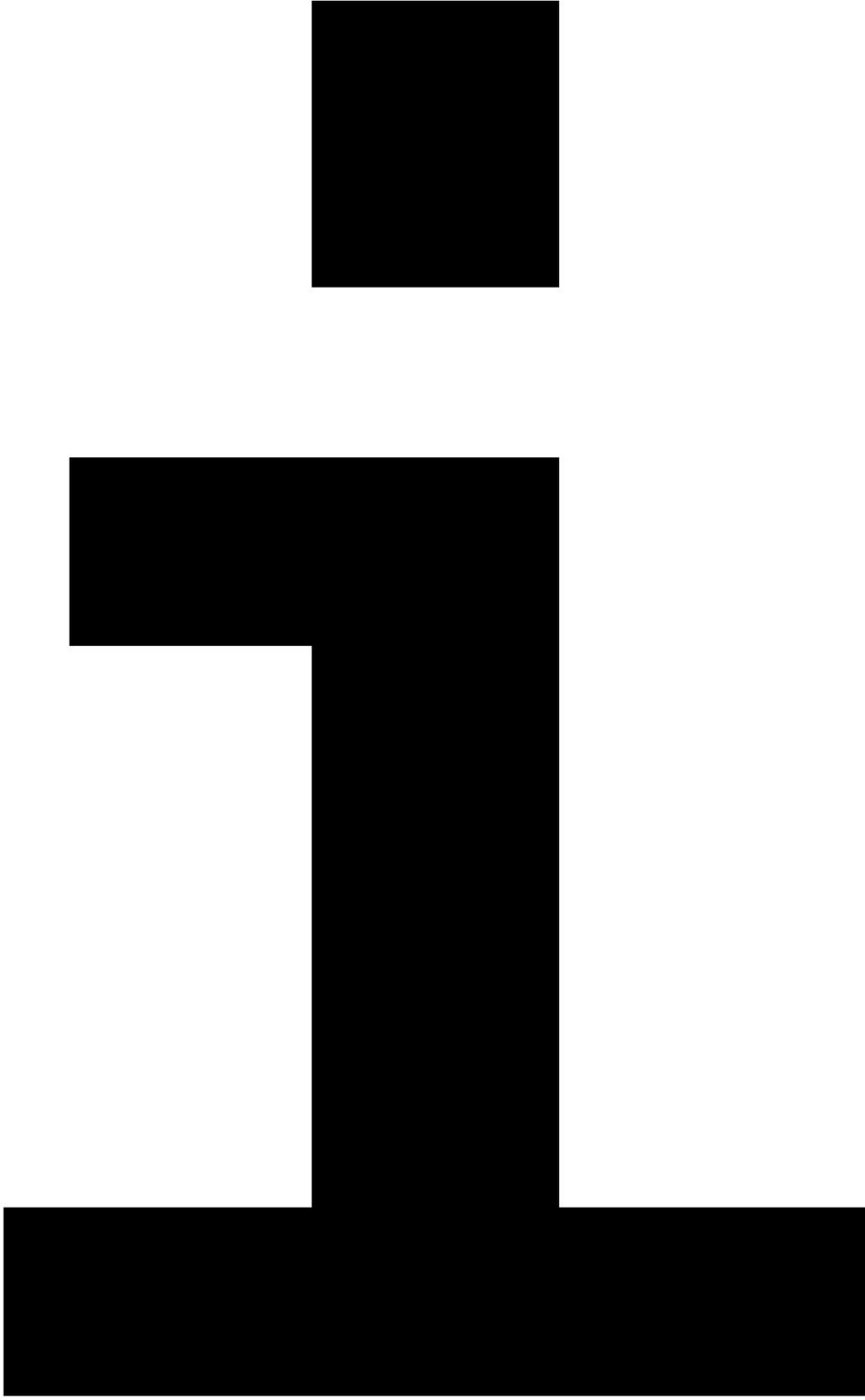
e

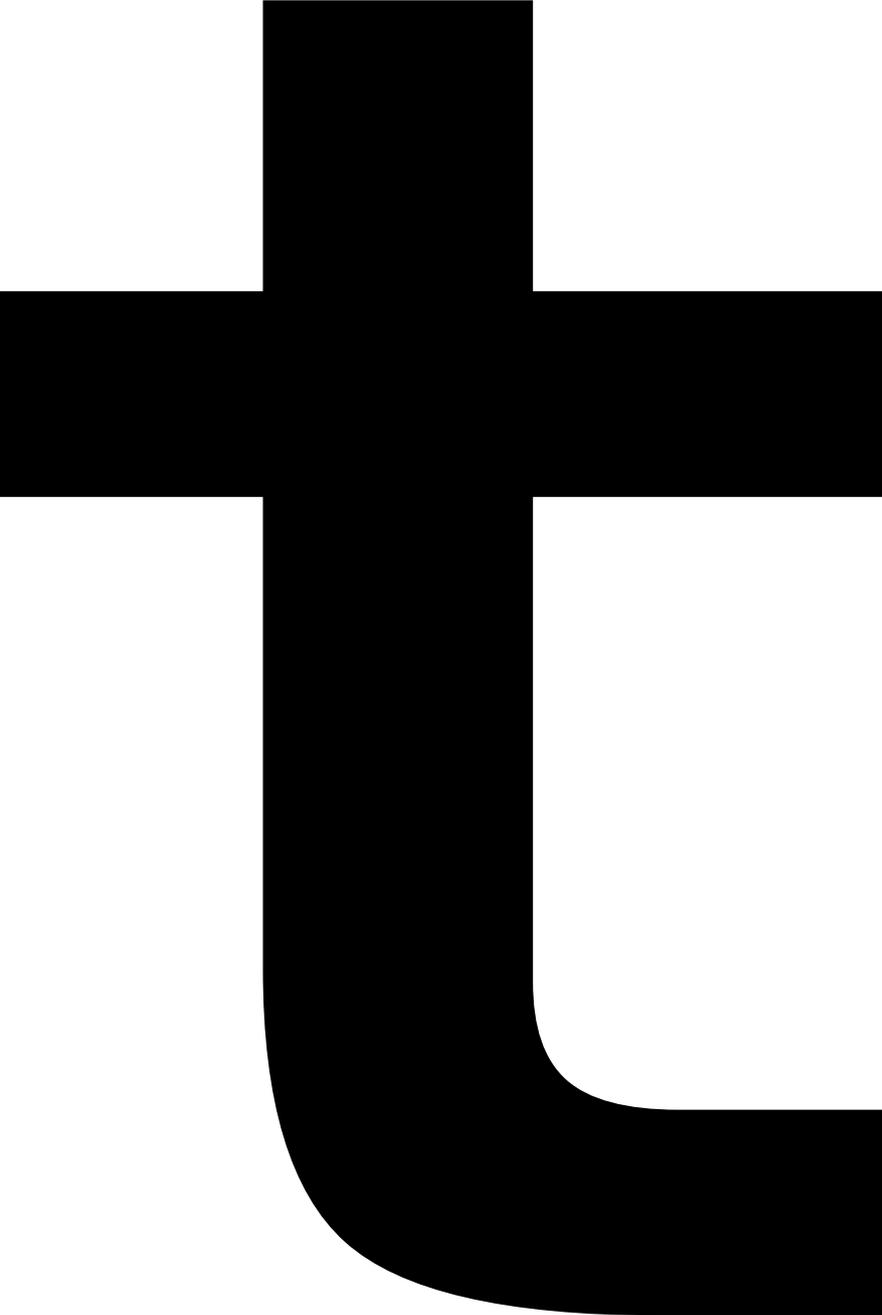


C

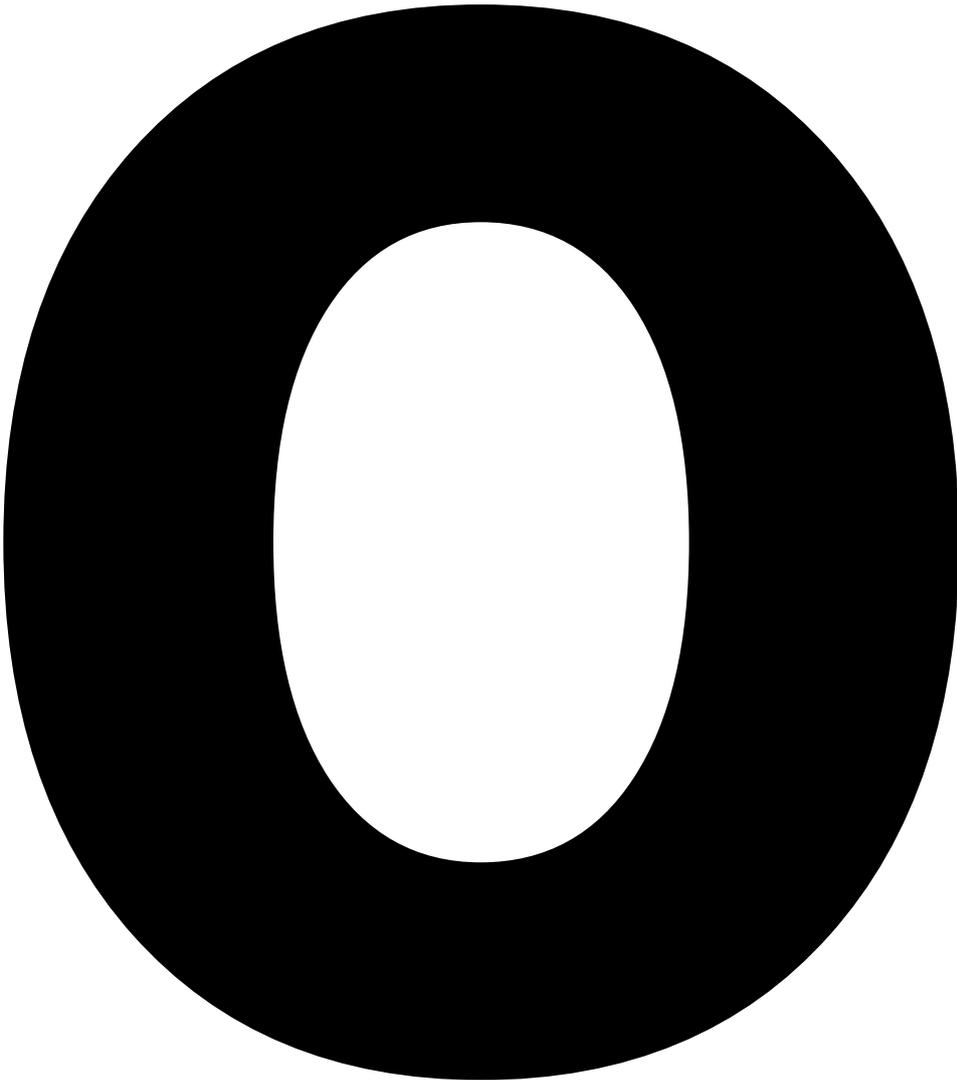
h

m





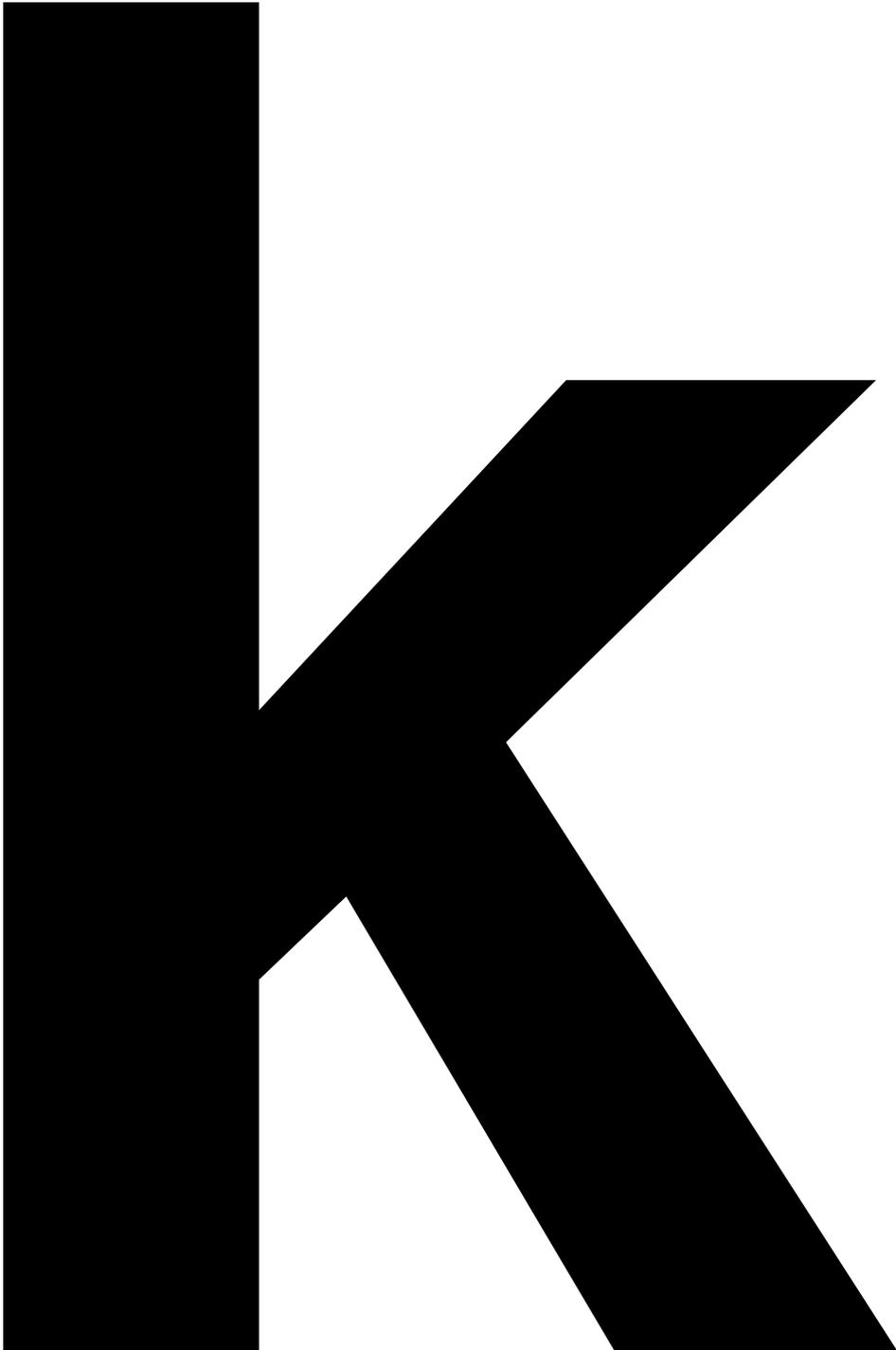
K

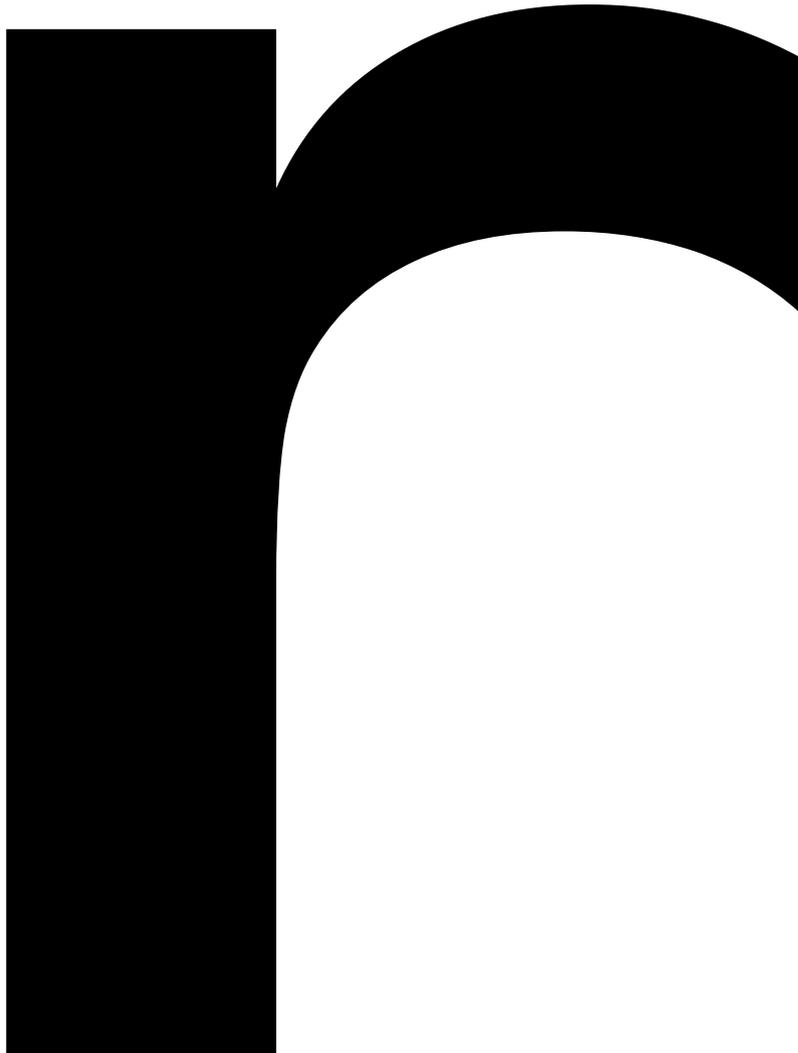


h

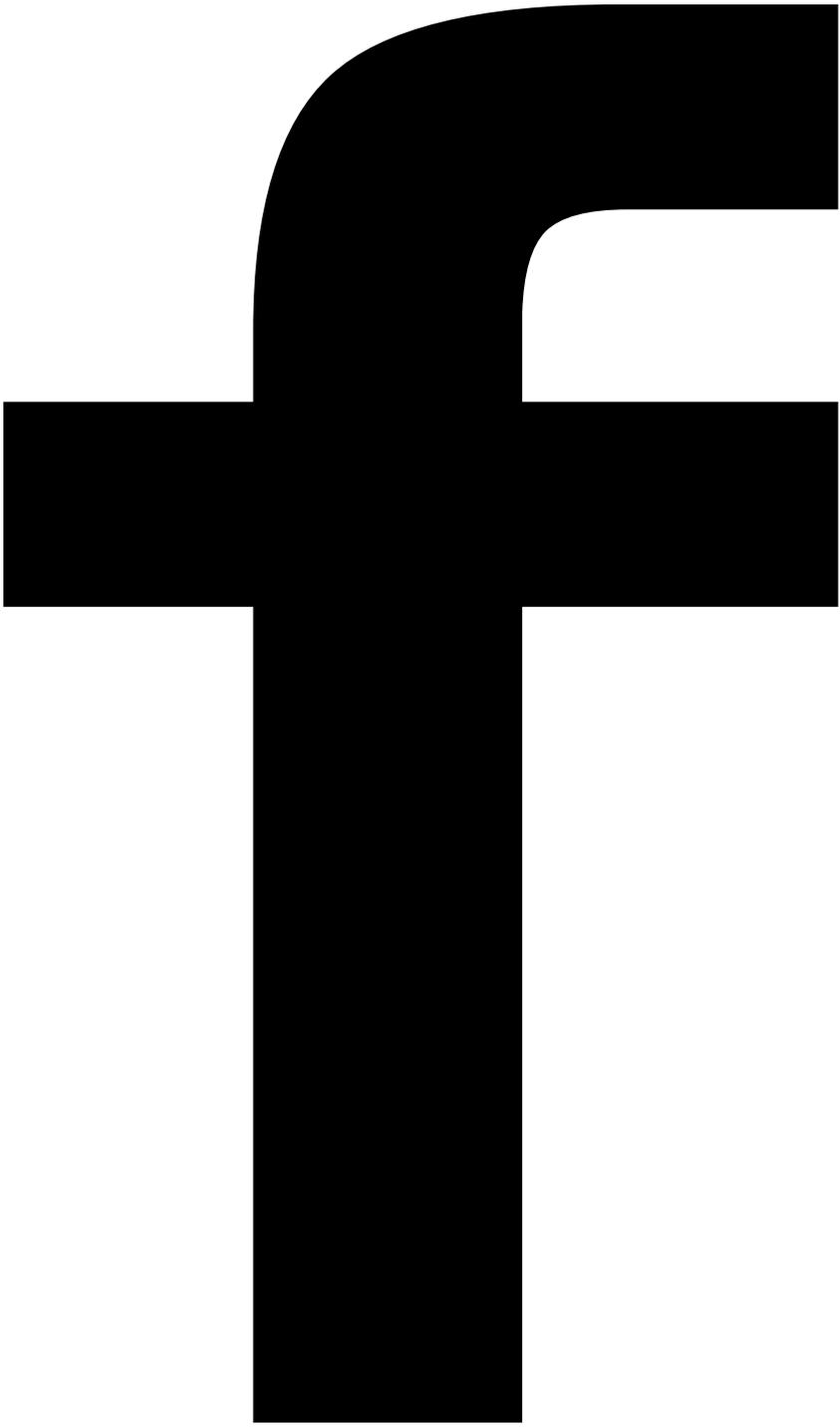
J

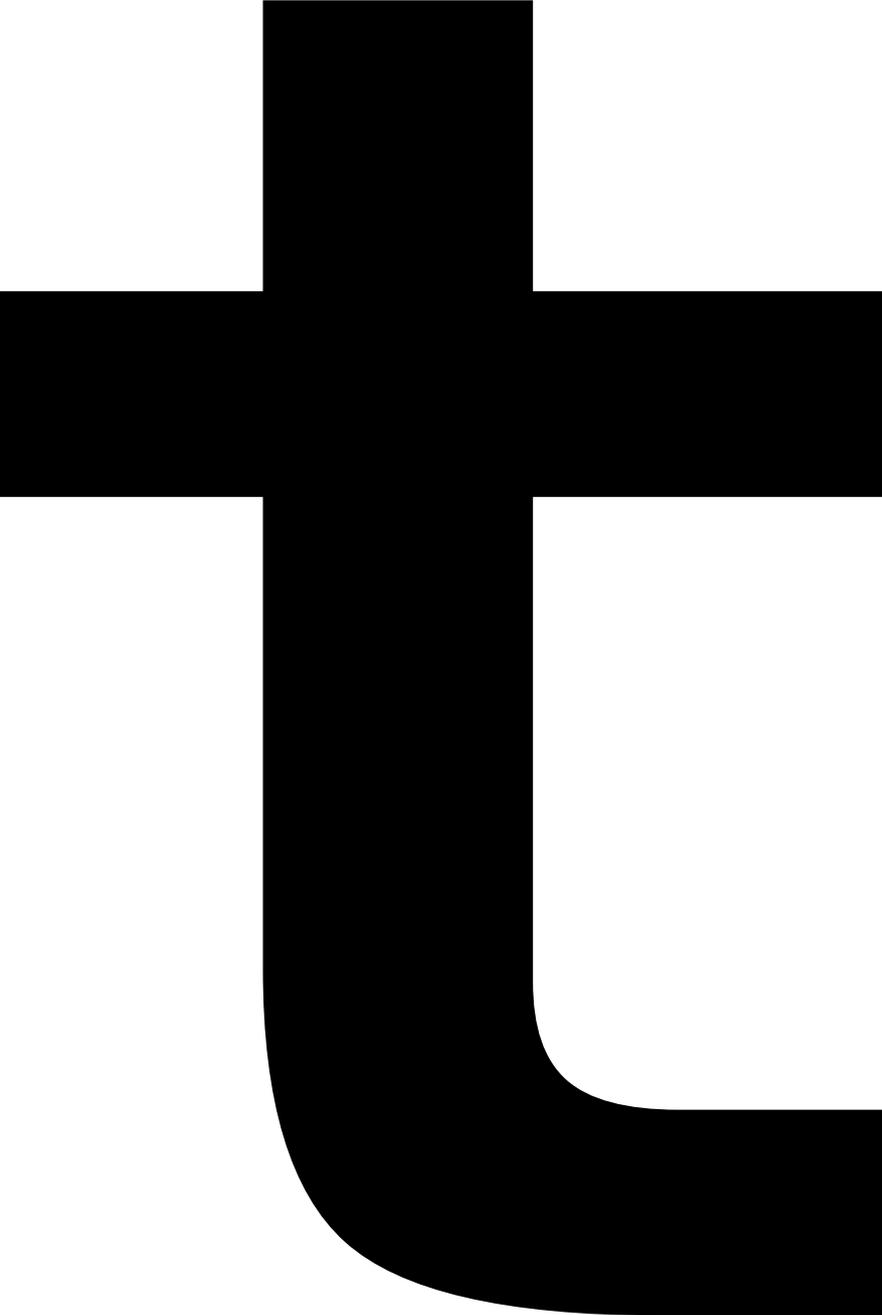
e





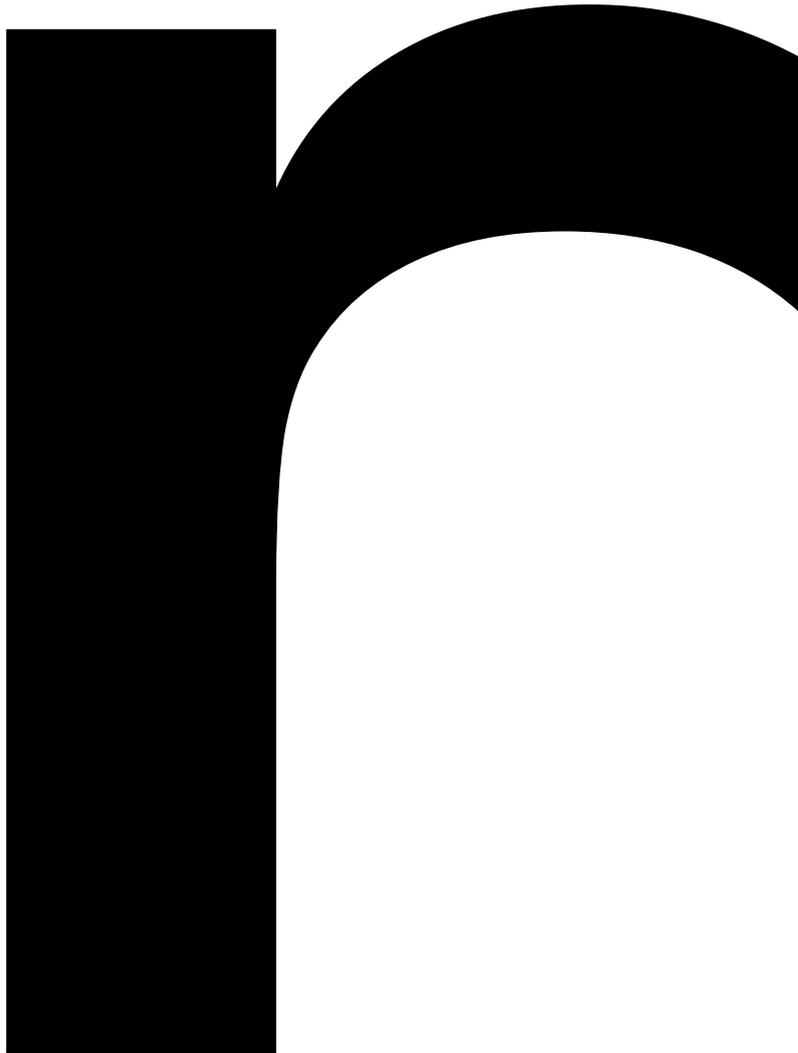
sa

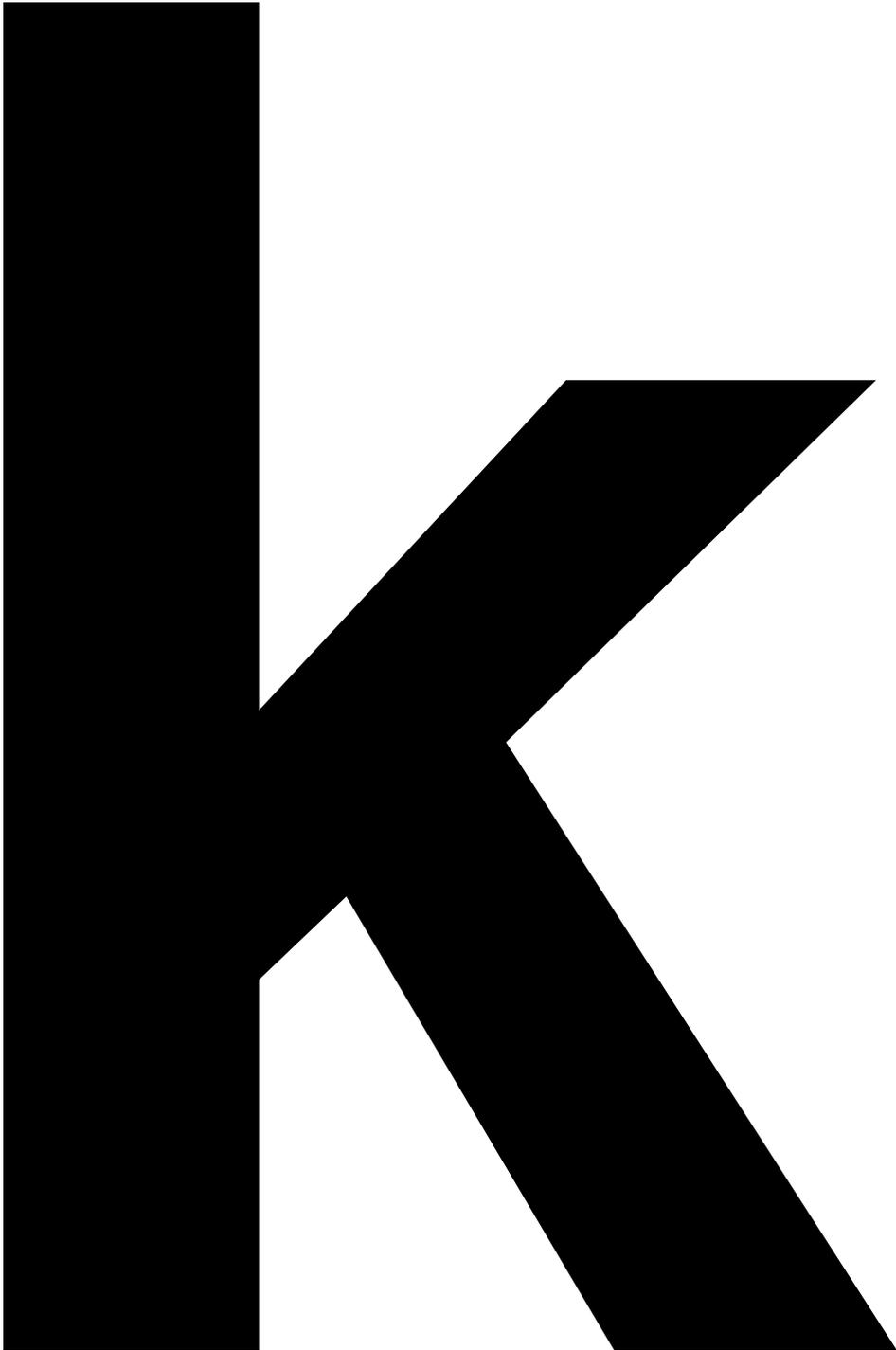




w

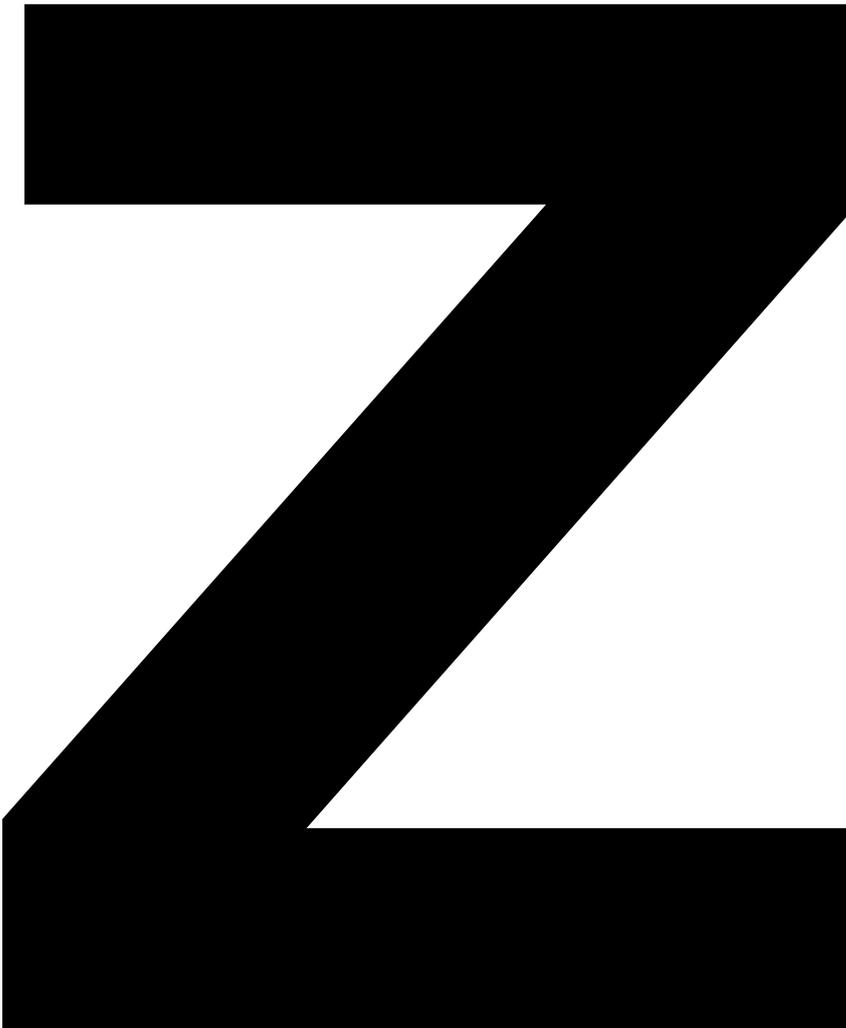
e





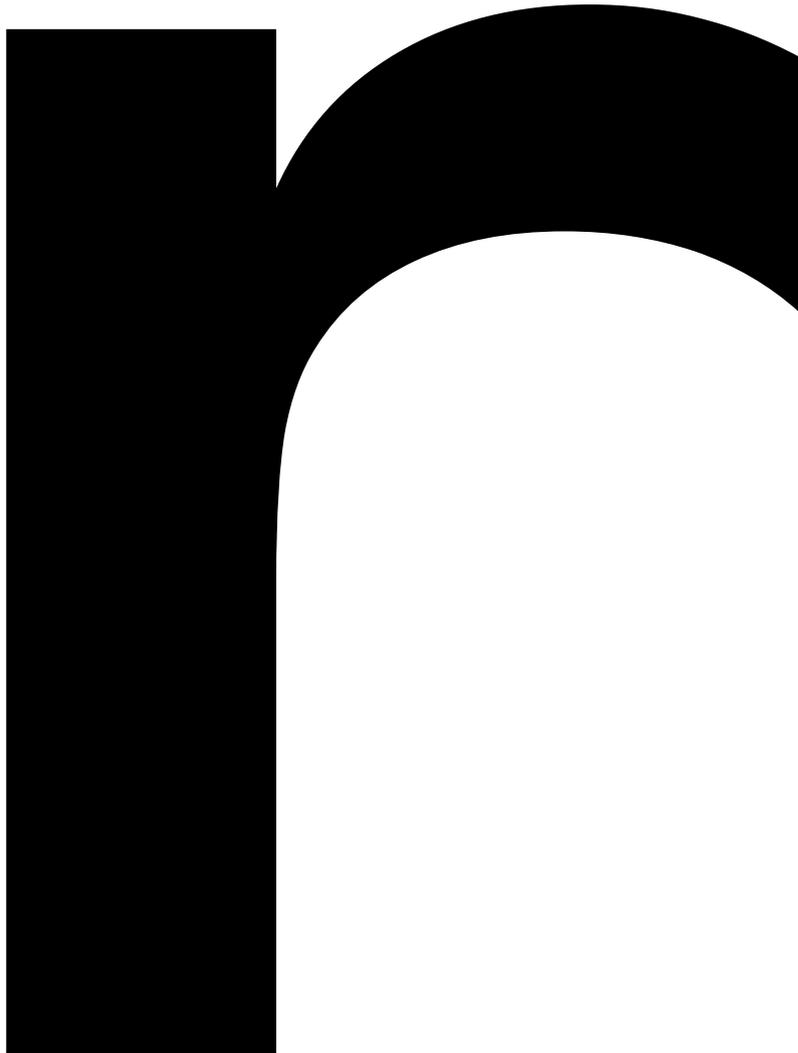
e

n

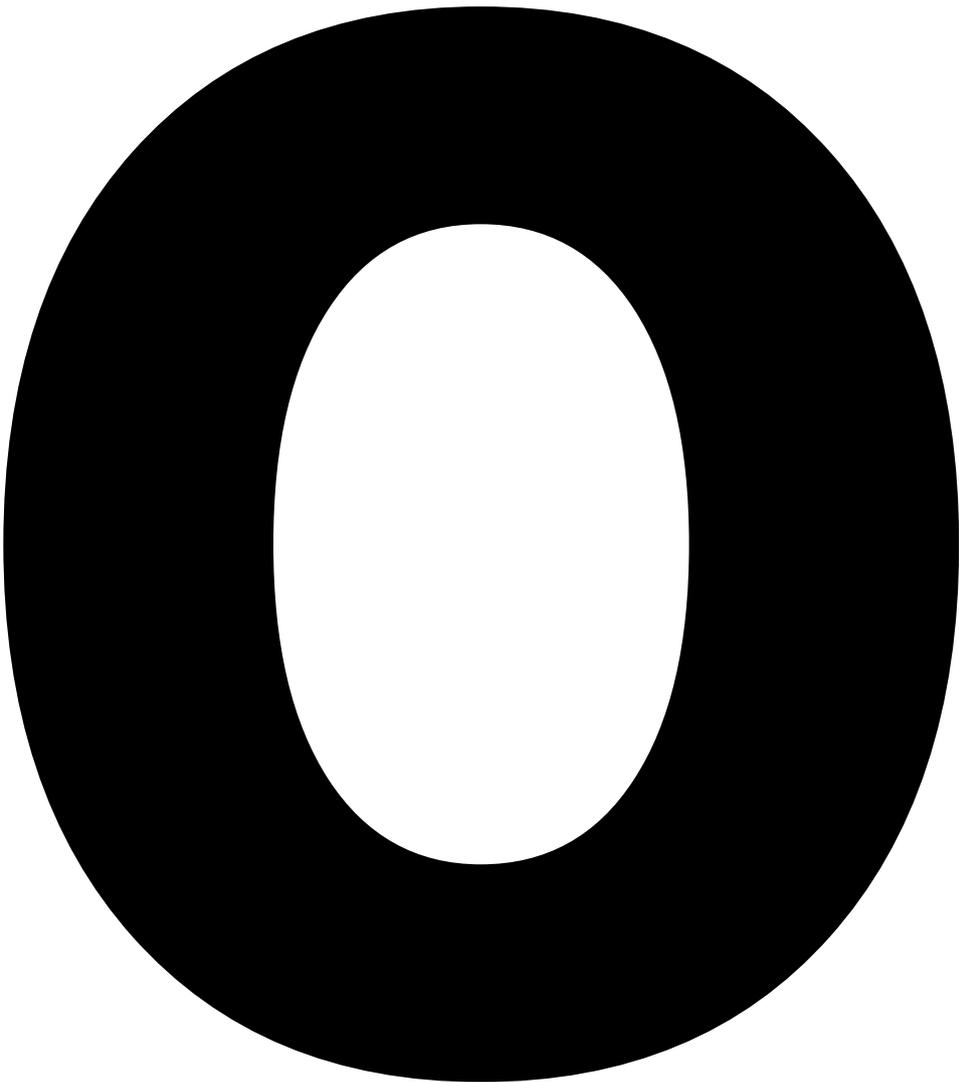
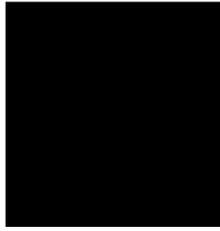
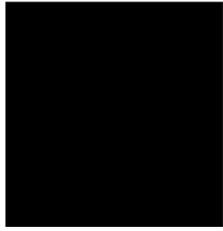


u

e

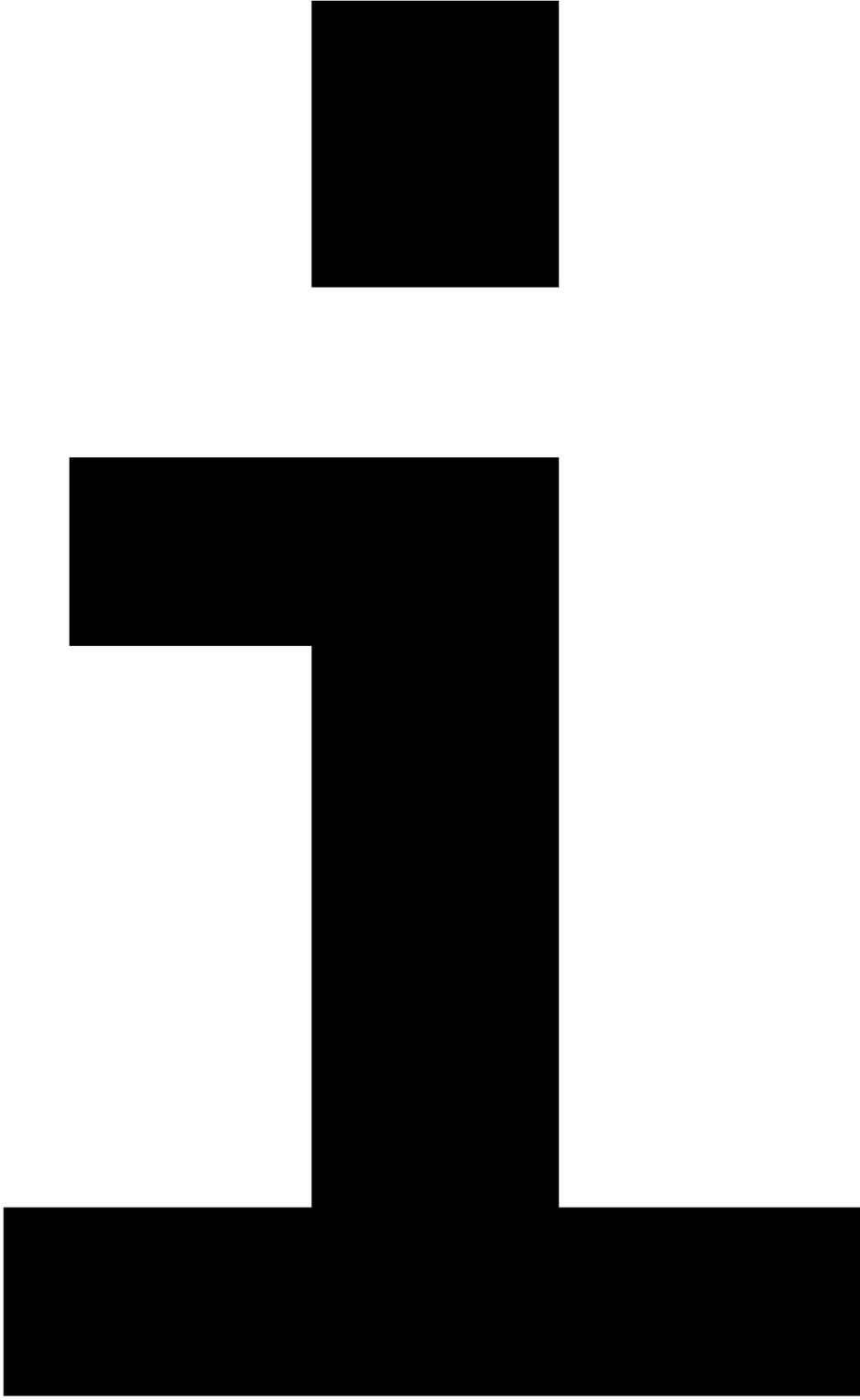


m



Q

J

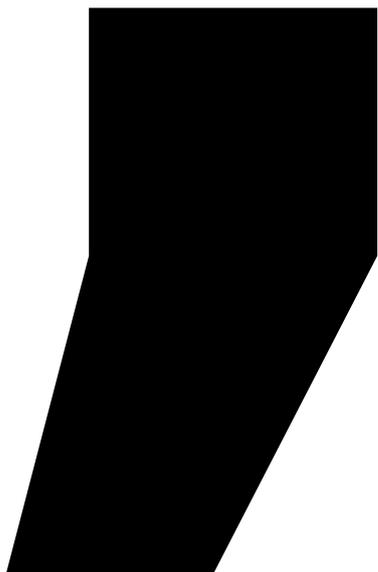


C

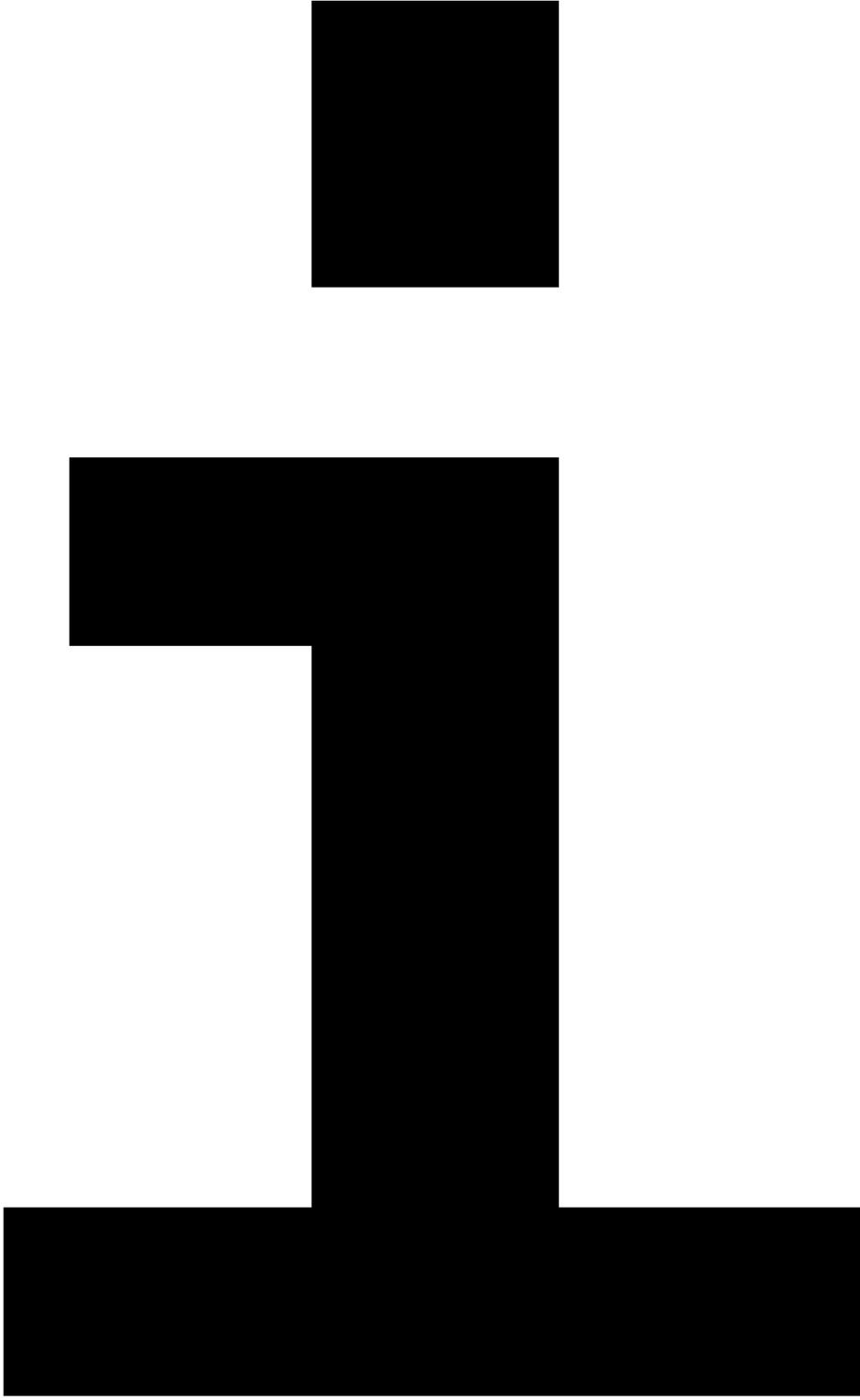
h

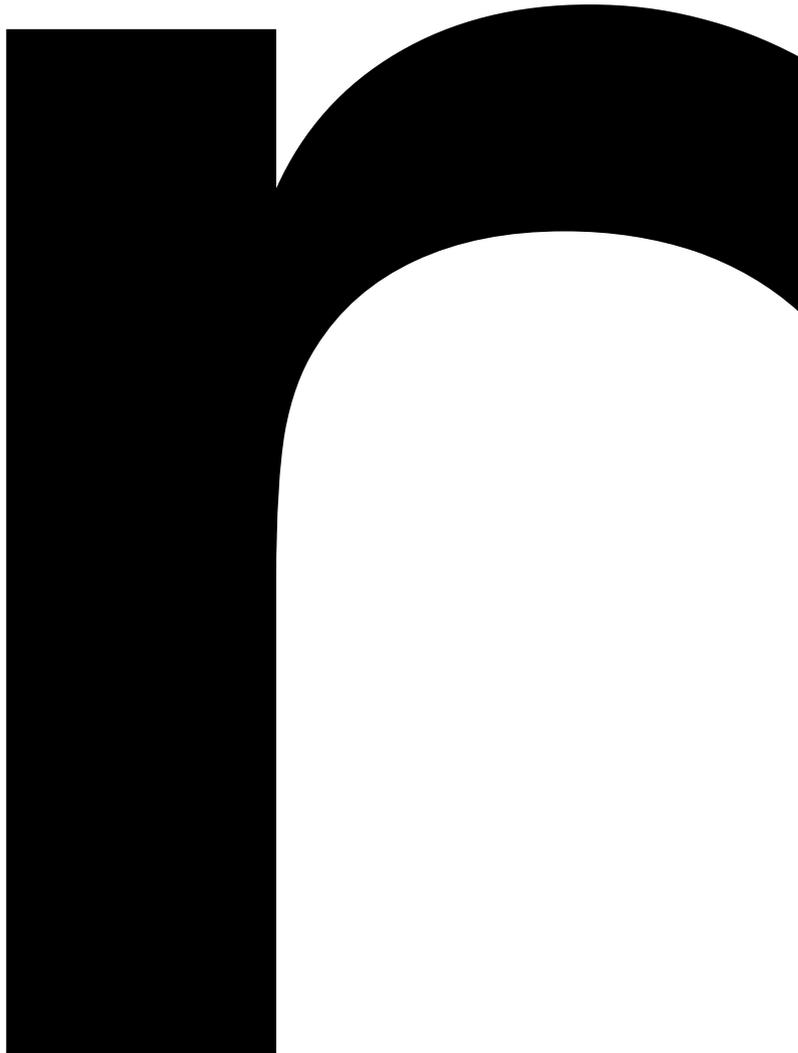
e

n



w





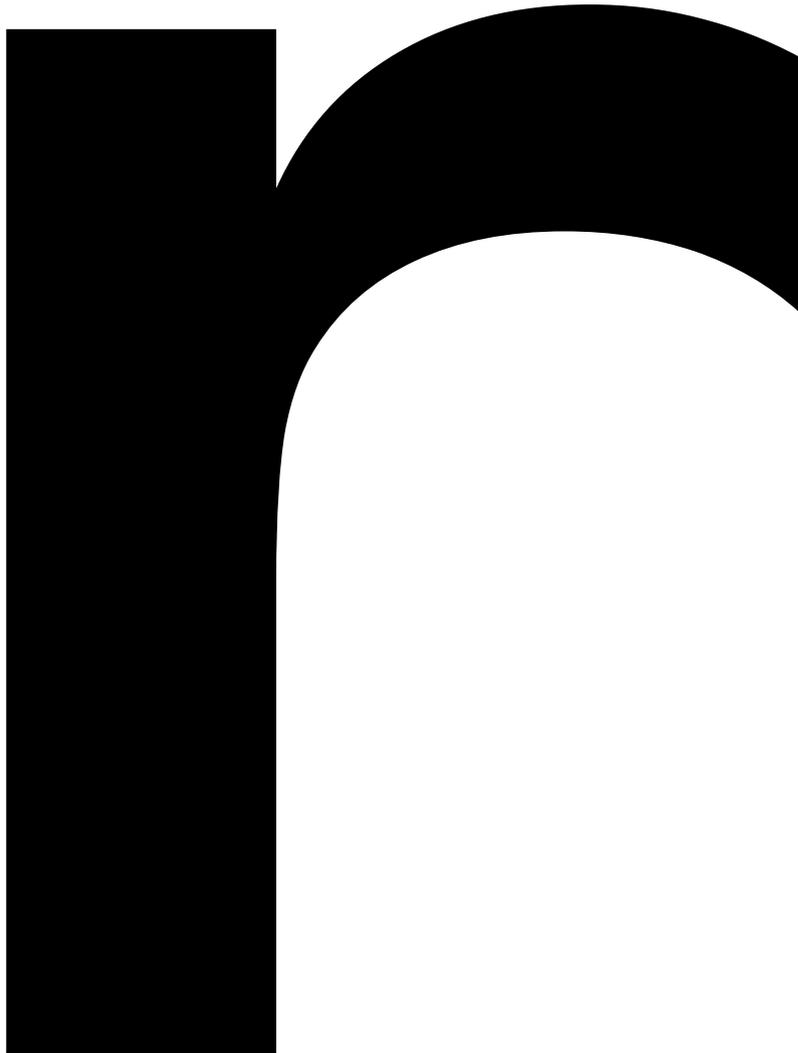
Q

Q

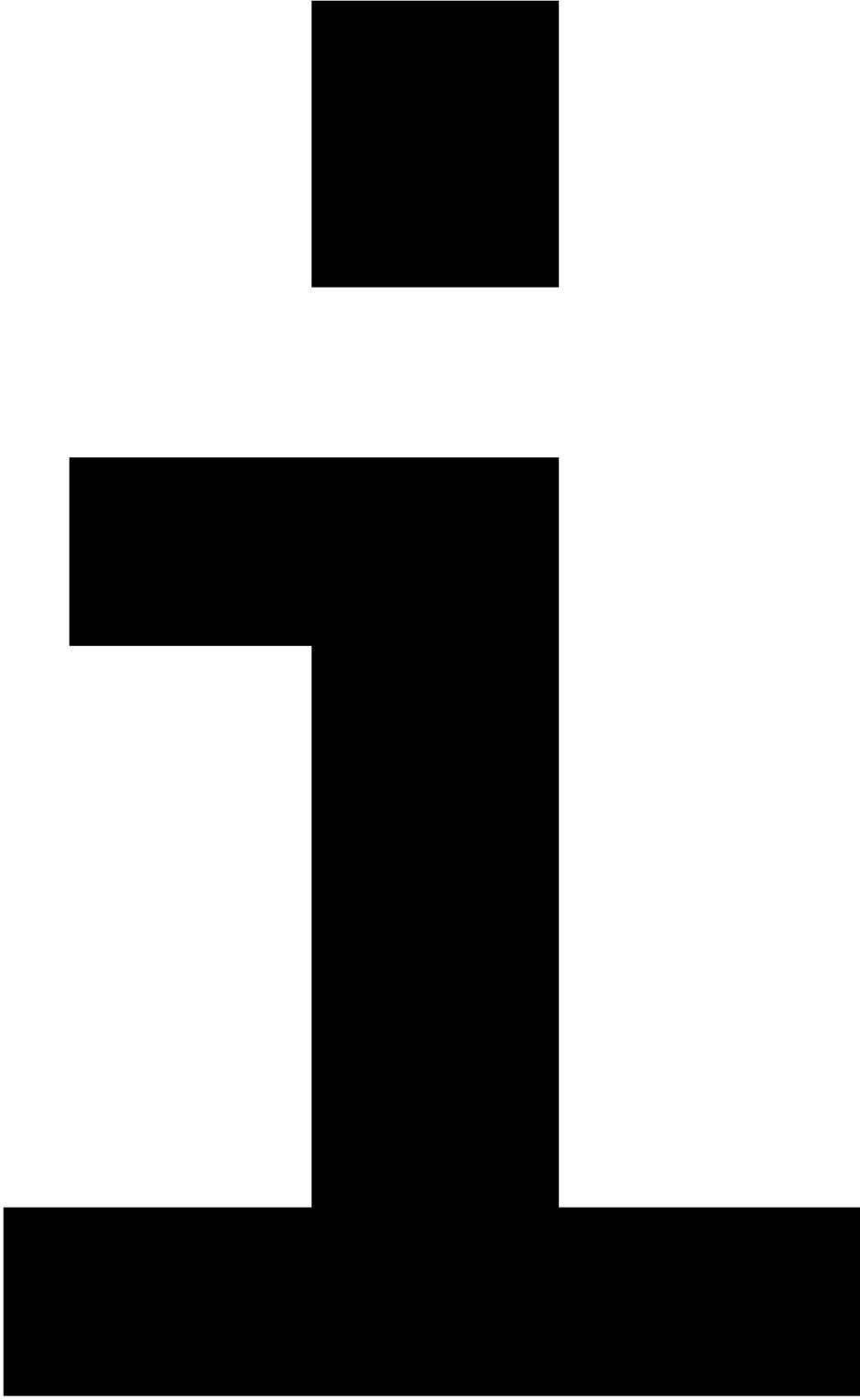
sa

h

e



Q



e

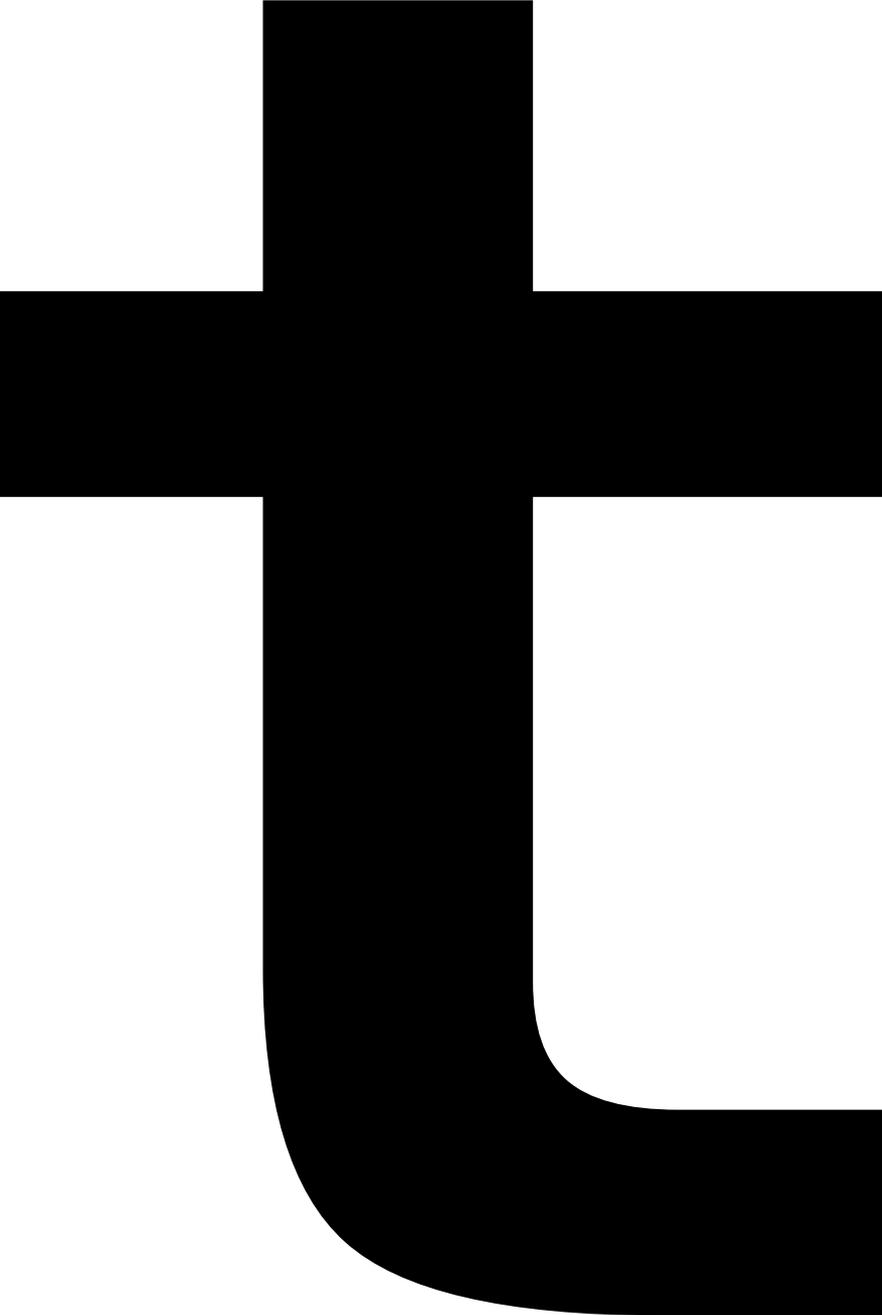
G

e

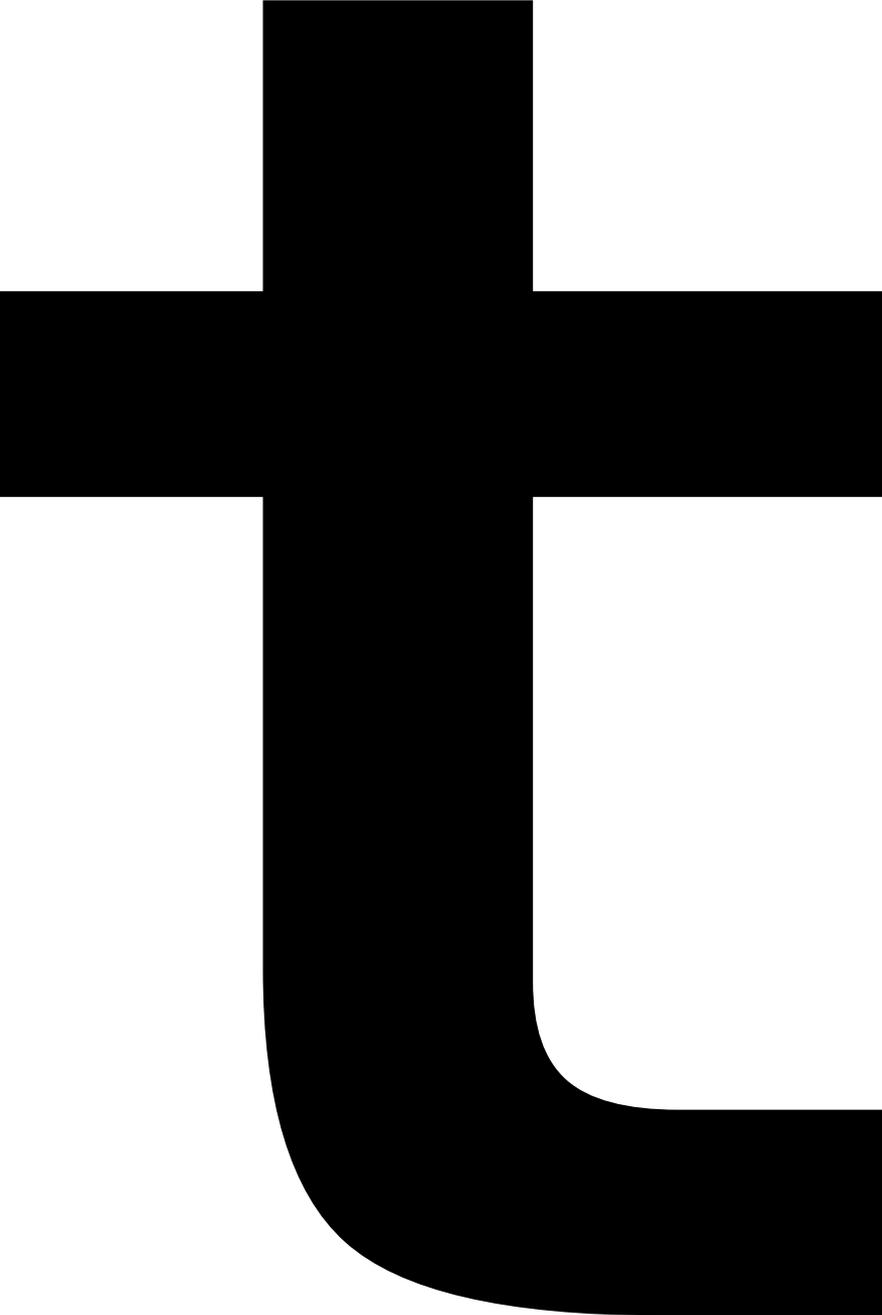
S

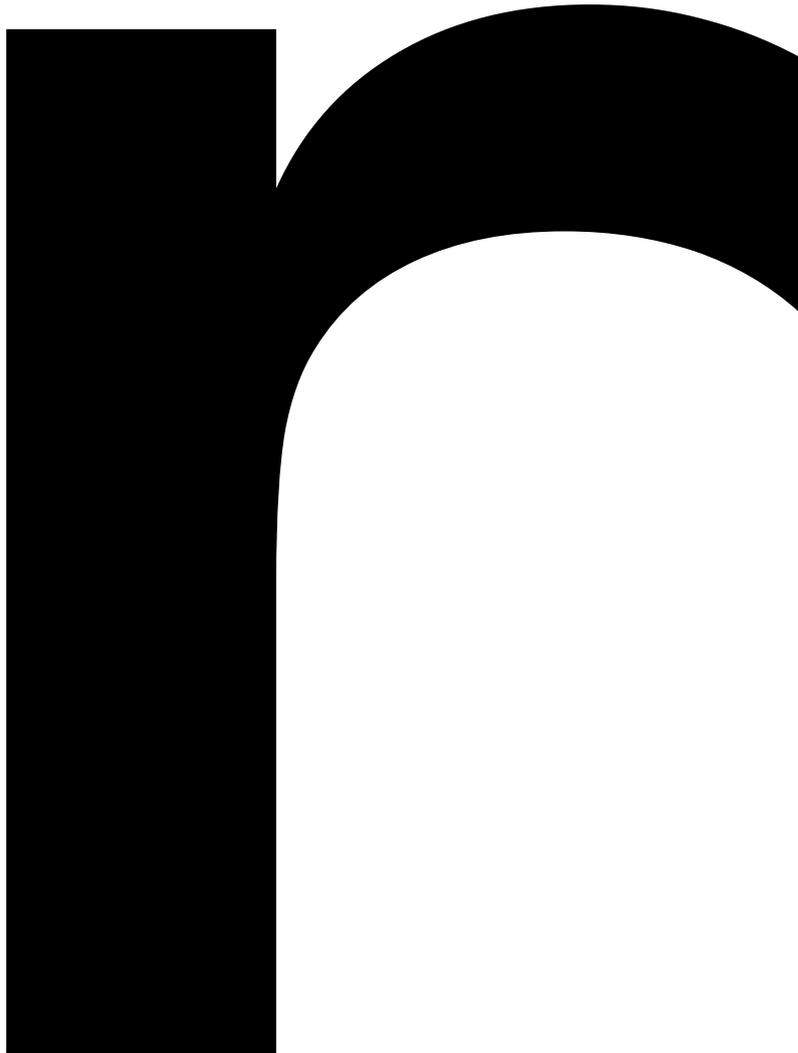
sa

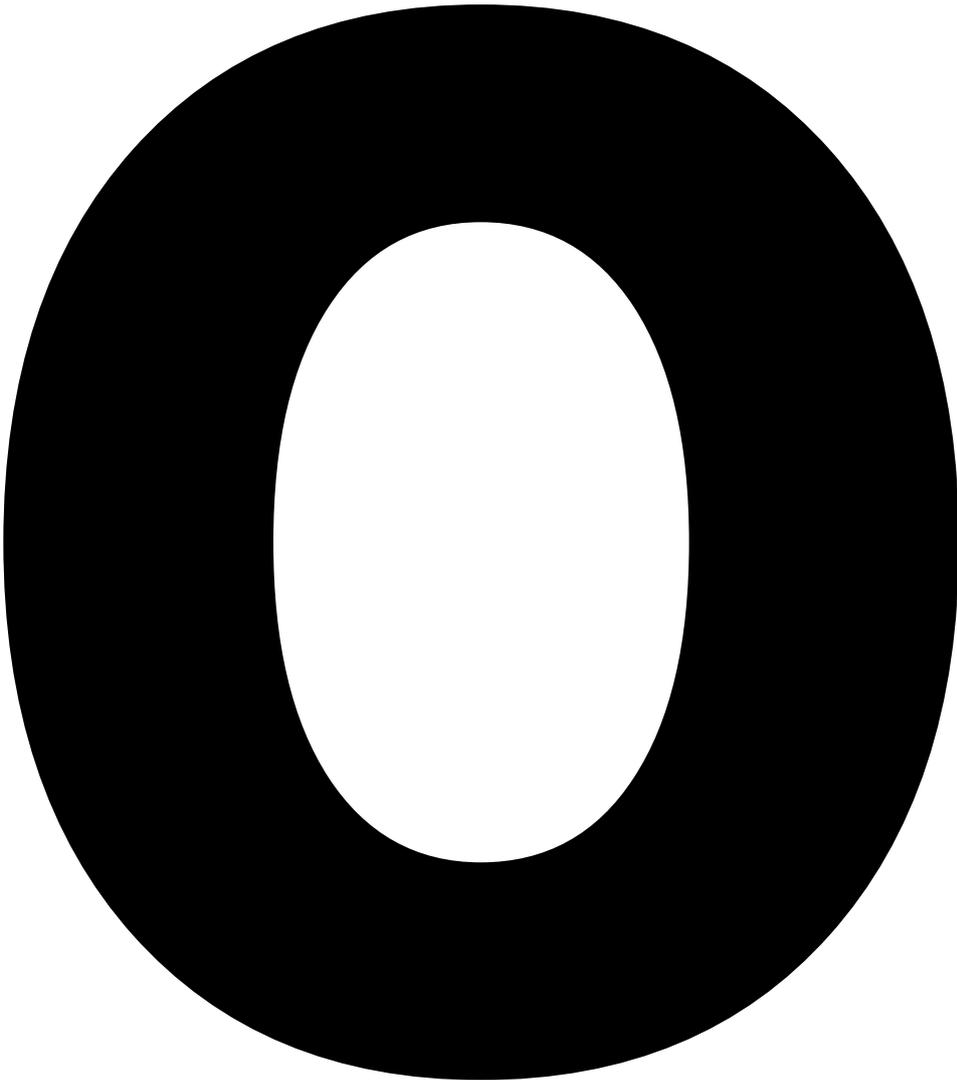
m



S

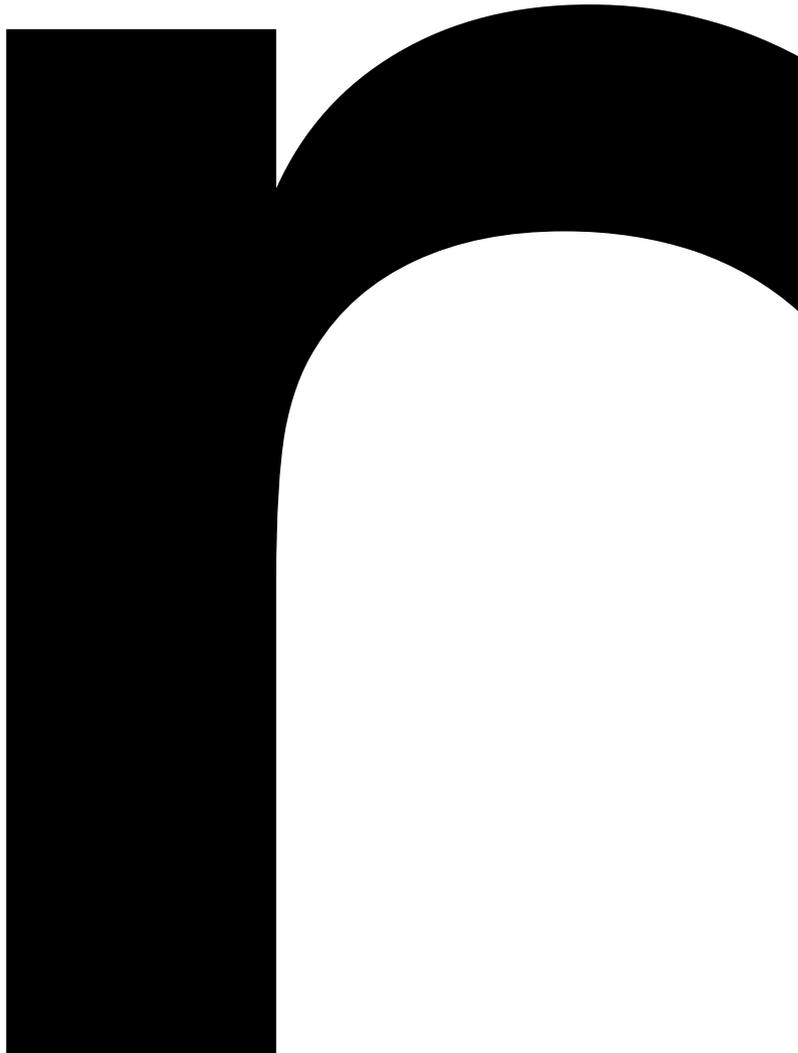


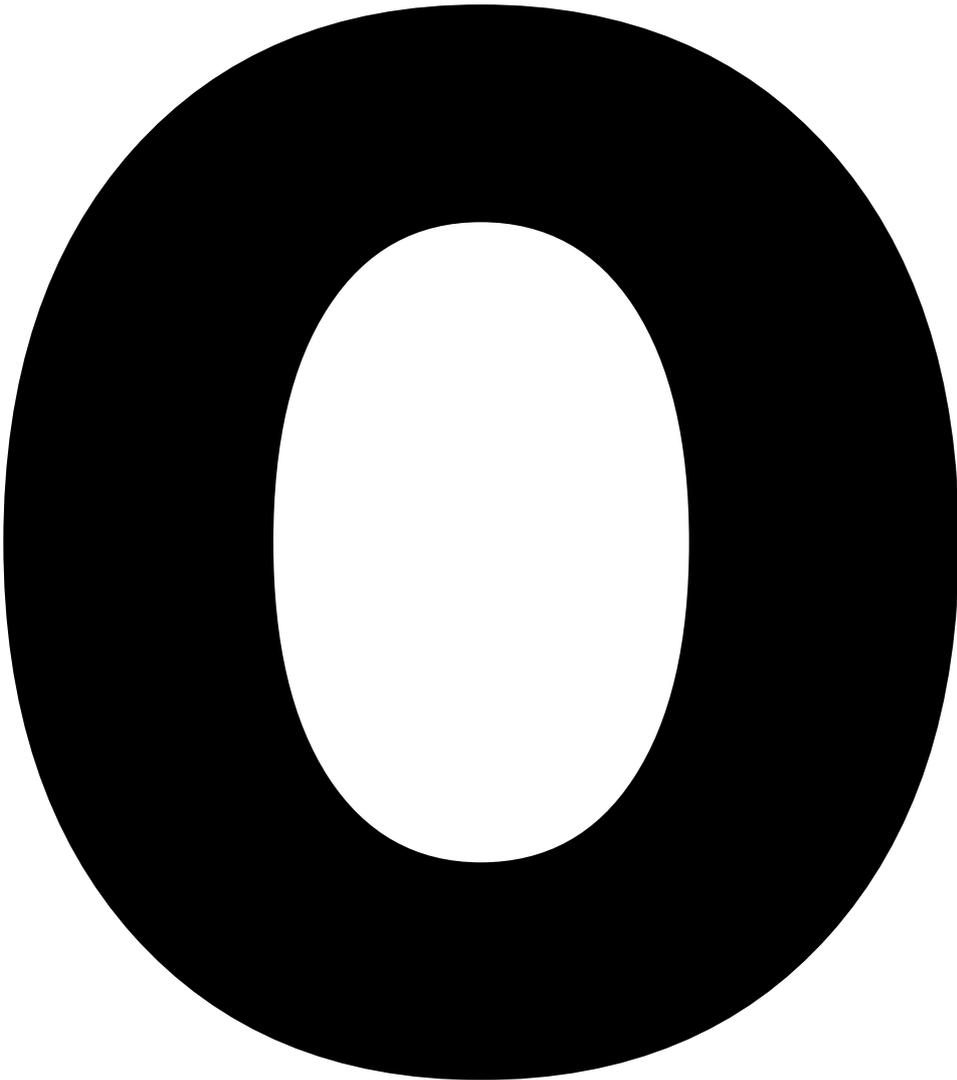




m

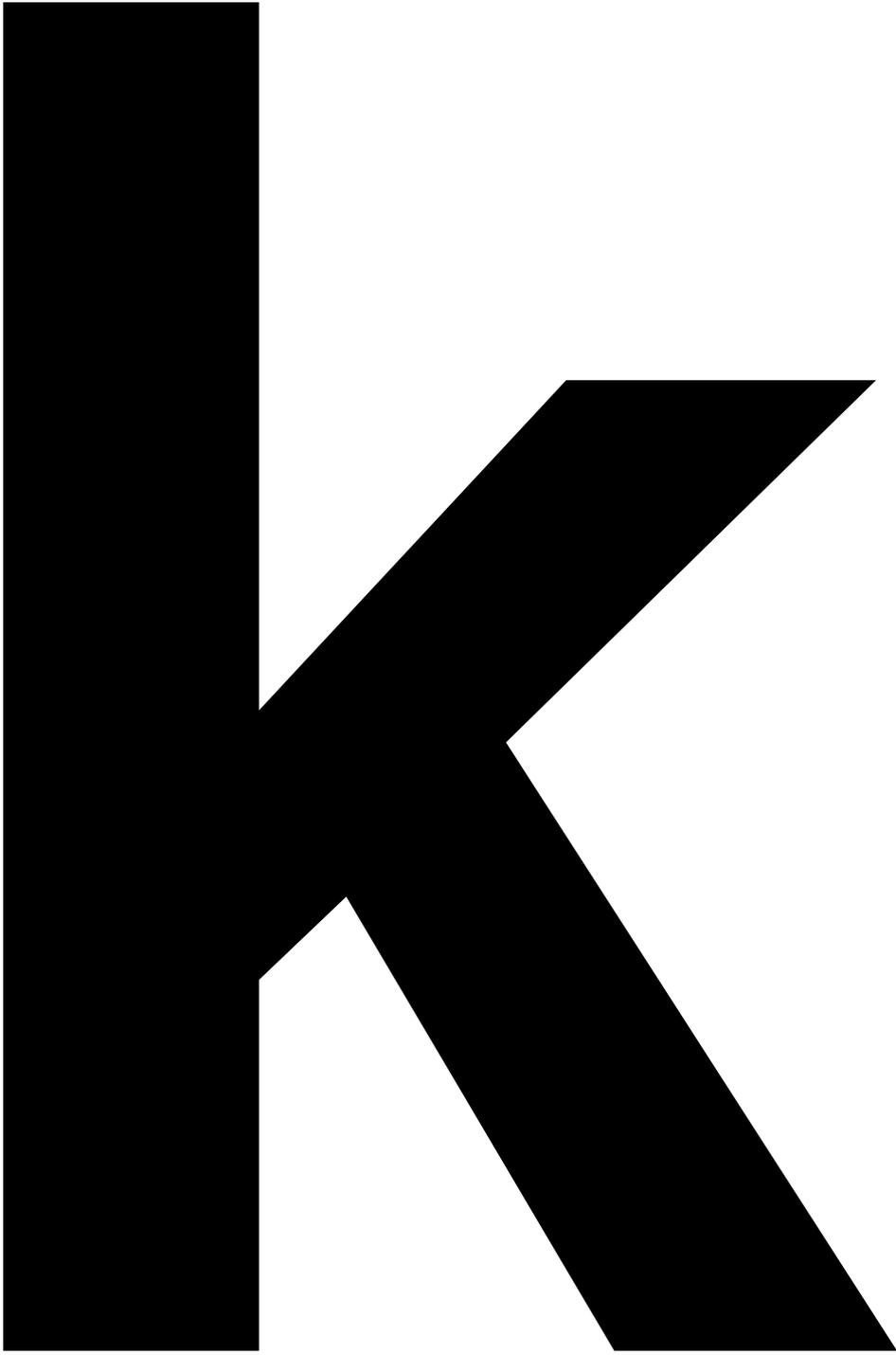
o

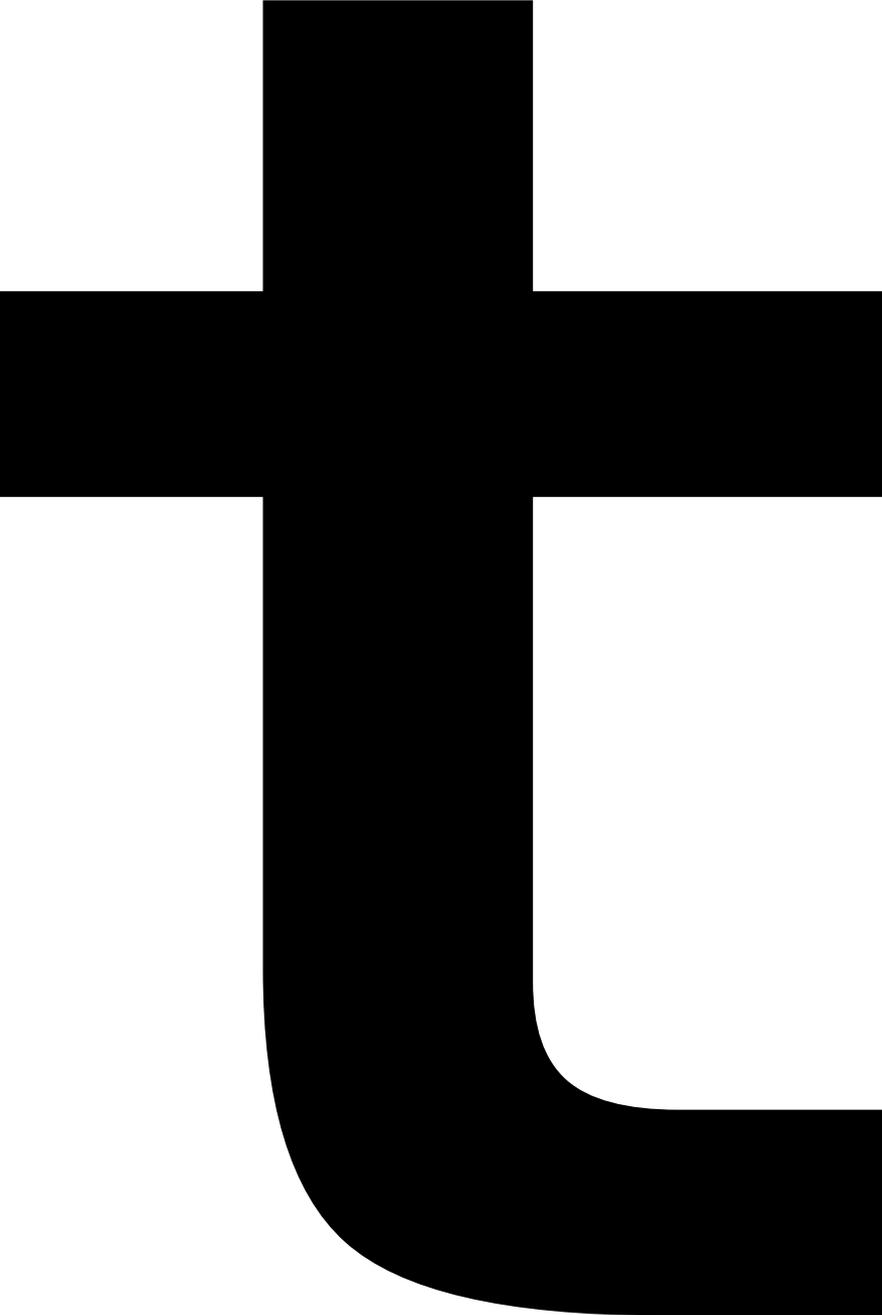


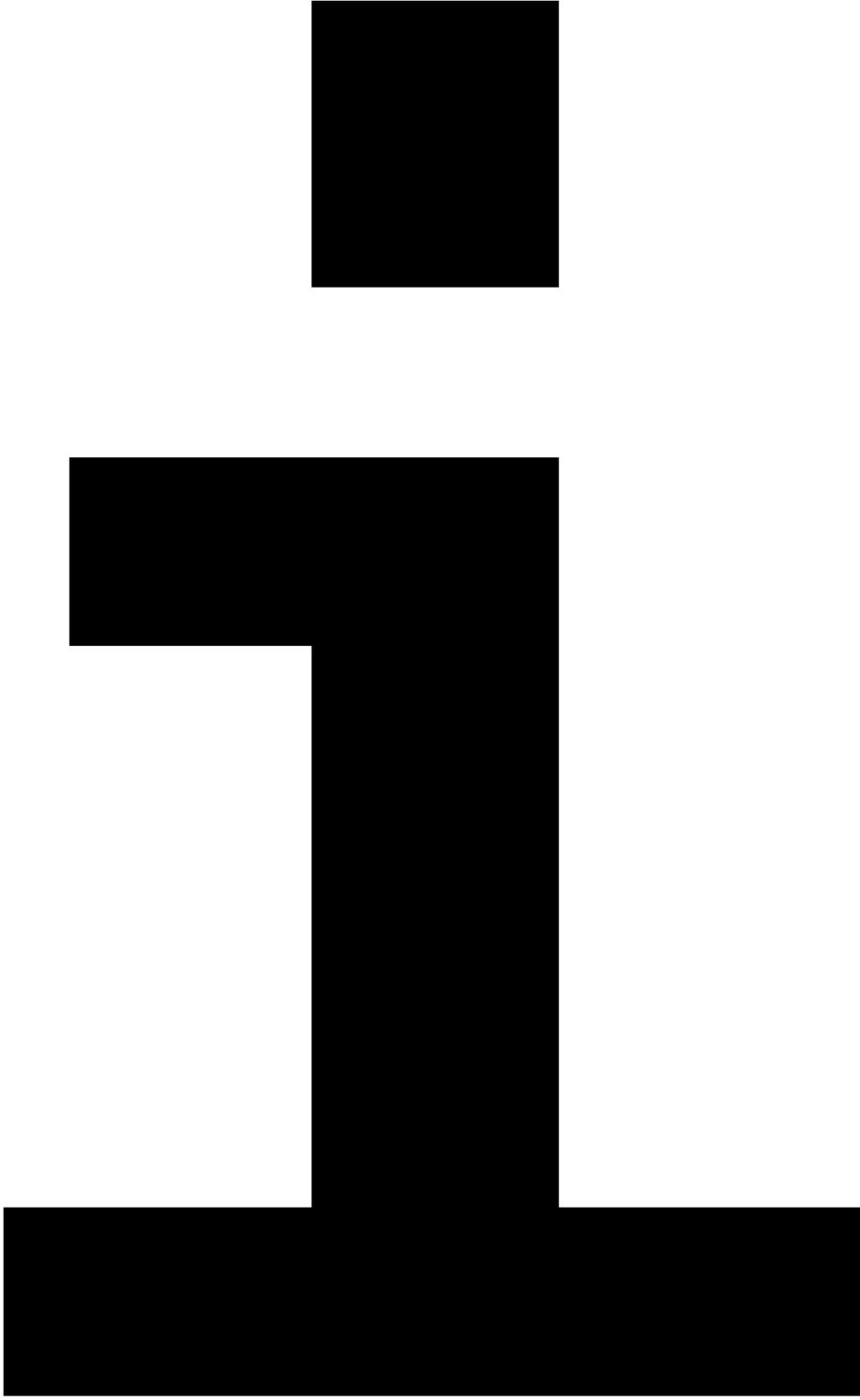


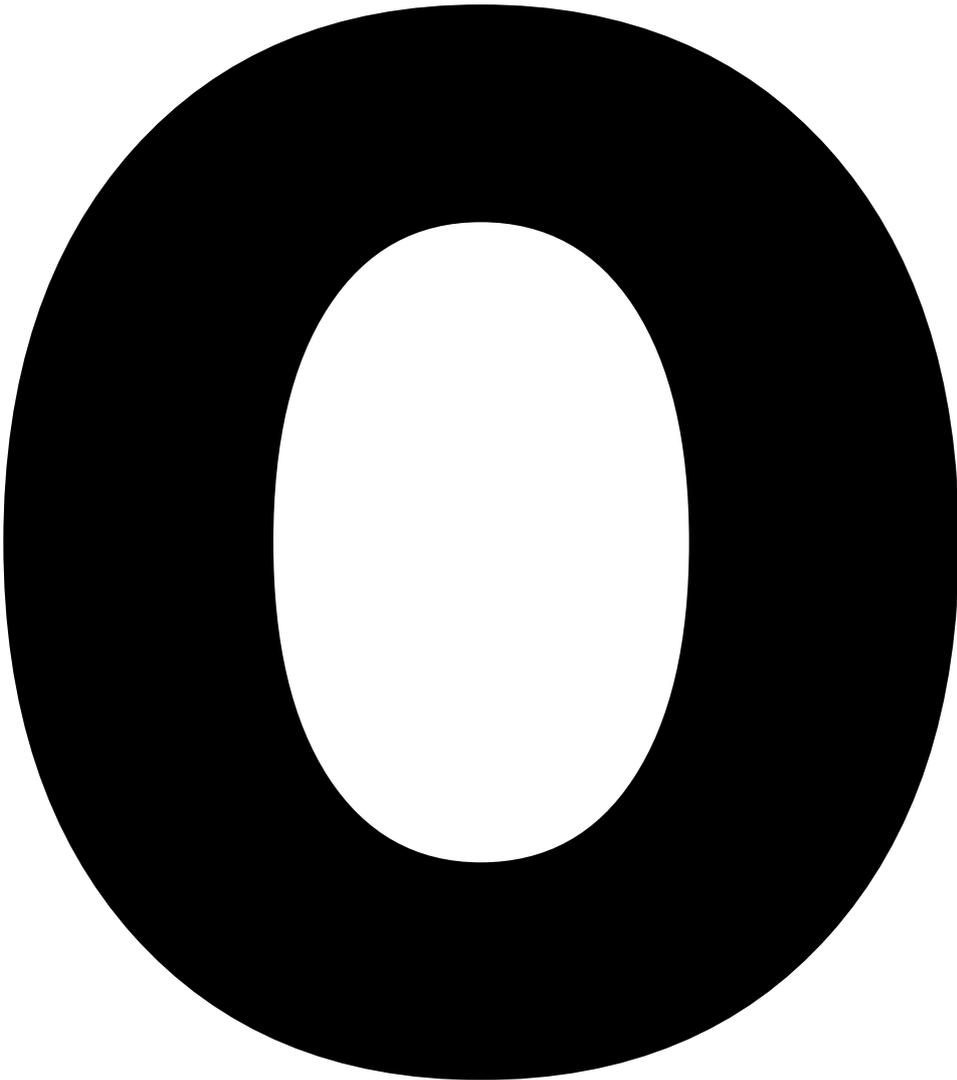
Q

u



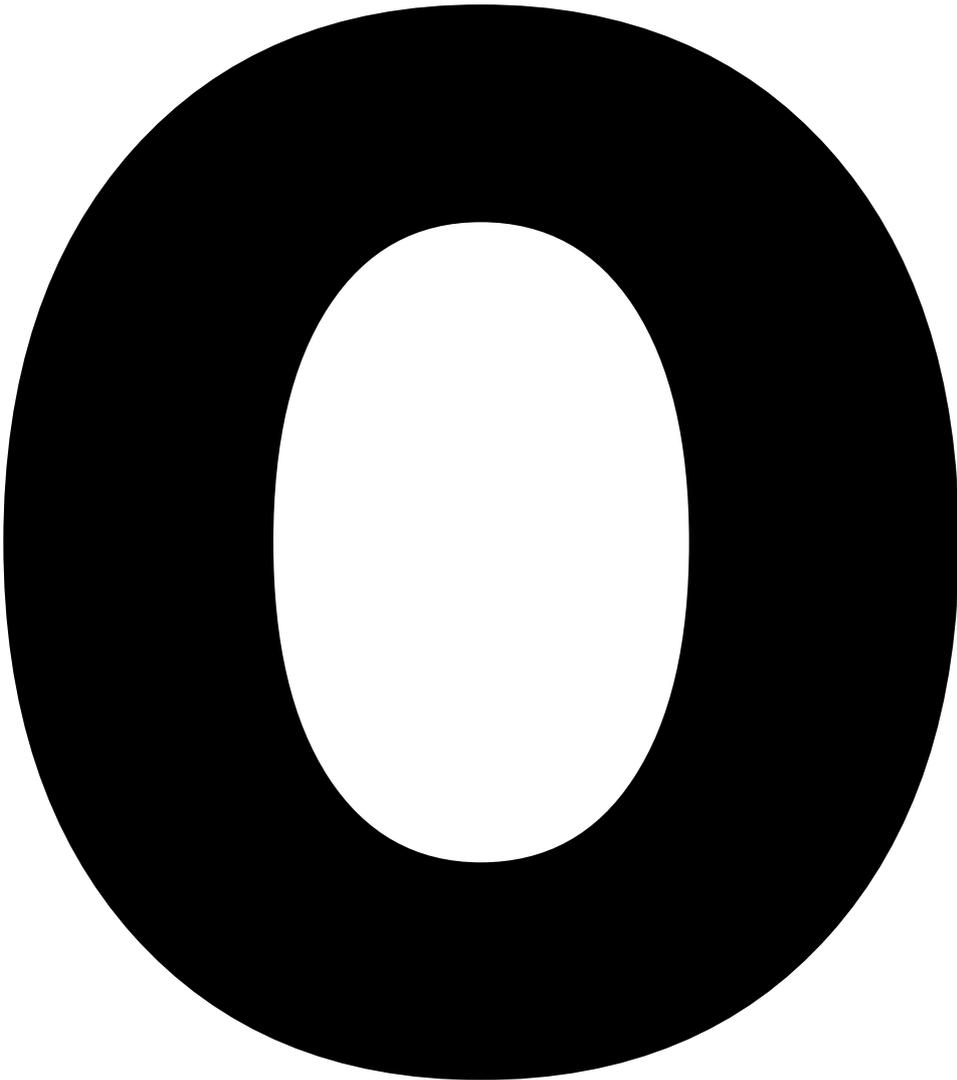






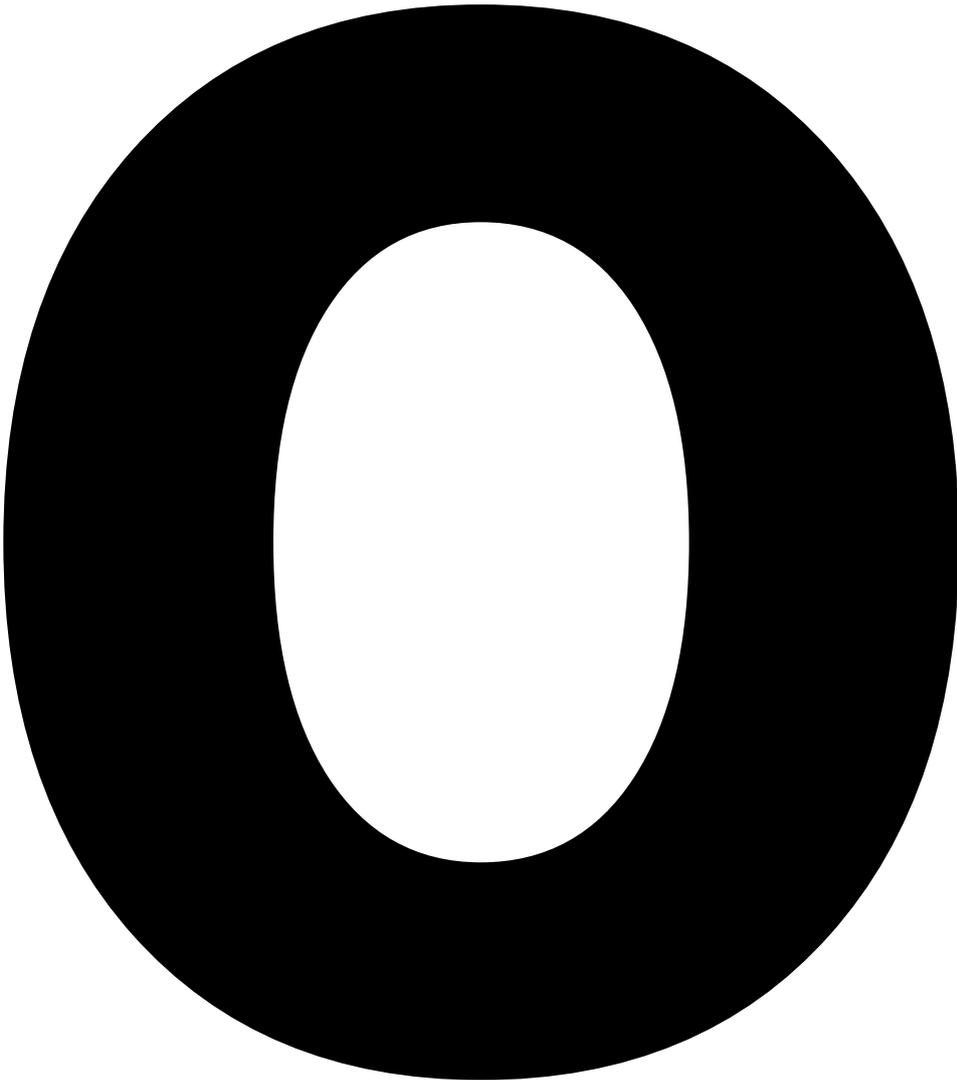
n

V



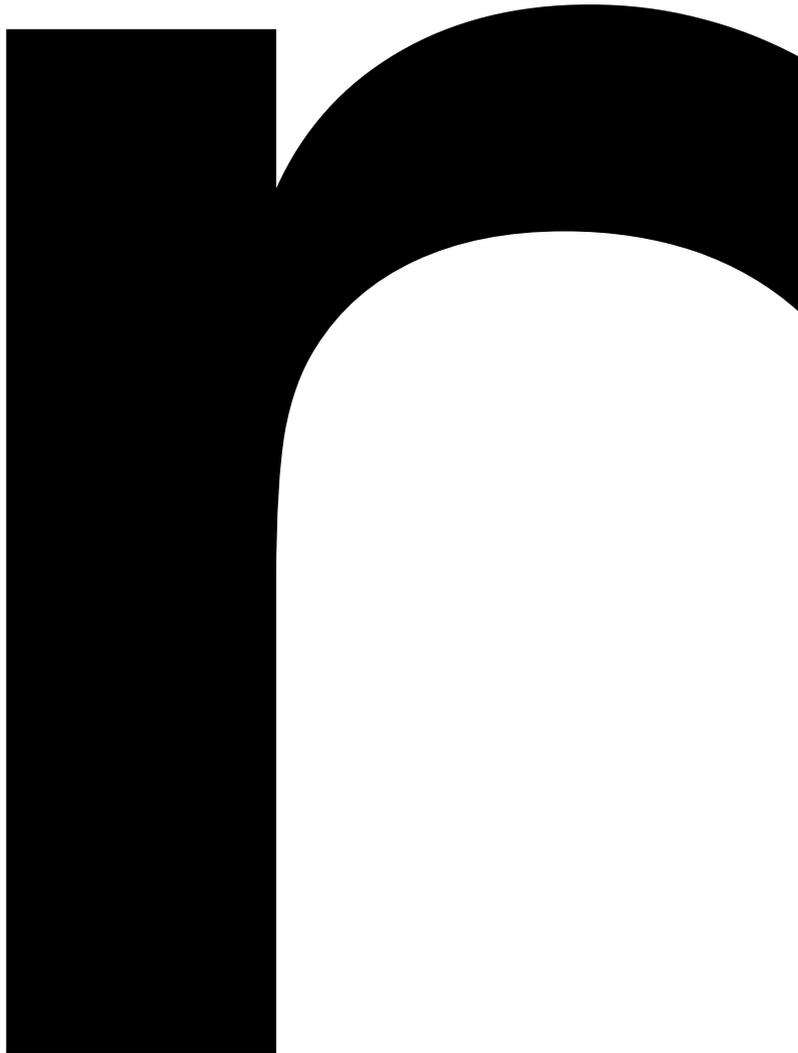
n

S



J

sa



o

sa

n

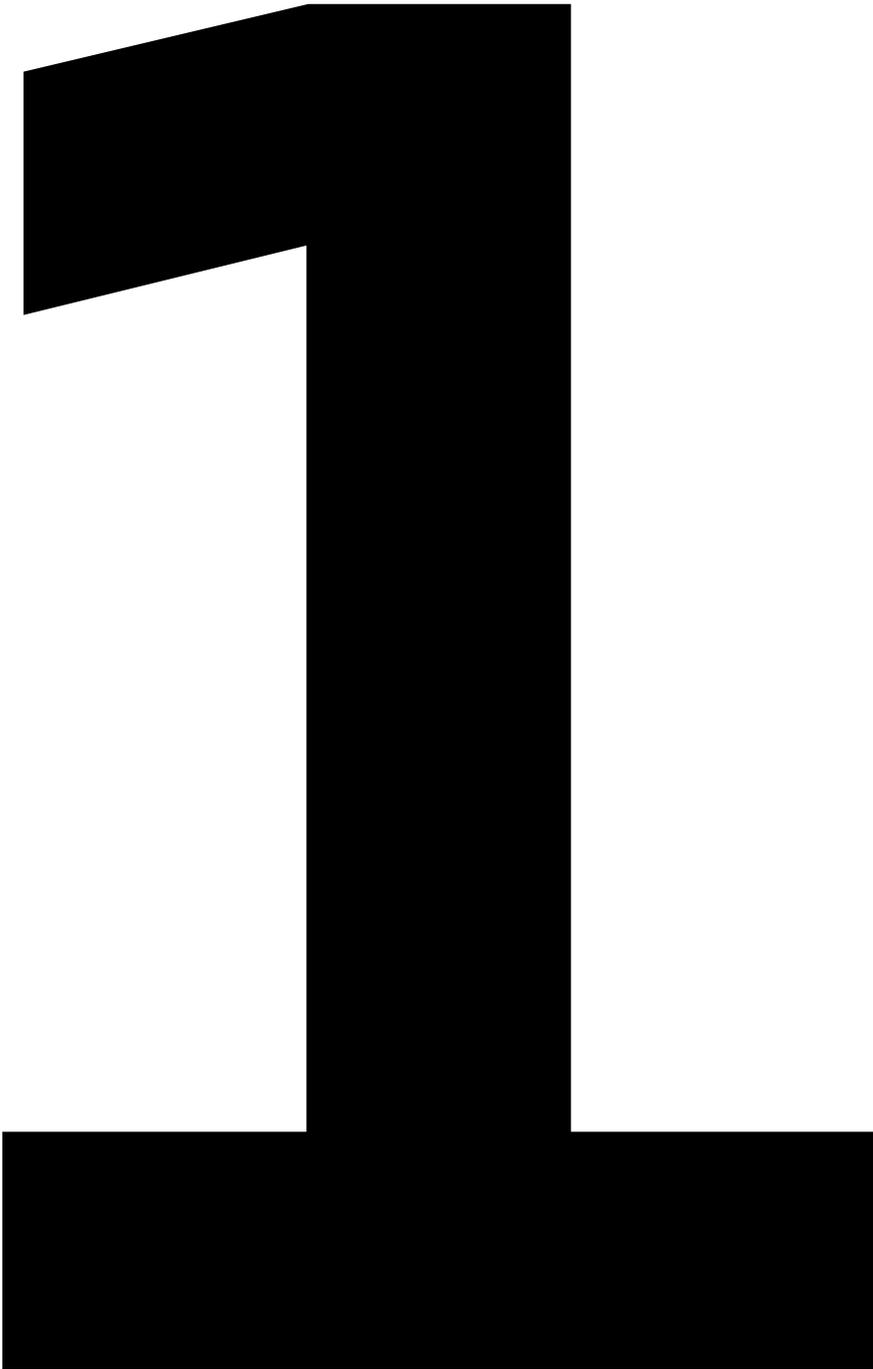
e

J

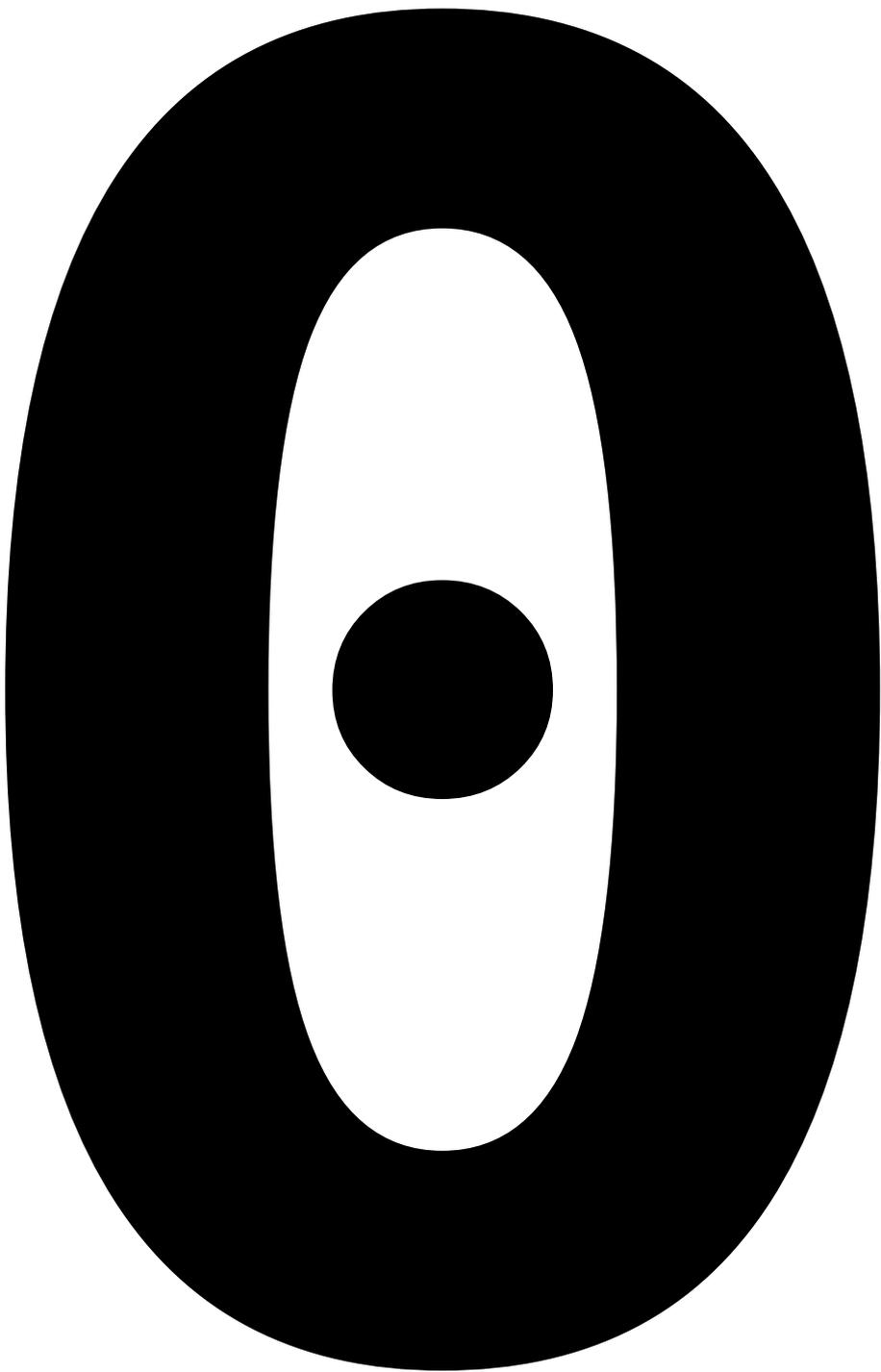
S

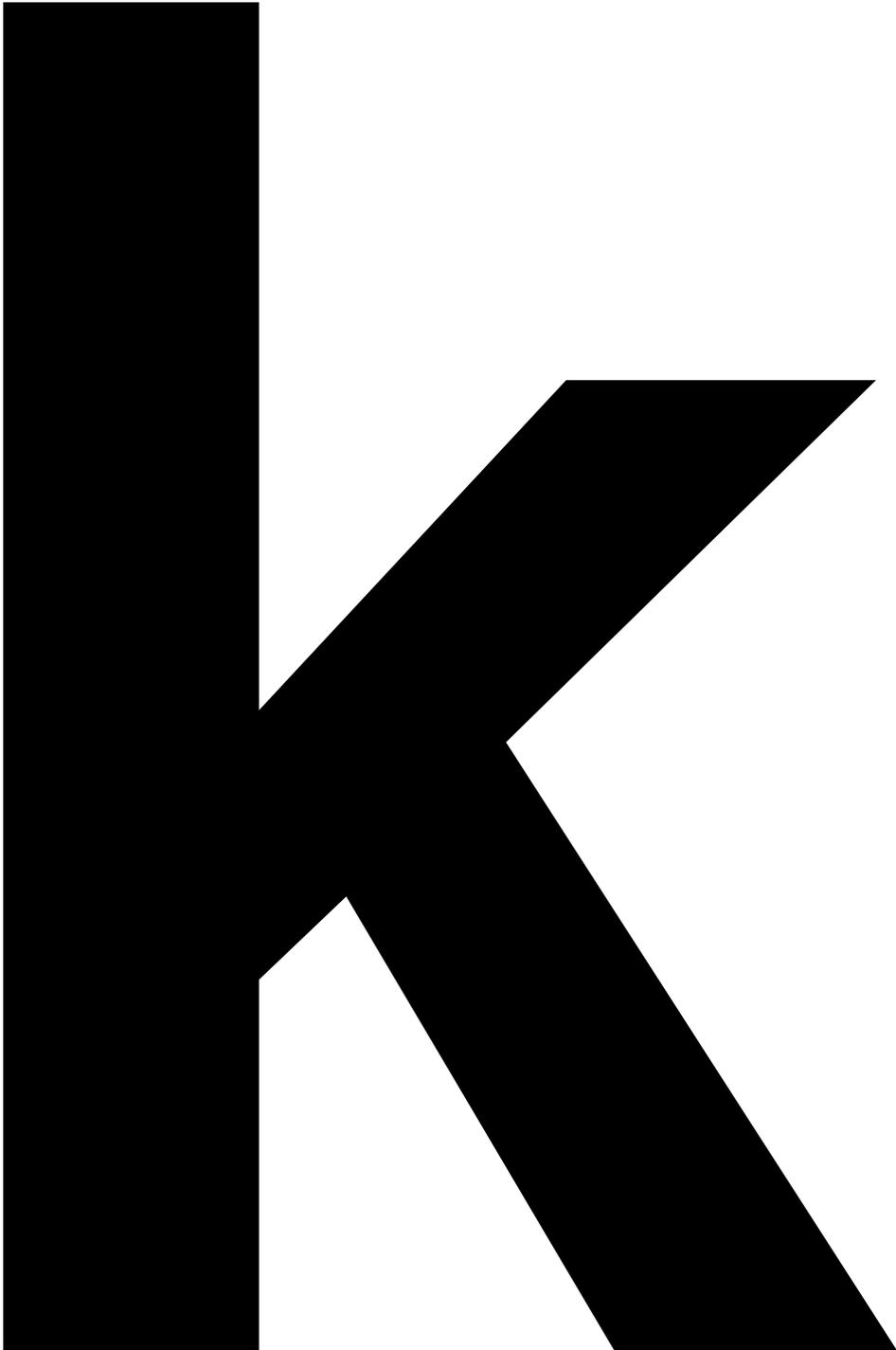
u

m



5

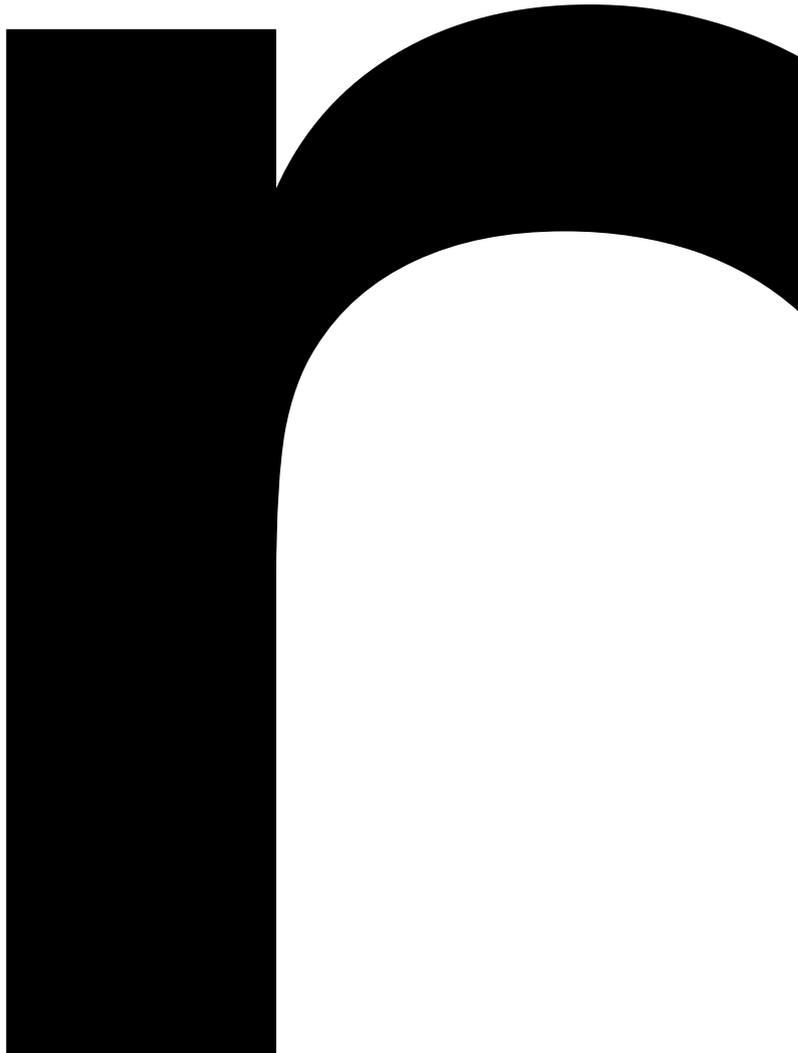


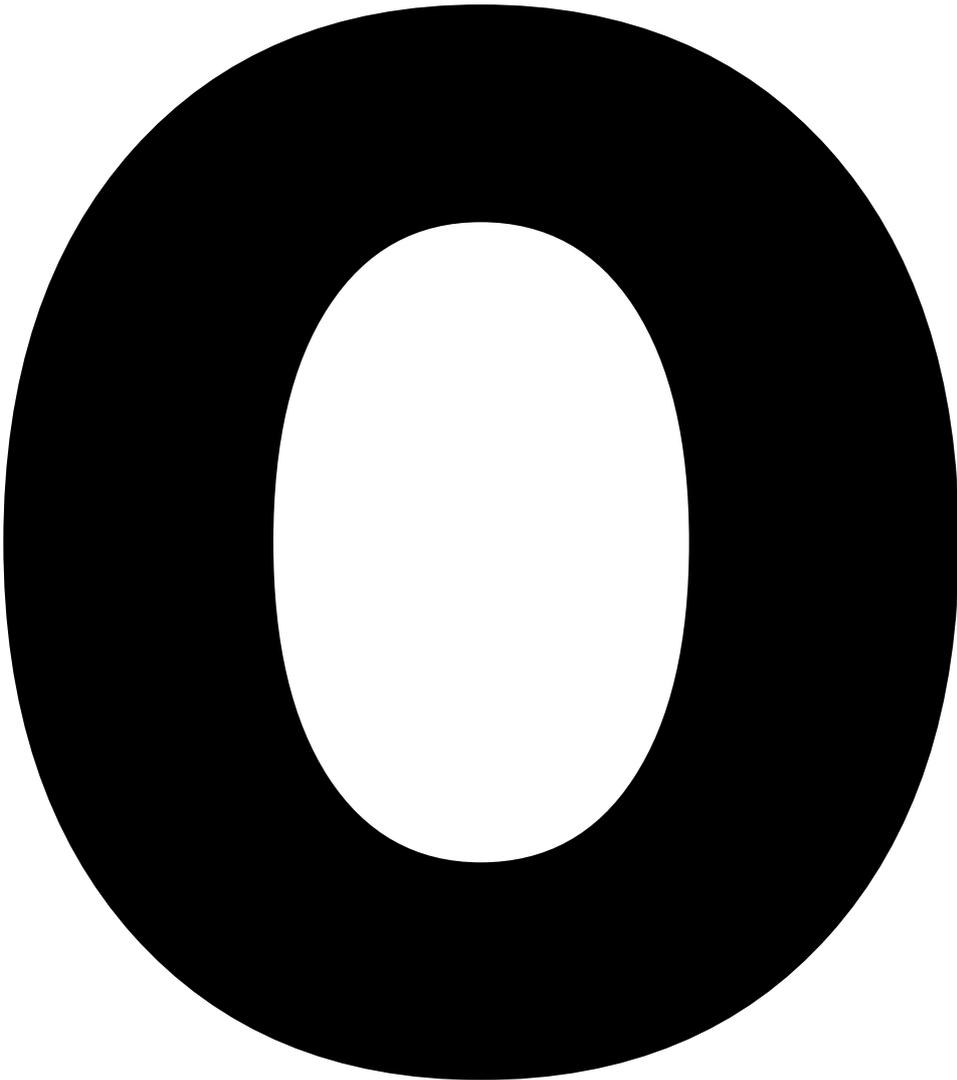


w

h

o





m

2

u

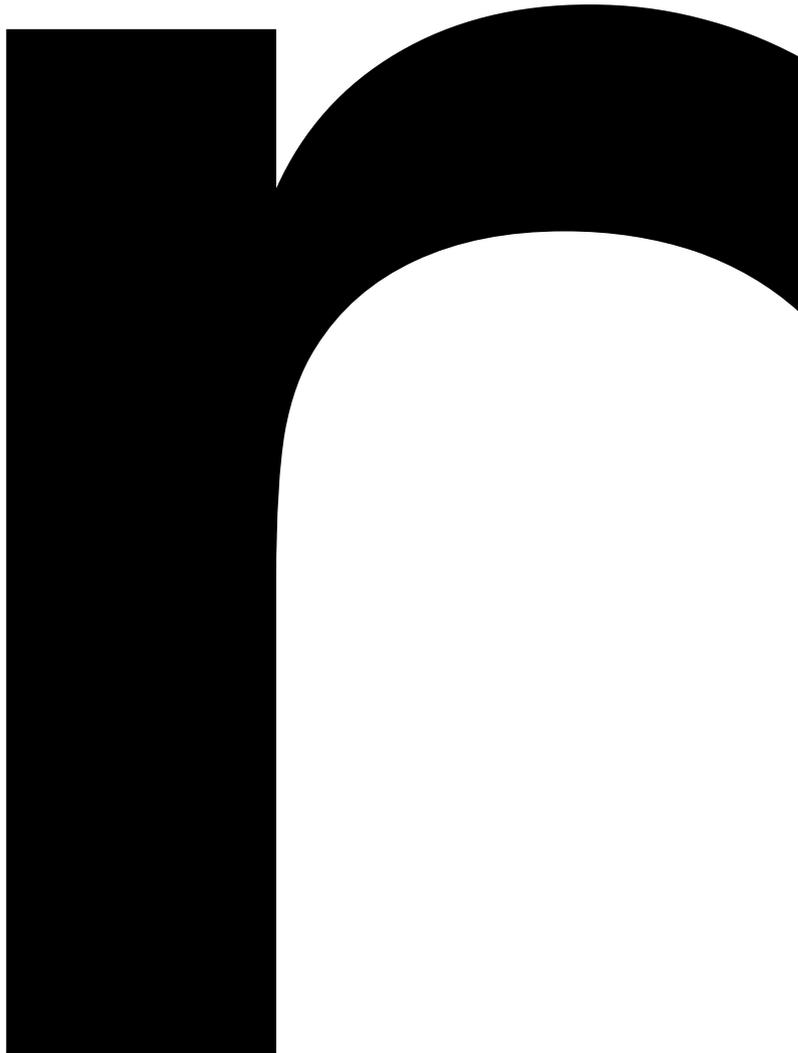
n

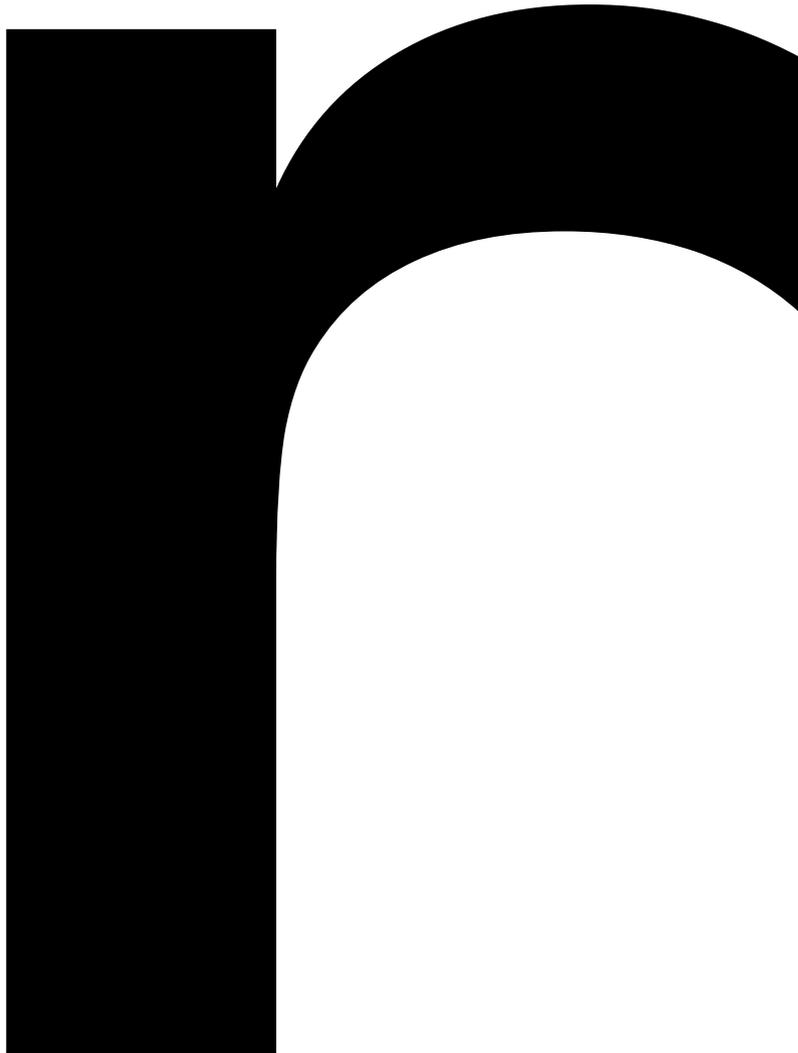
Q

J

sa

h

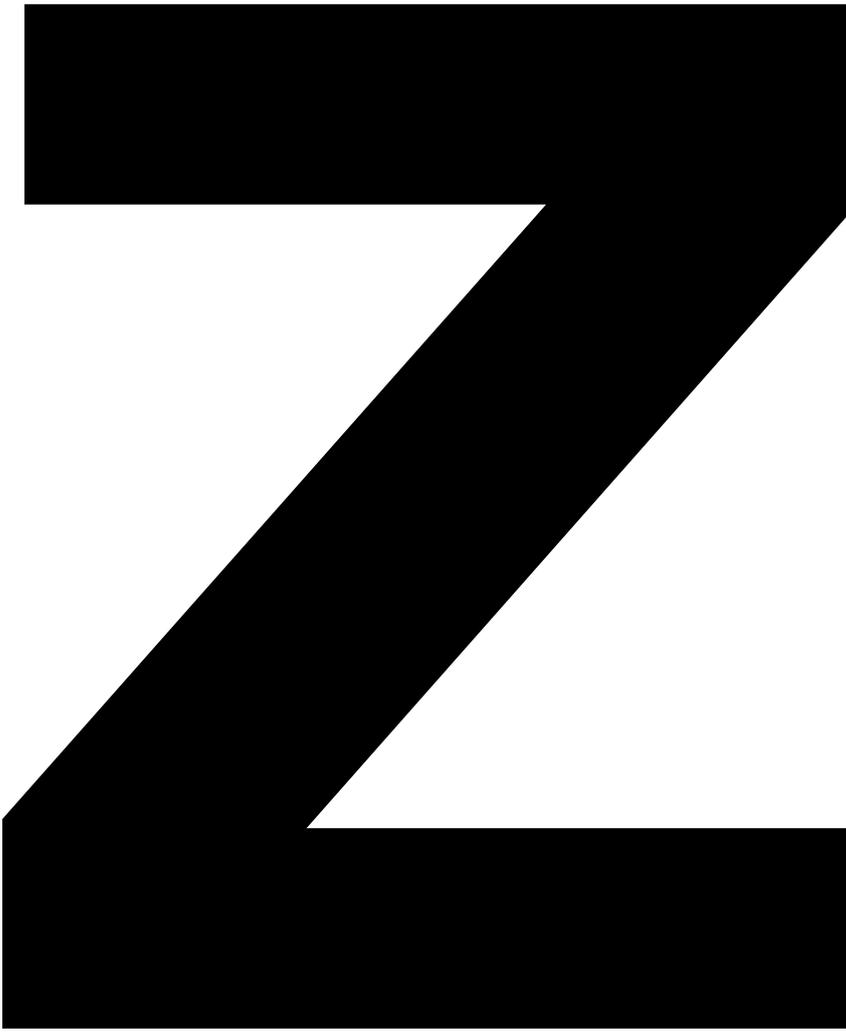


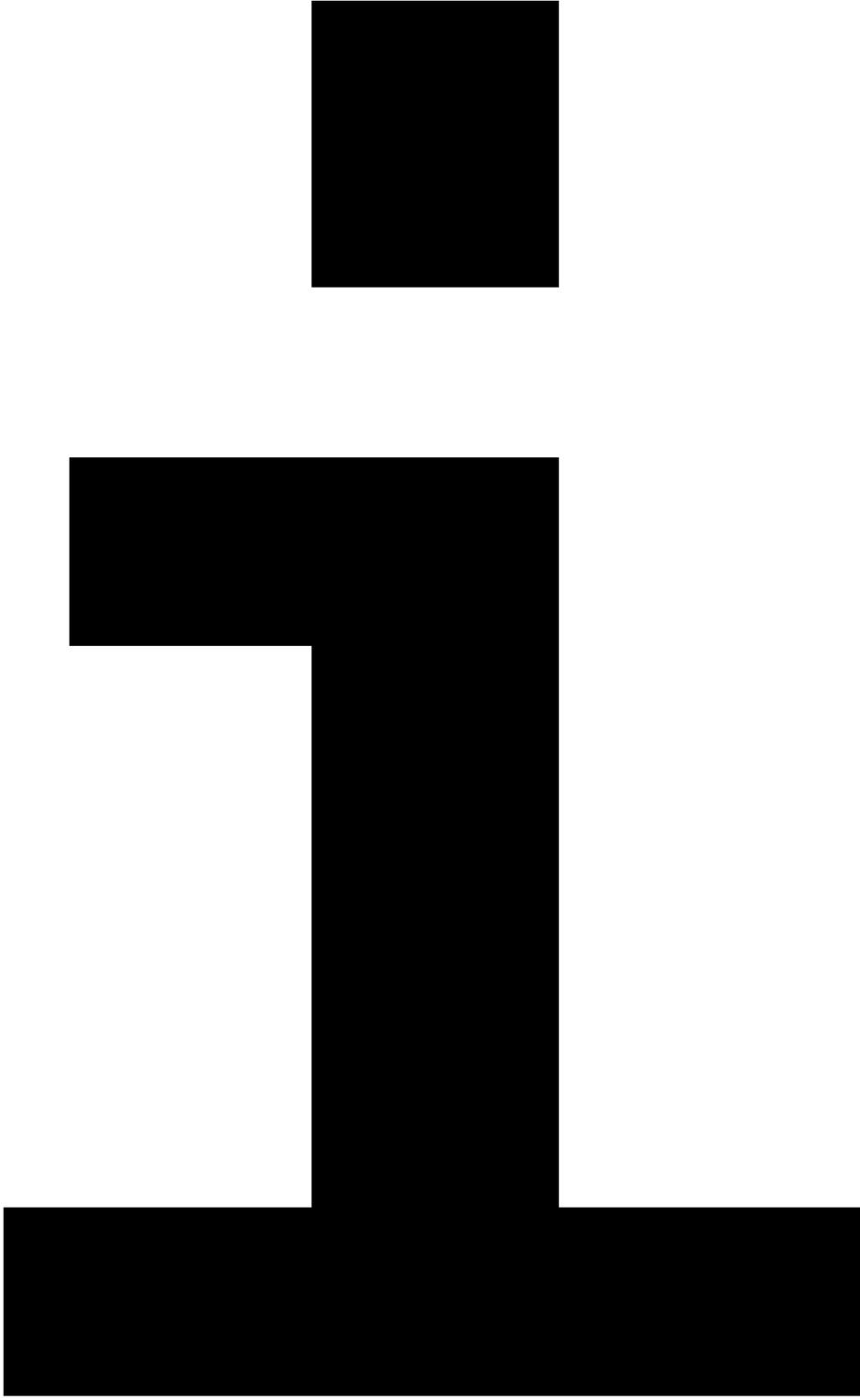


e

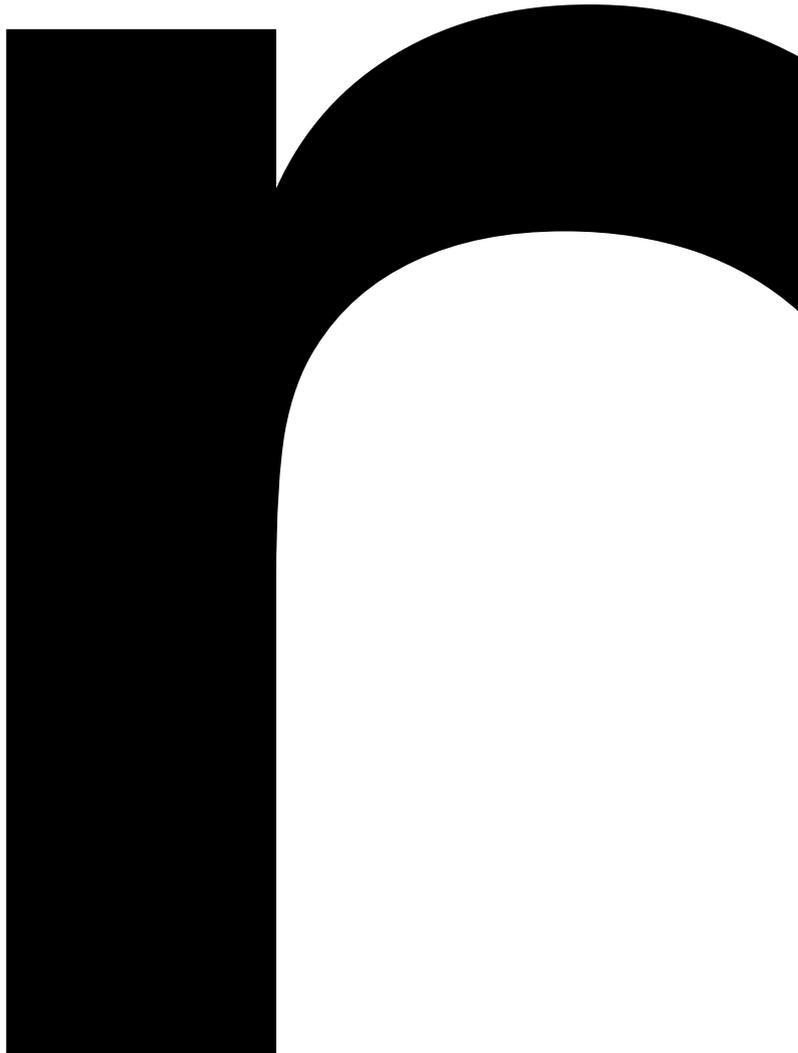
Q

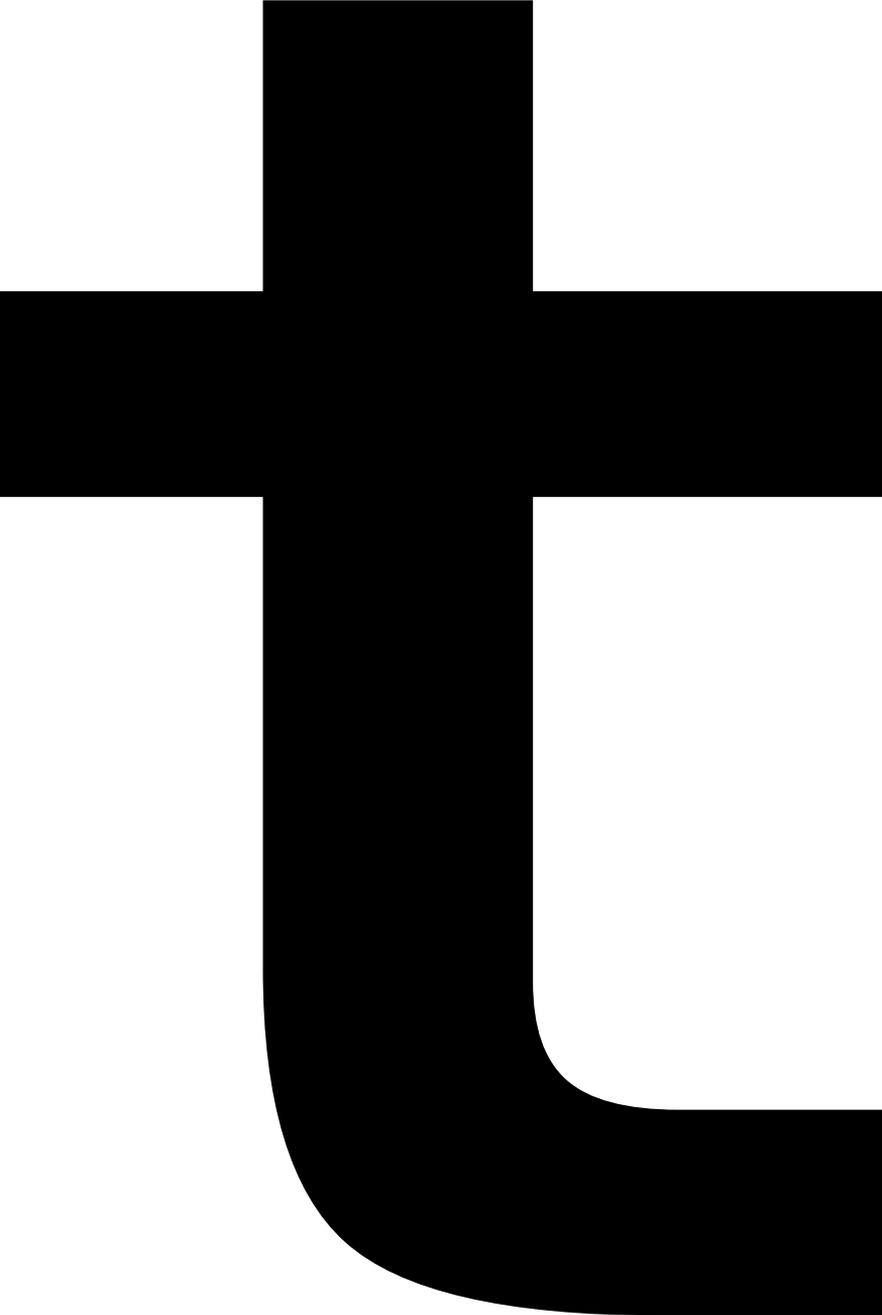
u

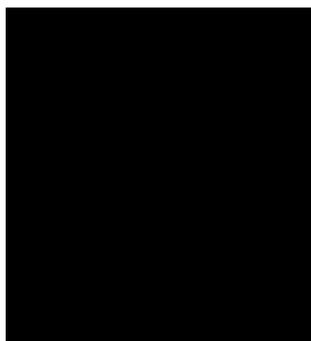




e







D

e

m

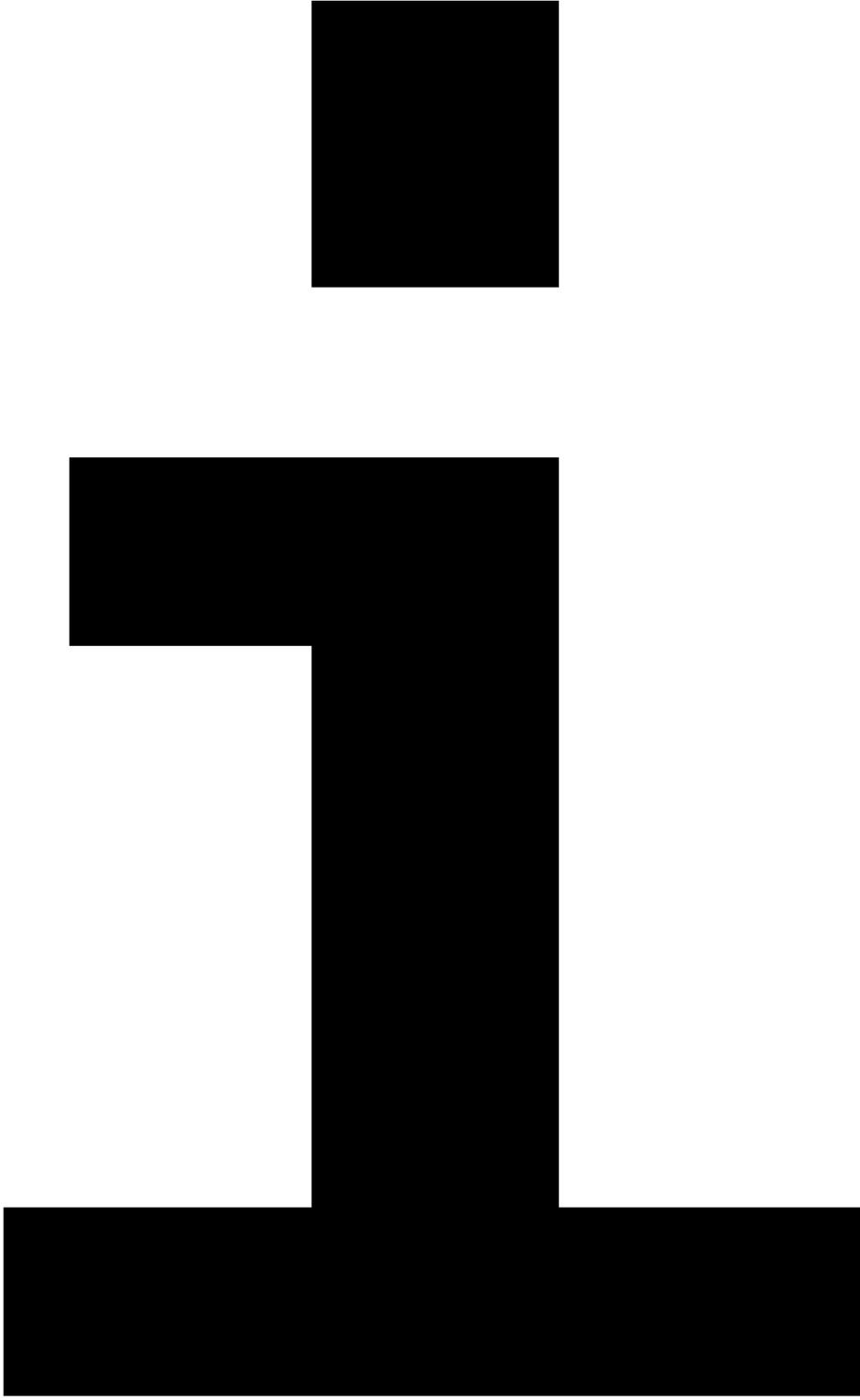
n

sa

C

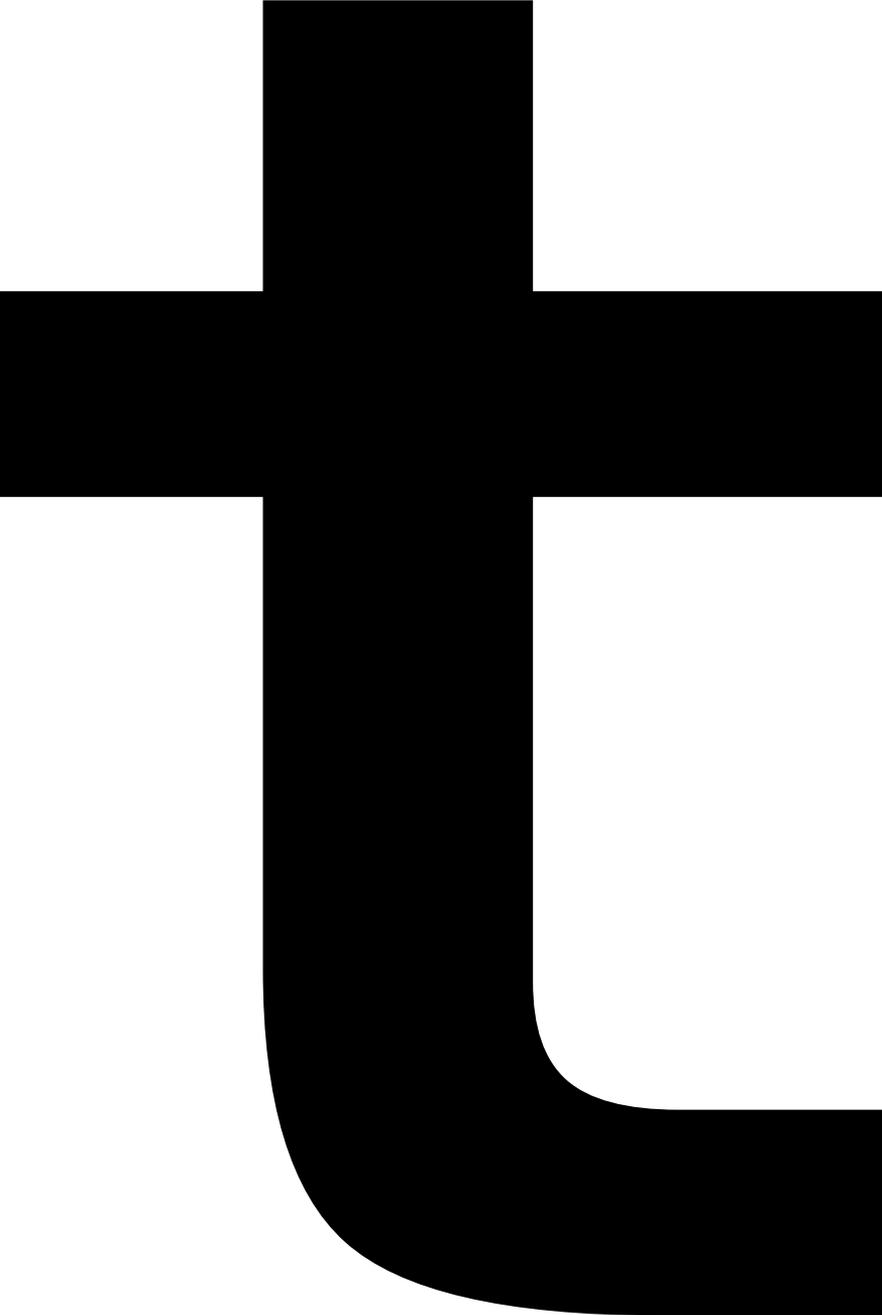
h

J



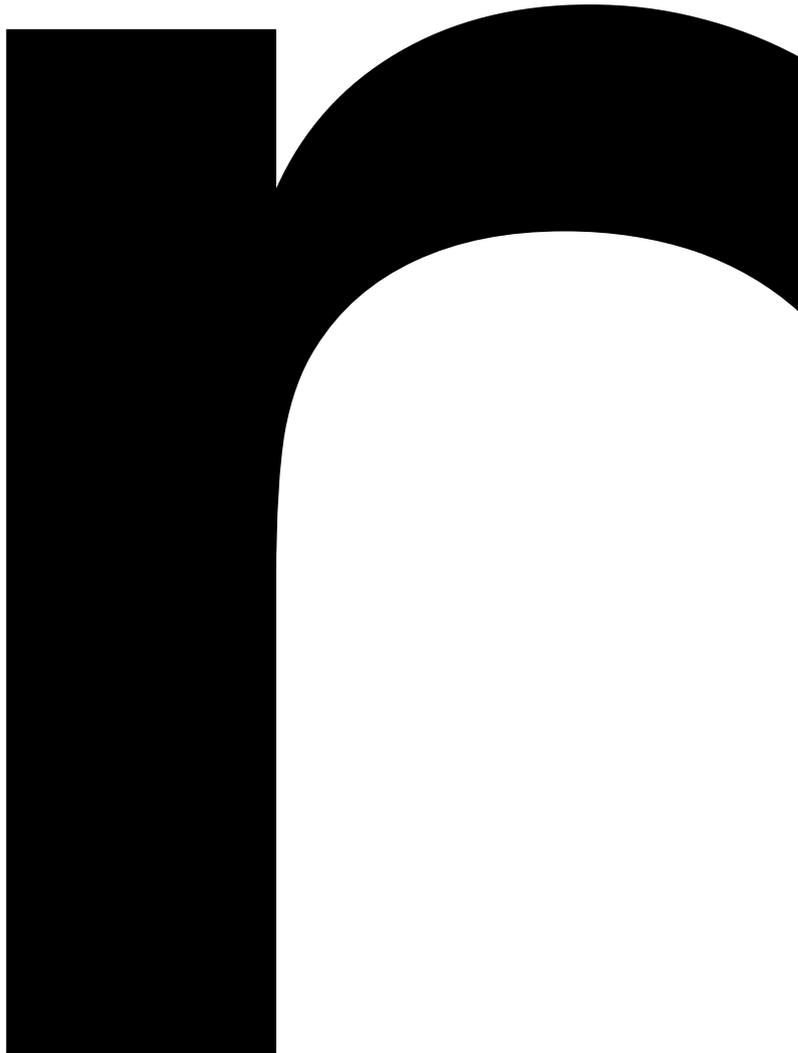
e

Q



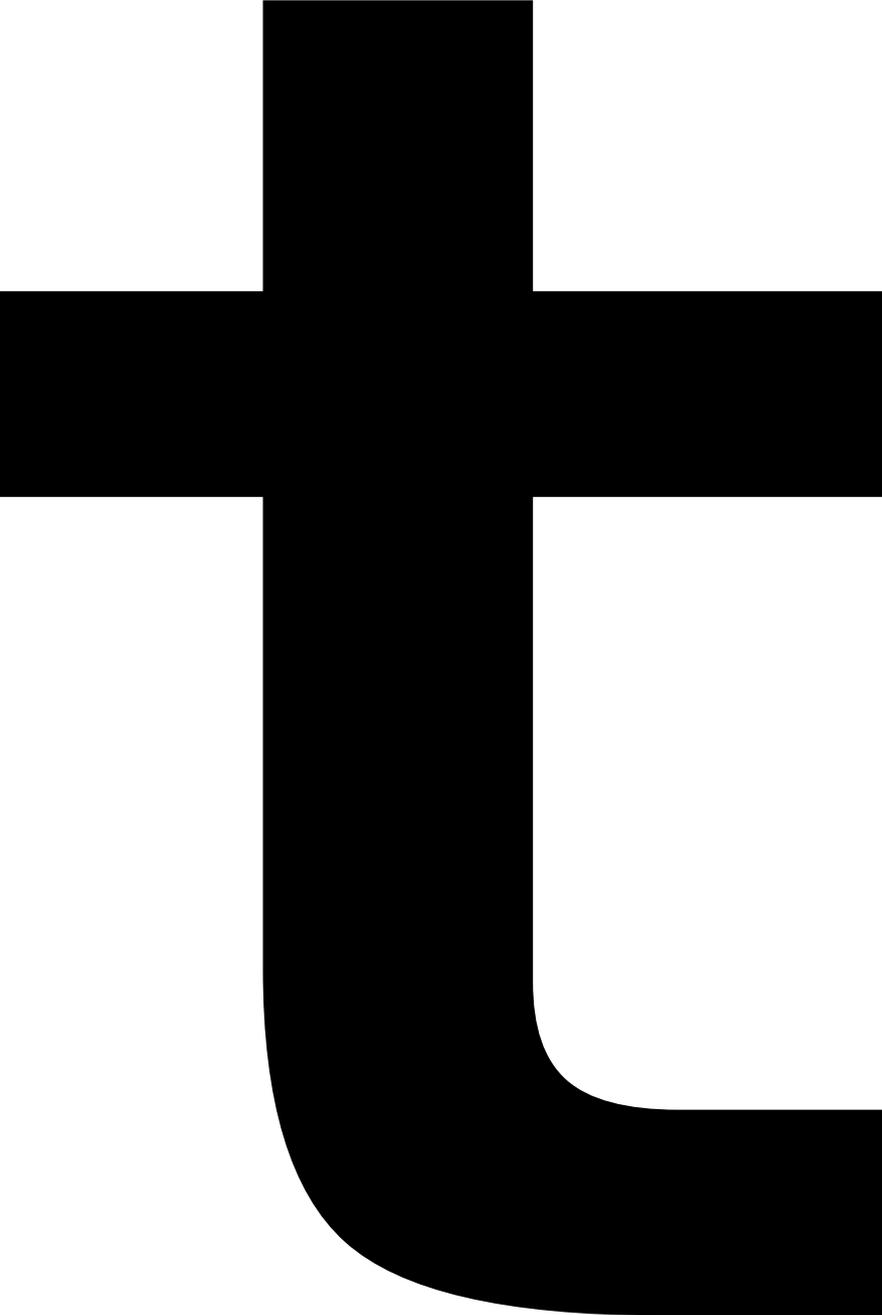
Q

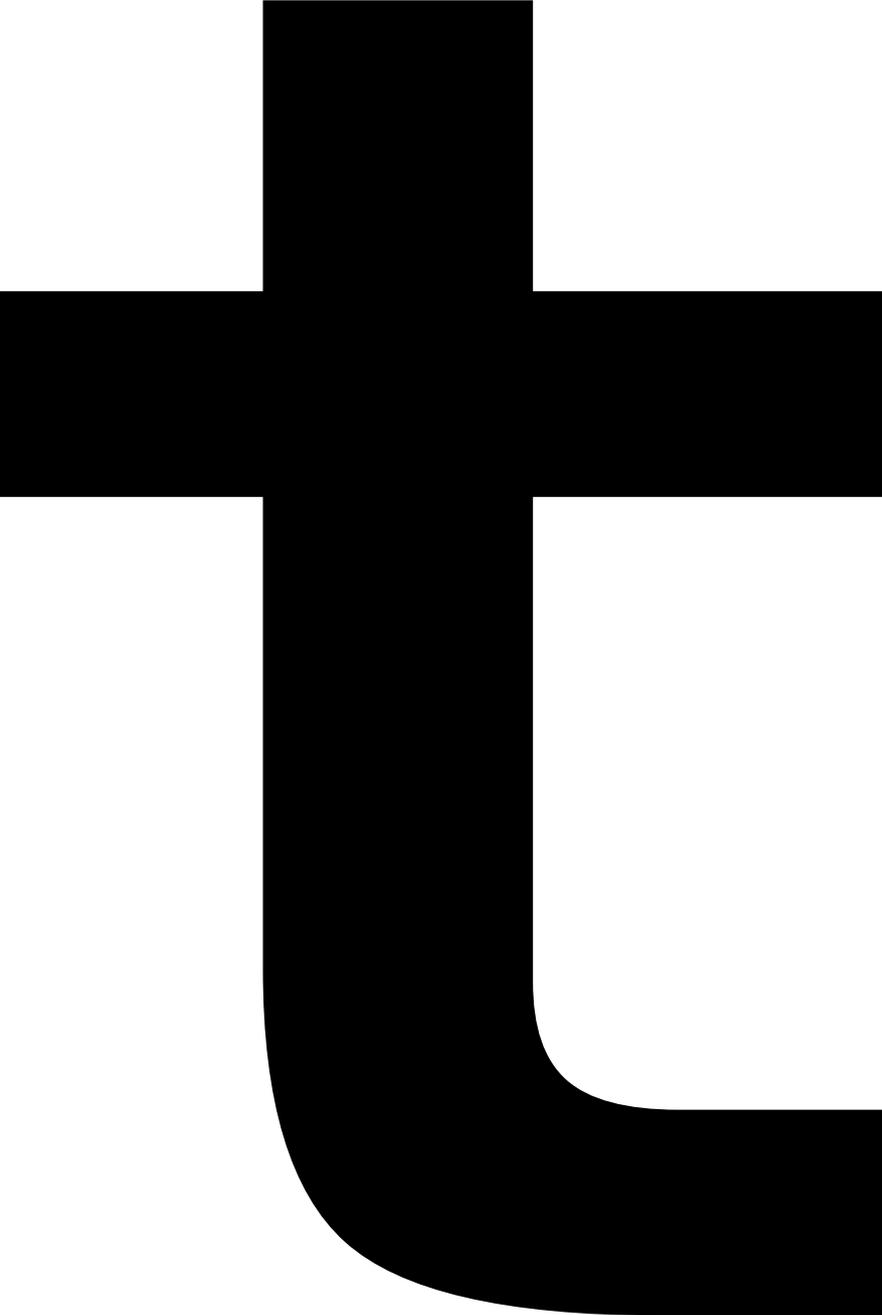
e

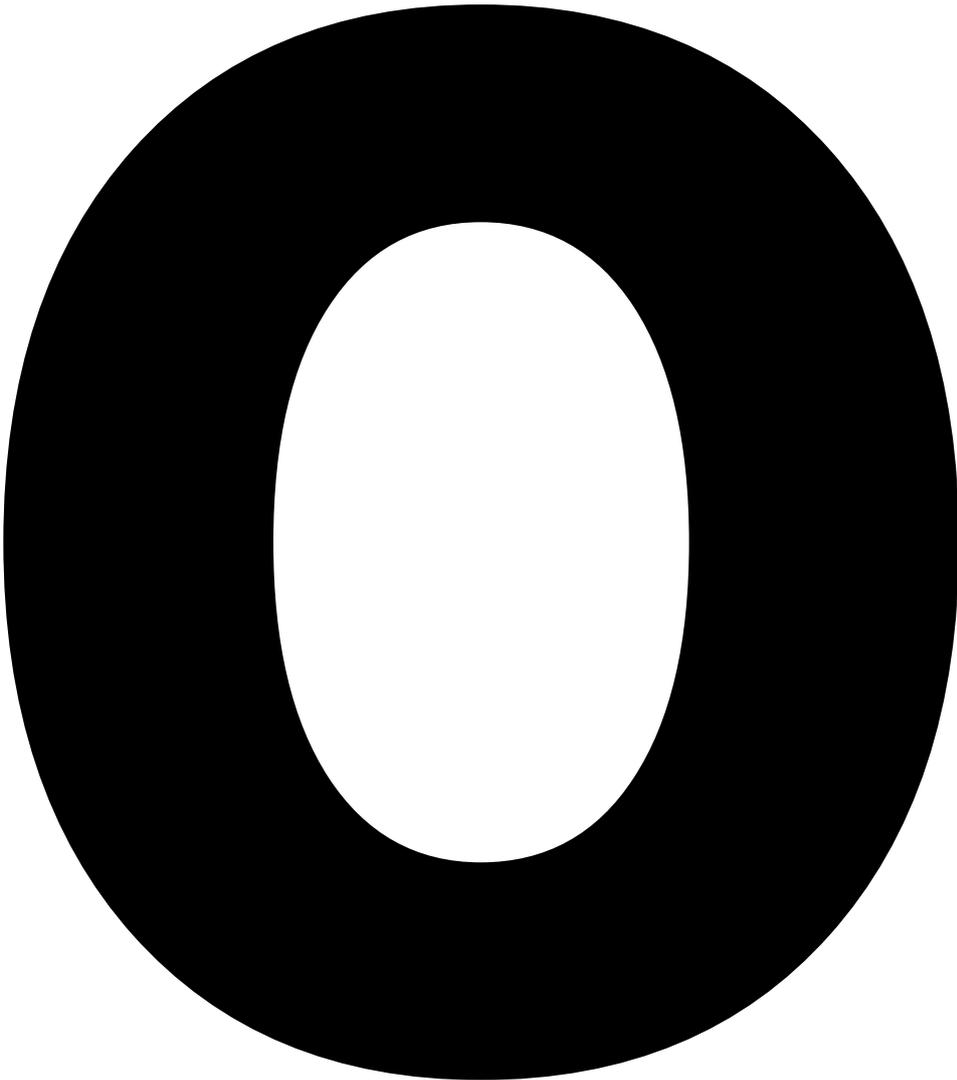


N

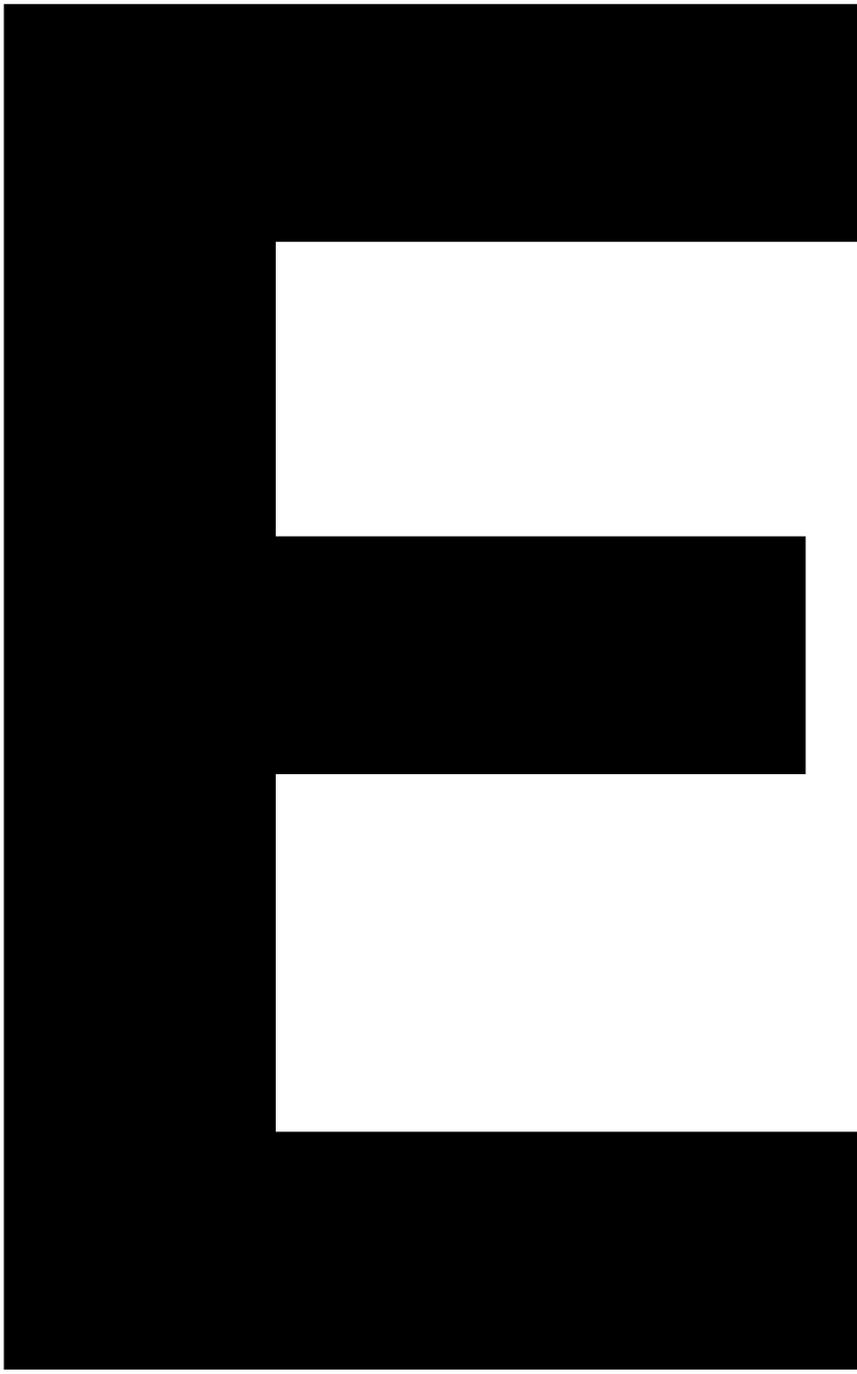
e

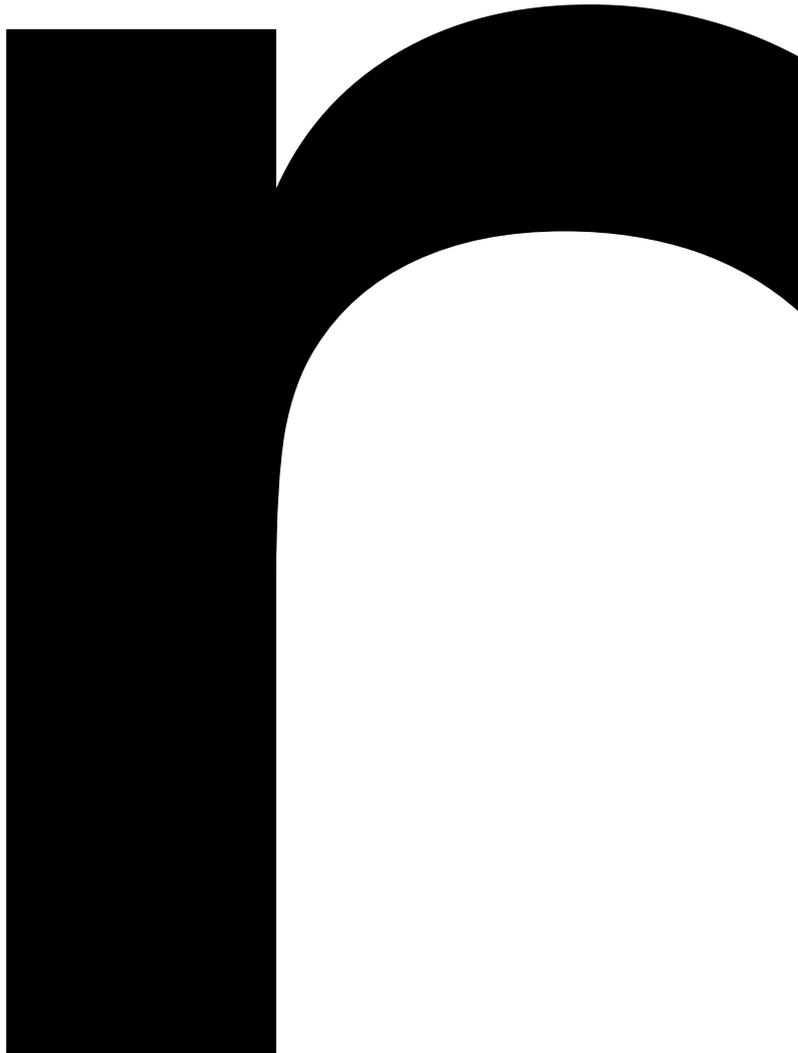


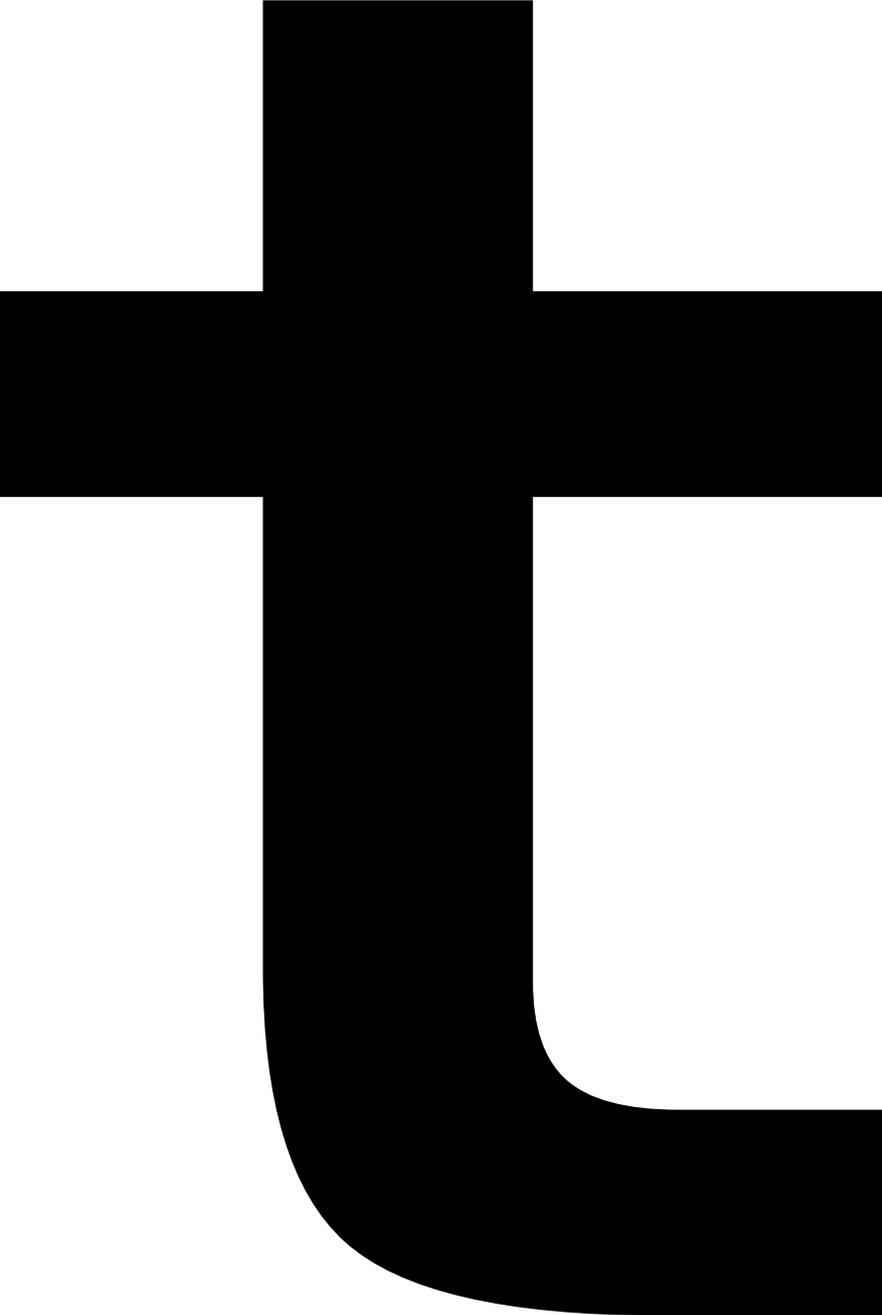


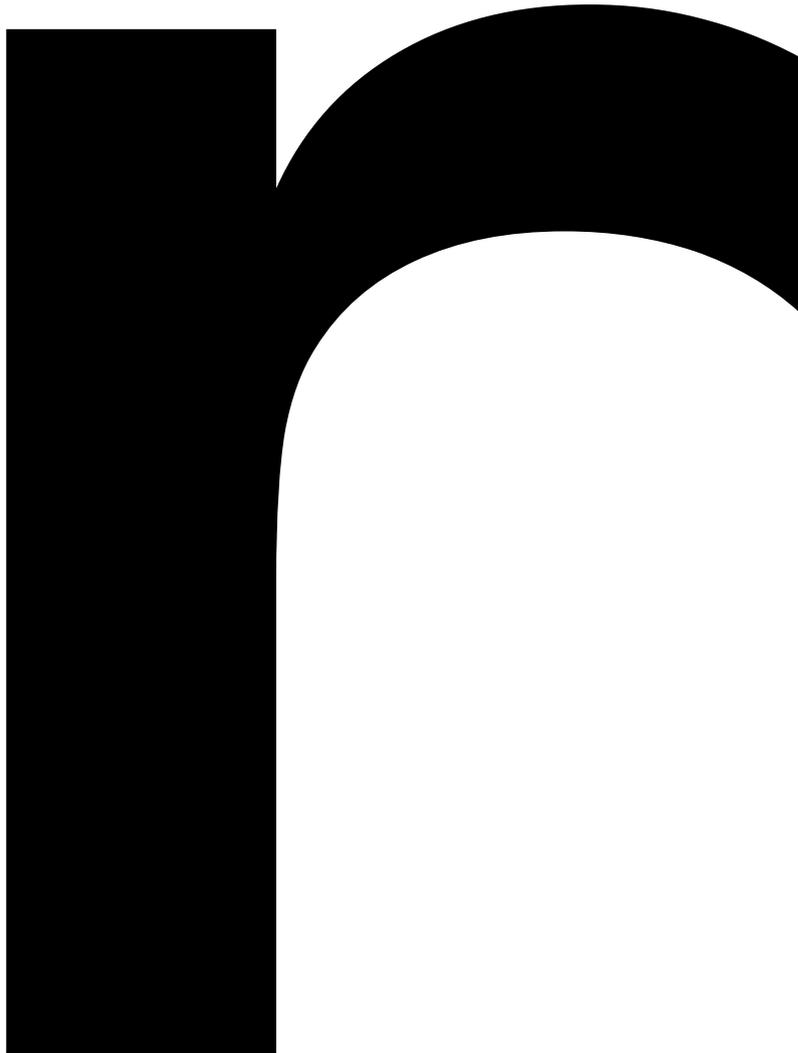








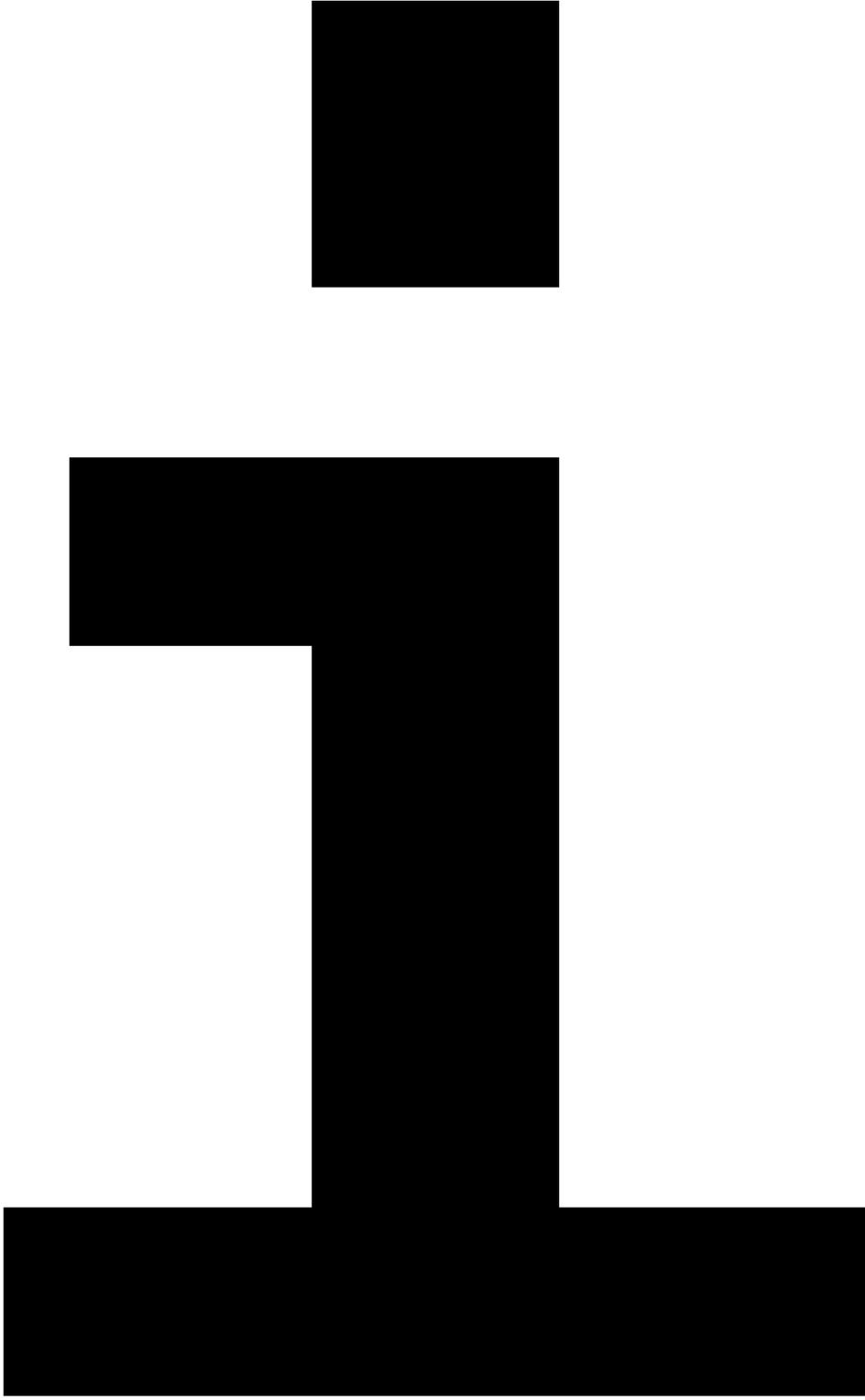




sa

Q

e

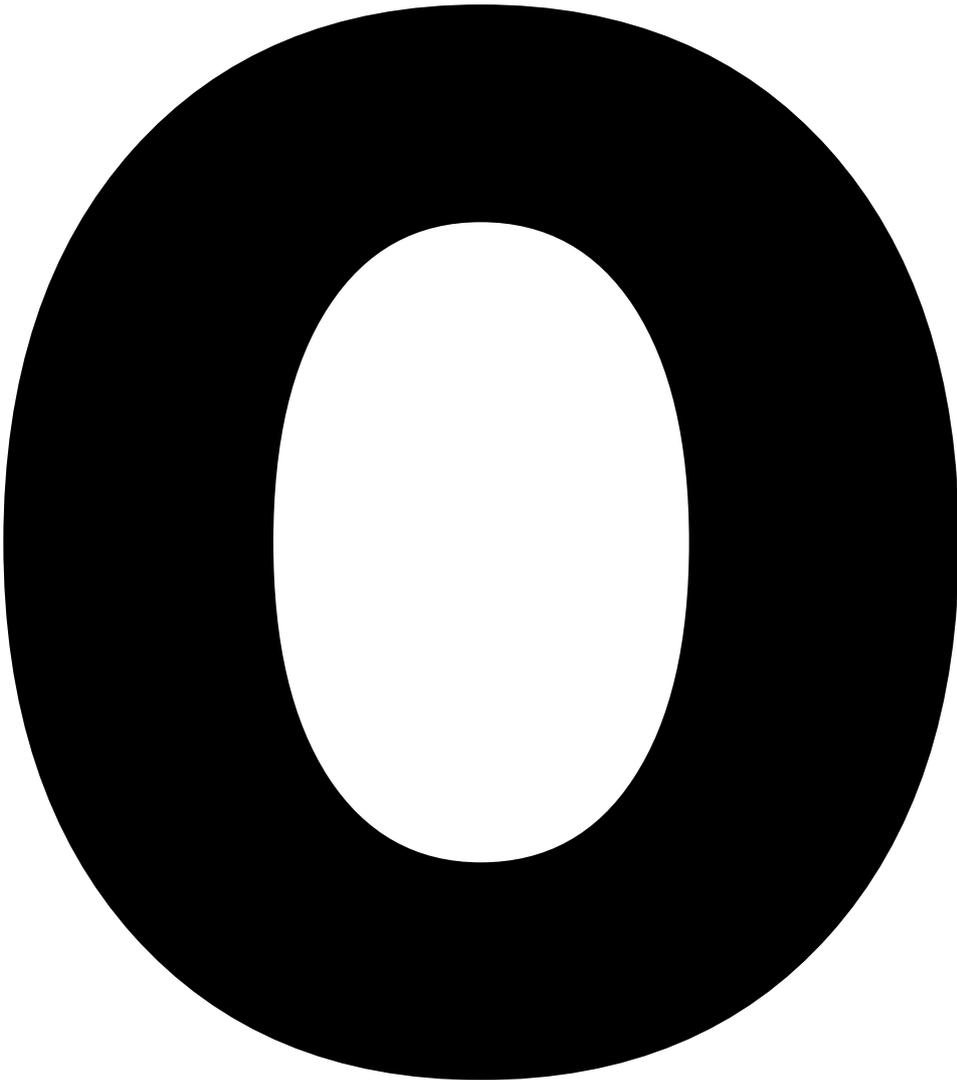


n

e

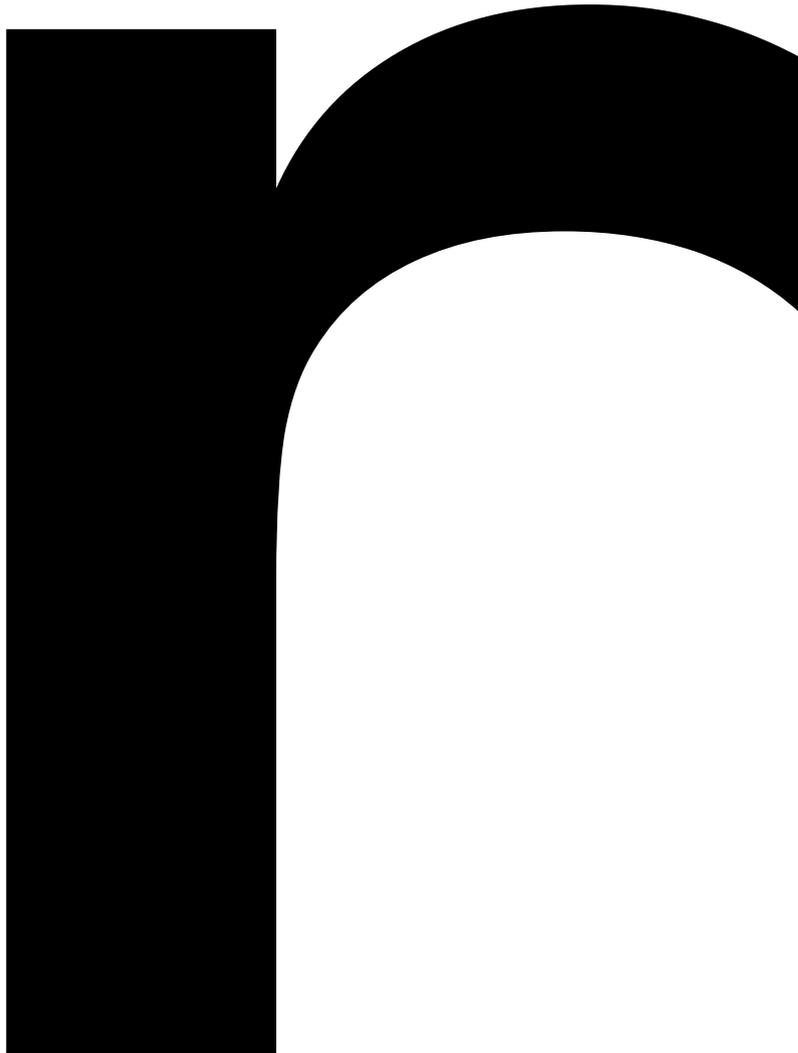
S

S



J

sa



o

sa

n

e

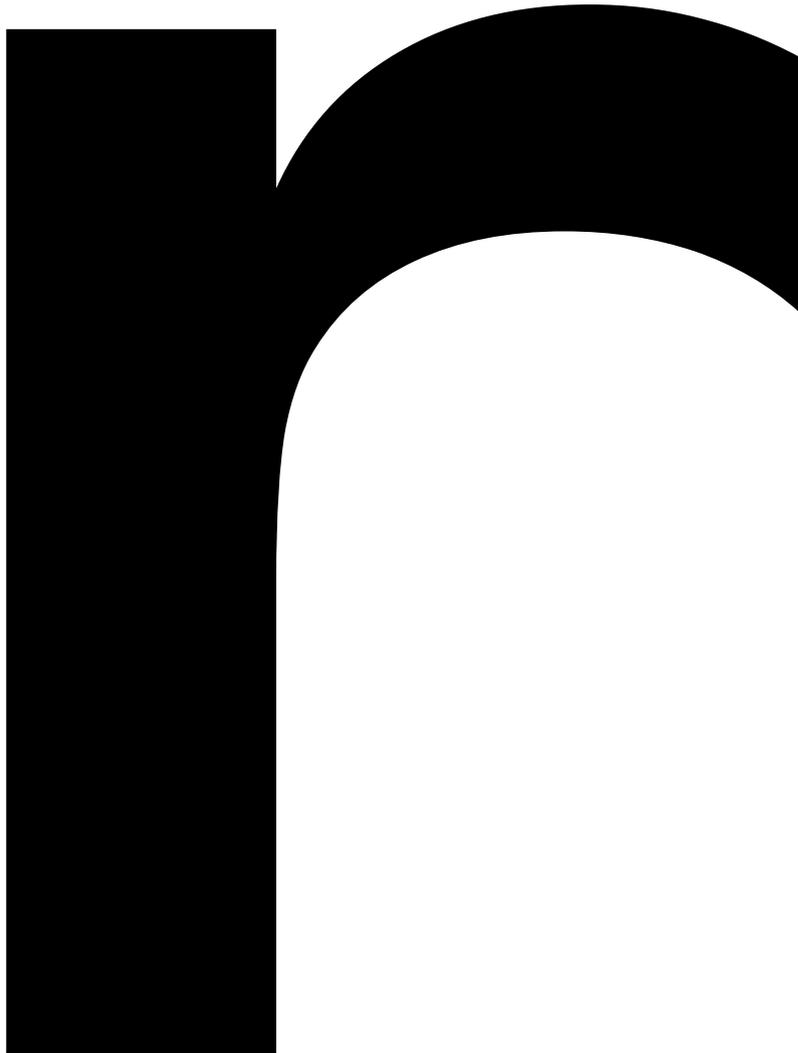
J

S

w



h



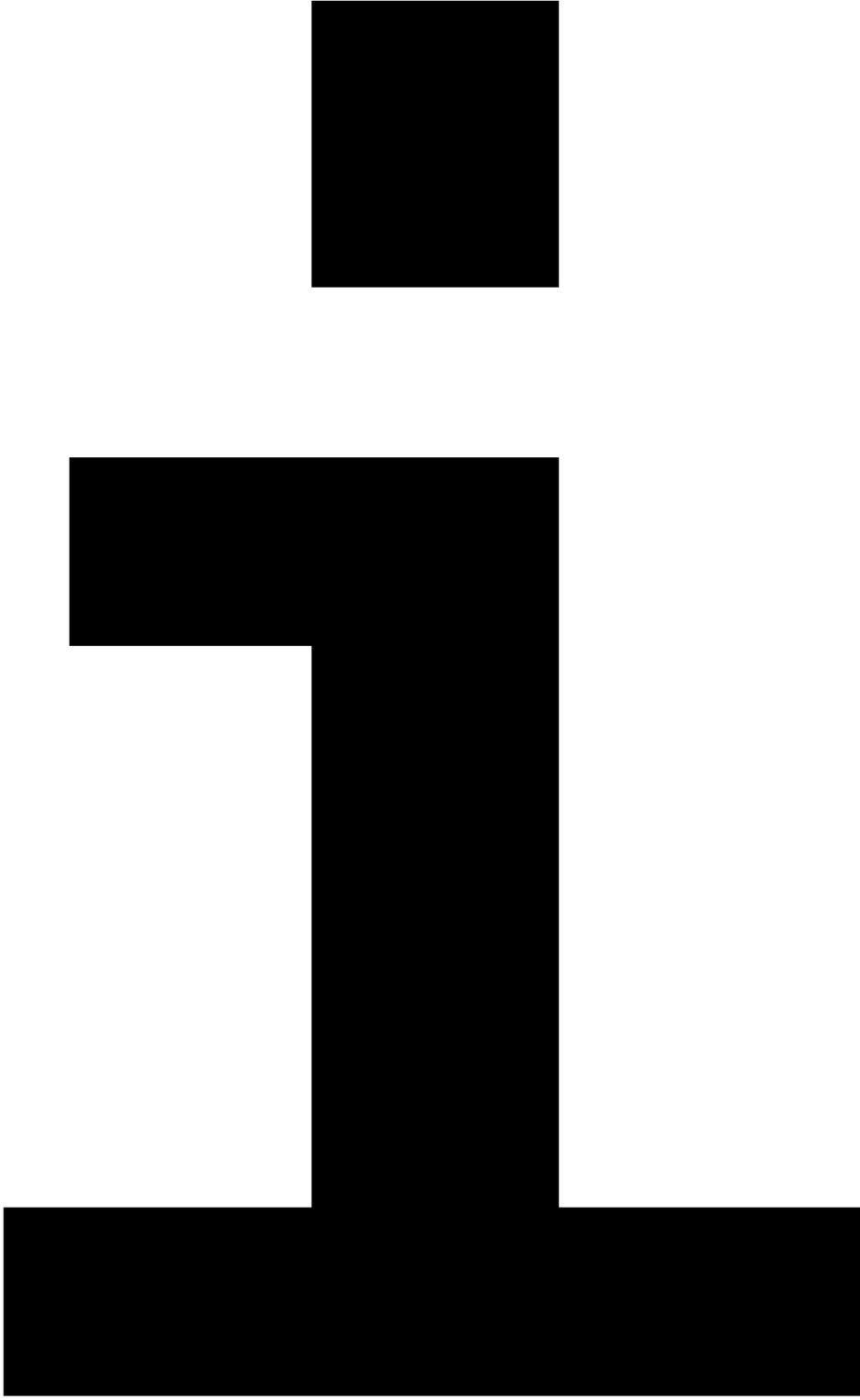
e

n

Q

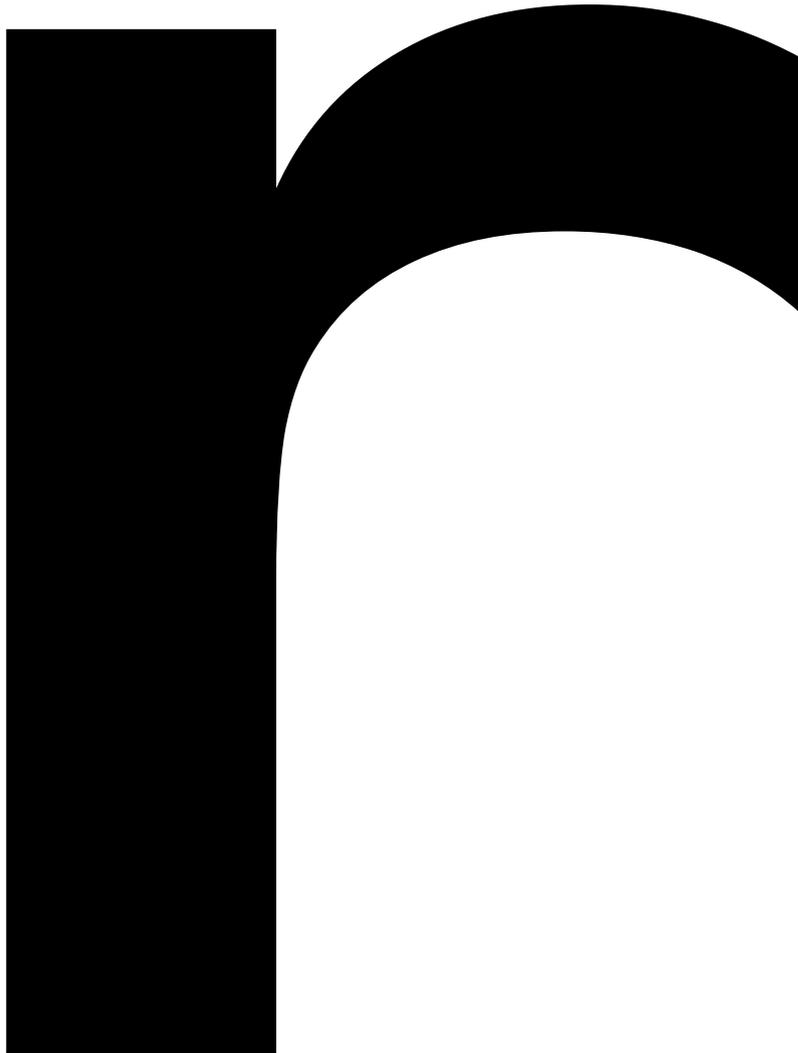
S

e



n

e





e

10

e

n

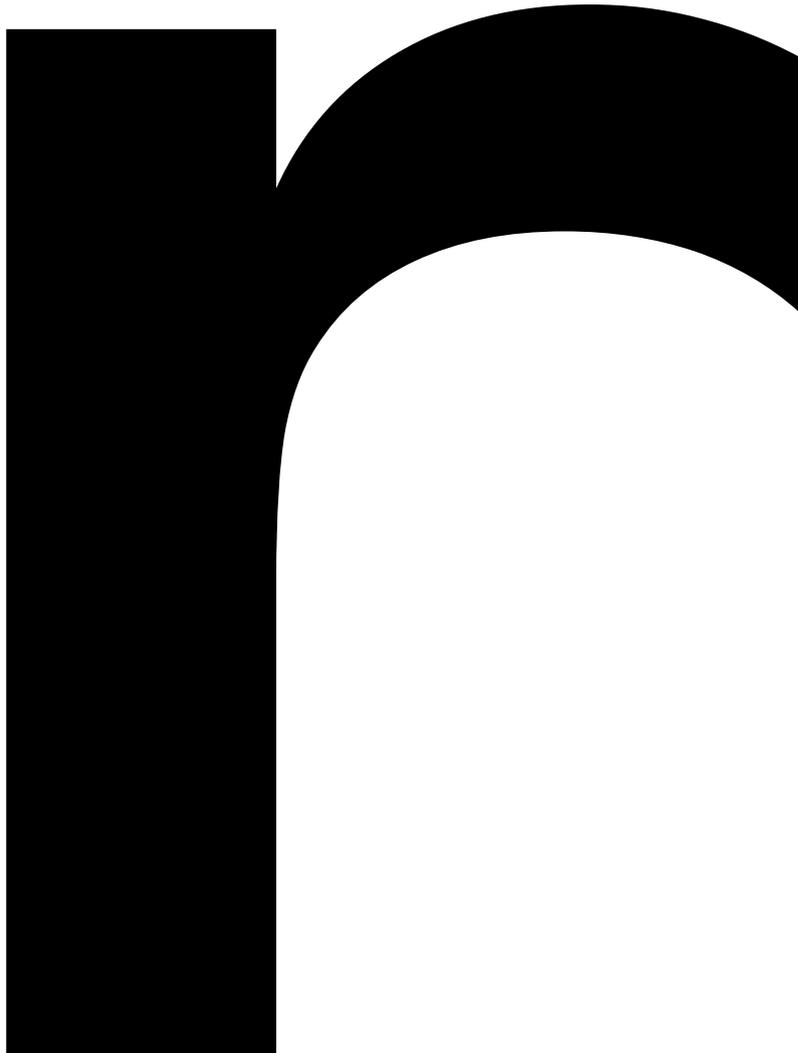
S

Q

sa

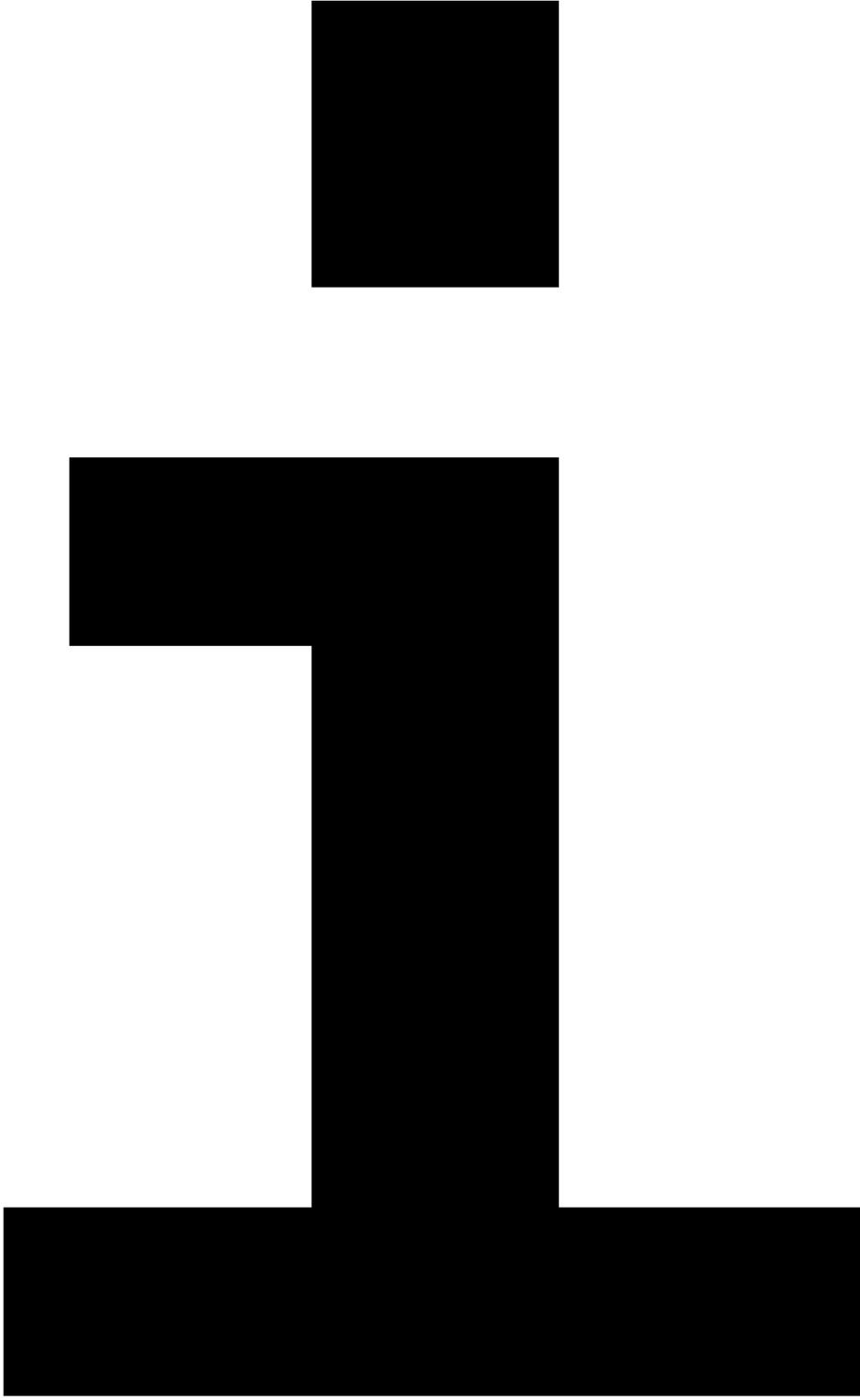
u

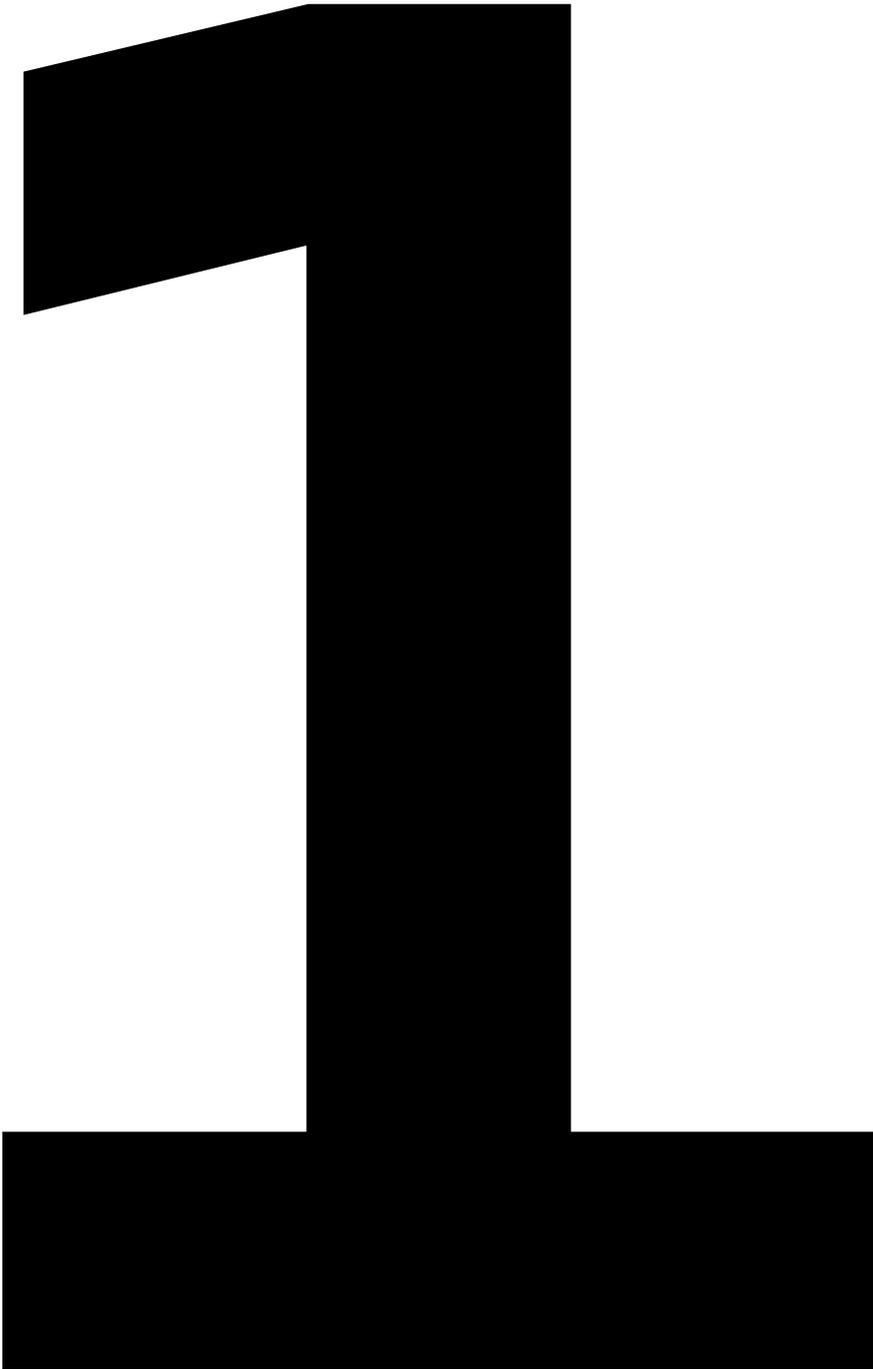
e

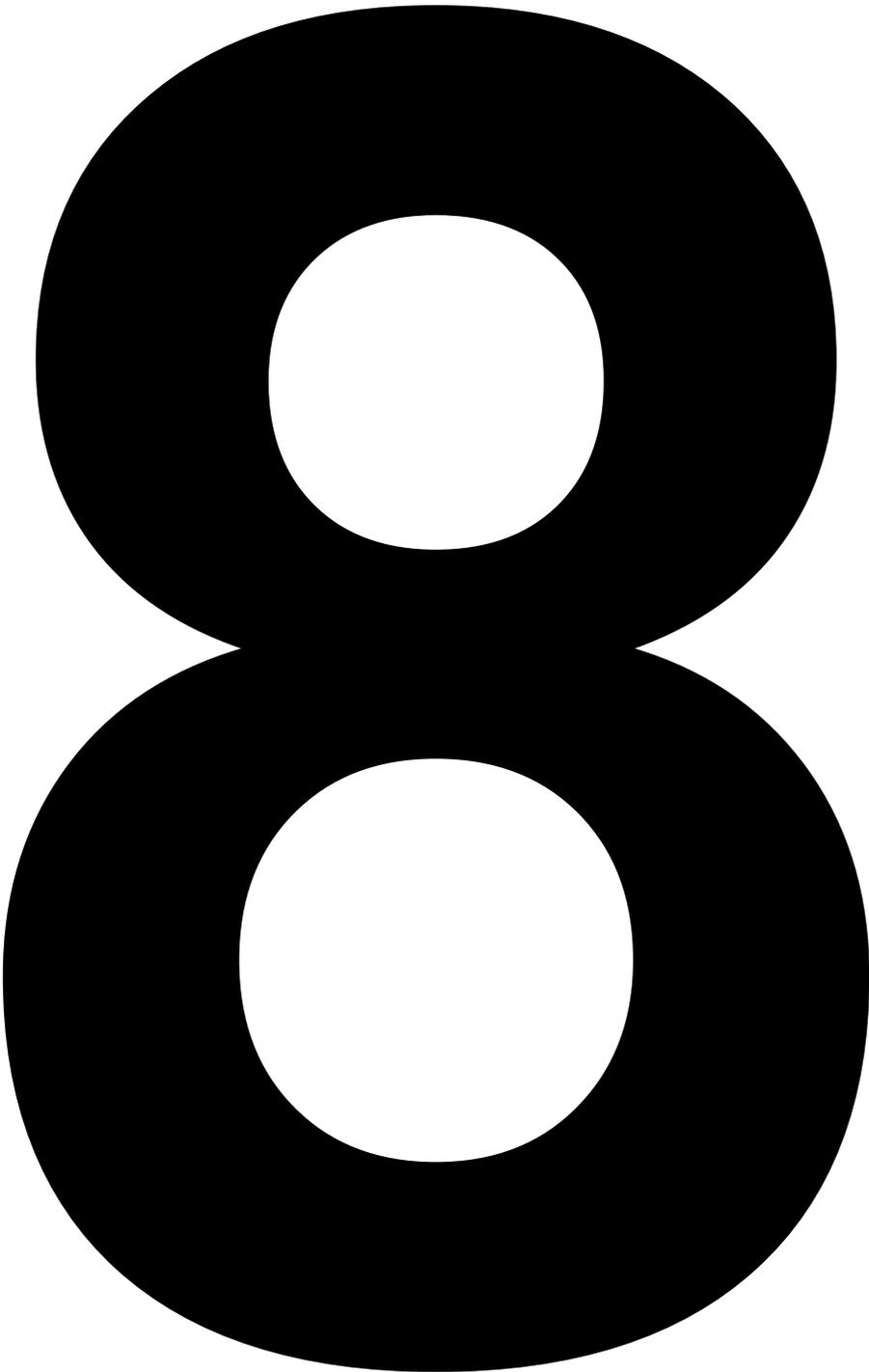


10

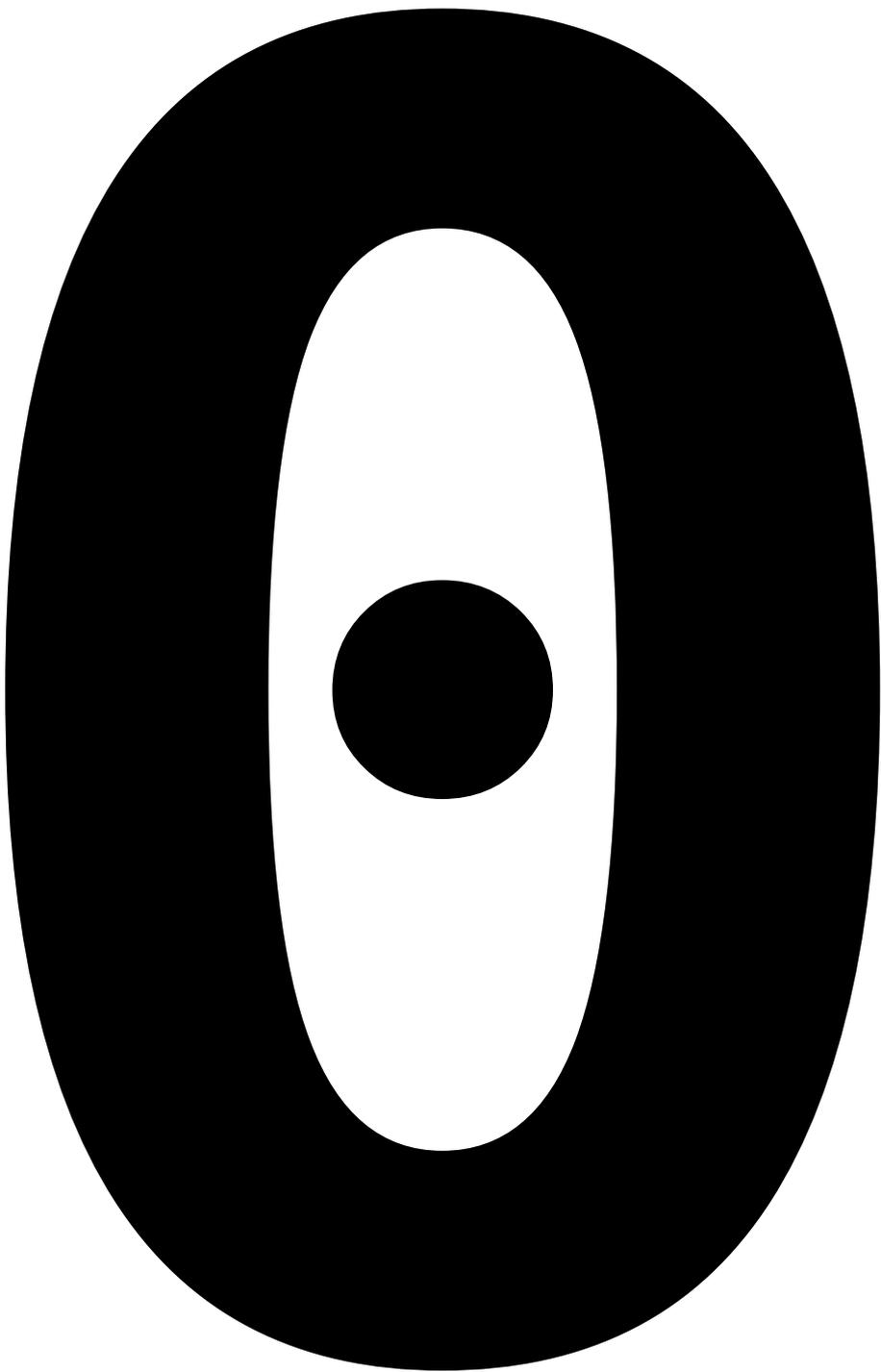
e

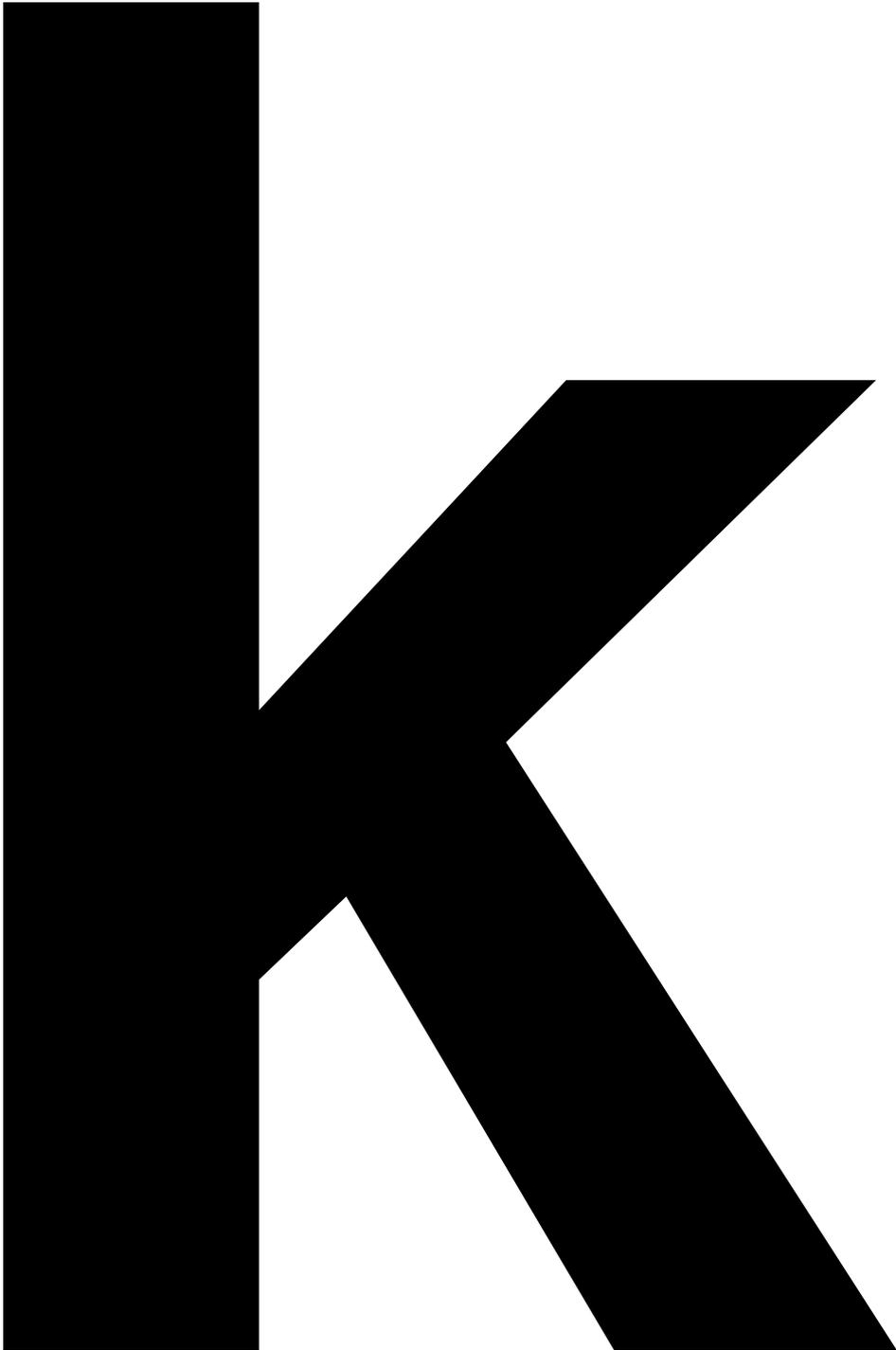






5





w

h

