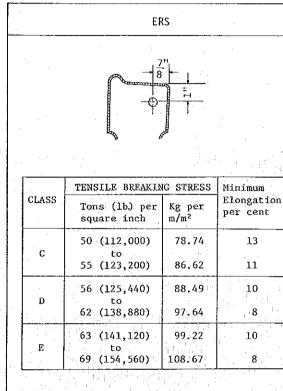
ERS	JRS (JIS)	uic e	BS	AAR
1. Quality of material	Quality	Quality	Quality	Quality
The wheels shall be forged and rolled from the highest quality of steel ingots of a length and weight to produce, after sufficient discard has been taken, two or more wheels blanks from each ingot. The forging and rolling process shall be performed in such a manner that the central axis of the ingot shall coincide with the axis of the wheel. The ingots shall be made by the acid or basic open hearth or electric process and the wheels shall show on analysis not more than the following limits of sulpher or of phosphorous.  "Steel made by the acid open hearth or electric process: not more than 0.06 per cent of sulpher or of phosphorous for Class C wheels, and not more than 0.05 for Class D & E wheels".	Wheels shall be manufactured from killed steel ingots produced by open-hearth furnace, electric furnace or pure-oxygen process. The ingot shall be bottom-poured and have round bottom, and the pipe caused shall be 75 mm or less in diameter at the center of the ingot. The top shall be discarded sufficiently as required.  The chemical composition is: (%)  C: 0.60 ~ 0.75  Si: 0.15 ~ 0.35  Mn: 0.50 ~ 0.90  P, S: 0.050 or less (for acid furnace processing)  0.045 or less (for basic furnace processing)	Wheels shall be manufactured from killed steel ingots produced in open-hearth furnace, electric furnace, or top-blown oxygen converter. Top and bottom of ingot shall be discarded sufficiently as required. Chemical composition shall be as given below.	Wheels shall be made from steel material produced in acid or basic open-hearth furnace or electric furnace process.  The ingot shall have sufficient amount of discard performed, and two billets or more shall be taken from each ingot. The chemical composition shall be as follows:  Class B (for any type of furnace) (%)  P, S ≤ 0.06  Class C (for any type of furnace)  P, S ≤ 0.06  Class D (for acid open-hearth furnace)  P, S ≤ 0.06  (for basic open-hearth furnace)  P, S ≤ 0.05	The material shall be produced in open-hearth furnace, electric furnace or converter. The ingot shall have its incomplete portions discarded sufficiently as needed. The chemical composition shall be as follows:  \[ \begin{align*} \text{Class V} & 0.65 & 0.80 \\ \text{Class L} & 0.47 \text{ or less} \\ \text{Class B} & 0.57 & 0.67 \\ \text{Class B} & 0.57 & 0.67 \\ \text{Class C} & 0.67 & 0.77 \end{align*} \]  \[ \text{Mn (2)} & 0.60 & 0.85 \\ \text{P (%)} & 0.05 \text{max.} \\ \text{Si (%)} & 0.15 \text{max.} \end{align*}
"Steel made by the basic open hearth process: not more than 0.06 per cent of sulpher or of phosphorous for Class C & D wheels, and not more than 0.05 per cent of sulpher or of phosphorous for Class E wheels".  The manufacturers shall supply an analysis of each cast when required to do so.		Type \( \frac{\xi}{2} \) \( \frac{\xi_1}{2} \) \( \frac{\xi_2}{2}	Class E (for any type of furnace) $P,\ S \leq 0.05$ Forging and rolling shall be performed in such a manner that the axis of ingot and the axis of wheel may coincide.	
2. Freedom from defects	Freedom from defects	Freedom from defects	Freedom from defects	Disc thickness tolerances
The wheels shall be free from defects of any kind, and accurately finished to the prescribed dimensions. The disc portion of the wheel shall be of uniform section and shall not vary more than 1/16 inch (1.5 mm) under or 1/8 inch 3 mm) over the specified dimensions, and in any one wheel the difference between the minimum and maximum thickness at any given radius shall not be more than 1/16 inch (1.5 mm). Measurements for thickness shall not be made, however, at any point	The wheel shall be uniform in quality and free from any defect in service.  Tolerances in plate thickness:  (i) In case that the finish is specified for curved portion at the root of the boss:  +6 ~ 0 mm  (ii) In case that no finish is specified for curved portion at the root of the	Surface defects on wheel shall be removed through all the processes.	Surface flaws shall be completely removed.  Tolerance for plate thickness shall be -1.6  Circumferential variation in thickness shall be within 1.6 mm.	Minimum values are specified by types of wheels.
where there may be an isolated depression less than 1 inch (25.50 mm) in length.	boss: +8 ~ 0 mm			

A finaling  A fina	ERS	JRS (JIS)	UIC	DC	
he shorted shall be districted by districted by districted by the shorted shall be districted by the shall be districted by the shorted shall be districted by the shorted shall be districted by the sh	<u> Para Perinangan Panggalangan Perinangan Perinangan Perinangan Perinangan Perinangan Perinangan Perinangan Pe</u>	i de la companya de l	UIC	BS STATE OF THE PROPERTY OF TH	AAR
in inducting from the control of the	. Branding	Stamping	<u>Stamping</u>	Stamping	Stamping
hell be one has them \$18° (0.5 nm) and not rectan 1/2° (12.5 mm) high.    East (reatment to the period of the second of the seco	he indentifying cast number. The name or nitials of the manufacturer, the letters E.R.", the order number and the date shall	indicate the stamping of date and charge name,	execution, date of manufacturer, position and quantity of unbalance (as indicated in the	portion, and the manufacturer's name and the date of manufacturer shall be stamped cold on the boss. The stamped letters shall be	manufacturer's name, class
Now	all be not less than 8/8" (9.5 mm) and not			9.5 to 12.7 mm in size.	(i) Locomotive Hot-stamped on int
Heat treatment  The Class J wheat shall center or exter- column.  The Class J wheat shall center or pieces  The Class J wheat shall new testing and temporing of Class J.  The Class J wheat shall center of the class of the clas	ore than 1/2" (12.5 mm) high.				rior rim face (or exterior end face
Real treatment   Real					(ii) Freight carCold-stamped on in rior end face of b
Mear treatment he wheels may be supplied with or without mattered. He wheels may be supplied with or without mattered at the option of the name acturer.  The Class 2 wheel shall have its tread heat-treated. He 77 - 45 for Class 1 and He 40 - 52 for Class 2.  Rusher of courses to be tested.  The maker of test pieces  Rusher of courses to be tested.  Whear treatment  The wheels of classes 2. A, B and C shall have its tread heat-treated. He 77 - 45 for Class 1 and He 40 - 52 for Class 2.  Rusher of courses to be tested.  The maker of test pieces  The maker of test pieces  As the maker of test pieces  The maker of test pieces  As the maker of test pi					(iii) Passenger car Cold-stamped on
The Class I wheel shall remain as rolled, and the Class I wheel shall remain as rolled, and the Class I wheel shall remain as rolled, and the Class I wheel shall laye its tread heat-restered.  Number of centres to be treated  The wheels for each for the shall be proposed, at the rate of one wheel for each to wheel only shall be selected. When substituted for treating of the case of the such of the shall be selected on the state of one wheel into shall be selected on the state of one wheel into shall be selected on the state of one wheel into shall be selected one at the rim and the other at the disc.  The class I wheel shall remain as rolled, and the Class 2 wheel shall be selected for each charge of the substitution o		10年以上海建設的第三人称单。			
and the Class 2 wheel shall have its tread heat-treated.  Be 37 - 45 for Class 1 and Hs 46 - 52 for Class 2.  Number of centres to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be tested  tran wheels for rearing to the manner countries to be selected for each classe so be any transformer of test pieces  The manner of test pieces  Number of test pieces  At the number of test pieces  At the number of test pieces  Number of test pieces  At the number of test pieces  Falling weight and tensile test specified.)  Wheels and two wheels shall be selected  to each one wheel only whall be selected for each clarge of up to 250 wheels; and two wheels shall be selected.  Two test pieces shall be taken from one wheel to represent rearing to manner the first of each charge of which they were leaved to the falling weight and tensile test specified.)  Wheels of test pieces  The manner of test pieces  Number of test pieces  Falling weight and tensile test pieces  Falling weight and tensile test pieces  The wheels of the samifacturer.  The wheels of test pieces  Falling weight and tensile test pieces  The manner of test pieces  Falling weight and tensile test pieces  The samifacturer.  T	. Heat treatment	Heat treatment	Heat treatment	Heat treatment	Heat treatment
Ref. 19 Nardening and tempering of tread  He 17 - 45 for Class 1 and He 46 - 52 for Class 2.  Number of centres to be tested  At He 25 - 32 in the contraction of the state of the contraction of the contr	eat treatment at the option of the manu-	and the Class 2 wheel shall have its tread	R1 ~ R3 Normalizing	The execution of heat treatment shall be left to the selection of the manufacturer.	The wheels of Classes L, A, B and C shall
Class 2.  Number of centres to be tested  tra sheels for testing in the assumer searched in Clauses 6 and 7 shall be proposed, and the search of the fact of testing and the search of test pieces shall be one pur charge.  The number of test pieces shall be one pur charge of testing the rate of one wheel for search of the transmission of the wheels of testing the selected for testing, with the exception at if there are not more than 110 wheels that be selected.  Wheels or portion thereof in each cast is abbailted for testing, with the exception at if there are not more than 110 wheels that is selected for the wheels as he may think oper to the extent of the wheels as he may think oper to the extent of the wheels as he may think oper to the extent of the wheels the selected for the wheels shall be maded over to the R.R. specified and shall be held to represent extend from the selected wheels shall some processed from the selected for the wheels selected for search of the selected for search of the selected wheels shall some processed from the selected for search of the selected for search	acturer.				
The number of test pieces shall be compared to the straight in the manner searched in Clauses 6 and 7 shall be produced by the manufacturers, at his own epense, at the rate of one wheel for each observed for each observed to the rate of one wheel for each observed to the cast one wheel only shall be selected for each observed the exception at if there are not more than 110 wheels or testing, with the exception at if there are not more than 120 wheels or testing, with the exception at if there are not more than 110 wheels the cast one wheel only shall be selected for each charge of more than 120 wheels or each observed from one wheel: one at the rim and the other at the disc.  Two test pieces shall be taken from one wheel: one at the rim and the other at the disc.  Wamher of test specimens  Number of test specimens  Falling weight and tensile test pieces shall be sampled one each per 120 charges.  Two test specimens  Falling weight and tensile test specimens, one wheel shall be saleted for each charge of up to 250 wheels, and two wheels shall be selected for each charge of up to 250 wheels, and two wheels shall be selected for each charge of more than 250 wheels.  Two test specimens  Number of test specimens  Falling weight and tensile test pieces shall be sampled one each per 120 charges.  Falling weight and tensile test specimens  Falling weight and tensile test pieces shall be aclereded to the specimens of the specimens of the specimens of the spec	n Anna an an Taona ann an Aireann an Airean A Aireann an Aireann a	Class 2.			A: HB 255 ~ 321 C: HB 321 ~ 363
The number of test pieces shall be compared to the straight in the manner searched in Clauses 6 and 7 shall be produced by the manufacturers, at his own epense, at the rate of one wheel for each observed for each observed to the rate of one wheel for each observed to the cast one wheel only shall be selected for each observed the exception at if there are not more than 110 wheels or testing, with the exception at if there are not more than 120 wheels or testing, with the exception at if there are not more than 110 wheels the cast one wheel only shall be selected for each charge of more than 120 wheels or each observed from one wheel: one at the rim and the other at the disc.  Two test pieces shall be taken from one wheel: one at the rim and the other at the disc.  Wamher of test specimens  Number of test specimens  Falling weight and tensile test pieces shall be sampled one each per 120 charges.  Two test specimens  Falling weight and tensile test specimens, one wheel shall be saleted for each charge of up to 250 wheels, and two wheels shall be selected for each charge of up to 250 wheels, and two wheels shall be selected for each charge of more than 250 wheels.  Two test specimens  Number of test specimens  Falling weight and tensile test pieces shall be sampled one each per 120 charges.  Falling weight and tensile test specimens  Falling weight and tensile test pieces shall be aclereded to the specimens of the specimens of the specimens of the spec	Number of				
one per charge.  one charge of up of the wheels on the lot one each per 120 charge.  one at		Number of test pieces	Number of test pieces	Number of test pieces	Number of test specimens
Two test of portion thereor in each cast is submitted for testing, with the exception tat if there are not more than 110 wheels the cast one wheel only shall be selected.  It is the cast one wheel only shall be selected.  It is the cast one wheel only shall be selected.  It is the cast one wheel only shall be selected.  It is the cast of the wheels as he may think oper to the extent of the number specified over. The wheels tested by the falling ight test shall be handed over to the E.R. specting Engineer free of charge if reited, and shall be held to represent rrectly the average quality of the lot essented from the cast from which they were lected. The selected wheels shall comply the the following tests without further heating or any other manipulation whaterer, either of the wheels selected for sting or of any portion cut therefrom to rnish the test pieces.	escribed in Clauses 6 and 7 shall be pro- ided by the manufacturer, at his own spense, at the rate of one wheel for each	The number of tensile test pieces shall be one per charge.	wheel shall be selected for each charge of up to 250 wheels, and two wheels shall be selec-		(No tensile test specified.)
e E.R. Inspecting Engineer shall select d test such of the wheels as he may think oper to the extent of the number specified ove. The wheels tested by the falling ight test sha-l be handed over to the E.R. specting Engineer free of charge if re- ired, and shall be held to represent rectly the average quality of the lot esented from the cast from which they were lected. The selected wheels shall comply th the following tests without further -heating or any other manipulation what- er, either of the wheels selected for sting or of any portion cut therefrom to rnish the test pieces.	submitted for testing, with the exception at if there are not more than 110 wheels		Two test pieces shall be taken from one wheel:		
over to the extent of the number specified over. The wheels tested by the falling ight test sha-l be handed over to the E.R. specting Engineer free of charge if re- ired, and shall be held to represent rrectly the average quality of the lot esented from the cast from which they were lected. The selected wheels shall comply th the following tests without further -heating or any other manipulation what- er, either of the wheels selected for sting or of any portion cut therefrom to rnish the test pieces.	ne E.R. Inspecting Engineer shall select				
specting Engineer free of charge if re- ired, and shall be held to represent rrectly the average quality of the lot esented from the cast from which they were lected. The selected wheels shall comply th the following tests without further -heating or any other manipulation what- er, either of the wheels selected for sting or of any portion cut therefrom to rnish the test pieces.	coper to the extent of the number specified				
rectly the average quality of the lot esented from the cast from which they were lected. The selected wheels shall comply th the following tests without further -heating or any other manipulation what- er, either of the wheels selected for sting or of any portion cut therefrom to rnish the test pieces.	specting Engineer free of charge if re-				
lected. The selected wheels shall comply th the following tests without further -heating or any other manipulation what- er, either of the wheels selected for sting or of any portion cut therefrom to rnish the test pieces.	rrectly the average quality of the lot				
-heating or any other manipulation what- er, either of the wheels selected for sting or of any portion cut therefrom to rnish the test pieces.	lected. The selected wheels shall comply the the following tests without further				
rnish the test pieces.	-heating or any other manipulation what- er, either of the wheels selected for				
	rnish the test pieces.				•
		•	· ·		

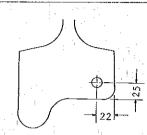
ERS	JRS (JIS)	UIC	BS	AAR
6. Falling weight test	Falling weight test	Falling weight test	Falling weight test	Falling weight test
The wheels shall be placed flat with its flanged side uppermost upon a circular metal ring having an internal diameter approximately the same as the internal diameter of the wheel and resting upon a block of metal of not less than 5 tons (11,200 lb. = block				
of metal of not less than 5 tons weight supported on a rigid concrete or other solid foundation and shall withstand without fracture blows from a falling weight of 1 ton. The weight shall be allowed to fall freely on to the boss from the height to 5 feet (1.5 m), 10 feet (3.0 m), 15 feet (4.5 m)				
and 20 feet (6.00 m) until the striking energy in foot/ton corresponds to that given by the following formula.				
$E = 2.8 \times R \times T$ Where E = Striking energy in foot/ton.	None	None	Same as ERS	None
2.8 = Constant				
R = Radius in inches, measured from the inside of the rim on the flange face of the wheel, as rolled.				
T = Thickness of the web in inches as rolled.				
The thickness of the web shall be measured at the junction of the boss radii and the web.				
The height of the final blow shall be reduced if necessary, to meet the requirements of the formula.				
A standard test piece C (see Appendix), machined cold from each wheel tested as above, and taken from the position shown in	Tensile test  The tensile test piece shall be taken from the position shown below.	Tensile test	Tensile test  Tensile test piece shall be taken at the position shown below.	Tensile test
fig. shall show the tensile breaking strength and minimum elongation given in the table, the intermediate elongations being in pro-				
portion.				
				- 5



Should a tensile test piece break outside the middle half of its gauge length (i.e. within the length covered by a quarter of the gauge length measured on either side of the centre point) it may be discarded, and such break shall not be considered as a failure of the test, and a fresh test, or fresh tests, may be made by the manufacturer with a test piece, or test pieces, taken from the same wheel from which the discarded test piece was taken.

#### 8. Additional tests before rejection

es C and 7 the E.R. Inspecting Engineer, as specified below, shall make further tests at the expense of the manufacturer before finally refusing or accepting the wheels represented:



JRS (JIS)

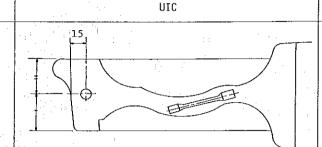
The mechanical properties shall be as follows:

Tensile strength: 80 ~ 100 kg/mm<sup>2</sup>

Elongation:

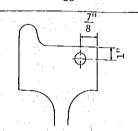
12 or more - 8 or more

Reduction of area: 16 or more - 12 or more



Mechanical properties shall be as follows:

Туре	Heat- treated	Yield point N/mm <sup>2</sup>	Tensile strength N/mm²	Elonga- tion	at 20°C I.V joules
Rl	- N	Recorded for reference purposes	600 ~ 720	12 18	- 15
R2	- N		700 ~ 840	9 14	- 10
R3	. <u>.</u>	•	800 ~ 940	7 10	- 10
R6	Т	11	780 ~ 900	15	15
R7	т	11	820 ~ 940	14	15
R8	Т	14	860 ~ 980	13	15
R9 -	Т	11	900 ~ 1050	12	10



The values shall be as follows:

Class	Tensile strength (kg/mm²)	Elongation
В	66.1 ~ 77.2	18 ~ 14 <
С	77.2 ~ 88.2	14< ~ 12<
D	88.2 ~ 99.2	12< ~ 10<
· E	99.2 ~ 110.0	10 <u>&lt;</u> ~ 8 <u>&lt;</u>

None

AAR

		N/mm²	N/mm²	Z.	joules	
Rl	- N	Recorded for reference purposes	600 ~ 720	12	- 15	:
R2	– N	- 1	700 ~ 840	9 14	- 10	
R3	N.		800 ~ 940 "	7 10	- 10	
R6	Т	11	780 ~ 900	15	15	
R7	т	11	820 ~ 940	14	15	].
		1 11	0.50			1

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In the event of the wheels selected for testing not satisfying the requirements of claus-

#### Additional test

In case that the tensile test result was not acceptable, re-test shall be conducted after the wheel is heat-treated (or re-heattreated), provided, however, such heat treatment shall be limited to only once.

#### Additional test

If the test piece fails to pass the test, the wheels of the lot represented by it shall be the object of rejection, provided, whoever, that the retest may be arranged between the manufacturer and purchaser.

## Additional Tests

(1) Falling weight test

If a wheel fails to pass the falling weight test, test shall be conducted on additional two wheels. In place of retesting on two wheels, or if one of the retested two wheels has failed to pass the falling weight test, the manufacturer may conduct test by re-heattreatment of the lot subject to the purchaser or its representative's approval.

### Additional Tests

ERS	JRS (JIS)	THE UTC	BS	AAR
) Should the wheel fail in the falling			(2) Tensile test	
wheight test the E.R. Inspecting Engineer shall select two more wheels from the			If a tensile test piece has failed to	la de la companya de
same lot, all of which, with his per-			satisfy the value given above, or if the	
mission, may be beat treated or re-			purchaser or its representative agrees that this unfavorable test piece does	1
heat treated before the selection is			not represent the lot correctly, the	
made. Should either of the retested			retest may be performed on additional	18.00
wheels fail to fulfil the conditions of			two wheels.	· . 
the falling-weight test, the manufactur-				1
er, with the concurrence of the E.R.			In place of conducting this retest, or	
Inspecting Engineer may heat treat or			if one of the test pieces of this retest	· .
re-heat treat the bulk from which the		1	fails to pass the test, the fa-ling	1.
E.R. Inspecting Engineer shall select			weight test and the tensile test may be performed after re-heat-treatment sub-	
two more wheels for further test. Should			performed after re-neat-treatment sub- ject to the approval of the inspector.	i i i i i i i i i i i i i i i i i i i
the results of these repeated tests be			ject to the approval of the inspector.	
satisfactory, the wheels represented				
shall be held to have passed the falling-	·			The second secon
weight test. Should either of these	1			
wheels fail to fulfil the conditions of the falling-weight test, the wheels re-				1
presented shall be rejected.				
breachted sharr he refeered.				
Should the wheel or wheels which have			The stage of the s	
passed the falling-weight test fail in				
the tensile test, two more tensile test				engen et de transport en
pieces shall be taken from the wheel				
has given the defective test, for re-				grande de la companya
peating the test.				
The wheels shall be accepted if the re-				
sults of these further tests are satis-				particular de la companya de la comp
factory should the repeated tensile tests				
not prove satisfactory the manufacturer,				
with the concurrence of the E.R. Inspect-				
ing Engineer, may heat treat or re-heat				
treat the bulk and present them again				$\mu^{(i,j)}$
for the falling-weight and tensile tests.				• · · · · · · · · · · · · · · · · · · ·
Should either or these fail, the lot				
shall be rejected. Should the results				•
of these repeated tests prove satisfac-				
tory, the wheels represented shall be				:
accepted.				f
				<b>.</b>
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ERS	JRS (JIS)	UIC	BS	AAR
9. Inspection	Inspection	Inspection	Inspection	Inspection
The E.R. Inspecting Engineer shall be allowed unhindered access to the manufacturer's works at all times during working hours when wheels	The manufacturing of wheels shall be subjected to the supervision and inspection by the inspector appointed by the Japanese National			The inspector will have free access for spection in any process of manufacture or
on order are in process of manufacture or delivery. He shall be at liberty to inspect the manufacture at any stage and to reject	Railways.	None	Same as ERS	wheels. The manufacturer shall supply a conveniences so that the inspector may r cognize that the manufacture of the whee
material which does not conform to his spe-				complies with the Specification.
cifications. Material so rejected shall be cut up immediately or marked at once in the				
presence of the inspector in such a way that it cannot be confused subsequently with satisfactory material.				
10. Testing facilities	Testing facilities	Testing facilities	Testing facilities	Testing facilities
The manufacturer shall supply the material required for testing free of charge, and at				
his own cost shall furnish and prepare the necessary test pieces and supply labour and				
appliances for such testing as may be carried out on his premises in accordance with this	None	None	Same as ERS	None
specification. Failing facilities at his own works for making the prescribed tests, the				ranger i de la companya di salah di sa Inggresi di salah di
manufacturer shall bear the cost of carrying out the tests elsewhere.				
		<u>Others</u>		Others.
		The following items are also specified in the UIC Standards:		The following items are also specified: (1) Ultrasonic flaw detection
V and	·	(1) Impact values		(2) Shot peening
		(2) Microscopic structures (3) Static balance test		(3) Magnaflux inspection
		(4) Hardness distribution in cross section		
		(5) Open area ratio		
		(6) Ultrasonic flaw detection (7) Magnaflux inspection		
		(,) anguittus inspection		
<del></del>				

٠	ERS	JIS	BS	Remarks
	No. M. 10-1959 Specification for Steel Castings	UDC 669.141.25  JAPANESE INDUSTRIAL STANDARD JIS  Carton Steel Castings G 5101-1975	BS 3100 : 1967 BS 592 CARBON STEEL CASTINGS FOR GENERAL PURPOSES	
	1. Scope This specification covers carbon steel castings for rolling stock, classified as Grade A and Grade B. Grade A: covers castings for general service. Grade B: covers castings for high stresses such as wheel centres, frame stretchers, borgie castings etc.	1. Scope This Japanese Industrial Standard specifies carbon steel castings including steel pipes made by centrifugal casting hereinafter referred to as the "steel castings".  2. Type and Symbol The types and symbols of the steel castings shall be as shown in Table 1.  Table 1. Type and Symbol  Type Symbol Remarks		
	2. Quality of material	1 SC 37 For electrical machine parts 2 SC 42 For general structure 3 SC 46 For general structure 4 SC 49 For general structure	Chemical composition. The steel shall con-	
	The castings shall be made from steel produced by the acid or basic open hearth, acid bessemer or electric furnace processes, and shall not show on analysis more than 0.06% of sulphur or of phosphorus.  The manufacturer shall supply an analysis of each cast when required to do so.	4.2 Chemical Composition  The chemical composition shall be determined by ladle analyses, and shall present less than 0.050% of P and S respectively. Concerning the contents of elements which are not specified, arrangements shall be made for determination between the purchaser and the manufacturer.	tain: BS 592: 1967    Element   Grade A   Grade B   Brade C   % % % % % max. max. max.	
			Chromium   0.25   -   -	
:				

e e	ERS	JIS	BS ·	Remarks
	3. Annealing	3. Method for Manufacture	14.1 Specified analysis	
	All castings shall be annealed at a suitable temperature and left to cool in such a way	The steel castings shall be heated uniformly in a furnace, and shall be processed by a	The specified ranges of chemical composition are based on cast analyses and, on	
	that a fine grain structure is obtained without any detrimental stresses arising in	heat-treatment by annealing, normalizing, tempering after normalizing or tempering after	request, the manufacturer shall supply a certificate of analysis of each cast of	
	the castings.	quenching. However, the heat treatment may not be effected if so approved by the purchaser.	steel. This will not include values for residual elements unless requested by the purchaser or unless there is reason to	
		Chaser.	suspect the presence of such elements in excessive amounts.	
			BS-592	
			Heat treatment. All castings shall be supplied in the heat-treated condition.	
			The heat treatment shall be carried out at suitable temperatures to give the mechanical properties specified.	
			car properties specified.	
	4. Moulding	4.5 Shapes, Dimensions, Weights and Tole- rances		
	The castings shall be accurately moulded in accordance with the pattern or working drawing supplied by the E.R. Mechanical and	The shapes, dimensions and weights of the steel castings shall conform to the drawings		
	Electrical Engineering Department with the addition of such lettering as may be pre-	or models. The tolerance shall be defined in accordance with JIS B 0412. However, if		
	scribed by the E.R. Inspecting Engineer.	agreements have been made regarding this matter between the purchaser and the manu-		
		facturer, such arrangements shall overrule JIS B 0412.		
	5. Branding	9. Marking	1.8 Identification	
	The cast number, the manufacturer's name	Each piece of the steel castings which has	If requested by the purchaser and by agree-	
	or initials, the order number, the letters "E.R." and the year of manufacture shall be stamped on each casting in letters 9	passed the inspection shall be clearly marked at the place of manufacture with the follow- ing particulars. When so approved by the	ment with the manufacturer, each casting shall be legibly marked, where practicable, with a number or identification mark by	
	mm. high, close to the moulded number of the pattern.	purchaser, a part of the marking may be omit- ted.	which it can be traced to the manufacturer and the cast from which it was made. Small	
		(1) Symbols of type (2) Melt number	castings may, by agreement, be batched, and the identification mark stamped on a	
		(3) Manufacturer's name of abbreviation thereof	tag attached to each batch.	
	<ol><li>Freedom from defects</li><li>The steel castings shall not exhibit any</li></ol>	4.1 The steel castings shall be uniform in quality and free from defects such as flaws	1.19 Freedom from defects The castings, as delivered to the purchas-	
	pouring defects such as blow holes, pores, sand holes, cracks, hard spots etc. liable	or blowholes which are harmful in actual utilization.	er, shall be free from harmful defects (see 1.13).	
	to deteriorate the usefulness or the maching properties or general workability of the products.			
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ERS	JIS	BS	Remarks
7. Repairs to defective castings	5. Repair	1.15 Rectification of castings	
Any defects or unsound metal present in a casting from whatever cause arising shall be left bare, and no filling with the object of obliterating such defects shall be permitted	5.1 The defects in the steel castings may be repaired by welding or other suitable methods. However, when required by the purchaser, or when there is a danger that the quality of the	Unless otherwise specified by the purchaser on the enquiry and order, castings may be rectified by welding without the previous sanction of the purchaser.	
unless previously sanctioned by the E.R. Inspecting Engineer. Any castings upon which such work has been done without such sanction having been obtained shall be re-	steel castings may be affected by the repair, discussions shall be held between the pur- chaser and manufacturer regarding the treat ment of the defects.	(1) Welding. It is recommended that rec- tification by welding shall be carri- ed out in accordance with Appendix A.	
jected. When any sanctioned repairs have been completed the casting shall be anneal- ed as provided in Clause 3.	7.5 The steel castings shall not receive painting or any other treatment which may interfare with the inspection prior to the	(2) Re-examination. If castings have been subjected to non-destructive testing by agreement between the manufacturer and the purchaser, the	
When steel castings in the rough are ordered, surfaces which will be machined ultimately must be rough machined by the suppliers to ensure soundness. Sufficient allowance	inspection.	castings shall be re-examined in the area of the repair following any rectifying operation performed on the	
must be made for finish machining to the dimensions shown on the drawing.		castings.	
8. Testing	6.1 Analysis	1.10.1 If a purchaser requires the manu-	
The steel castings shall be tested at the manufacturer's works. The E.R. Inspector shall receive a list of the castings in lots or melts if they can be reliably separated. The castings are to be divided in lots up	6.1.1 The specimen for analysis shall be extracted from the ladle. When required by the purchaser, however, the product analysis shall be conducted to the steel castings. In this case, the sampling method and the	facturer to provide a certificate giving the results of tests, he shall state this on the enquiry and order and the type, location and number of test samples shall be at the discretion of the manufacturer.	
to 3000 kgs., or part melts up to 5000 kgs. to be put separately according to the class of material and the method of casting on the test block.	tolerance range for chemical composition shall conform to agreements between the purchaser and the manufacturer.	1.10.2 If a purchaser requires tests to be carried out in his presence or in the presence of his representative, he shall state this on the enquiry and order (see	
	6.2.1 Unless otherwise specified, the mechanical tests shall be conducted at the manufacturer's work. In this case, the manufacturer shall have the purchaser witness the	1.2(9) and 1.17) and the following procedure shall apply:	
	test when required by the purchaser.		
	The manufacturer shall submit to the purchaser the results of specified test as a detailed report stating the melt number.		

 ERS	JIS	BS	Remarks
9. Selection of test pieces  (a) For castings over 500 kgs. weight each. A test block for the main and the additional test pieces shall be cast on each casting.  (b) For castings between 100 and 500 kgs. weight each. A test block for one tensile test piece is to be cast on each casting. If this will endan- ger the castings, a special agreement shall be made between the E.R. Inspector and the manu- facturer.	7.3 Test Specimen  The test specimen shall be prepared by the following procedures. In the case of the cast steel pipe made by centrifugal casting, however, the test specimens shall be prepared by the agreements between the purchaser and manufacturer.  (1) The test specimen shall be cast jointly with the steel castings. The test specimen may be cast separately only when so approved by the purchaser.	1.10.2.1 At least one set of tests, as required by the relevant specification, shall be made from each cast or each heattreatment batch.  1.10.2.3 By agreement between the purchaser and the manufacturer, test bars shall be cast attached to, or separate from the castings. When test bars are attached, the precise location and method of attachment shall be the subject of agreement, since the attachment of test bars may have adverse effects on the qua-	
(c) For castings under 100 kgs. weight each. A test block for one tensile test piece shall be cast on each casting, or, if possible, the test piece shall be cut from the casting, otherwise separate test pieces shall be cast from each melt.	<ul><li>(2) The dimensions of the test specimen shall conform to either of the following shapes. However, this shall not apply when approved by the purchaser otherwise.</li><li>(3) Unless otherwise specified, the test specimen shall be cut off after the final</li></ul>	lity of the casting. If the purchaser does not make such an agreement with the manufacturer prior to placing the order, the method of providing the test bars shall be decided by the manufacturer.  In the case of castings where it is im-	
	heat treatment of the steel castings. When it is difficult to give a heat treatment to the specimen jointly with the steel casting, or when the specimen has been cast separately, the specimen shall be processed by a simultaneous heat treatment together with the steel castings.	practicable to provide attached test bars, separate test bars or additional castings from each melt of steel may be provided, as may be agreed between the purchaser and the manufacturer. When separate test bars are used, they shall be cast from the same heat of steel at the castings they represent and shall be heat-treated with those	
	7.4 One tension test piece shall be prepared from each specimen which has been taken from the same melt and the same heat treatment. Regarding the steel pipes made by centrifugal castings, the number of the specimens shall be decided by a mutual agreement between the purchaser and the manufacturer.	castings except as provided in 1.11.4.  1.10.2.4 If test bars are cast attached to the casting, they shall not be detached until after the heat treatment of the casting has been completed, nor until they have been stamped by the purchaser or his representative. Test bars shall be stamped after the heat treatment process.	
		1.10.3 For room temperature tensile and impact or bend tests, one test piece for the room temperature tensile test and one test piece for the bend test or one test piece with three notches in accordance with BS 131, Part 1* for the Izod impact test, shall be prepared from each test	
		sample if required by the relevant material specification. Bend test pieces shall be either 1 in (25.4 mm) diameter or of rectangular section 1 in wide by 3/4 in (19.1 mm) thick, or proportionately smaller for smaller castings. The corners of rectangular test pieces may be sightly	
		rounded to a randius not exceeding 1/16 in (1.6 mm). At the manufacturer's option	

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			the test pieces may be unmachined, smooth machined or ground.	
			1.10.4 For low temperature impact tests, three test pieces shall be taken to represent each cast or heat-treatment batch. The impact test pieces shall be prepared in accordance with BS 131, Part 2*.	
			1.70	1
	The E.R. Inspector shall choose two test pieces out of each lot or part melt. In case the test is not satisfactory, the following procedure is to be taken:  (a) For castings over 500 kgs. weight each. Additional test piece of the same casting and test pieces from every casting will be tested. Castings, whose additional test pieces fail, shall be rejected.  (b) For castings under 500 kgs. weight each. Two additional test pieces from two other castings will be tested, if one of them fails the lot shall be rejected.  (c) For castings under 100 kgs. weight each, and without cast on test piece.  Two additional test pieces cut from the casting or cast from the same melt, will be tested if one of them fails the lot shall be rejected.  (d) Test pieces rejected for obvious small defects (such as blowholes, slag effect, etc.) shall not be counted.	8. Retests 8.1 When the test piece shows defective finish or flaws which are not likely to be due to the quality of the material, the test piece may be discarded before the test and may be replaced by other test piece newly provided. 8.2 When the test piece is ruptured in a tension test at a point beyond 1/4 of the gauge length from the center of the gauge marks, and if the result does not satisfy the requirements, the test shall be cancelled, and a retest may be conducted on another test piece extracted from the same lot of specimen from which the failed test piece was taken. 8.3 When some portions of the mechanical tests do not satisfy the specified criteria, a retests may be conducted regarding the unsuccessful portion by extracting test pieces, twice as many in number of pieces as the specified test piece number, from the same specimen from which the test pieces were extracted for the original tests. 8.4 If the results of the tests on the heat treated specimens do not satisfy the specified requirements, specimen may be processed again by a heat treatment, and a retest may be conducted. Such a heat treatment shall not be conducted more than twice. The number of the specimens in the retest shall be the same as in the first test, and all the mechanical test shall be conducted again. The obtained test results shall satisfy the specified standards.  Not specified	cal test carried out on test pieces fail to conform to the requirements of the spe- cification, the manufacturer may, if he so desires, adopt one of the following proce- dures.  1.12.2 He may repeat the mechanical test (including the intercrystalline corrosion test) under which failure occurred on two additional test pieces. In the event of either of these duplicate test pieces fail- ing to meet the requirements of the speci- fication, the manufacturer may then follow the procedure given in 1.12.4.	
	Inspector, be submitted to a pressure test. The nature of the test and the testing pressure shall not be less than the pressure to which the casting is subjected in service.		castings shall be pressure tested in a manner agreed between the purchaser and the manufacturer, see BS 4080*.	

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		12. Tens	ile test				6.2.2	2 Tensi	on Test				1.11 Mechanical te	sts		:				-
		of these standard (see Appe other mar less thar strength ing table	dimension test piecendix), with the minimand elonger.	iece D, or ns cannot loce C or terithout any n whatever imum tensi gation give	be obtai st piece re-heat , shall le break en in th	ned, a M or N ing or any show not ing e follow-	(2) 4.3	or No.1 The tes dance w Mechani	O specif t shall ith JIS cal Prop al prope	shall be Tried in JIS be carried Z 2241. Derties erties of toordance wi	Z 2201.  out in  he steel	accor-	1.11.1 Tensile tes are required by the cification, they sh accordance with BS termination of the when specified.  Mechanical propertiperties to be obtained by the selected, prepared	relevan all be p 18*, inc yield or es. The ned on t and test	nt materi performed cluding t proof s mechani cest piec	al spe- l in the de- stress cal pro- ces	) Ce		:	
		Descrip- tion	breaking	g strength	gatio			Table	2. Med	chanical Pi	operties		with the requirement as follows:	ts of Se	ection 1	shall b	e			
<b>③</b>			tons/in4	2 kg./mm <sup>2</sup> approx.	Test C or D	piece M N		Symbol	Yield	Tensi Tensile	le Test	D - 1	Property	Grade A	Grade E	Grade	С	:		
		Grade A	24	38 52	25 19	23 21 17 15	Туре	39111001	point kgf/mm			tion %	Tensile strength, tonf/in <sup>2</sup> min. kgf/mm <sup>2</sup> min.	28 44	32 50.5	35 55				
*		Grade B	33.			11, 12	1	SC 37	18 mir (177 mir	n. 37 min. (363 n.) min.)	26 min.	35 min.	Yield stress or 0.5% proof stress, tonf/in <sup>2</sup> min. kgf/mm <sup>2</sup> min.	15 23.5	17 27	19 30	*			
	· ·				1,4,7		2	SC 42	(206	1. 42 min. (412 1.) min.)	24 min.	35 min.	Elongation, % min., on 5.65 VSo Angle of bend	22 120°	18 90°	14	in a language of the second se			
							3	SC 46	23 min (226 min	46 min. (451 n.) min.)	22 min.	30 min.	Radius of bend  Izod impact value, ft lbf min.	1 1/2t		10				
	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA						4	SC 49	25 min (245 min	1. 49 min. (481 1.) min.)	20 min.	25 min.			:					
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11. Inspection  The K.K. inspecting Segimener shall be allowed at white desired access to the manufacturer's works at all times during working hours show containing to order first pull be all theory to impact the manufacture as any stage and to reject entiting or material not bonforming to this specification. Any confidential of the property of the specification, any confidential of the property of the specification. Any confidentially or material at one can be considered to the specification. Any confidentially or material at one can be considered to the specification. Any confidentially or asked at they or it comment be commended submended with satisfactory testings or material.  10. Testing facilities at the confidential of the confi		ERS	JIS	BS	Remarks
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ture of dilivery. He shall be at liberty to impact the manufacture at any tage, and to reject castings or saterial not conforming to this specification. Amy castings to material marked at once in the presence of the impactor in such a way that they or it cannot be consused subsequently with satisfactory castings or material.  14. Testing facilities  The manufacture shall supply the castings reported of the impactor of the interest of the satisfactory castings or material.  14. Testing facilities  The manufacturer shall supply the castings reported of the interest of the presence of the purchaser's representative, it shall be outsided in the enquiry and order.  15. Testing facilities  The manufacturer, in supplying the test bars as required for testing, shall prepare the uncessory test pieces, and supply labour and appliances for making all tests on his pressess in accordance with the relevant specification.  16. Salancing test  17. Eating facilities in the presence of the impactor of the enquiry and order.  18. Testing facilities in the presence of the impactor of the enquiry and order.  19. Testing facilities in the same and the presence of the purchaser's representative, it shall be outsided in the enquiry and order.  18. Testing facilities and the presence of the purchaser's representative, it shall be outsided in the enquiry and order.  19. Testing facilities and the presence of the purchaser's representative, it shall be outsided in the enquiry and order.  19. Testing facilities and the presence of the testing and testing the presence of the purchaser's representative, it shall be considered the manufacture shall be substantial to the presence of the purchaser's representative, it shall be considered and tested in the enquiry and order.  19. Testing facilities in the shall be considered the purchaser of th		works at all times during working hours when		those parts of the manufacturer's works	
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mitted to the balance test. When the wheels are ordered in the rough, one wheel out of every lot of 50 wheels or part thereof shall be tested after being bored and turned.  The non-compensated weight measured at the outer circumference of the rim shall not exceed 0.5 kg. (approx. one Pound).  The non-compensated weight is to be stamped on the side face of the rim.  16. Guarantee  The supplier shall be bound to replace such wheel centre which within two years service become unfit for use.		그는 그 바다 하나가 되는 것이 되는 것이 하는 것이 없는 것이 없는 것이 없는 것이 없다.			
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outer circumference of the rim shall not exceed 0.5 kg. (approx. one Pound).  The non-compensated weight is to be stamped on the side face of the rim.  16. Guarantee  The supplier shall be bound to replace such wheel centre which within two years service become unfit for use.		하고 그리는 그리는 회에 가장 그 후에서 참고를 살고 보는 기사에 되었다.			
on the side face of the rim.  16. Guarantee  The supplier shall be bound to replace such wheel centre which within two years service become unfit for use.					
The supplier shall be bound to replace such wheel centre which within two years service become unfit for use.					
wheel centre which within two years service become unfit for use.		16. Guarantee			
		wheel centre which within two years service			
The supplier can take back, at his own expense, the faulty wheel centres.		The supplier can take back, at his own expense,			

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SPECIAL CLAUSE FOR AXLEBOXES  Other tests for cast steel axleboxes are to be according to specification M 250.	JIS		BS	Remarks
· · · · · · · · · · · · · · · · · · ·				
Other tests for cast steel axleboxes are to be according to specification M 250.				
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	ERS	JIS	BS	Remarks
	No. M. 13-1960 Specification for Grey Iron Castings. (Ordinary Grade)	UDC 669.131.6:621.74  JAPANESE INDUSTRIAL STANDARD JIS  Grey Iron Castings G 5501-1976	BS.1452: 1961 BRITISH STANDARD SPECIFICATION FOR GREY IRON CASTINGS	
-111	1. Scope	1. Scope	Scope	
	This specification covers castings in grey cast iron of ordinary grade quality for general castings.	This Japanese Industrial Standard specifies the iron castings which show grey in fracture.  2. Class and Symbol The grey iron casting shall be classified as shown in Table 1.  Table 1 Class and symbol	The state of the s	
		Class Symbol Grey iron casting Class 1 FC 10 Grey iron casting Class 2 FC 15	The basis of this standard is the tensile test but data relating to the transverse	
		Grey iron casting Class 3 FC 20 Grey iron casting Class 4 FC 25 Grey iron casting Class 5 FC 30	test are given in Appendix A, so that this may be used as a control test.	
		Grey iron casting Class 6 FC 35		
•	2. Manufacture  The castings shall be made from metal melted in any type of metallurgical plant other than an iron ore smelting furnace.	3. Manufacture 3.1 The grey iron casting shall be manufactured in cupola furnace, baby cupola, reverberatory furnace, electric furnace, crucible furnace and otherproper melting furnaces.	Quality of metal  2. The metal used for the manufacture of the castings shall be good quality cast iron of the grade specified. The castings shall be cast from metal melted or refined in any suitable metallurgical plant. An	
		3.2 The grey iron casting shall be annealed so that the casting stress may be removed, when required by the purchaser.	iron ore smelting furnace shall not be used unless special permission shall have been obtained from the purchaser.	
		The grey iron casting may be softened by agreement with the purchaser.		
	3. Chemical composition  The composition of the iron as cast is left to the discretion of the manufacturers.	4.3 The P and S contents in Class 3 to Class 6 shall be agreed upon between the purchaser and the manufacturer.  6.2 Chemical analysis	2. The composition of the iron as cast shall be left to the discretion of the manufacturer, but a minimum and/or a maximum percentage of phosphorus may be specified by agreement between the purchaser	
<i>.</i>		6.2.1 The sample for chemical analysis shall, as a rule, be taken from ladle. Check analysis, however, shall be made on the product when required by the purchaser. In this case,	and the supplier.	
9		the sampling and the allowable deviation of chemical composition shall be agreed upon be- tween the purchaser and the manufacturer.		

and the control of t The control of the control of

		S Chang Dimension Height and Talenter	Moulding	
	4. Moulding  The castings shall be accurately moulded in accordance with the patterns or drawings sup-	5. Shape, Dimension, Weight and Tolerance Thereon The shape, dimension and weight of the	4. The castings shall be accurately moulded in accordance with the pattern or work-	
	plied by the E.R. Inspecting Engineer. Each casting shall have the letters "E.R." cast on it in letters not less than 1/2" (12.5 mm.) high, together with such other markings (cast	iron casting shall be determined by using its drawing or model, and the tolerance thereon shall be agreed upon between the manufacturer and the purchaser.	ing drawing as supplied by the purchaser with the addition of such lettering as may be specified.	
	or stamped) as may be directed by the E.R. Inspecting Engineer.	9. Marking		
		The grey iron casting which have passed the inspection shall be marked on every casting by the workshop with the mark "Inspected", symbol for type, molten number, name of		
		workshop or its abbreviation. In the case these markings are difficult to be done, however, other appropriate way may be adopted.		
		When approved by the purchaser, the above items may be partially omitted.		
	5. Freedom from defects	4.1 The grey iron casting shall have uniform	Freedom from defects	
	The casting shall be free from cracks, gas holes, flaws and excessive shrinkage. The surfaces shall be free from burnt-on sand	quality and shall be free from detrimental flaws or cavities.  7.2 The inspection of appearance, dimensions	3. The castings shall be sound, clean and free from distortion and injurious defects. They shall be well dressed or fettled and	
	and shall be reasonably smooth. They shall be well dressed or fettled and shall be machinable.	and mass shall be carried out for each grey iron casting. The flaws or cavities that only slightly affect the use may be repaired by	by the purchaser. They shall be machinable	
A.,	Any flaws (blowholes, etc.) on the surface shall be left bare and no attempt shall be made to fill or otherwise obliterate them	welding or other appropriate means, provided that the purchaser approves.	by the normal methods for the grade of iron specified.  By agreement between the manufacturer and the purchaser, defects may be rectified.	
i	without the express agreement of the E.R. Inspecting Engineer. Any casting upon which such work has been done prior to such consent having been obtained will be		Any casting showing defects during subsequent manufacturing operations does not comply with this British Standard, notwith-	
e.	rejected.	<ul> <li>A second of the s</li></ul>	standing any previous certificate of satis- factory testing, provided the casting has not been improperly treated after delivery.	
1	1	<u> </u>	↓ The state of the state o	1

ERS	JIS	BS	Remarks
6. Provision of test bars	6. Test	Provision of test bars	
全国重新企业中的企业中,1991年中,199	6.1 Mechanical test	7. Test bars shall normally be cast sepa-	
The E.R. Inspecting Engineer will state at the		rately from the castings to which they are	
time the order is placed whether tensile or traverse tests, or both, are required. Test	6.1.1 The mechanical test shall, as a rule,	related, but shall be poured at the same	
bars shall be cast separately from the casting	be carried out in the manufacturing shop.	time and from the same ladle of metal.	
under the same sand conditions (i.e. green sand	In this case, the manufacturer shall allow the	· Sufficient test bar material to meet the	
or dry sand) as the castings, and from a ladle	purchaser to attend the test when requested	requirements of Clauses 10 and 11 shall be	
or ladles of the same metal as that used to	by the purchaser.	provided.	
pour the castings. The test bars shall receive	7.3.1 Test specimen	When castings are moulded in loam or dry	
the same mechanical and thermal treatment, if		sand the test bars representing the cast-	·
any, as the castings, and in the case of heat	(2) The test specimen shall be cast separate-	ings shall be cast in dry sand. When	
treatment the test bars shall be treated	ly from the gray iron casting. In this case, the mould for the test specimen shall, as a	castings are moulded in green sand the	
adjacent to the castings they represent. The	rule, be of the same type as that for the	test bars representing the castings shall	
test bars shall not be cleaned by tumbling un- less the castings are so cleaned.	grey iron casting, and it is required to cast	be cast in green sand or in dry sand.	
"我们就是我们,我们就是看着我们的,我们就是一个一个,我们就是一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个	the specimen with the same molten under the	If the castings are produced in any other	
Tensile test pieces shall be machined from	same conditions as that for the grey iron	mould material, the material to be used for	
transverse test bars. Tensile test pieces	casting. By an agreement with the purchaser,	the mould for the test bar shall be agreed between the purchaser and manufacturer.	
cast to size are not recognised by this speci-	however, the test specimen may be cast in	医三环转旋 化转点 克朗特 医电影 人名英格兰 电电路 化二烷烷烷	
fication.	monoblock with the gray iron casting.	Castings may be ordered where none of the	
	(3) The test specimen shall have 30 mm in	standard test bars in Table 1 would reason-	
•	diameter as cast. When the test specimen is	nably represent the material in the cast-	
	determined according to principal wall thick-	ing and in this care provision may be	
	ness of the grey iron casting, however, the	made, by agreement between the purchaser and manufacturer, for an additional piece	
	diameter as cast shall follow Table 3.	to be cast on to the casting which can	
	(4) The dimensions as cast of test specimen	subsequently be removed and used to pro-	
	from the gray iron casting below 4 mm and	duce a test piece of suitable size in	
	above 50 mm in principal wall thickness shall	conformity with Table 2.	
	be determined by an agreement between the		
	purchaser and the manufacturer.	When castings are subjected to heat treat- ment the test bars shall be treated under	
	the state of the s	similar conditions.	
		All test bars shall be marked to identify	
		them with the castings they represent.	
7. Dimensions of test bars	6.1.2 Tension test	Dimensions of test bars	
(A) Transverse test bars. The transverse	(1) Test Piece	8. Tensile test bars. Tensile test bars	
test bars shall be cast to one of the follow-	It shall be formed from the test specimen or	from which the appropriate test piece is	
ing dimensions:-	from the test piece fractured by deflection	machined shall be cast as uniform cylind-	
그 사람들은 사람들이 가장 없는 사람들이 되었다. 그 사람들은 사람들은 사람들이 되었다.	test to No. 8 specified in JIS Z 2201.	rical bars to the dimensions given in	
(a) 1.2 inches diameter and 21 inches over-		Table 1.	
all length.	(2) Test Method The test method shall follow JIS Z 2241.	It is permissible to use material original-	
(b) 30 mm. diameter and 650 mm. overall	THE LEST MELHOU SHAIL TOTTOW 313 Z ZZ41.	ly provided for transverse test. If it	
length.		is not practicable to use a 1.6 in (40.6	
If the diameter of a transverse test bar is		mm) or 2.1 in (53.3 mm) nominal size test	
found to be more than 0.05 inch (1.2 mm.		bar because of limitation of testing faci-	
approx.) greater or less than the dimen-		lities, the 1.2 in nominal size bar may	
sions given, it shall be rejected. Trans-		be used subject to agreement with the	
		purchaser. In this case, the mechanical	
verse tests shall not be carried out on	1	properties specified for the 1.2 in bar	

No. 8 Test piece  This test piece shall be principally used for remaind test of search large ocatings. The remainder test of search large ocatings are the search test of the search tes		ERS		•		JIS		. '				BS	4			Remarks	
Table 1 Tensile test bars as cast    Cross-sectional thickness of cast ing   Diancter as minimum overall length					This test tension t shall be mensions	piece shest of ge made out given in	eneral iron of the same the Table,	castin le wit and th	ngs. It th the di- he parallel	apply adopt of Cla ths of propr piece	. An alter that given ause 7, and trained shained shained was produced.	mative proceduling the third in this case all be those for bar, even if	dure is to I paragraph e the streng for the ap- E a small to	g- est			
Cross-sectional thickness of cast ing			* 1								:	alle test bars	as cast				
Division of test casted parallel portion (dia.) P						4	Fig. 8	# 1	Parties and	Cross thick casti	-sectional ness of ng Up to and	Diameter as	Approxima minimum overall	te			
13   8   more   374   1 1/8   1.2   9   1 1/8   1.5   1 1/8			14.		of test	casted sample	parallel portion P		Radius of shoulder R	-	3/8	0.6	5				
30   20   more					8B	13 Approx. 20	8 Approx. 12.5	12,5	more 25 or more	1 1/8	1 5/8	1.6	11	<u>.                                    </u>			
						30 Approx.	20 Approx.		more 64 or						-		
	i	er e				7.3											
				tu e									. 1				
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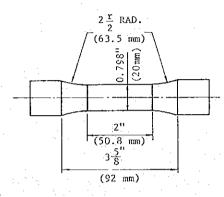
ERS

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BS

Remarks

(B) Tensile test bars. The tensile test bars shall conform to the following dimensions:



The test pieces shall be machined from the appropriate transverse test bars, as provided above in clause 6.

#### 8. Mechanical tests

The castings must comply with the transverse and tensile tests specified below. The test pieces will be selected by the E.R. Inspecting Engineer or his representative, and the test must be carried out in his presence and to his satisfaction.

#### (A) Transverse test

A transverse test bar cast to dimensions in clause 7 (A) shall be supported on knife edges or rollers, whose axes are prependicular to that of the test bar, and shall sustain a progressively increasing load vertically applied at its centre.

Table 2 Mechincal property

Corps.	870001	Principal wall	Moneter	frances tes	Bellection	rest .	AATEM!
		then conting	er cust el tent epectema	Treatin acres ath bgf/==2 (E/==2)	Kerinan lood hef (hr)	Suffee vion un	Beta-el Pg
Crey from canting Class I	FC 10	6 to 50 (ac).	.30	19 utn. (10.1 utn.)	700 min. (6.800 min.)	3.) min.	201 64
Over time	×υ	4 to 6 facl.	13	39 ata. (186 etc.)	(L.770 win.)	2.5 ele.	241 200
Clave 2		Over 2 to 13 (ac).	20	17 min. (287 min.)	400 min. (3.720 min.)	7.5 min.	₹21 m.:
		Deer 15 to 20 Lack.	<b>32</b> :	(147 ede.)	200 sfs. [7,850 sis.)	1.0 min.	212 840
		Owner JR to 30 lact.	43	13 ed 6. (127 m2 n.)	(15.470 mate.)	4.0 els.	201
Drey Irea couling	TC 20	te 8 bel.	17	[L wis. (15 min.)	200 ais. [1.990 ais.)	7,0 ata.	253 840
Cares 1	,	Seer 8 to 13 lact.	×	22 sin. (214 mis.)	430 min. (8.410 min.)	).0 ata.	235 1843
		Sect 15 to 39 feet.	30°.	20 air. (196 air.)	900 als. (0.030 ats.)	1.5 Ha.	313 eas
		to 30 fact.	**	(147 mts.)	2000 mts. (19.8)8 m(s.)	4.5 ±4.	217
Green from	# B	4 pe à Incl.	13	28 ata. (275 wtu.)	2:0 ata. (7.140 wis.)	7,0 aca	A1
Class 4	l i	Description to the target.	20	(25) min.)	300 min. (4.900 min.)	3.0 112.	749 ==
		feer 15 to 10 tocl.	ж.	15 ed e. (245 ed e.)	1000 mis. (9.310 mis.)	3.0 min.	241 ===
	<u> </u>	Ome M to M Lick.	45	12 mln. 1716 mln.1	2)00 etc. 122.360 mts.)	7.0 eta	229 641
Grey tree courting	R 3	I to D lact.	30	31 mlm. (334 mlm.)	530 mir. (3.744 mts.)	3.5 nie.	247 142
Class 5		Over 15 to 30 Inch.		(294 min.)	t[00 ets. (10.790 mis.)	5.5 eta.	202 ma
		Owner 30 to 30 local-	45	27 min.)	3500 eta. (25.500 eta.)	7.5 mlm.	245 002
Droy Leve	кв	I to B tect.	я.	15 min. (341 min.)	1200 min. (11.770 min.)	5.5 ata.	277 843
Clase &		0-r 2 to 30 loc1.	13	37 els. (316 mis.)	7900 mis.	7.5 mla.	267 m.

#### 6.1.3 Deflection test

(1) Test piece The test piece specified in JIS Z 2203 shall be used.

# (2) Test method

Lay the test piece between two fulcrums, apply a load to the test piece in the middle part until its breakage, and measure the maximum load that the test piece could withstand and the deflection.

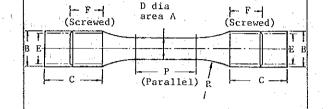


Table 2 Machined tensile pieces

	Post-al	Genda	2-74	På + .	Ela.	\$ \$1e1:	444	Screen	-	Asyrett-
ogeting.	of cost ber as cast	discotor P		parel- lel length	rection	MA. 410- Union	Ma. Laugth	lie•	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	esta at- niaum overali lovath
<del></del>			10.2	1-	1.	- 12	-		<del></del>	t n
t= .	14	<u> </u>	10.	1.0	! <b>!-</b>	-			i '	
let escending VI	4.4	0.301	0.175	1.1	1	4.34	1 1/4	9/14 8.3.7. 9/14 8.3.V.	1/11	1 1/1
Deer 1/3 met oar- raading 1/4	0.173	0.341	0.15	3.5		4.73	1 3/1	3/4 1.5.1. 1/8 3.5.0.	1/4	t 1/E
Down 3/4 box ex- modified 1 1/8	1.2	0,219	a.5a	2.0		1.69	5 715	1 L/2 1.5.1. 1 L/2 1.5.V.	1 1/8	3/-
Peer 1 E/S ove seconding 5 3/8	1.3	1.318	1.00	2.8	٠.	1,00	2 3/4	1 1/2 1.5.7.	1 1/2	10 1/2
Progr 3 3/8	13.1 i	1.491	1.75	2.5	! a	1.45	3	2 5.5.7.	12	12 7/8

#### Mechanical tests

9. Tensile tests carried out on a test piece machined to conform to the dimensions shown in Table 2 shall show a tensile strength of not less than that given in Table 3 appropriate to the size of test piece and grade of iron.

Self-aligning grips are recommended to ensure axial loading.

After reaching 50 per cent of the anticipated tensile strength, the rate of increase of stress on the test piece shall not exceed 10 tons/in<sup>2</sup> per minute (15.75 kg/mm<sup>2</sup> per minute).

Remarks JIS ERS The rate of application of the load shall be Flexure Test Piece for Metals JIS-Z 2203-1956 (Reaffirmed: 1971) such that the increase of the bending stress Table 3 Tensile test will not exceed 2 tons per square inch (ap-1. Score prox. 3 kg/mm<sup>2</sup>) per second. This standard specifies standard test piece The results of the test shall conform with (hereinafter referred to as the "test piece") the following:to be used for flexure test of metals. (a) A test bar casted 1.2 inches diameter, Whether any test piece is to be used or not when placed on supports set at 18 inches shall comply with those specified by the apart, shall show a rupture stress of not respective standards. less than 21.8 ton per square inch and a deflection before breaking of not less 2. Type of test piece than 0.15 inches. The test piece shall be divided into from A to (b) A test bar casted 30 mm. diameter, when D in accordance with the shape and size and placed on supports set at 600 mm. apart, these reference dimensions shall comply with APPENDIX A shall show a rupture stress of not less than the following: TRANSVERSE TESTS 34 kg/mm<sup>2</sup> and a deflection before breaking of not less than 7 mm. Load Test bars (B) Tensile test Al. Transverse test bars shall conform to A tensile test bar machined to the dimenthe dimensions shown in Table 4 appropriasions shown in clause 7 (B) above must show te to the main cross-sectional thickness Fulcrum Fulcrum a breaking strength not less than 11.5 tons of the casting. per square inch (approx. 18 kgs per mm<sup>2</sup>). Table 4 Transverse test bars Cross-sectional Unit: mm thickness of Limits on Over-Nominal diameter diameter all casting Type of Diameter Diametral Fulcrum Length of bar (plus and length 0ver Up to and test D tolerance gauge as cast minus) including piece Α 13 +1.0 200 About 300 in in in ín В 20 300 About 350 3/8 0.6 0.045 10 +1.0 C - 30 +1.5 450 About 500 3/8 3/4 0.875 0.065 15 21 45 600 About 650 0.090 D +2.0 3/4 1.2 1 1/821 1 1/8 1 5/8 1.6 0.10 3. The test piece shall be as-cast. Provided 1 1/8 2.1 0.10 27 that the surface may be machine-finished on account of the dimensional adjustment within the range of tolerance.

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	ERS	JIS	BS	Remarks
	9. Number of tests  The number of tests required shall be:-  (a) One tensile or/and one transverse test	(1) One test specimen, besides extra ones, shall be sampled from every molten. When required by the purchaser, however, the quantity of test specimens may be altered.	Tests  10. The test shall be the tensile test and shall be carried out at a frequency not less than that shown below.	
	for every 2 tons of castings or part there- of. or (b) One tensile or/and one transverse	In the case a molten exceeds 10 t, one test specimen shall be sampled from every 10 t or the fraction thereof.	Grades 10* and 12: one tensile test for up to 10 tons (10.16 tonnes) of castings.	
	test for every 30 pieces of castings or part thereof.	One molten of cupola and baby cupola shall be the tapping amount, when composed of same	Grade 14 and 17: one tensile test for up to 5 tons (5.08 tonners) of castings.	
		blend, for every three hours.  When hot metal from more than two furnaces	Grade 20, 23 and 26: one tensile test for up to 1 ton (1.016 tonne) of castings.	
		has been gathered into one ladle, the gathered metal shall be considered one molten.	In the case of castings weighing over the specified weight for the grades shown above, there shall be one tensile test per casting.	
Ì				
· .	10. Additional tests before rejection	8. Retest	Retests	
	If a faulty or unsound test bar gives a re-	8.1 When the test piece is found to be badly	11. a. Tensile test. Should any of the	
I	sult not in accordance with the specifica-	finished or to have flaws, it may be dis-	tensile test pieces fail to pass the tests,	
	tion the result shall be ignored and a	carded before the test and replaced by another test piece.	two further tensile tests shall be made.  If both pass, the batch of castings repre-	
. :	fresh test made.		sented complies with the test requirements,	
	If a sound test bar fails a second test shall be made. If this meets the speci- fication the batch or casting represented	When flaws are found out after the tests and are considered to have affected results of the test, the results shall be invalidated.	but should one fail, the batch does not comply with this British Standard.	
	shall be accepted, but if it fails the batch or casting represented shall be re-	8.2 When a part of results of the mechanical test can not satisfy the requirements but the	b. Casting defects. Should any test piece which failed show obvious casting	
	jected.	results other than that are satisfactory, test	defects, a test piece may be taken from spare test bar material or cut from a	
:	If a transverse test bar fails to meet the specification a tensile test piece machined from one of the broken ends shall be tested, and if this meets the requirements	pieces of a quantity two times as many as specified shall be taken from the group to which the rejected test pieces belong, to be retested for the test item the original test	casting from the same batch, and the results obtained from this substituted for those obtained from the defective bar.	
	of the specification, the batch or casting represented shall be accepted.	pieces have failed in satisfying the requirements. In the retest any one of the test	Additional tests	
		pieces shall satisfy the requirements.	12. If the purchaser desires any tests or special requirements not specified in this standard, he shall state these at	
-			the time of enquiry and order.	
٠.				
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	ERS	JIS	BS	Remarks
	11. Inspection	7. Inspection	Inspection	
	The E.R. Inspecting Engineer shall be allow-	7.1 The results of the inspection for appea-	13. The purchaser or his representative	
	ed unhindered access to the manufacturers	rance, dimensions and mass, tension test, de- flection test, hardness test and chemical	shall have access at all reasonable times to those parts of the manufacturer's works	
	work at all times within working hours when castings on order are in process of manu-	analysis shall satisfy the requirements des-	engaged on his order; he shall be at li-	
	facture or delivery. He shall be at liberty	cribed in 4. and 5. When the correction is	berty to inspect the manufacture at any	
	to inspect the manufacture at any stage and	applied in accordance with 6.1.3 (3), however,	stage, to witness the required tests and	
	to reject any castings which do not conform to this specification. Any castings so re-	the corrected maximum load shall be used.	to reject any material that does not comp- ly with the specification. When the	·
ļ	jected must be broken up at once or marked	When approved by the purchaser, the mechanical	castings are to be inspected during manu-	and the second second
	in the presence of the inspector in such a	test may be partially or completely omitted.	facture and tested in the presence of the	
	way they cannot be confused subsequently with	The inspection of appearance and dimensions, tension test and deflection test shall be	purchaser's representative, it should be so stated in the enquiry and order.	
)	satisfactory castings.	generally performed, but the inspection of	so stated in the enquiry and order.	
1.0		mass, hardness test and chemical analysis shall		·
		be performed only when designated by the pur-	·	
		chaser.		
		10. Report		
		The manufacturer shall submit to the purchaser		
1		a record containing the molten number and re-	La company of the com	
:		sults of the test.		
-				
	12. Testing facilities	Not specified	Testing facilities	
	The manufacturer shall supply the material		14. The manufacturer, in supplying the	
	required for testing free of charge, and at		test samples as required for testing shall prepare from them the necessary test	
	his own cost shall furnish and prepare the necessary test pieces and supply labour		pieces and supply the labour and appliances	
	and appliances for such testing as may be		for making all tests on his premises in	
)	carried out on his premises in accordance		accordance with the specification.	
'	with this specification. Failing facilities at his own works for making the tests		Failing facilities for carrying out the	
	the manufacturer shall bear the cost of		prescribed tests at his own works, the manufacturer shall carry out the tests	
	carrying them out elsewhere.		elsewhere.	
	Representation of the second states of the second s			
		6.1.4 Hardness test		
.:		(1) Test Piece The test piece for the deflection or tension		
		test shall be locally used.		
		(2) Test method		
		The test method shall follow JIS Z 2243.		
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	ERS	JIS	BS	Remarks
-	No. M. 14-1955 Specification for Grey Iron Castings (High Grade)	UDC 669.131.6:621.74  JAPANESE INDUSTRIAL STANDARD JIS  Grey Iron Castings G 5501-1976	BS 1452: 1961 BRITISH STANDARD SPECIFICATION FOR GREY IRON CASTINGS	
	1. Scope	1. Scope	Scope	
	This specification covers castings in grey cast iron of high grade quality for locomotive cylinders, pistons, piston valve heads and liners, piston rings, cylinder and steam chest covers, superheater header, regulator heads, regulator elbows, steam stands, etc.	This Japanese Industrial Standard specifies the iron castings which show grey in fracture.  2. Class and symbol The grey iron casting shall be classified as shown in Table 1.  Table 1 Class and symbol	1. This British Standard relates to seven grades of grey iron castings, viz. Grades 10, 12, 14, 17, 20, 23 and 26: The grades are numbered in accordance with the minimum tensile strength which can be expected on a 1.2 in (30.5 mm) diameter test bar. Material ordered to Grade 10 will be tested for its mechanical properties only when	
		Class Symbol	specifically requested by the purchaser.  The grade required should be stated at the time of enquiry and order.	
		Grey iron casting Class 1 FC 10 Grey iron casting Class 2 FC 15 Grey iron casting Class 3 FC 20	The basis of this standard is the tensile test but data relating to the transverse test are given in Appendix A, so that this may be used as a control test.	
		Grey iron casting Class 4 FC 25		
		Grey iron casting Class 5 FC 30 Grey iron casting Class 6 FC 35		
	2. Quality of material	3. Manufacture	Quality of metal	
	The Cast Iron used must be the best close- grained tough quality made from the most suitable mixtures of best selected pig iron. The Cast Iron used for piston rings to be slightly softer than that used for the cylinders, valve chamber lines and piston valves.	3.1 The grey iron casting shall be manufactured in cupola furnace, baby cupola, reverberatory furnace, electric furnace, crucible furnace and other proper melting furnaces.  3.2 The grey iron casting shall be annealed so that the casting stress may be removed, when required by the purchaser.	2. The metal used for the manufacture of the castings shall be good quality cast iron of the grade specified. The castings shall be cast from metal melted or refined in any suitable metallurgical plant. An iron ore smelting furnace shall not be used unless special permission shall have been obtained from the purchaser.	
		The grey iron casting may be softened by agreement with the purchaser.		
·	3. Chemical composition  The composition of the iron as cast is left to the discretion of the manufacturers.	6.2 Chemical analysis 6.2.1 The sample for chemical analysis shall, as a rule, be taken from ladle. Check analysis, however, shall be made on the product when required by the purchaser. In this case, the sampling and the allowable deviation of chemical composition shall be agreed upon between the purchaser and the manufacturer.	2. The composition of the iron as cast shall be left to the discretion of the manufacturer, but a minimum and/or a maximum percentage of phosphorus may be specified by agreement between the purchaser and the supplier.	
		4.3 The P and S contents in Class 3 to Class 6 shall be agreed upon between the purchaser and the manufacturer.		

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		$\mathcal{A}_{ij} = \{ (i,j) \mid i \in \mathcal{A}_{ij} = \{ (i$		$\mathcal{H}_{\mathcal{A}} = \{ \mathbf{x} \in \mathcal{A} \mid \mathbf{x} \in \mathcal{A} \mid \mathbf{x} \in \mathcal{A} \mid \mathbf{x} \in \mathcal{A} \}$
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	4. Moulding	5. Shape, Dimension, Weight and Tolerance	Moulding	
1	The castings shall be accurately moulded in	Thereon	4. The castings shall be accurately mould-	
	accordance with the patterns or drawings sup-	The shape, dimension and weight of the grey	ed in accordance with the pattern or work-	
	plied by the Chief Inspecting Engineer. Each	iron casting shall be determined by using its	ing drawings as supplied by the purchaser	·
	casting shall have the letters "E.S.R." cast	drawing or model, and the tolerance thereon shall be agreed upon between the manufacturer	with the addition of such lettering as may be specified.	
	on it in letters not less than 1/2" (12.5 mm high, together with such other markings (cast	and the purchaser.	be specified.	
	or stamped) as may be directed by the Chief			
	Inspecting Engineer.	9. Marking		·
.		The grey iron casting which have passed the		
.		inspection shall be marked on every casting by the workshop with the mark "Inspected",		
		symbol for type, molten number, name of		
		workshop or its abbreviation. In the case		
		these markings are difficult to be done, how-		
		ever, other appropriate way may be adopted.		
		When approved by the purchaser, the above		
. '	ente de la composition de la compositio La composition de la	items may be partially omitted.		
	5. Freedom from defects	4. Quality	Freedom from defects	
٠. ا	The casting shall be free from cracks, gas	4.1 The grey iron casting shall have uniform	3. The castings shall be sound, clean	
- : :  -	holes, flaws and excessive shrinkage. The surfaces shall be free from burnt-on sand	quality and shall be free from detrimental flaws or cavities.	and free from distortion and injurious defects. They shall be well dressed or	
	and shall be reasonably smooth	医水体性 海绵 医直角性 化二氯甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基	fettled and shall be free from chill and	
	The casting shall be well dressed or fettled	7.2 The inspection of appearance, dimensions and mass shall be carried out for each grey	other indications of free carbides except	The state of the state of
	and shall have a suitable degree of machin-	iron casting. The flaws or cavities that only	as specified by the purchaser. They shall be machinable by the normal methods for the	
:	ability. Runners, risers, fins and other	slightly affect the use may be repaired by	grade of iron specified.	
	cast on pieces are to be removed.	welding or other appropriate means, provided that the purchaser approves.	By agreement between the manufacturer and	
	Any flaws (blowholes, etc.) on the surface	that the parenaser approves.	the purchaser, defects may be rectified.	
. :	shall be left bare and no attempt shall be made to fill or otherwise obliterate them		Any casting showing defects during subse-	
	without the express agreement of the E.R.		quent manufacturing operations does not	
	Inspecting Engineer. Any casting upon which		comply with this British Standard, notwith- standing any previous certificate of satis-	
	such work has been done prior to such consent having been obtained will be rejected.		factory testing, provided the casting has	
			not been improperly treated after delivery.	1.5
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		7.3.1 Test specimen			
	6. Provision of test bars		Provision of test bars		
	Test bars shall be cast separately from the	(2) The test specimen shall be cast separate-	7. Test bars shall normally be cast sepa-	•	
	casting under the same sand conditions (i.e. green sand or dry sand) as the castings, and	ly from the grey iron casting. In this case, the mould for the test specimen shall, as a	rately from the castings to which they are related, but shall be poured at the same		-
	from a ladle or ladles of the same metal as	rule, be of the same type as that for the	time and from the same ladle of metal.		
	that used to pour the castings. The test bars	grey iron casting, and it is required to cast	Sufficient test bar material to meet the		•
	shall receive the same mechanical and thermal treatment, if any, as the castings and in the	the specimen with the same molten under the same conditions as that for the grey iron	requirements of Clauses 10 and 11 shall be provided.		
	case of heat treatment the test bars shall be	casting. By an agreement with the purchaser,			
	treated adjacent to the castings they repre-	however, the test specimen may be cast in mo-	When castings are moulded in loam or dry sand the test bars representing the cast-	:	
	sent. The test bars shall not be cleaned by	noblock with the grey iron casting.	ings shall be cast in dry sand. When		
	tumbling unless the castings are so cleaned.	(3) The test specimen shall have 30 mm in	castings are moulded in green sand the	·	
	Tensile test pieces shall be machine from	diameter as cast. When the test specimen is	test bars representing the castings shall		
	transverse test bars. Tensile test pieces cast to size are not recognised by this spe-	determined according to principal wall thick- ness of the grey iron casting, however, the	be cast in green sand or in dry sand. If the castings are produced in any other		
	cification.	diameter as cast shall follow Table 3.	mould material, the material to be used		
		(4) The dimensions as cast of test specimen	for the mould for the test bar shall be		
		from the grey iron casting below 4 mm and	agreed between the purchaser and manu- facturer.		
		above 50 mm in principal wall thickness shall			
		be determined by an agreement between the purchaser and the manufacturer.	Castings may be ordered where none of the standard test bars in Table 1 would rea-		
		purchaser and the mandraceurer.	sonably represent the material in the		*
			casting and in this case provision may be		
			made, by agreement between the purchaser		
			and manufacturer, for an additional piece to be cast on to the casting which can		•
	The state of the s		subsequently be removed and used to pro-		
			duce a test piece of suitable size in con-		
			formity with Table 2.		
			When castings are subjected to heat treat-		
			ment the test bars shall be treated under similar conditions.		
İ			All test bars shall be marked to identify	14 Ag	
			them with the castings they represent.		
* 11	international de la companya de la Companya de la companya de la compa				
	7. Dimensions of test bars	C 1 0 m			
• •		6.1.2 Tension test	<u>Dimensions of test bars</u>		
	(A) Transverse test bars. The transverse test bars shall be cast to one of the fol-	(1) Test piece It shall be formed from the test specimen or	8. Tensile test bars. Tensile test bars	i .	1 1
	lowing dimensions:	from the test piece fractured by deflection	from which the appropriate test piece is machined shall be cast as uniform cylindri-		
	(a) 1.2 inches diameter and 21 inches over-	test to No. 8 specified in JIS Z 2201.	cal bars to the dimensions given in Table		
}	all length.	(2) Test method			
	(b) 30 mm. diameter and 650 mm. overall	The test method shall follow JIS Z 2241.	It is permissible to use material original-	1.1	
.	length.		ly provided for transverse tests. If it		•
			is not practicable to use a 1.6 in (40.6 mm) or 2.1 in (53.3 mm) nominal size test		· · · · · · · · · · · · · · · · · · ·
			bar because of limitation of testing faci-		
			lities, the 1.2 in nominal size bar may be		
					:
			grant and agrant and a second and	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	

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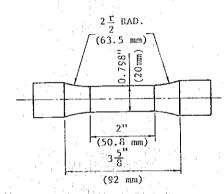
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If the diameter of a transverse test bar is found to be more than 0.05 inch (1.2 mm. approx.) greater or less than the dimensions given it shall be rejected. Transverse tests shall not be carried out on machined bars.

(B) Tensile test bars. The tensile test bars shall conform to the following dimensions:



The test pieces shall be machined from the appropriate transverse test bars, as provided above in clause 6.

#### 8. Mechanical tests.

The castings must comply with the transverse and tensile tests specified below. The test pieces will be selected by the E.R. Inspecting Engineer, and the tests must be carried out in his presence and to his satisfaction.

#### (A) Transverse test

A transverse test bar cast to dimensions in clause 7 (A) shall be supported on knife edges or rollers, whose axes are perpendicular to that of the test bar, and shall sustain a progressively increasing load applied at its centre.

The rate of application of the load shall be such that the increase of the bending stress will not exceed 2 tons per square inch (approx. 3 kg/mm<sup>2</sup>) per second.

The results of the test shall conform with the following:-

No. 8 Test piece

This test piece shall be principally used for tension test of general iron castings. It shall be made out of the sample with the dimensions given in the Table, and the parallel portion shall be finished to the diameter D.

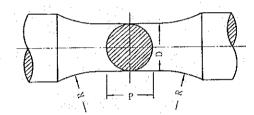


Fig.

		rig. o		Unit: mm
Division of test piece	Size of casted sample (dia.)	Length of parallel portion P	Dia. D	Radius of shoulder R
8A	Approx.	Approx.	8	16 or more
8B	Approx. 20	Approx. 12.5	12.5	25 or more
8C	Approx. 30	Approx. 20	20	40 or more
8D	Approx. 45	Approx. 32	32	64 or more

used subject to agreement with the purchaser. In this case, the mechanical properties specified for the 1.2 in bar appropriate to the grade of iron shall apply. An alternative procedure is to adopt that given in the third paragraph of Clause 7, and in this case the strengths obtained shall be those for the appropriate larger bar, even if a small test piece was produced from the test portion of the casting.

Table 1 Tensile test bars as cast

castir	ness of Ig Up to and including	Diameter as cast	Approximate minimum overall length
in	in	in	in
·	3/8	0.6	5
3/8	3/4	0.875	7
3/4	1 1/8	1.2	9
1 1/8	1 5/8	.1.6	11
1 5/8	_	2.1	13

. [					
		ERS	JIS	BS	Remarks
(á	a) A test bar cast	ed 1.2 inches diameter, rts set at 18 inches			
a <sub>l</sub> tl	part, shall show a han 24.3 ton per sq	rupture stress of not less uare inch and a deflection ot less than 0.16 inches.		F   D dia   F     (Screwed)   F	
(t	b) A test bar cast laced on supports s	ed 30 mm. diameter, when et at 600 mm. apart,	Carp tree   FC 10   & to 20 last.   20   10 sts.   200 sts.   3.0 sts.   3.	B E B	
s1 4(	hall show a rupture	stress of not less than ection before breaking of	Over 15 to 25 incl. 25 (15 over 15 to 25 incl.) 25 (15 over 15 to 25 incl.) 25 (15 over 15 to 25 incl.) 25 (15 over 15 to 36 to 15 over 15 over 15 to 36 to 15 over 15 over 15 to 36 to 15 over 15	Parallel) R C (Parallel) R	
. (1	B) Tensile test	achined to the dimensions	Geny Stem   No 20   Vot   Lact.   23   1/2   1	Table 2 Machined tensile test pieces  Cross-sectional Radical Cross area (22. Bin. Flat rolls Strong page Approximately Continged of Tool Strong Strong Page Approximately Continged Strong Page Approximately Continue Con	
sl	hown in clause 7 (B	) above must show a break- s than 14 tons per square	Grey 1con PC 23 & to 5 toch: 17 23 str. 220 str. 2.0 str.	2: A. F E B C II. F.  In In to Lo? in to	
:   11	nen (approx. 22 kgs	. per man~).	Board LS vo 30 incel. 30   33 uits   1000 min. 5.0 min. 10.0 min. 6.0 min. 10.0 min. 6.0 min. 10.0 min. 6.0 min. 10.0 min. 6.0 min. 10.0 min. 10	coefing 2/5 Over 1/4 and no 1,2 0.798 0.50 1.8 1 1.00 2.192 1.78 8.3.9, 1.19 8.3/4 coefing 1.1/5 Over 1.1/8 and 1.5 1.1/2 2.00 2.8 1 1.48 1.3/2 1.1/2 8.3.9, 1.1/2 1.00 1/2 concerning 1.1/5	
			Comparison   Com	Over 2 3/5 2-4 2-43 1-75 2-8 1 1-85 3 12 2-3-5-7- [2 92 2/4	
	ing distribution of the second		Core D to 50 bock 15 33 size. 2000 size. 2.3 size. 2.3 size. 2000 size. 2.3 size		
	1				
-1		and American States of the Community of	6.1.3 Deflection test	Mechanical tests	
•			(1) Test piece The test piece specified in JIS Z 2203 shall	9. Tensile tests carried out on a test piece machined to conform to the dimen-	
			be used.  (2) Test method  Lay the test piece between two fulcrums, ap-	sions shown in Table 2 shall show a ten- sile strength of not less than that given in Table 3 appropriate to the size of test	
			ply a load to the test piece in the middle part until its breakage, and measure the maximum load that the test piece could with-	piece and grade of iron.  Self-aligning grips are recommended to ensure axial loading.	
			stand and the deflection.	After reaching 50 per cent of the antici-	
				crease of stress on the test piece shall not exceed 10 tons/in <sup>2</sup> per minute (15.75 kg/mm <sup>2</sup> per minute).	

	ERS	JIS	BS	Remarks
		Flexure Test Piece for Metals JIS-Z 2203-1956 (Reaffirmed: 1971)  1. Scope This standard specifies standard test piece (hereinafter referred to as the "test piece") to be used for flexure test of metals. Whether any test piece is to be used or not shall comply with those specified by the respective standards.	Table 3 Tensile test    Cross-sectional tablebeer of continue to the continue test of the con	
		2. Type of test piece The test piece shall be divided into from A to D in accordance with the shape and size and these reference dimensions shall comply with the following:	APPENDIX A TRANSVERSE TESTS	
		Load  Fulcrum P Fulcrum	Test bars  Al. Transverse test bars shall conform to the dimensions shown in Table 4 appropriate to the main cross-sectional thickness of the casting.  Table 4 Transverse test bars	
		Type of Diameter Diametral Fulcrum Length test Diametral Fulcrum gauge P L A 13 +1.0 200 About 300	Cross-sectional thickness of casting diameter diameter of bar as cast minus)  Over Up to and including in	
: :		A 13 ±1.0 200 About 300 B 20 ±1.0 300 About 350 C 30 ±1.5 450 About 500 D 45 ±2.0 600 About 650	-     3/8     0.6     0.045     10       3/8     3/4     0.875     0.065     15       3/4     1 1/8     1.2     0.090     21	
wile The state of the state of		3. The test piece shall be as-cast. Provided that the surface may be machine-finished on account of the dimensional adjustment within the range of tolerance.	1 1/8     1 5/8     1.6     0.10     21       1 1/8     -     2.1     0.10     27	
				- 82
•				

	ERS	JIS.	BS	Remarks
	9. Number of mechanical tests	(1) One test specimen, besides extra ones,	<u>Tests</u>	
	m to a first manufact chall be	shall be sampled from every molten. When re-	10. The test shall be the tensile test	
	The number of tests required shall be:-	quired by the purchaser, however, the quantity	and and shall be carried out at a freque	
	(a) One tensile and one transverse test for	of test specimens may be altered. In the case	oney not long than that chown below	
	every 2 tons of castings or part thereof.	a molten exceeds 10 t, one test specimen shall		
	or (b) One tensile and one transverse test for every 30 castings or part thereof.	be sampled from every 10 t or the fraction thereof.	Grades 10* and 12: one tensile test for up to 10 tons (10.16 tonnes) of castings.	
		One molten of cupola and baby cupola shall be	Grades 14 and 17: one tensile test for up	
	Big and highly stressed castings, such as cylinders and superheater header, shall be	the tapping amount, when composed of same	to 5 tons (5.08 tonnes) of castings.	
1	tested piece by piece.	blend, for every three hours.	Grades 20, 23 and 26: one tensile test for	
	tested processy process	When hot metal from more than two furnaces has	up to 1 ton (1.016 tonne) of castings.	
		been gathered into one ladle, the gathered	In the case of castings weighing over the	
		metal shall be considered one molten.	specified weight for the grades shown	
			above, there shall be one tensile test per	
			casting.	
				<u> </u>
	10. Hydraulic tests	Not specified		
	Castings, which are under internal pressure			(1)
	in service, shall be tested under a hydraulic			• .
	pressure equal to the working pressure plus			
	30 lbs. per square inch (approx. 2 kgs/cm <sup>2</sup> ).			
		O. Patront	Retests	
	11. Additional tests before rejection	8. Retest		
	If a faulty or unsound test bar gives a re-	8.1 When the test piece is found to be badly	ll. a. Tensile test. Should any of the	
	sult not in accordance with the specifica-	finished or to have flaws, it may be dis-	tensile test pieces fail to pass the tests,	
,	tion the result shall be ignored and a	carded before the test and replaced by another	two further tensile tests shall be made.  If both pass, the batch of castings re-	
	fresh test made.	test piece.	presented complies with the test require-	
	If a sound test bar fails a second test	When flaws are found out after the test and	ments, but should one fail, the batch does	
	shall be made. If this meets the specifi-	are considered to have affected results of	not comply with this British Standard.	
:	cation the batch or casting represented	the test, the results shall be invalidated.		
: - :	shall be accepted, but if it fails the	8.2 When a part of results of the mechanical	b. Casting defects. Should any test	
:	batch or casting represented shall be rejected.	test can not satisfy the requirements but the	piece which failed show obvious casting defects, a test piece may be taken from	
	Jected.	results other than that are satisfactory, test	spare test material or cut from a casting	
		test pieces of a quantity two times as many	from the same batch, and the results	
		as specified shall be taken from the group to	obtained from this substituted for those	
		which the rejected test pieces belong, to be	obtained from the defective bar.	
		retested for the test item the original test		
		pieces have failed in satisfying the require-	Additional tests	
		ments. In the retest any one of the test	12. If the purchaser desires any tests or	
		pieces shall satisfy the requirements.	special requirements not specified in this	
			standard, he shall state these at the time	
			of enquiry and order.	
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•			and the second s	The state of the s

	ERS	JIS	BS .	Remarks
Ī	12. Inspection	7. Inspection	Inspection	
	The E.R. Inspecting Engineer shall be allowed	7.1 The results of the inspection for appea-	13. The purchaser or his representative	
-	unhindered access to the manufacturers' work	rance, dimensions and mass, tension test,	shall have access at all reasonable times	
- 1	at all times within working hours when cast-	deflection test, hardness test and chemical	to those parts of the manufacturer's works	
	ings on order are in process of manufacture or delivery. He shall be at liberty to in-	analysis shall satisfy the requirements described in 4. and 5. When the correction is	engaged on his order; he shall be at li- berty to inspect the manufacture at any	
-	spect the manufacture at any stage and to re-	applied in accordance with 6.1.3 (3), how-	stage, to witness the required tests and	
	ject any castings which do not conform to this	ever, the corrected maximum load shall be	to reject any material that does not comp-	
	specification. Any castings so rejected must	used.	ly with the specification. When the cast- ings are to be inspected during manufacture	
	be broken up at once or marked in the presence of the inspector in such a way that they can	When approved by the purchaser, the mechani-	and tested in the presence of the purchas-	and the second second
	not be confused subsequently with satisfactory	cal test may be partially or completely omitted.	er's representative, it should be so stat-	
	castings.		ed in the enquiry and order.	
		The inspection of appearance and dimensions, tension test and deflection test shall be		· ·
		generally performed, but the inspection of		
		mass, hardness test and chemical analysis		
		shall be performed only when designated by the purchaser.		
. [		the purchaser.		
ŀ		10. Report		are the second of the second o
		The manufacturer shall submit to the purchaser		14.
1		a record containing the molten number and re-		
		sults of the test.		
		W-tified	Testing facilities	
	13. Testing facilities	Not specified	Int <del>roduce a set of the control of t</del>	
•	The manufacturer shall supply the material required for testing free of charge, and at		14. The manufacturer, in supplying the test samples as required for testing shall	!
	his own cost shall furnish and prepare the		prepare from them the necessary test pieces	·
	necessary test pieces and supply labour and		and supply the labour and appliances for	
	appliances for such testing as may be car- ried out on his premises in accordance		making all tests on his premises in accordance with the specification.	
.	with this specification. Failing facili-		Failing facilities for carrying out the	
	ties at his own works for making the tests		prescribed tests at his own works, the	
	the manufacturer shall bear the cost of carrying them out elsewhere.		manufacturer shall carry out the tests	
	carrying cham out disconners.		elsewhere.	
Ī		6.1.4 Hardness test		:
		(1) Test piece		
-		The test piece for the deflection or tension		
		test shall be locally used.		
		(2) Test method		
		The test method shall follow JIS Z 2243.		
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ERS NO. M106-1959	JRS & JIS
A. Plain Glass for General Use	JIS R3201 Sheet Glass
Each pane to be of the best glass, free from defects and throughly annealed. The two faces should be ground and polished to give clear and undistorted vision. Glass panes should be so treated as to stand normal shocks without fracture, and if subjected to abnormal shocks, no splinters should follow the consequential breakage.	Glass shall be manufactured generally by mechanical drawing method, and have a fire-smoothed surface.  Thicknesses shall be 1.9 + 0.2 (Nominal 2 mm), 3 + 0.3, 5 + 0.3 mm.  Quality shall be classified into Class A and Class B, which are judged by bubble, inclusion, code/wave, speck/stain/scratch, flow, chip/flare, warp etc.  JIS R3202 Float, Polished Plate Glass  Manufacture shall be by floating or polishing system.
	Thicknesses shall be 3, 4, 5, 6, 8, 10, 12, 15, 19 mm. (with tolerance varying by cases)
	Criteria for judgement of quality for general use, similar to JIS R3201.  JRS 63103-1F-15AR7A Sheet Glass for Rolling Stock  (Reference Standards: JIS R3201, R3202)
	Manufacturing method, same as JIS.  Thicknesses shall be 1.9, 3, 5 mm for ordinary sheet glass  3, 5, 6 mm for polished sheet glass.
	Judgement of quality is same with JIS in items, but different in criteria.
B. Plain Glass for Mirrors	JRS-67101-1F-15AR6A Mirrors for Rolling Stock
Each pane to be of the best glass, free from defects and throughly annealed. The two faces should be ground and polished to give clear and undistorted vision before coating.	Classified into Class A (for general use) and B (for humid environment use).  Materials shall conform to JIS R3202.
	The back shall be silver-plated.
	Thickness shall be 6 mm.
	The judgement of quality and the test method are specified.

ERS NO. M106-1959	JRS & JIS
C. Frosted Glass	JIS R3201 Sheet Glass
Each pane to be of the best glass, free from defects or wavine and throughly annealed. The frosting is to be one side only a of such a depth that clear outlines of objects in a lighted reshall not be visible through the glass. Glass Panes should be so treated as to stand normal shocks without fracture, and if subjected to abnormal shocks, no splinters should follow the consequential breakage.	transparent sheet glass pane shall be processed by means of sand grinding, sand blasting or corrosion.
	Judgement of quality shall be subject to Class B.
	JRS-67103-1F-15AR7A Sheet Glass for Rolling Stock
	Manufacturing method is the same as JIS.
	Thicknesses are 3, 5 mm.
	The judgement of quality is same as JIS in items, but different in criteria.
Tolerance:	JIS R3201 Sheet Glass  JIS R3202 Float, Polished Plate Glass
The panes are to be cut to sizes within the following tolerand.  The four sides are to be exactly square. Tolerance on Thickney	ces. in mm in mm
± 0.4 m/m., & on Length & Width ± 0.5 m/m.	Length/ Thickness Width Thickness Width
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
	JRS-67103-1F-15AR7A Sheet Glass for Rolling Stock
	Ordinary sheet glasses shall be 2, 3 and 5 mm in thickness, and the float, polish d sheet glasses, 3, 5 and 6 mm, with tolerances subject to JIS.
Edges:	
Each sheet to be supplied with round edges and corners, unless otherwise stipulated.	

**(4)** 

ERS ERS NO. M106-1959	JRS & JIS	
Marking:  Each pane should be etched by the letters E.R. in Arabic as per drawing. No. M.28838 but to the dimsn. 18 x 25 mms, on the top right hand cornder, and 20 mms apart from sides.  Makers trade mark may be etched underneath the E.R. marking and not to exceed 20 x 10 mms in size.		
Packing:  Fvery care is to be taken in packing the sheets. They are to be separated by a sheet of paper and put closely in strong closed cases made of 50 millimeters frame work, 15 millimeters sides, 40 millimeters battens. The frames to be bolted right through and the lids secured with nuts on the bolts.  An alternative method of packing, may be proposed by the tenderer in submitting his quotation but should be such as to ensure the safe arrival of the contents at destination with a minimum of breakage.	JIS R3201 Sheet Glass  JIS R3202 Float, Polished Plate Glass  Packing:  Packed, as a rule, by using suitable cushion materia or container shall be marked with:  Type of glass, dimensions, number of glasses contain facturer's name.	
	JIS-67103-1F-15AR7A Generally pursuant to the abo	ve JIS's.

	Egypt	pt Japan				U.S.A.		United Kingdom		West Germany	France		U.S.S.R.				China					
Name of Standards	ERS	JIS				ASTH		BS		DIN	NF			GOST				СВ				
Standard No.	M170	к2204				D975		2869		51601	H15 H15 -008		305				252					
Date of publishment	1971	1976			1975.3		L970		1975.4	1	1975		1975				1972.12					
Classification	1055 Cal./gr	No. 1	No. 2	No. 3	No. 3S	No. 1-D	No. 2-D	Class Al	Class A2		Cas Oil	Fuel Dil Domesti- que	1.	2	zs	A	No. 10	No. 0	No10	No20	No30	
Density, 15°C, kg/l	0.820 ~0.850	= .	-	-	-	-	-	-	-	0.815 10.855	0.810 10.890		Report 61(Cen- eral)	Report 40(Gen- eral)	Report	Report -		-		-	• • • • •	
Flash point, °C (not less than)	65	50	50	50	50	37.8	51.7	55	55	55	55 ∿120	55	40 (Speci- fied)	35 (Speci- fied)	35 (Speci- fied)	30 (Speci- fied)	65	65	65	65	59	
Distillation temperature, °C. 50% evaporated		-		-	-		-	-	-	-	-	-	260	250	280	240	300	300	300	300	300	
65% evaporated		11 21 14	-		-	-	-	-		-	250	250	-	-	· -	-	-	-	-		<u> </u>	
85% evaporated	-	-	-	-	-	-	-	-	-	350	350		-		-			-	-	-		
90% evaporated	- 1	350 (Not more than)	350 (Not more than)	330 (Not more than)	330 (Not more than)	287.8 (Not more than)	282.2 338	357	357	- 1	-	-	-	-	-	-	355	355	350	350	-	
96% evaporated	- 1		-	-	-		-		<del>  -</del>	-			-	<u> -</u>	7.7		365	365		- 1	350	
96% evaporated		-			-	- :		-	4.5	* *, .a = . *,	-	. i - i -	360	340	340	330		11 <del>-</del> 1	.=	-	-	
Pour point, *C (not core than)	0	-5	-10	-20	-30						-7(Apr ∿Sep) -12(Oct ∿Har)	-3(Apr ~Sep) -6(Oct ~Mar)	-10	-35	-45	-55	+10	0	-10	-20	-30	
	4	1 2	1	<u> </u>		<u> </u>		O(Mar	O(Mar		·mai/	waij	-5	-25	-35	_	-		4	11,2,3		
Cloud point, °C (not more than)								Nov) -7(Dec ∿Feb)	^Nov) -7(Dec ∿Feb)							5. S.		. 4				
Filtration test value, °C (not more than)		-	14,1	-	-	: _	-	-		O(Summer -12(Win- ter)	: =: :	-	Report	Report	Report	Report		-	1 1	<del>-</del>	)	
Carbon residue in 10% bottom oil, % (not more than)	-	0.10	0.10	0.10	0.10	0.15	0.15	0.2	D.2	0.1		0.35	0.30	0.30	0.30	0.30	0.4	0.4	0.3	0.3	0.3	
Cetane number (Cetane index) (not less than)	:55	:50	45	45	45	40	40	50	45	45	50	40	45	45	45	45	50	50	50	45	43	
Kinematic viscosity, 37.8°C, cSt	-	-	-	-	-	1.4 ~2.5	2.0 ^4.3	1.6 16.0	1.6 ^6.0	· ·	7	11	3.5 46.0 (General)	2.2 45.0 (General)	1 <b>-</b> .	17		'- -		.:- : <u> 1 1                                 </u>	·-	
30°C, cSt	-	2.7	2.5	2.0	1.8	-		-		-	-		:	-		1544	-			1 -	·	
20°C, eSt	i i i. V	= 1,		-	-	-	Ī.	-	_	1.8 √10	9.5 (Not more than)	9.5 (Not more tham)	3.0%6.0 (Speci- fied)	1.8-3.2 (Speci- fied)	1.8\3.2 (Speci- (led)	1.5 (Not more than) (Specified)		3.0 \3.0	3.0 18.0	2.5 ~8.0	2.5 17.0	
Sulphur, % (not more than)	1.5	0.50	0.50	0.50	0.50	0.50 or Legal	0.50 or Legal	0.5	1.0	0.55	0.70	0.55	0.2(G-1) 0.21\0.5 (G-2)	0.2(C-1) 0.21^0.5 (G-2)	0.2(G-1) 0.21°0.5 (G-2)	0.2(G-1) 0.21^0.4 (G-2)	0.2	0.2	0.2	0.2	0.2	
Water and sediment, w/v 2 (not core than)	± 1,		-	-	-	0.05	0.05	i	11	<u>-</u>	-	0.10	· -	· -	<u> </u>				١	- T.	1-1	
Water, v/v % (not more than)	0.15	-	-	-	-	- ::	<del>-</del>	0.05	0.05	0.1	Trace	0.10	Not con- tained	Not con- tained	Sot con- tained	Not con- tained	Trace	Trace	Trace	Trace	Not con- tained	
Sediment (Impurities), % (not more than)	0.01	- :	-	-	-	- 4		0.01	0.01	-	Not con- tained	=	Not con- tained	Not con- tained	Not con- tained	Not con- tained	Not con- tained	Not con- tained	Not con- tained	Not con- talned	Not con- tained	
Ash, I (not more than)	0.01	-		-	-	0.01	0.01	0.01	0.01	0.02	Not con- tained	-	10.0	0.01	0.01	0.01	0.025	0.025	0.025	0.025	0.025	

