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0 - INTRODUCTION

The conditions contained in the present leaflet shall apply to international teleprinter links. These conditions are mainly concerned with the technical principles of international teleprinter links. The operational aspects are dealt with in UIC Leaflet 750.

Exceptions may be allowed in the case of circuits of a local nature which cross frontiers. Such circuits will be established by direct agreement between neighbouring Railways and will comply, as far as possible, with the conditions prescribed in the present leaflet.

★ Insofar as there are no provisions to the contrary in the present leaflet, the CCITT recommendations (1) shall apply to the Railways' international teleprinter circuits.

1 - TELEPRINTERS AND ASSOCIATED EQUIPMENT

★ 1.1 - Alphabet

Teleprinters for international traffic shall be provided with characters which use the signal code of the international alphabet recommended by the CCITT (Alphabet No. 2). This alphabet is reproduced in Appendix 1.

1.2 - Modulation rate

★ The modulation rate for teleprinters shall be 50 bauds.

(1) CCITT - International Telegraph and Telephone Consultative Committee.

It is recommended that care be taken to ensure that teleprinters, designed for a speed of 50 bauds, are also capable to operate at higher speeds.

★ 1.3 - Stop signal

Teleprinters shall be designed for a stop signal having a duration of 1.5; they shall, however, be capable of normal operation when a single length stop signal is received.

★ 1.4 - Types of machine

Only page teleprinters shall be used in international communications.

The number of characters (including intervals) which may be contained in one line of text has been fixed at 69.

1.5 - Identification device

★ All teleprinters used in international service shall be fitted with a complete identification device : answer-back unit and device for activating correspondent's answer-back unit ("Who are you ?" call key).

★ An answer-back transmission shall be composed of a series of 20 signals, as follows :

1. "letters inversion" signal,
2. "carriage return" signal,
3. "line feed" signal,
4. "digits inversion" signal,
5. the following signal(s) : correspondent's number (the last two digits at least), and, wherever possible, supplementary letters for clearer identification of the correspondent.

The final signals before the 20th signal form the abbreviation of the Railway (e.g. : DB, PKP, SNCF); if the Railway code consists of several letters, it may, where necessary, be shortened by replacing it by the country-code.

20. "letters inversion" signal.

Example :

Signal number :

- | | |
|---|---|
| 1 : letters inversion, | 1 : letters inversion, |
| 2 : carriage return, | 2 : carriage return, |
| 3 : line feed, | 3 : line feed, |
| 4 : digits inversion, | or 4 : digits inversion, |
| 5 to 15 : Correspondent's No. and identification letters, | 5 to 17 : Correspondent's No. and identification letters, |
| 16 to 19 : SNCF, | 18 and 19 : DB, |
| 20 : letters inversion. | 20 : letters inversion. |

If a postal Administration requests a country code at the end of the answer-back transmission for teleprinters connected to the telex network and does not accept the abbreviation of the Railway as a country-code, the answer-back transmission shall terminate with the country-code in question in accordance with Appendix 3; in this case the "line feed" signal shall precede the country-code (signal 17 or 18 depending on whether the country-code consists of one or two letters), and the abbreviation of the Railway shall be placed in front of the "line feed" signal.

Examples :

- | | |
|--------------------------|--------------------------|
| 1 : 12 | 1 : 13 |
| 13 : "line feed" | 14 : "line feed" |
| 14 : 17 SNCF | or 15 : 16 NS |
| 18 : "line feed" | 17 : "line feed" |
| 19 : F | 18-19 : NL |
| 20 : "letters inversion" | 20 : "letters inversion" |

It is recommended that endeavours should be made to reach an agreement with the postal Administrations to eliminate the country-code and use the same answer-back signals as those employed by the Railways internally.

1.6 - Other technical properties of the machines

★ The starting time required before the rated speed of the equipment is reached shall not exceed one second. The deviation from the rated speed must not be greater than $\pm 0.75\%$.

★ The start-stop distortion when transmitting shall not be greater than $\pm 5\%$. The overall start-stop distortion of the teleprinter, from the connecting line up to and including the terminal slide adjuster at the central office, shall not be greater than $\pm 10\%$.

★ The margin at the receiving end shall not be less than $\pm 35\%$.

In accordance with the CCITT Recommendations, "digits" signals or signals corresponding to the letters F, G and H may be employed for national requirements. Where a Railway does not use these signs it is desirable that they should be replaced, if possible, by a conventional sign (e.g. a square).

★ Combination 32 of the international alphabet No. 2 must not be used for international links.

★ Machines which do not function correctly upon receipt of a single "carriage return" or "line feed" sequence shall not be used in international service.

★ Teleprinters used in a direct link between fixed points shall be fitted with a device which will bring them to a stop after a transmission pause from 30 to 60 seconds. Railways concerned shall ensure that the disconnection times of the two machines are of as near as possible values.

★ Teleprinter units shall be provided with a bell, remotely-operated by means of an appropriate key.

The transmission of the «bell» and «who are you?» signals is not absolutely necessary, but is recommended.

Teleprinter connections to control boxes shall, if they are separate, consist, as far as possible, of 4 wires, in order to enable the subsequent provision of 2 - or 4 - wire connections to the transmission equipment.

1.7 - Punched tape transmitters and receivers

It is recommended that automatic punched tape perforators and transmitters be used for the preparation and transmission of telegrams in international service.

Punched tapes may either be prepared by keyboard perforators or by teleprinters working in conjunction with control boxes with a local feeder circuit (the control box may be separate or incorporated in the teleprinter). The latter arrangement shall be such as to enable local use to be made of the teleprinter without requiring contact to be established with another remote teleprinter.

★ When such control boxes are used locally, the connections must be so arranged that a reply is given, within three seconds, to a call received from a distant teleprinter.

The tendency in the future must be to use a device which will ensure the remote connecting and disconnecting of the perforator unit. In accordance with the procedure envisaged by the CCITT, the signals CCCC and FFFF have respectively been provided for the connecting and disconnecting operations.

It is recommended that any break in local working, following receipt of an external call, should automatically give rise to the disconnecting of the reperforator. In the latter case, measures should be taken to prevent the reperforator from being remotely switched back into operation.

1.8 - Calling dial (fitted to the control boxes)

★ Where automatic selection is controlled by the operation of a calling dial, the latter shall transmit at the rate of 10 pulses per second, with a tolerance of ± 10%. The idle time of the dial between two successive pulse trains shall be at least 200 milliseconds. If the dial is replaced by a pulse generator, the period between two successive pulse trains shall be at least 600 milliseconds. The pulse ratio (break to make) shall be between 1.2 : 1 and 1.9 : 1, allowing for the fact that the ratios 1.5 : 1 or 1.6 : 1 are to be selected as nominal values. Where selector signals are required to pass through a regenerator, it is advisable to select the ratio 1.5 : 1 as a nominal value.

2 - SWITCHING EQUIPMENT

2.1 - Connection to switching equipment

International circuits should, as far as possible, be connected to automatic switching equipment. If this is impossible, and taking account of long transmission periods which, sometimes, may be occasioned by manual exchanges, it is recommended that the international link should terminate on a teleprinter provided with a perforator.

2.2 - Interconnection of automatic switching equipment

It is recommended that the automatic exchanges of neighbouring Railways be connected so as to ensure a fully automatic interconnection of all users concerned on both networks.

★ International circuits between networks shall be connected to the main switching centres of the network.

★ If a national network incorporates more than one switching centre of this category, the switching centres of the national network under consideration shall be interconnected by means of through circuits.

★ When it proves impossible to connect two networks on different Railways by means of fully automatic circuits, owing to differences in the system or other causes, a semi-automatic service shall be introduced involving a single retransmission process, preferably undertaken in the receiving country by means of punched tape.

★ This semi-automatic system shall also be used in transmissions with networks of Railways which use an automatic retransmission process controlled by the actual messages.

2.3 - Automatic switching equipment

★ If international circuits are connected to networks with automatic dialling, only the digits 1, 2, ..., 9, 0 shall be used as dialling signals, according to the signalling system in use (see article 13). The dialling signals shall be transmitted :

- a) as dialling pulses, in accordance with Point 1.8, or
- b) as a dialling code, in accordance with Alphabet No. 2 (see Appendix 1).

If the code is used, an initial dialling signal is required, which shall be Combination No. 30 (Digits inversion) and an end dialling signal, which shall be combination No. 26 (+).

2.4 - Criteria for automatic switching in international service

★ 2.4.1 - Line clear

The "line clear" situation is characterised by a permanent condition corresponding to the start pulse of Alphabet No. 2 ("start polarity" or "Condition A"), on the "outward" and "backward" signalling paths.

★ 2.4.2 - Calling signal

The call is characterised by the change from the "line clear" condition to the reverse condition ("stop polarity" or "Condition Z"), on the "outward" signalling path.

★ 2.4.3 - Call confirmation

A call-confirmation signal shall be transmitted over the "backward" signalling path with a maximum of 150 ms after receipt of the call signal at the distant terminal installation.

★ 2.4.4 - Proceed-to-select signal

If international circuits terminate at an automatic switching unit which is unable to accept the selection signals immediately after receipt of the call, a proceed-to-select signal shall be transmitted over the "backward" signalling path after the call-confirmation signal, in order to indicate that selection signals may be transmitted.

If the proceed-to-select signal is indispensable, it shall be transmitted, in 99% of cases which arise, within 5 seconds after receipt of the call.

★ 2.4.5 - Call-connected or called party-free signal

A call-connected signal (indicating that the called party is free) is transmitted over the "backward" signalling path to indicate that the connection has been established through to the desired party.

★ 2.4.6 - "Idle" or contact-established condition

After the connection has been obtained, the "idle" or contact-established condition between the two correspondents is characterised by a permanent condition corresponding to the "stop" pulse on the two transmission channels (outward and backward paths).

★ 2.4.7 - Clearance signal

The clearance signal is characterised by the return to the condition defined under 2.4.1 above, in one direction of transmission, until the circuit is once again completely cleared. The terminal supervisory equipment of an international circuit shall be capable of identifying, as a clearance signal, any signal with start polarity which has a duration of between 300 and 1 000 ms.

★ 2.4.8 - Clearance confirmation signal

Clearance confirmation is characterised by the return to the condition defined under 2.4.1 above, in the direction opposite to that on which the clearing signal was given. After transmission of a clearance signal over an international circuit, the clearance confirmation signal shall be returned within a period of 400 to 1 500 ms.

2.5 - Service signals

Although, on the internal networks, Railways must use the type of signalling (type A or type B of the CCITT - see Recommendation U1) best suited to their requirements, it should be borne in mind that the inter-connections provided for the purposes of international traffic should, in principle, enable all teleprinters to operate as a single network. The signalling system to be employed in international circuits shall consequently

be standardised to the greatest possible extent; special care should be taken to ensure that any supplementary circuits or extensions, particularly those introduced with a view to providing new transit facilities, do not involve any appreciable modification to existing installations on other Railways' networks.

★ Failing an agreement between adjoining Railways, the CCITT type B signalling system shall be adopted.

★ The signals to be employed are as follows :

- for call-confirmation, forming, at the same time, the proceed-to-select signal : one pulse of stop polarity with a nominal duration of 25 ms (between 17.5 and 35 ms);
- for selection : decimal pulses transmitted by a dial or a decimal pulse generator controlled by the teleprinter keyboard;
- as call-connected signal : one pulse of at least 2 seconds stop polarity;
- as a busy signal : a pulse of 200 milliseconds stop polarity (between 165 and 260 ms), followed by a pulse of 1 500 milliseconds start polarity (tolerance \pm 30%);
- in the event of disturbance, of unobtainable numbers, etc. : the busy signal (1);
- for return to the idle condition : permanent start polarity.

★ If two neighbouring Railways use CCITT type A signalling system on their national networks, the same system shall also be used on the inter-connecting circuits between the two Railways in question.

★ The CCITT type A signals to be employed in this case are as follows :

- for call-confirmation : permanent stop polarity;

(1) On existing installations which cannot be altered, a permanent start polarity is allowed.

- for proceed-to-select : one pulse of 40 ms (\pm 8 ms) start polarity;
- for selection : telegraph signs corresponding to the digits;
- as call-connected signal : one pulse of 150 ms (\pm 11 ms) start polarity; followed by one pulse of stop polarity lasting at least 2 seconds;
- as busy signal : telegraph signs followed by a clearance signal;
- in the event of disturbance, unobtainable numbers etc. : telegraph signs followed by a clearance signal.

2.6 - Fully manual exchanges

★ If circuits are connected to manual exchanges, the condition of the circuit, during the whole length of time it remains unoccupied by communications, shall correspond to that of the start pulse. The circuit is busied by means of current reversal.

An incoming call signal shall not be automatically confirmed immediately upon receipt; it will suffice for the operator to reply to the call when establishing contact. The signal establishing contact is transmitted to the caller in telegraph signs.

★ The end of transmission signal shall be transmitted to the exchange in the form of a pulse of at least 1 000 milliseconds, with the same polarity as that of the start pulse.

★ The clearance signal transmitted to the calling party or calling exchange shall be characterised by the return to the original condition (i.e. start polarities on both "outward" and "backward" signalling paths).

2.7 - Local lines of automatic networks terminating on manual exchanges

★ If local lines of automatic networks terminate on manual exchanges, each call passing from the automatic network to the manual exchange shall automatically be confirmed, immediately upon receipt, by means of a call-connected signal, and followed by a brief text, such as "MOM". The operator signals his intervention by transmitting telegraph signs to the caller.

★ The other signs and signals shall conform to those specified in Point 2.6.

2.8 - Point-to-point connections

★ When in the idle condition, the currents passing in the circuit shall correspond to the stop pulses of the teleprinter signals.

Calling from the office at the other end shall, as far as possible, be effected by interrupting the current passing when the circuit is idle, e.g. by depressing the "letters inversion" key.

2.9 - Automatic networks. Retransmission and information points

★ On automatic networks, at least one information point shall be provided for each large exchange.

It shall be capable of supplying information, establishing contact and, possibly, retransmitting telegrams to several addresses in international traffic; it shall, as far as possible, be given a standard call number over the whole network and shall be provided with receiving reperforators.

2.10 - Telegraph regenerator-retransmitters.

★ When automatic telegraph networks are interconnected, the distortion level shall be kept under close observation and maintained within acceptable limits. The country of origin shall consequently ensure that the output distortion of its network does not exceed 15%.

★ If this limit is exceeded, telegraph signal regenerator-retransmitters shall be brought into use. This equipment shall not be used while a call is being set up, particularly during the dialling pulse selection process.

★ The telegraph regenerator-retransmitters used :

- shall operate at the modulation rate of 50 bauds, with a tolerance on working speed not exceeding $\pm 0.5\%$;
- shall have an effective synchronous margin of at least 40%;
- shall operate in such a manner that the interval between the significant instants of the modulation retransmitted and the corresponding instants of the modulation of a perfect start-stop unit, working at the same rate of modulation, shall not be more than plus or minus one millisecond, it being understood that the significant instants at the beginning of the start transmission coincide on both units;
- shall, in no case, have significant instants corresponding to the beginning of the start elements transmitted at spacings of less than 7 unit intervals.

3 - TRANSMISSION SYSTEMS

3.1 - Choice of system

Voice-frequency telegraphy or time-division multiplex systems (interlacing of bits) shall be used for international telegraph circuits.

★ These various systems shall be allowed insofar as they comply with CCITT recommendations.

For voice-frequency telegraph systems, Point 3.2 gives, among these recommendations, those which are sufficient for the equipment opposability. For time-division multiplex systems, Point 3.3 includes only the main characteristics and reference shall be made, therefore, to CCITT Recommendation 101.

3.2 - Frequency-division multiplex systems (MRF) - (voice-frequency telegraphy)

When it is optional, frequency modulation should be chosen in preference to amplitude modulation.

★ In the case of frequency modulation equipment, the lowest frequency shall correspond to the stop polarity. With amplitude modulation systems, transmission of the stop element is characterised by transmission over the line.

3.2.1 - Frequency band and frequency stability of channels

As far as possible, voice-frequency telegraphy shall be used on telephone circuits transmitting a frequency band of 300 to 3 400 Hz.

★ The virtual carrier frequencies of carrier current telephone systems used as carriers for telegraph transmission, shall be stable to within the limits of ± 2 Hz.

Where 12-channel carrier current telephone transmission systems are used for voice-frequency telegraphy, it is advisable, as far as possible, to avoid using channels 1 and 12.

3.2.2 - Frequencies

★ In the case of voice-frequency telegraphy, it is necessary to comply with the following series of international frequencies :

Channel No.	Frequency Hz	Channel No.	Frequency Hz	Channel No.	Frequency Hz	Channel No.	Frequency Hz
1	420	7	1 140	13	1 860	19	2 580
2	540	8	1 260	14	1 980	20	2 700
3	660	9	1 380	15	2 100	21	2 820
4	780	10	1 500	16	2 220	22	2 940
5	900	11	1 620	17	2 340	23	3 060
6	1 020	12	1 740	18	2 460	24	3 180

3.2.3 - Frequency precision and frequency swing

★ In amplitude modulation systems, frequencies shall not deviate from their nominal values by more than 3 Hz. With frequency-modulated systems, the frequency swing shall be ± 30 Hz for channels with 120 Hz spacing and ± 60 Hz for channels with 240 Hz spacing. The difference between the two characteristic frequencies of one and the same channel (corresponding to pulses of start and stop polarity) shall be 60 Hz or 120 Hz depending on the nominal spacing between consecutive channels. As an exceptional measure, a difference of 70 Hz instead of 60 Hz may be accepted by mutual agreement between neighbouring Railways. The tolerance on the difference between the two characteristic frequencies of any one channel shall not exceed 3 Hz.

In the event of a failure of the modulator control voltage, it would be necessary, as far as possible, to transmit a frequency corresponding to the start polarity. In cases where the telegraph channel is cut, the receiver shall remain blocked at start polarity.

3.2.4 - Transmission level over channels

★ At the relative 0 level of the carrier telephone circuit, transmission level of the telegraph channels shall have the following values for an actual resistance of 600 ohms.

LEVEL IN DECIBELS (dBmo)		
Number of channels	Amplitude modulation systems	Frequency modulation systems
1 to 12	- 14.5	- 19.5
13 to 18	- 18.5	- 21.5
19 to 24	- 20.5	- 22.5

3.2.5 - Variations in receiving level

★ Amplitude modulation systems must be suitable for slow variations of ± 6 dB, even in cases where several circuits are end-to-end connected. As regards frequency modulation systems, the receiving equipment must operate satisfactorily when the receiving level falls to 17.5 dB beneath the nominal level.

Transmission receiving units on which the normal input level falls by 18.5 dB unintentionally in the case of amplitude modulation systems, and by 23.5 dB in the case of frequency modulation systems, should give rise to a break in communication (clearance).

3.2.6 - Start-stop distortion

★ Telegraph transmission systems shall not cause more than 8% start-stop distortion in each section.

The following table indicates the start-stop distortion which must not be exceeded when several channels are connected in series :

- 2 channels : 13% start-stop distortion,
- 3 channels : 17% start-stop distortion,
- 4 channels : 21% start-stop distortion,
- 5 channels : 25% start-stop distortion.

3.3 - Time-division multiplex systems (MRT)

3.3.1 - Types of system - Capacities - Selection of system to be standardised

The CCITT defines two categories of such systems : character-to-character multiplexing systems and bit-to-bit multiplexing systems.

★ Bit-to-bit multiplexors, defined in CCITT Recommendation 101, shall be selected for international links because they have minimum transfer times.

Recommendation 101 defines two possible variants which, besides, cannot be compared to one another :

- Variant A, which supplies 48 channels at a speed of 50 bauds or 22 channels at 75 bauds,
- Variant B, which can supply all combinations of numbers and speeds over channels (50, 75, 100, 110, 134.5, 150, 200 and 300 bauds), so that the product "number x speed" is about 2 400 bauds (e.g. 48 channels at a speed of 50 bauds or 40 channels at 50 bauds and 1 channel at 300 bauds, etc.).

★ In view of the fact that it may be necessary to increase telegraph transmission speeds, Variant B shall be selected for international links.

3.3.2 - General organisation of the system

The multiplexor transmits all elements of characters, which comprise 7.5 unit elements, including 1.5 for the stop element at speeds of 50 and 75 bauds, and up to 10 or 11 unit intervals, including 1 or 2 for the stop element, at other speeds.

The multiplexor includes bits corresponding to the stop polarity for non-equipped or non-allocated channels, and for the "open" condition of the start-stop channels which are served.

The multiplex frame consists of 47-bit sub-frames, the first bit being a synchronisation bit, and of main frames made up of 2 sub-frames.

★ The sub-frame is divided into four groups of channel numbers. All bits of groups 3 and 4 give inverted polarities.

The synchronisation is achieved on 3 main frames. The loss in synchronisation at one of the terminals is indicated to the other in less than 240 ms and acknowledged in the time of 2 synchronisation sequences. The lapse of time necessary for the resumption of normal transmission, after restoration of the composite signal, is less than 300 ms.

3.3.3 - Tolerances on modulations

a) Entry of start-stop channels

★ The tolerance on modulation speed shall be $\pm 2\%$ at speeds of 50 and 75 bauds and $\pm 1.8\%$ at other speeds.

The system admits start elements with 0.4 unit interval and, for incoming separate signals at 50 or 75 bauds, stop elements with 1 unit interval.

Its actual net margin shall be no less than 40%.

★ The system admits control signals of types A and B with, in the latter case, speeds of 9 to 11 dial pulses per second with a break to make ratio of 1/1.2 to 1/1.9.

b) Exit of start-stop channels

★ The degree of start-stop distortion on a channel shall not exceed 3% and the tolerance on speed $\pm 0.2\%$.

Dial pulses are produced with the same tolerances as in a) above.

The other control pulses shall, as a general rule, have a tolerance of ± 3 ms.

3.3.4 - Carrier transmission channel

★ The carrier transmission channel of the composite signal must have the characteristics defined in UIC Leaflet 911-4, for the binary signalling rate of 2 400/bits/s. It must be provided with modems complying with the type also defined in the same leaflet.

3.4 - Operation in progressive stages

★ On telephone circuits carrying international telegraph links, the telegraph channels which are not in service may only be used internally by a country after prior agreement has been obtained from the other participating Railway.

Such channels shall, as far as possible, be reserved for extensions of international links.

When these channels are used exceptionally by a country for its internal traffic requirements, they shall be connected by means of an appropriate system (high impedance shunt for voice-frequency telegraph systems or intermediate multiplexor for time-division multiplex systems).

3.5 - Operating reliability

It is recommended that emergency power supplies be provided for telegraph installations. As far as possible, such power supplies should be switched into service automatically, ensuring that the installations remain in continuous operation, without the slightest break in communication.

★ Each break caused by a supply failure shall be of sufficient duration to enable it to be accurately identified by the receiving office.

3.6 - Maintenance and measurements

★ When the start-stop distortion between two teleprinters is measured on international circuits, one of the following model texts shall be used :

1. voyez le brick géant que j'examine près du wharf
2. kaufen Sie jede Woche vier gute und bequeme Pelze XYZ 1234567890
3. the quick brown fox jumps over the lazy dog

★ The following text shall be used for testing the various parts of a complete international telegraph link :

- Letters inversion
- S
- carriage return
- Line feed
- Q
- digits inversion
- space
- 9

If, however, distortion-meters are used for the purpose of making adjustments, it is convenient to use signals with 1/1, 2/2, 1/6, 6/1 ratios.

★ The transmission and receiving levels shall be measured once each month. Telegraph relays shall be inspected once in every three months. The neutral position of the receivers shall be checked once each month.

However, in cases where two neighbouring Railways agree to apply the margin and distortion systems of maintenance (see Appendix 2), the levels and telegraph relays need only be checked when measurement of the margin and telegraph distortion indicates that the values are insufficient.

★ The central switchgear where the international circuits terminate shall be provided with adequate measuring instruments. The latter shall comprise at least one start-stop distortion-meter and one distortion-free transmitter of start-stop signals.

INTERNATIONAL ALPHABET No. 2

N°	Unit					Letters	Digits and signs
	1	2	3	4	5		
1	•	•				A	-
2	•			•	•	B	?
3		•	•	•		C	:
4	•			•		D	Who are you ? ☒
5	•					E	3
6	•		•	•		F	} Available for internal use
7		•		•	•	G	
8			•		•	H	
9		•	•			I	8
10	•	•		•		J	☞ Bell to ring the correspondent
11	•	•	•	•		K	(
12		•			•	L)
13			•	•	•	M	.
14			•	•		N	,
15				•	•	O	9
16		•	•		•	P	0
17	•	•	•		•	Q	1
18		•		•		R	4
19	•		•			S	!
20					•	T	5
21	•	•	•			U	7
22		•	•	•	•	V	=
23	•	•			•	W	2
24	•		•	•	•	X	/
25	•		•		•	Y	6
26	•				•	Z	+
27				•		Carriage return	(1)
28		•				Line feed	(2)
29	•	•	•	•	•	Letters inversion	(3)
30	•	•		•	•	Digits inversion	
31			•			Blank space	
32						Not in use	

(1) May print the sign ☞ on tape equipment for signal check purposes.

(2) May print the sign = on tape equipment for signal check purposes.

(3) Enables an error to be cancelled in cases where a tape is prepared.

APPENDIX 2

MAINTENANCE BY MEASUREMENT OF MARGIN
AND TELEGRAPH DISTORTION

1 - Margin and distortion

The degree of start-stop distortion present in transmission, as also the complementary concept of receiving margin, both constitute very sensitive criteria of the quality of a start-stop signal train. These factors are normally measured to an accuracy of 2%, equivalent to an error of ± 0.4 ms.

The limiting values laid down at the terminals of each teleprinter are as follows :

$$d_o \leq 5 \% \quad M_o \geq 35 \%$$

The effective values are the *local* distortion and margin.

2 - Margin and telegraph distortion considered from a general aspect

On any telegraph circuit established between two teleprinters I and II and passing through certain items of equipment (switches, telegraph channels), a value for the margin and distortion can be obtained at any point: these being the values at this point (i) for the margins and telegraph distortions of teleprinters I and II. The respective values are as shown below :

$(d_I)_i$ and $(d_{II})_i$, the distortions in respect of I and II;

$(M_I)_i$ and $(M_{II})_i$, the margins in respect of I and II;

For an exchange of telegrams to be possible, it is clearly necessary that, in each point i, the margin be greater than the telegraph distortion, and this with a certain degree of reliability. If, for example, a reliability factor of 10% is desired, it would be necessary to have the following values :

$$(M_{II})_i - (d_I)_i \geq 10 \% \quad \text{and} \quad (M_I)_i - (d_{II})_i \geq 10 \%$$

APPENDIX 2

3 - Limiting values for margin and telegraph distortion on a simple network connected through a single switch

When measured from the particular point formed by the switch, each teleprinter shows a certain margin and telegraph distortion, irrespective of the length and composition of the local lines.

The limiting values, both under margin and telegraph distortion conditions, may, when measured at the switch point, serve to define the quality of the local lines terminating at the switch; if the lower margin (i.e. the most inferior) is greater than the highest telegraph distortion observed for this switch, communication may be established between any pair of teleprinters connected to this switch.

In practice, the telegraph distortion of any teleprinter can easily be measured by means of a distortion-meter; the margin of a teleprinter shall be determined by transmitting a message to it from a calibrated transmitter, with an increasing known and adjustable distortion, until reception is marred by the presence of errors.

4 - Margins and telegraph distortions in a network comprising several switches

It is sufficient, in such a network, to consider, for each switch, only the teleprinter producing the greatest telegraph distortion and the teleprinter which has the smallest margin; where long distance communications are concerned, these two values suffice to indicate the characteristics of each switch. On reflection, it will be seen that the Railways can replace the latter by their most unfavourable teleprinters.

e.g. $M_A d_A$ as $M_B d_B$, the values for two switches A and B.

By measuring, at switch B, the margin and telegraph distortion on the least favourable teleprinters of switch A, across the circuits connecting A to B, new values are obtained, these being $(M_A)_B$ and $(d_A)_B$.

Once again it is necessary that : $(M_A)_B - d_B \geq 0$ and

$$M_B - (d_A)_B \geq 0$$

APPENDIX 2

The establishment of pairs of values for all the switch pairs of the network will result in the determination of a corresponding number of unmatched equations which will all require to be resolved before the network can deal with all communications to be exchanged.

In practice, it is useful, when carrying out checks based on this method, to have available in each switching station, for the purposes of long distance tests, a signal transmitter incorporating a known distortion corresponding to the telegraph distortion of the least favourable teleprinter connected to this switch; in the same way, it is useful to have available a teleprinter on which the marginal adjustment has been offset in order to give the least favourable margin of all those encountered in this switch. It is thus possible for long distance measurements to be rapidly undertaken through all the other switches; such tests greatly facilitate maintenance and avoid the need to adjust the settings of polarised relays, etc.; in view of the ease and rapidity with which they can be undertaken, the tests can be carried out at frequent intervals.

APPENDIX 3

COUNTRY-CODE FOR THE IDENTIFICATION DEVICES
IN ACCORDANCE WITH THE CCITT RECOMMENDATIONS

A	=	Austria
B	=	Belgium
BG	=	Bulgaria
CH	=	Switzerland
CS	=	Czechoslovakia
D	=	German Federal Republic
DD	=	German Democratic Republic
DK	=	Denmark
E	=	Spain
EI	=	Eire
F	=	France
GB	=	Great Britain
GR	=	Greece
H	=	Hungary
I	=	Italy
L	=	Luxembourg
N	=	Norway
NL	=	Netherlands
P	=	Portugal
PL	=	Poland
R	=	Rumania
S	=	Sweden
SF	=	Finland
TR	=	Turkey
YU	=	Yugoslavia

APPLICATION

With effect from 1 January 1982 as regards obligatory provisions, and for new installations and those installations which will be largely modified.

All Railways in the Union.

RECORD REFERENCES

Headings under which the question has been dealt with :

- Various telecommunications questions :

a) extension and standardisation of international communications by teleprinters.

b) c)
(4th-5th Committees -E- : Hamburg, June, 1954).

- Various telecommunications questions :

a) Extension and standardisation of international links by teleprinters.

b) c) d)
(4th-5th Committees -E- : Copenhagen, May, 1956).

- Various questions concerning the improvement of telecommunications links :

a) b) c) d) Equipment and arrangement of circuits for telegraph transmission by teleprinters ;

e)
(5th Committee -E- : Budapest June, 1953. - 7th Committee -S- : Prague, June, 1959 ; Stuttgart, May, 1960 ; Paris, May, 1961. - Urgency procedure).

- Various questions concerning the improvement of telecommunications links.

- Revision of Leaflets 752 to 756.
(Sub-Committee for Telecommunications : Paris, January 1970).

- Revision of leaflets concerning radio, telephony and telegraphy.
(Way and Works Committee : Madrid, June 1981).