

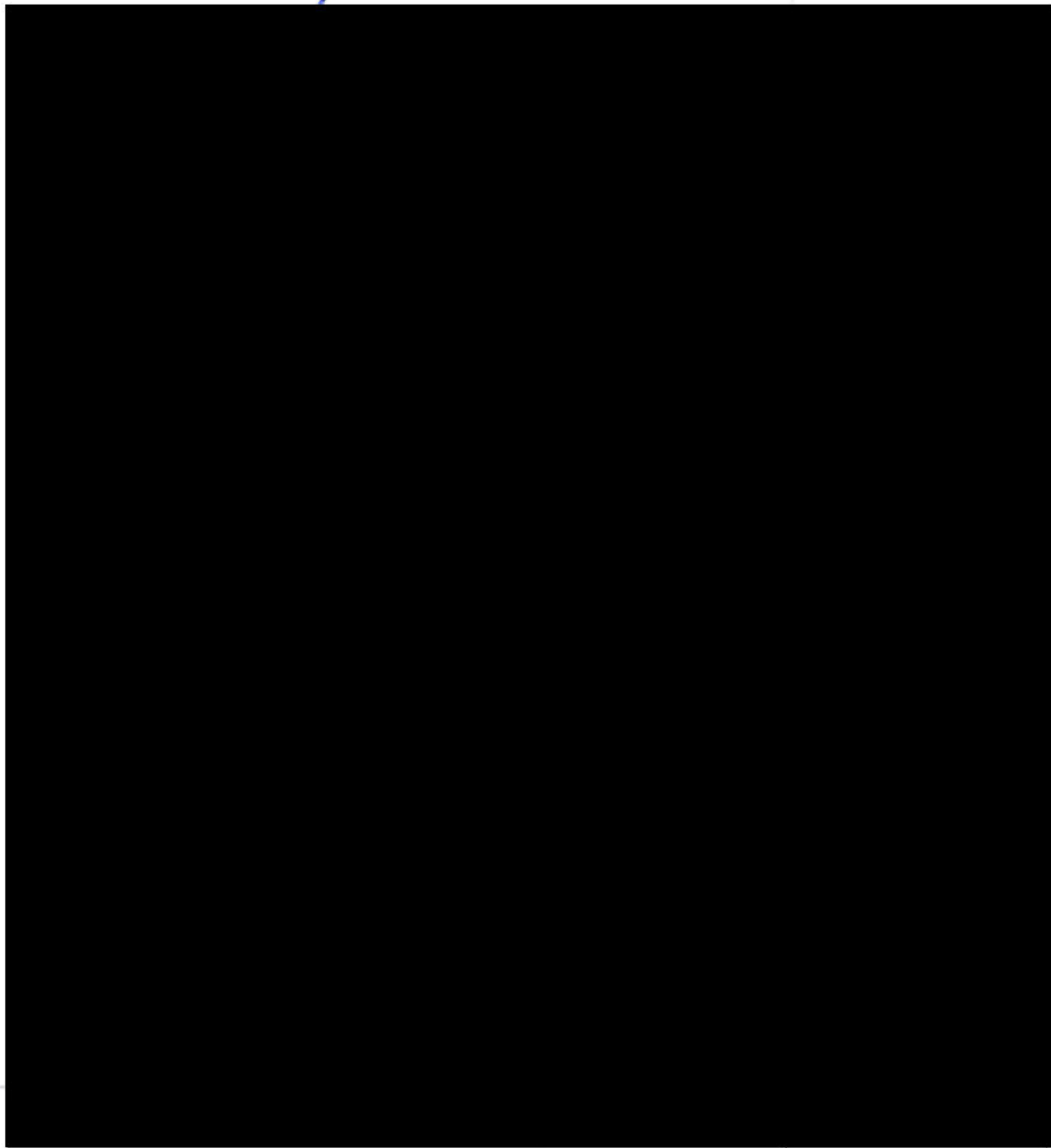
judgment and take proceedings in any other jurisdiction in which the Service Provider is incorporated or in which any assets of the Service Provider may be situated. The Parties agree irrevocably to submit to that jurisdiction.

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THE CONTRACT has been signed for and on behalf of the Parties the day and year written above.

Signed by
for and on behalf of
the **Authority**

Signed by
for and on behalf of
the **Service Provider**



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Section 1

SCHEDULE 1 - KEY CONTRACT INFORMATION

Contract Reference Number: LT-C-18-136

Name of Service Provider: Liebherr Transportation Systems

Commencement:

(a) **Contract Commencement Date:** 07th December 2018

(b) **Service Commencement Date:** 07th December 2018

Duration/Expiry Date: 6 months + 3 months

Payment (see Clauses 5.1, 5.2 and 5.4):

Clause 5.1

30 working days from invoicing

Clause 5.2

NA

Clause 5.4

30 working days from invoicing.

Address where invoices shall be sent:

London Trams
Accounts Payable
1st Floor
PO Box 45276
14 Pier Walk
London
SE10 1AJ

**Electronic format required (if any) for submission of orders by the
Authority and of invoices by the Service Provider:** NA

Time for payment where not 30 days (see Clause 5.4): 30 working days
from invoicing.

Details of the Authority's Contract Manager

Name: [REDACTED]
Address: London Trams, Tramlink Depot
Coomber Way
Croydon, CR0 4TQ
Tel: [REDACTED]
Fax: [REDACTED]
Email: [REDACTED]

Details of the Authority's Procurement Manager

Name: [REDACTED]
Address: 11th Floor, Knollys House
17 Addiscombe Road
Croydon CR0 6SR
Tel: [REDACTED]
Email: [REDACTED]

Service Provider's Key Personnel:

Name & Position	Contact Details	Area of Responsibility
[REDACTED]	Liebherr-Transportation Systems GmbH & Co KG Liebherr-Sunderland Works Ltd. Ayes Quay, Deptford Terrace, Sunderland, SR4 6DD, UNITED KINGDOM [REDACTED]	Commercial & Sales

Notice period in accordance with Clause 27.4 (termination without cause):
Clause 27.4 does not apply



Address for service of notices and other documents in accordance with
Clause 36:

For the Authority:

London Trams
11th Floor, Knollys House
17 Addiscombe Road
Croydon
CR0 6SR

For the attention of: Senior Commercial Manager

For the Service Provider: Liebherr-Transportation Systems GmbH & Co KG
Liebherr-Sunderland Works Ltd
Ayres Quay
Deptford Terrace
Sunderland
SR4 6DD

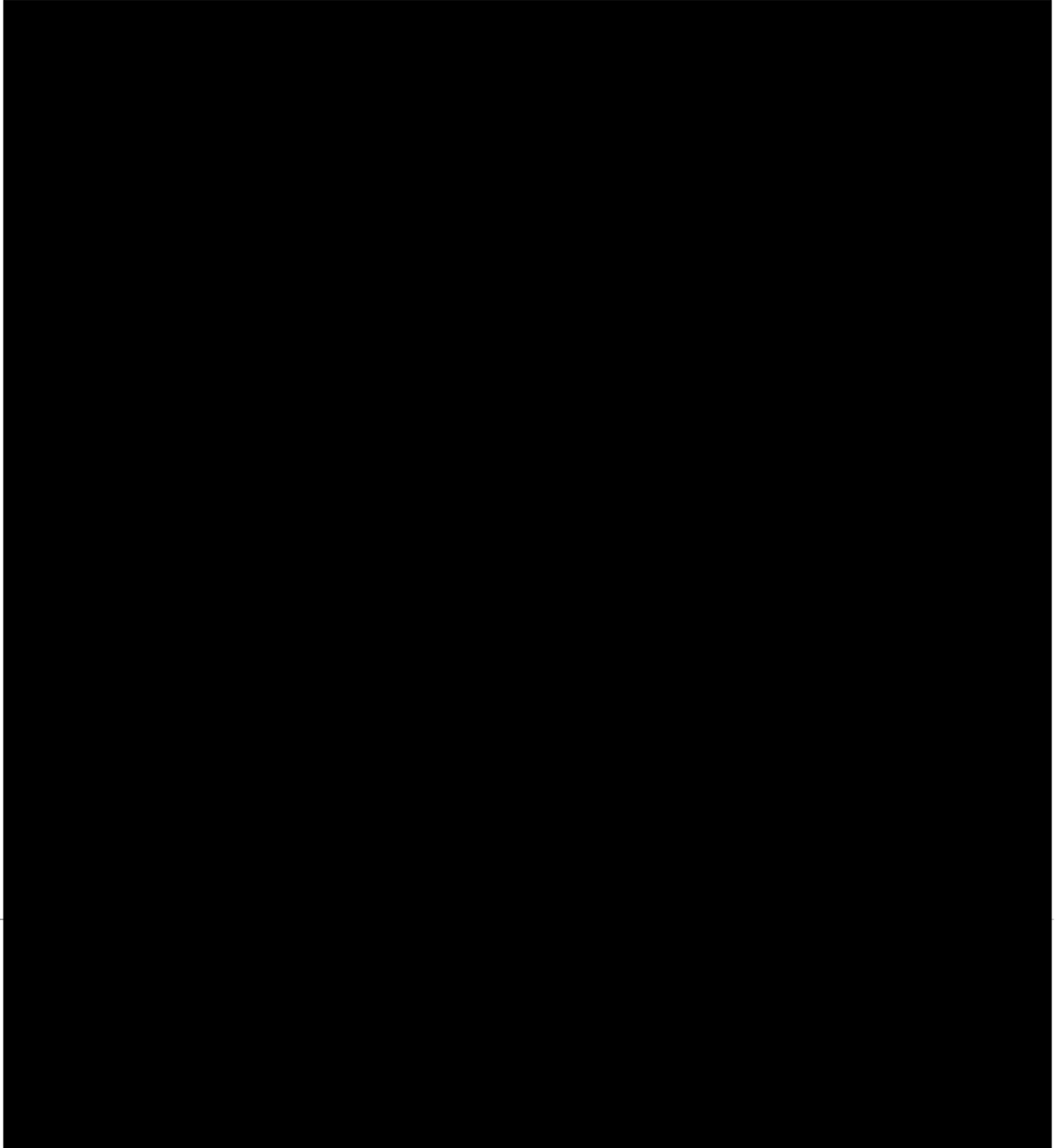
For the attention of: Contract Manager

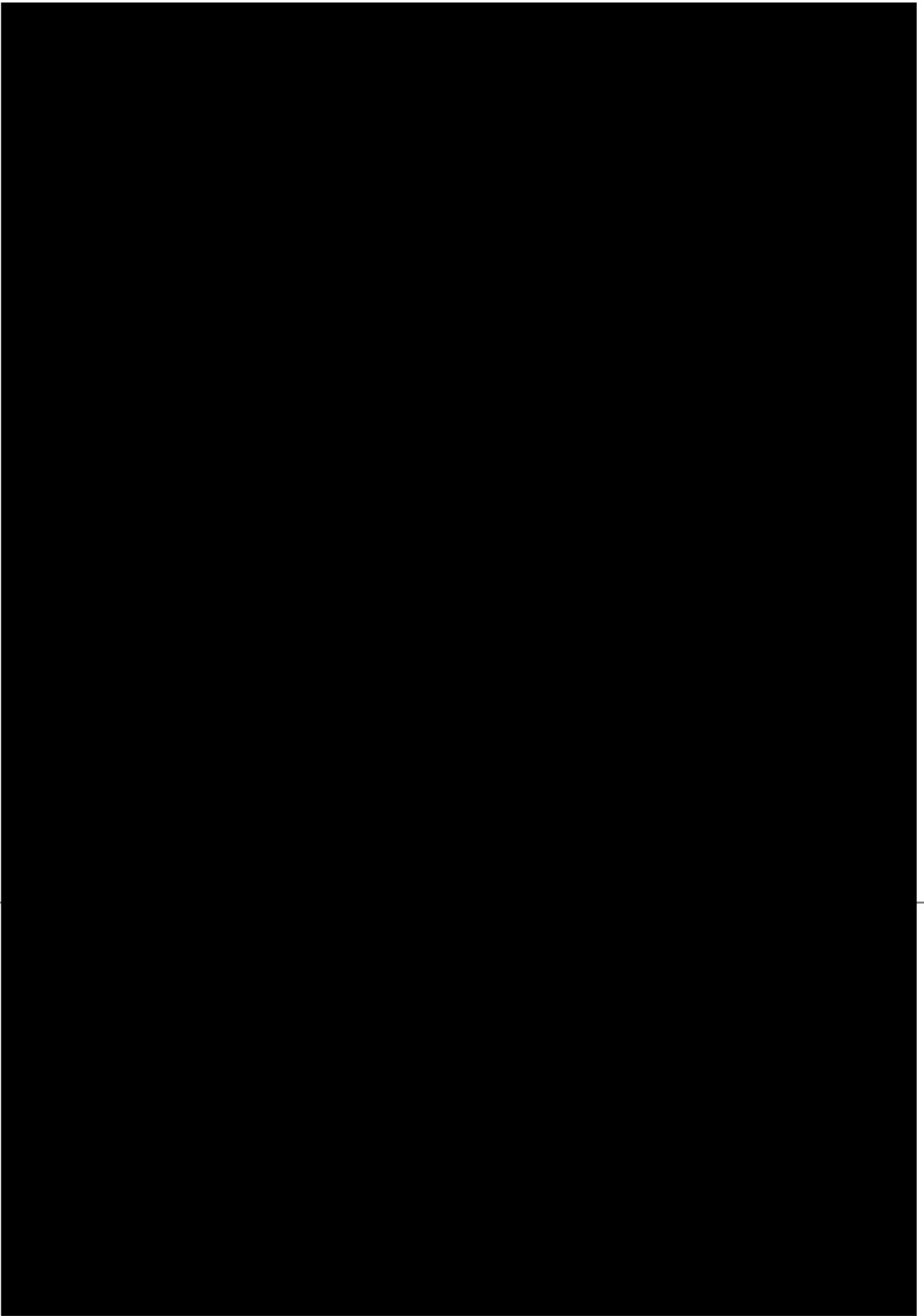
Office facilities to be provided to the Service Provider in accordance with
Clause 11.3: NA

Training to be provided by the Service Provider in accordance with Clause
8.8: NA

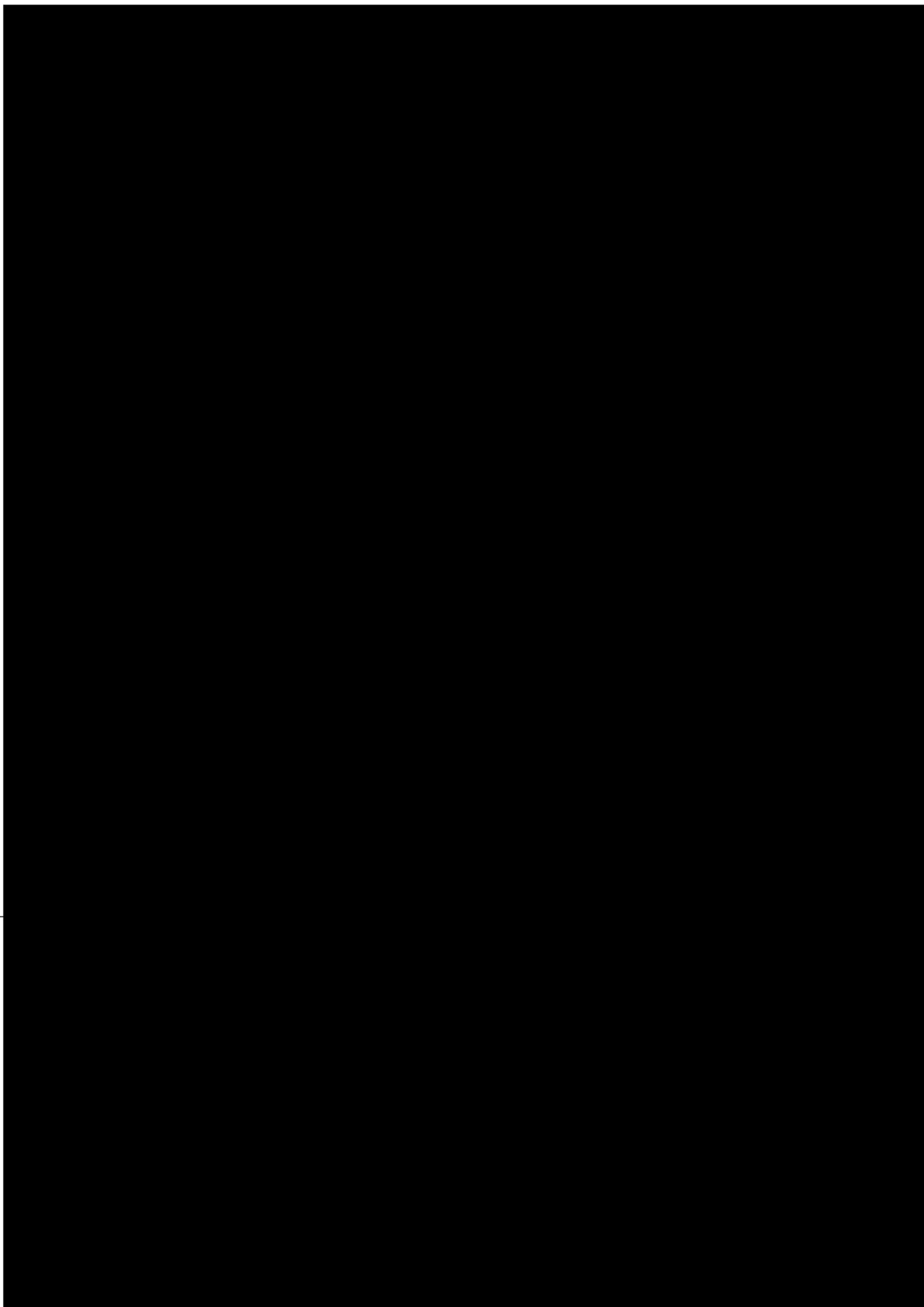
Section 2

SCHEDULE 2 - SPECIAL CONDITIONS OF CONTRACT

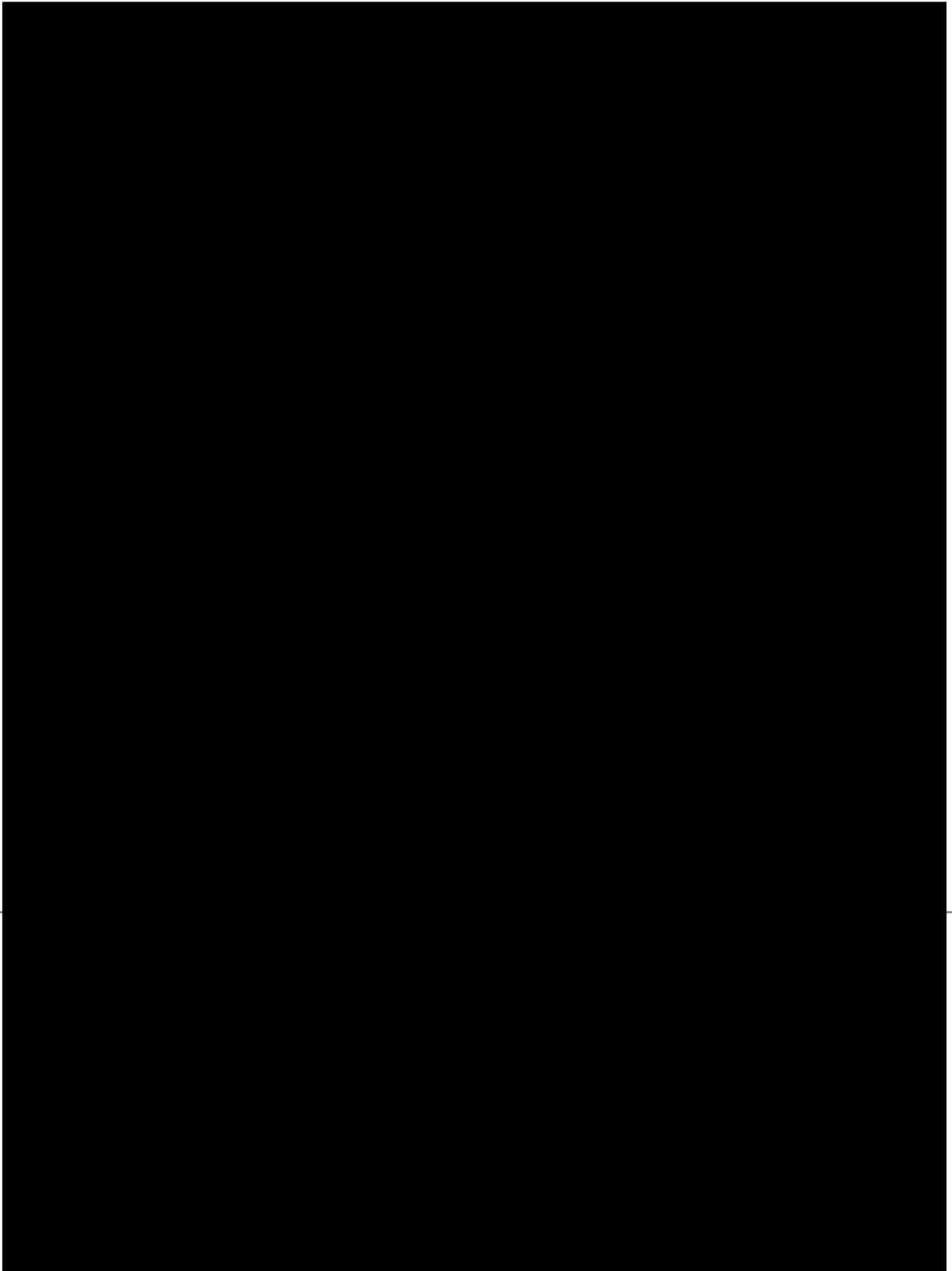




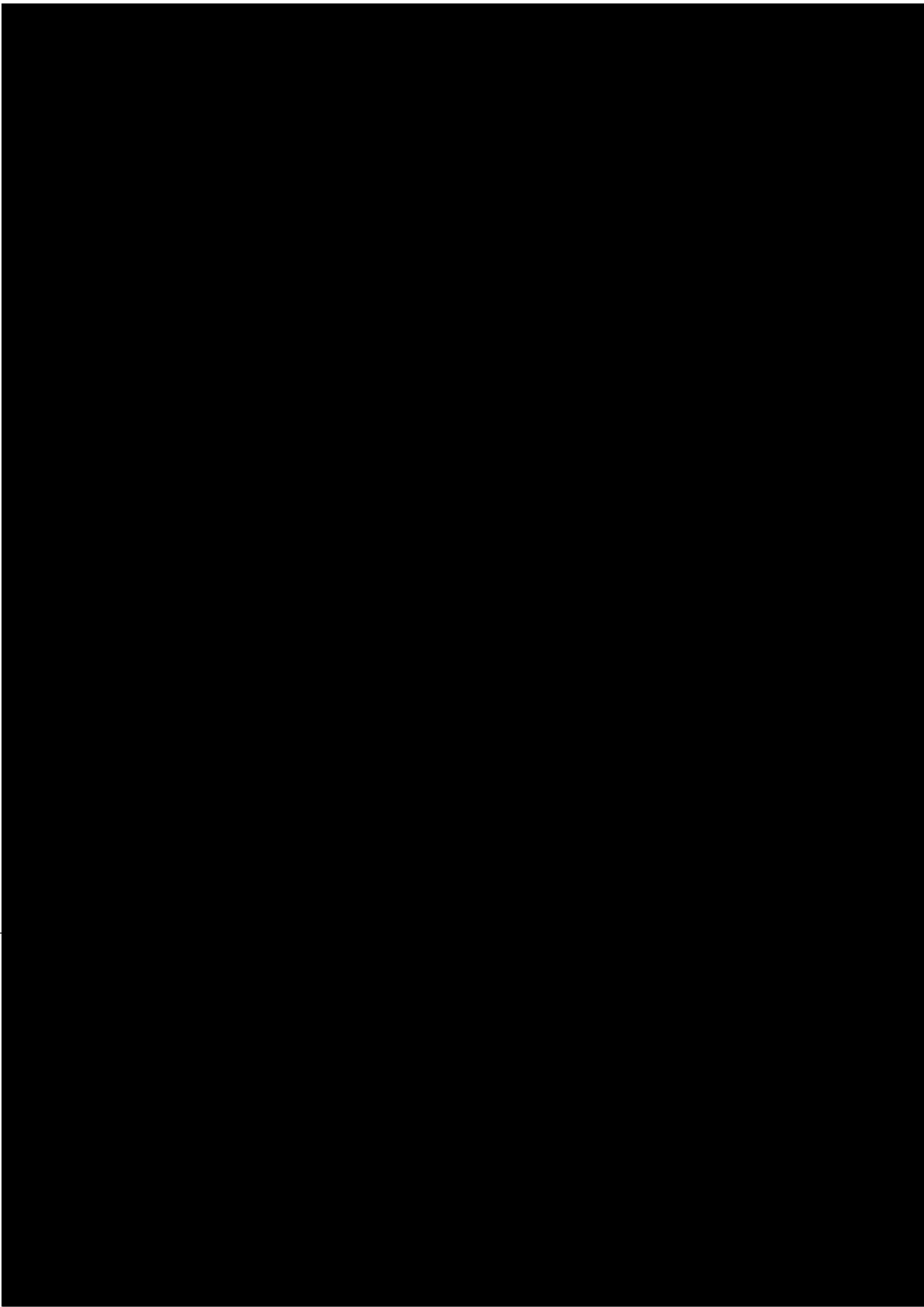
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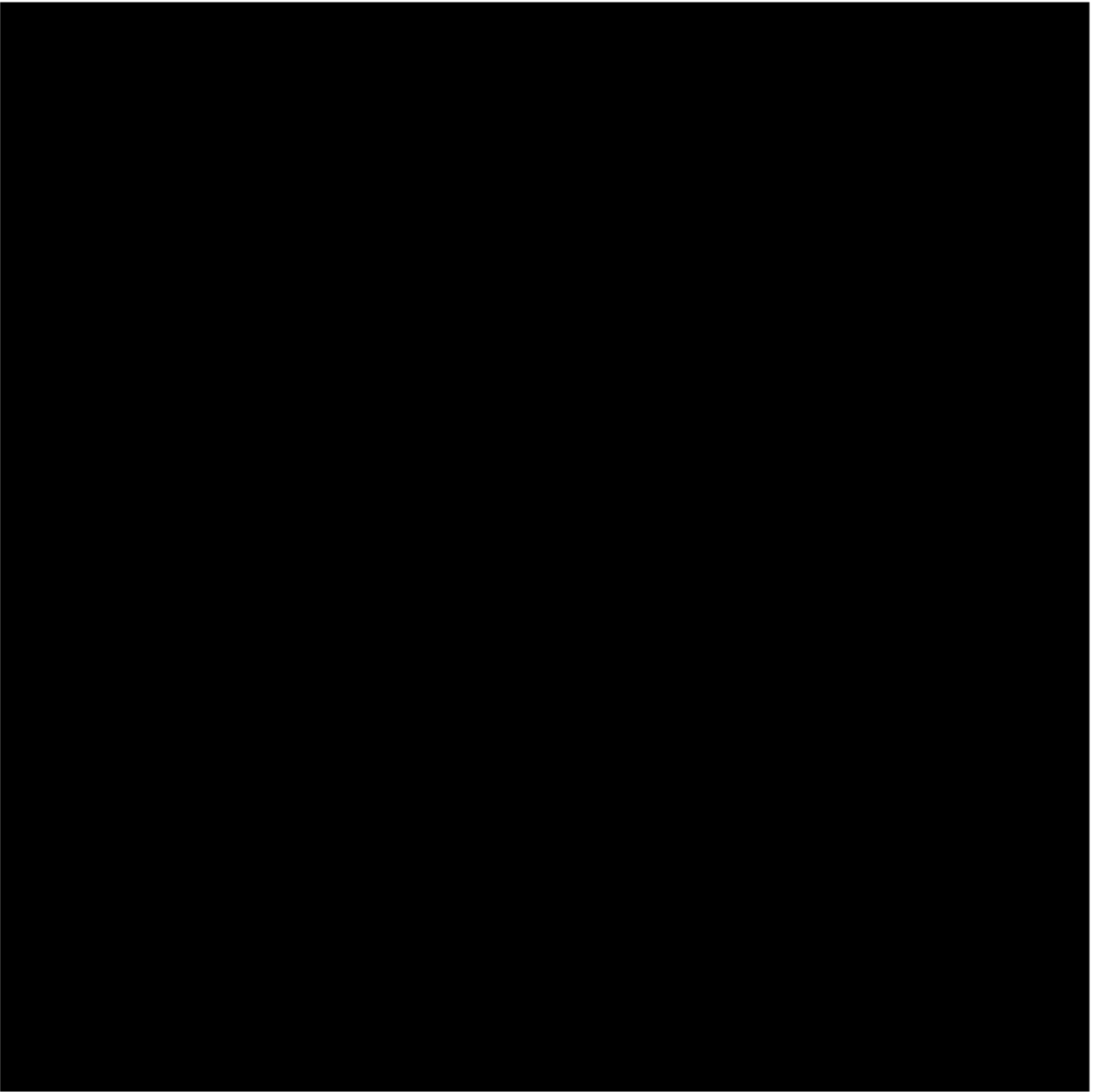
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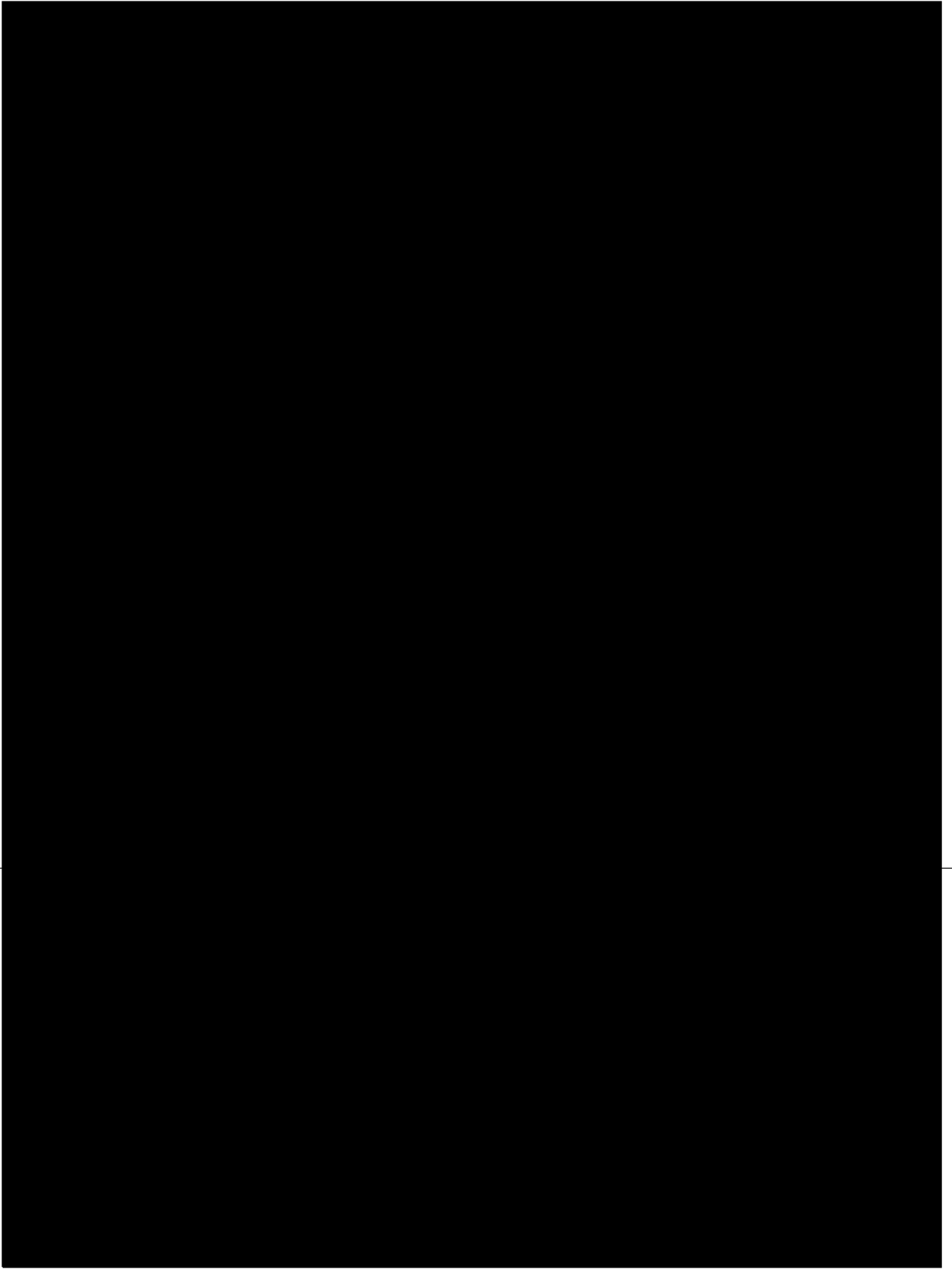
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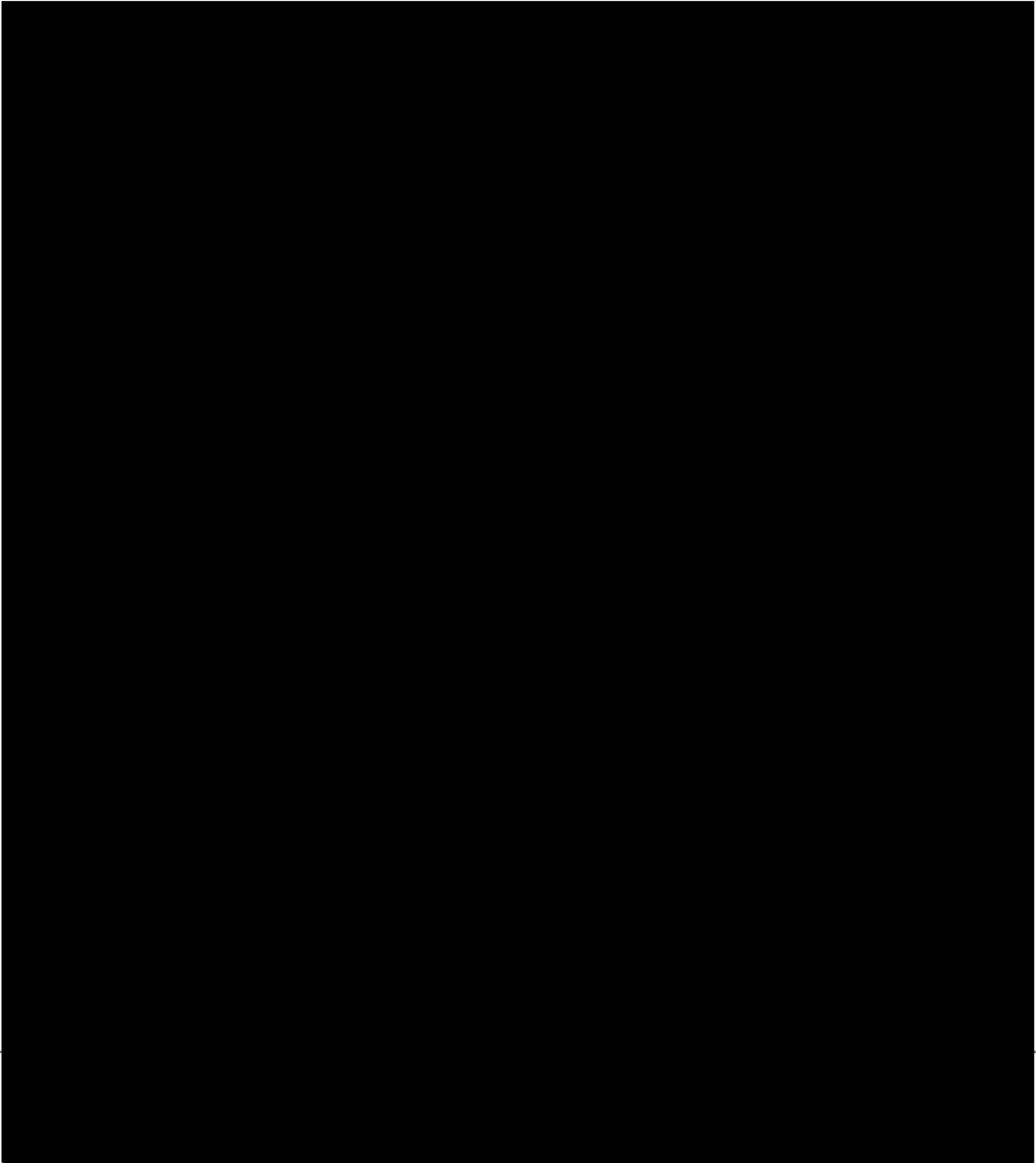
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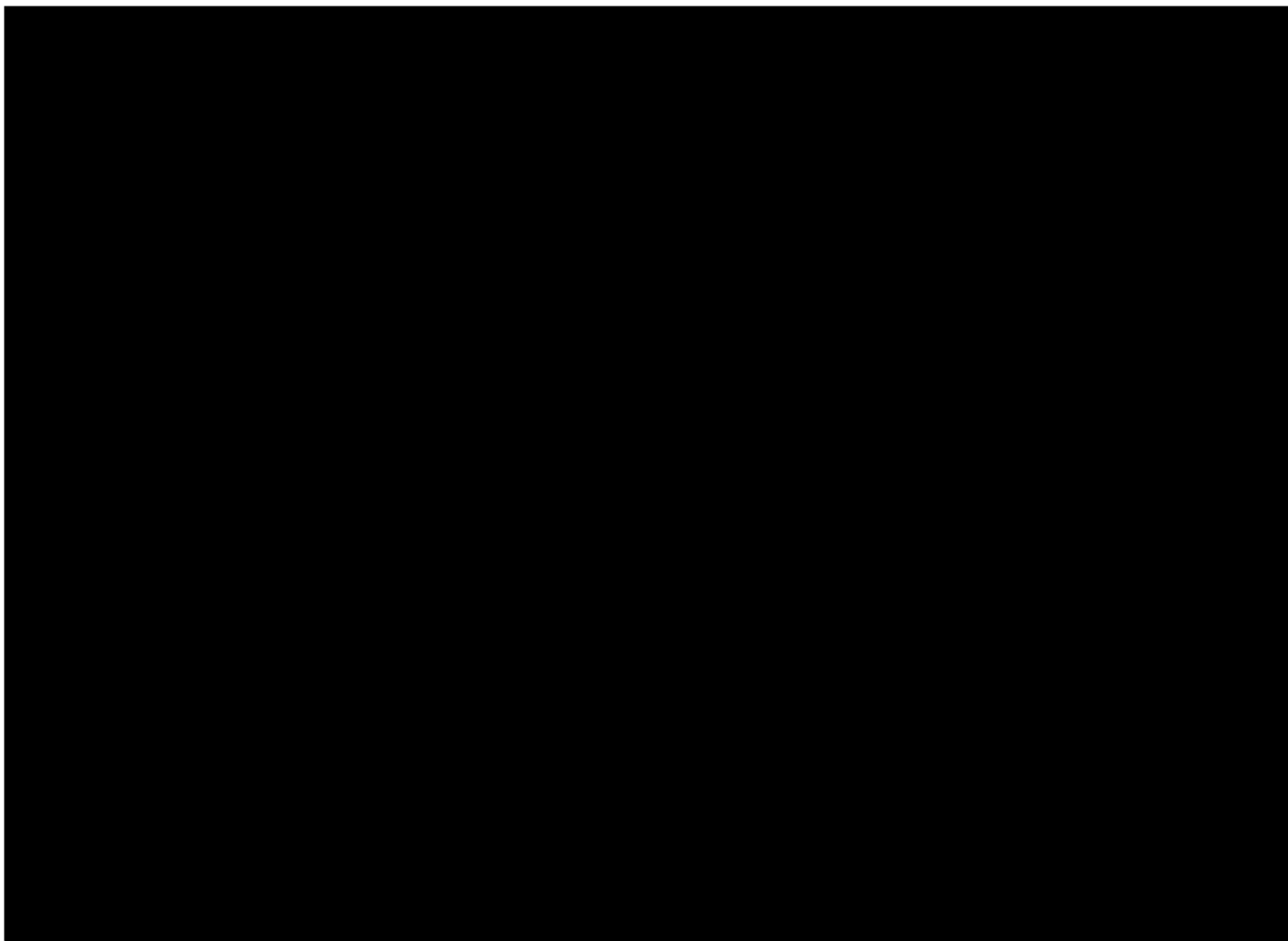
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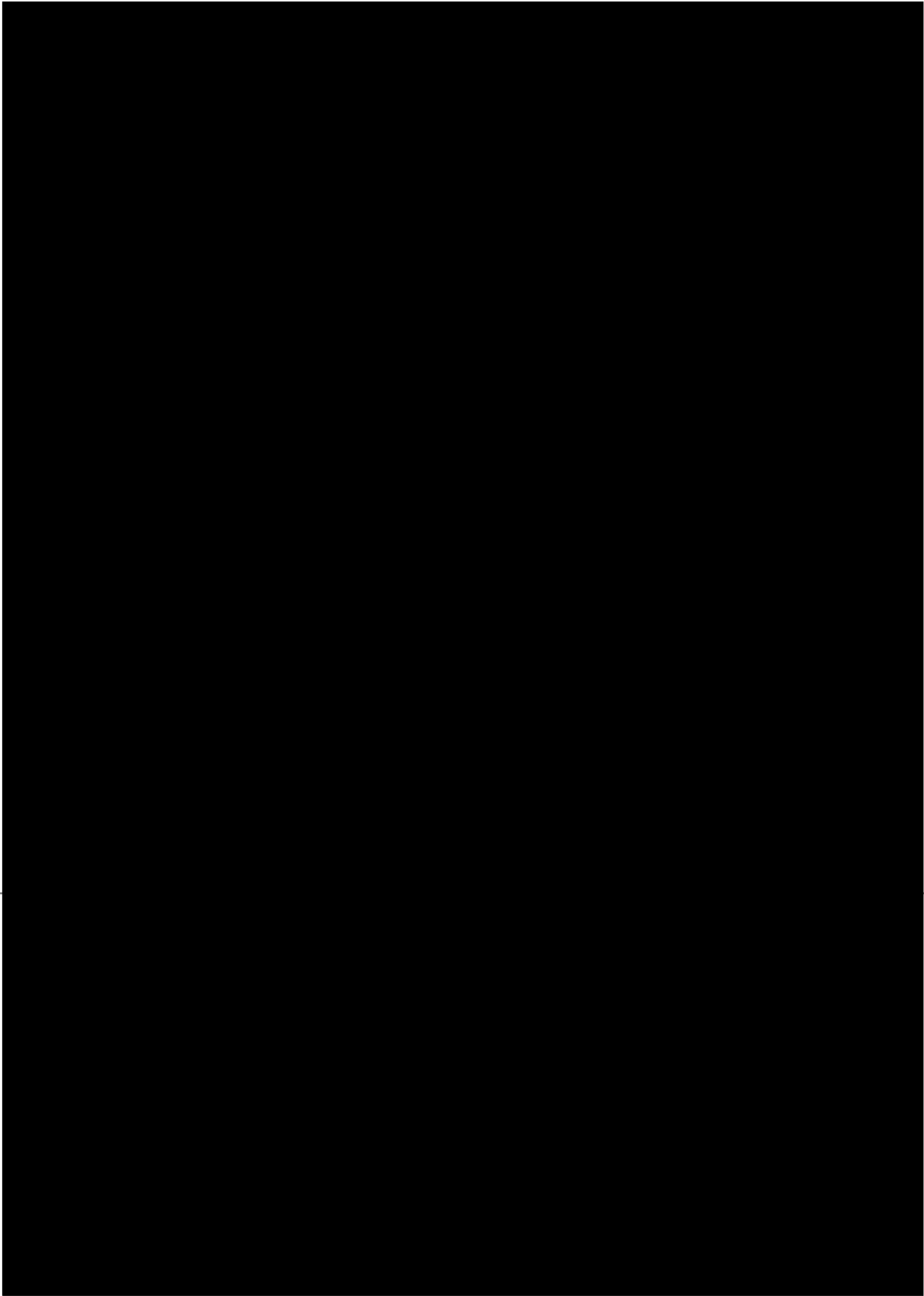
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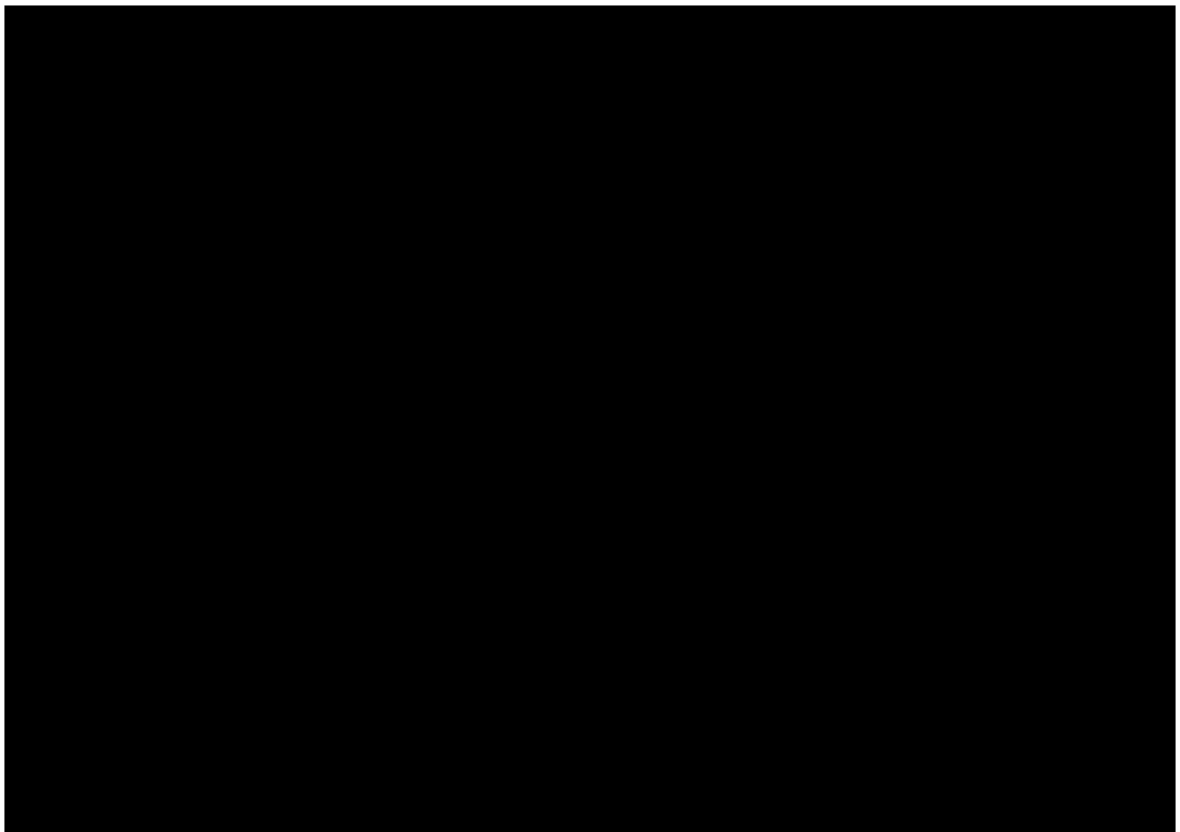
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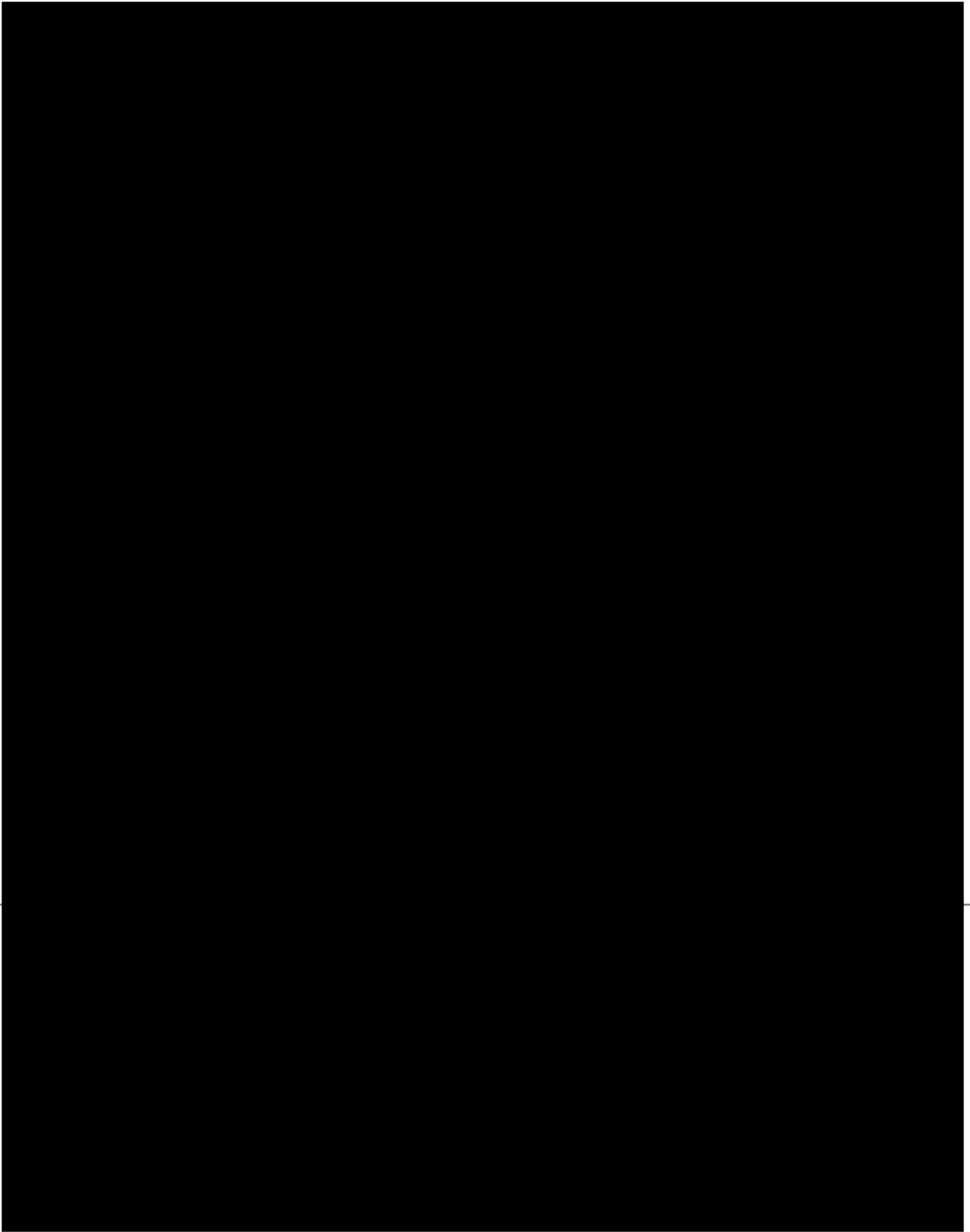


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Section 3

SCHEDULE 3 – SPECIFICATION

1. Purpose of Goods / Services

- 1.1 This specification describes a proposal from the Original Equipment Manufacturer (OEM) LIEBHERR, to install three component modifications to the Saloon Heating, Ventilation, and Air Conditioning (HVAC) units on the STADER Variobahn Tram (SVT) fleet.
- 1.2 The objective of this proposal is to resolve the three highest reliability failures identified by LIEBHERR to date.
- 1.3 London Trams interprets the statement in 1.2 above as the failure modes as reported by LIEBHERR to be resolved resulting in the condenser coils lasting for the remaining operational life of the HVAC units (within normal operating conditions being fair wear and tear) and both heater elements and pressure switches not requiring an interim replacement between overhaul intervals as a minimum.

2. Background

- 2.1 London Trams has 12 SVT's which are fitted with LIEBHERR's HVAC systems for cooling and heating of the cabs and saloons.
- 2.2 Each Tram is fitted with two saloon HVAC units.
- 2.3 There are 27 saloon HVAC units in total across the SVT fleet comprising of 24 saloons HVAC units fitted to Trams and three spare units.
- 2.4 A review of the reliability and performance of the saloon HVAC system highlighted the top three system issues as;

Condenser Coil Failures:

- 2.4.1 The condenser coils are failing due to corrosion, weakening the coil structure and causing refrigerant leaks via cracks that have resulted from structural weakening within the coil assembly.
- 2.5.2 The coil assembly on the SVT HVAC systems is of an aluminium design as originally specified.
- 2.5.3 LIEBHERR has recommended a replacement copper coil design of which they have experience across other rail applications to have a higher level of resistance against corrosion, structural weakening and failure of the coil assembly.

2.5.4 It should also be noted that the condenser coil assembly is normally good for the full operational life of the HVAC unit and therefore it is expected that this modification will remove the corrosion and structural failures (cracks) and allow the condenser coil to run until end of the operational life of the HVAC unit.

Heating Element Failures:

2.5.5. The heater banks have been found to fail due to deformation (sagging) of the individual heater elements within the centre of the bank where the elements are un-supported.

2.5.6 Deforming and sagging of the individual elements results in element failure and the entire heater bank within the module becoming defective.

2.5.7 LIEBHERR has proposed to replace the heater banks with heater elements of a larger outer diameter design (increased to 10.2mm outside diameter) of which they have had proven operational history on other rail fleets to not suffer from this type of defect and require not electrical or power supply modification to the tram or HVAC unit

High and Low, Pressure Switch Failures

2.5.8 All the pressure switches have been found to suffer from water ingress and corrosion on the electrical connections and contact tips, thus resulting in switch failures.

2.5.9 On the saloon HVAC system, pressure switch failures have been causing damage to the compressors resulting in compressor failures prior to their overhaul periodicity.

2.5.10 LIEBHERR are offering a solid state IP65 rated combined low and high-pressure switch assembly for the core system and an IP55 rated (cannot obtain a higher rating for the switch spec) for controlling the condenser fans.

2.5.11 LIEBHERR has also conducted a level of accelerated corrosion testing by exposing the IP 55 rated switch to their salt water test enclosure and the results to date have shown no corrosion developing.

3. Scope

3.1 The scope of work will be divided into two sections being the responsibility of London Trams and secondly the responsibility LIEBHERR.

3.2 Responsibility of London Trams

3.2.1 Inspecting the physical condition of the saloon HVAC unit prior to removal from the Tram and noting and recording any areas of known defects that require attention.

3.2.2 The inspection results will be recorded on a works order and a copy sent with the saloon HVAC unit to LIEBHERR.

3.2.3 Removal of the saloon HVAC unit from the tram

3.2.4 Transportation of the saloon HVAC unit to LIEBHERR

3.2.5 Refit of the saloon HVAC unit onto the Tram

3.2.6 Completing a physical inspection on each saloon HVAC unit prior to installation and a functional test post installation onto the Tram.

3.2.7 The details of the functional test are to be discussed and agreed with LIEBHERR but anticipate that this is to include running a functional heating and cooling cycle test as a minimum whilst checking that the system is operating within design parameters (temperatures, pressures and airflow, depending on what is measurable within software parameters) and responding to commands.

3.2.8 A copy of the physical inspection and functional test results will be provided to LIEBHERR and added to a works order for completing the installation.

Responsibility of LIEBHERR

3.3.9 Complete a physical inspection on the condition of the saloon HVAC unit and record and advise London Trams on any issues that are deemed to require attention.

3.3.10 Complete a 'Health Check' which must include but not limited to the following;

1. Checking the condition of all the electrical components, measuring and recording insulation and resistance values.
2. Inspection for any refrigerant gas leaks
3. Checking the condition of the condenser and fresh/recirc. air motors and impellers/rotors
4. Checking the condition of the damper motors and flaps
5. Checking the condition of the heater banks
6. Checking the condition of the insulation/dampening material within the unit
7. Checking the condition of the electrical harness and all connection points

8. Checking the condition of the flexible and rigid refrigerant pipe system and access points/valves and pressure switch points and pipework.
9. Checking the condition of the expansion valve, capillary tube, bulb and insulation
10. Checking the condition of the compressor, oil level, crank case heater and flexible/anti-vibration mounts
11. Checking the condition of moisture indicator (Wet/Dry Indicator)
12. Checking the condition of the evaporator coil
13. Checking the condition of all temperature sensors and over-temperature protection
14. Checking the condition of the equipment case, hinges, gas struts, locks and seals
15. Checking the condition of the control equipment, relays and contactors

3.3.11 The results of the 'Health Checks' must be recorded, and a copy provided with the HVAC unit when returned to London Trams or post inspection or with any request to London Trams advising that additional work or repairs are required.

3.3.13 Remove all air filters and perform an interior and exterior clean of the unit inclusive of a clean of the evaporator coil, fresh/re/circulation air fan impellers, condenser fan impellers and the heater bank

3.3.14 Reclaim the refrigerant from the unit and complete the proposed modification package;

1. Removing the old aluminium condenser unit and replacing it with the new copper condenser unit.
2. Removing the old heater bank and replacing it with the new heater bank fitted with the 10.2mm outer diameter elements.
3. Removing the old low and high pressure switches and fitting the new solid state low and high pressure group to IP65 and the condenser fan pressure switch to IP55.

3.3.15 Complete a test on the compressor oil to test for evidence of acid as acid in compressor oil is a sign of degradation of the motor windings. Acid in compressor oil will be reported to London Trams as AAW "compressor at imminent risk of failure". Clean refrigerant oil will not be replaced.

3.3.16 Replace the filter dryer and pressure/leak test the refrigerant system

3.3.17 Recharge the refrigerant system

3.3.18 Fit new air filters

3.3.19 Perform a functional test by running up both heating and cooling cycles of the HVAC system and check that the system is operating within specification parameters. LIEBHERR to provide London Trams a copy of the proposed test parameters.

3.3.20 Details of the functional test must be recorded and supplied with the documentation returned to London Trams for each saloon HVAC unit.

3.3.21 LIEBHERR must provide full details of the functional tests that they propose to complete as it is not presently known whether LIEBHERR can power up and run the units within their factory environment.

3.3.22 Return transportation of the saloon HVAC unit from LIEBHERR to London Trams Depot, Coomber Way, CR0 4TQ.

3.3.23 Access to a London Trams representative to conduct a post modification inspection and witness testing completed on the first set of modified saloon HVAC units.

4. Additional Arising Works

4.1 After inspection (Health Check) of the HVAC unit, any additional arising work (AAW) shall be reported immediately by written communication (email) to a London Trams representative.

4.2 The Service Provider shall complete a Proforma to request AAW outlining the technical reasons for the work providing evidence where possible, costs and any additional materials (as required).

4.3 Additional materials not mentioned in the Specification of this contract shall be charged to London Trams at commercial rates. London Trams would also expect LIEBHERR to propose a 'shopping list' of high risk AAW spares ~~based on their technical experience and knowledge and to offer a managed~~ stock level of these at the modification facility (quantities to be agreed with trams) to minimise the impact of lead times extending the length of the project.

4.4 The Contract Manager's representative shall respond to the request for AAW within 24 hours within the working weekdays or an agreed time frame.

4.5 No AAW should be conducted without prior approval from the Contract Manager's representative.

5. Constraints

5.1 Saloon HVAC units will be released in sets of 2 (two) so the maximum number in the overhaul cycle is 2 (two) at any time.



5.2 Any engineering change must comply with the London Trams Change to Rolling stock (CRS) LT-IMS-ENG-401, Modification panel and Derogation processes, the responsibility for which lies with London Trams

5.4 Any AAW required will be notified to the nominated Contract Manager's representative for formal approval and instruction.

5.5 The total modification cycle time is 7 (seven) business days including collection and delivery timescales.

5.8 Due to operational requirements, there is no guarantee that the programme deliveries and collections will run concurrently.

6. Deliverables

6.1 Completion of the scope of work as detailed in section three above within the time constraints as noted in section five above.

6.2 Supply of the following technical documentation to satisfy London Trams change control requirements for changed/ modified components;

6.2.1 A copy of the technical specifications for the new copper condenser, pressure switches and heater elements.

6.2.2 A high level technical review performed by LIEBHERR supporting their technical justification for suitability of the proposed modification components against the expectations of London Trams

6.2.3 Details of any changes to the maintenance or operating requirements to London Trams, associated with the modifications

6.3 For every saloon HVAC unit a Certificate of Conformance (CofC) documentation to allow 'Technical Acceptance' by London Trams. The following is required for each HVAC unit;

Acceptance Criteria

6.3.1 A record of all missing and damaged parts following arrival of the saloon HVAC units to LIEBHERR including proposed plan for mitigation

6.3.2 A record of all components changed, reason for change and a record of the old and new serial numbers where serialised.

6.3.3 A copy of the inspection and test records as detailed in the scope, section three above

6.3.4 Details of all Additional Awaiting work together with authorisation sought

6.3.5 Details of any Additional Work highlighted that was not completed during the modification and therefore require attention at a later date

6.3.5 A test report detailing all test parameters inspected and recorded following inspection and testing of the modified saloon HVAC units

6.3.6 A record of any agreed variation or derogations against the agreed scope of works for each HVAC unit

7. Project Reporting

7.1 Project reporting is to be provided every four weeks by the supplier based around the following headings;

7.1.1 Executive Summary and Key Issues

7.1.2 Health and Safety, Security and loss prevention

7.1.3 Progress, including updated programme

7.1.4 Programme Narrative and delay analysis as relevant

7.1.5 Subcontractor Performance

7.1.6 Commercial including budgetary performance and AAW

7.1.7 Risk Management

7.1.8 Quality and Assurance

7.1.9 Special subjects as the need arises

8. KPI's

8.1 Delivery within project timescales

<u>DELIVERY</u>	KPI METRICS	RED	AMBER	GREEN	FREQUENCY OF REPORTING	Data Source	Owner
Programme	27 HVAC units modified within a rolling 7 working days (milestones) undertaken by the supplier in the period versus the number actually achieved.	R = 100%	No amber	G = 100%	4 weekly	Supplier to provide data on a 4 weekly basis to Trams	Trams Fleet Manager

8.2 Active management of AAW

VALUE FOR MONEY	KPI METRICS	RED	AMBER	GREEN	FREQUENCY OF REPORTING	Data Source	Owner
FINANCIAL PERFORMANCE	Actual cost of modification service versus spend	Variance is $> 5\%$	Variance is between 2.5% and 5%	Variance is $\leq 2.5\%$	4 weekly	Supplier to provide data on a 4 weekly basis to Trams	Trams Fleet Manager

9. Warranty

As per Appendix 1

9.1 Endemic and Epidemic Defects Definition

Endemic/Epidemic failures – Endemic: a defect that appears no later than 3 years after the delivery of the final unit of the contract and as demonstrated by independent risk assessment is likely to appear any similar part or parts which have been supplied.

Epidemic – the same defect that has appeared in 20% or more of the parts supplied but no later than 3 years after delivery of the final unit of the contract.

Section 4

SCHEDULE 4 – CHARGES

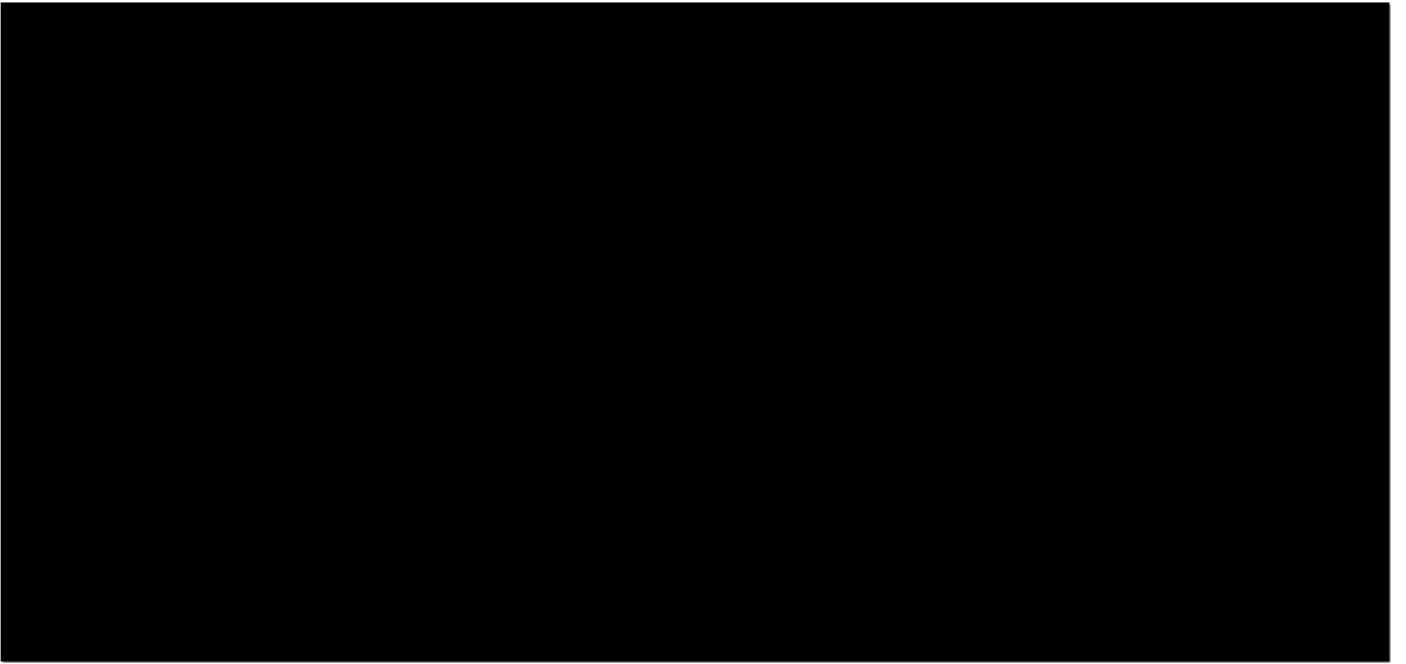
1. The modification cost is a fixed price lump sum per HVAC unit based on the core overhaul service in schedule 3.
2. The price per HVAC unit modification service is €6,473 each including redelivery.
3. The total price of core overhaul service of 27 Saloon HVAC units is €174,771.

Application for payment

After the modified HVAC units have been redelivered to the depot with the testing certifications and CoCs. Invoices can be sent to TfL Account payable for each qualified delivery.



Section 5



Section 6

SCHEDULE 6- FORM OF VARIATION

PART A

Contract Parties: *[to be inserted]*

Contract Number: *[to be inserted]*

Variation Number: *[to be inserted]*

Authority Contact Telephone: *[to be inserted]*

Fax: *[to be inserted]*

Date: *[to be inserted]*

AUTHORITY FOR VARIATION TO CONTRACT (AVC)

Pursuant to Clause 32 of the Contract, authority is given for the variation to the Services and the Charges as detailed below. The duplicate copy of this form must be signed by or on behalf of the Service Provider and returned to the Procurement Manager as an acceptance by the Service Provider of the variation shown below.

DETAILS OF VARIATION	AMOUNT (£)
ALLOWANCE TO THE AUTHORITY	
EXTRA COST TO THE AUTHORITY	
TOTAL	

.....
For the Authority (signed)

.....
(print name)

ACCEPTANCE BY THE SERVICE PROVIDER	
Date	Signed

PART B – SUPPLY CHAIN FINANCE OPTION RELATED VARIATIONS

1. The Authority is developing a scheme and system whereby the Service Provider may be permitted, at the Authority's sole discretion, to seek payment of invoices in respect of Charges under this Contract within a time period less than the 30 days of receipt set out Clause 5.4.1 in consideration for a reduction in the Charges due thereunder (the **"Supply Chain Finance Option"**).
2. The Service Provider hereby agrees that where such requests are made by the Service Provider and approved by the Authority, by way of such process and/or systems put in place by the Authority acting either on its own behalf or by or via its employees, agents, contractors or otherwise such request, approval and resulting accelerated and reduced payment shall constitute the Service Provider's exercise of the Supply Chain Finance Option and the valid and legally binding:
 - 2.1 variation by the Parties of the related Charges due and payable to the Service Provider under this Contract; and
 - 2.2 waiver by the Service Provider of any right held previously by it to invoice for and be paid the amount by which the Charges are reduced pursuant to its exercise of the Supply Chain Finance Option.



Section 7

SCHEDULE 7 - CONTRACT QUALITY, ENVIRONMENTAL & SAFETY CONSIDERATIONS

1. The following London Trams documents shall apply: -
2. LT-IMS-ENG-106 Assurance of new and altered LT assets.
3. LT-IMS-ENG-107 List of assurance documents
4. LT-IMS-ENG-401 Change to Rolling stock
5. LT/Derog/16/04/01 Derogations to LT Standards Application
6. Health and Safety

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Section 8

SCHEDULE 8 – RE-TENDER COOPERATION

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