



*Joseph H. Vicari, Director
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John P. Kelly, Commissioner*

*Tristin J. Collins, Director, Management & Budget
Jennifer L. Bowens, Purchasing Agent*

*County of Ocean
Administration Building
101 Hooper Avenue
Toms River, NJ 08754*

BID

***LONG TERM SERVICE AND MAINTENANCE CONTRACT FOR
COGENERATION SYSTEM AT THE COUNTY JUSTICE COMPLEX NO. II***

2023

***ADVERTISEMENT DATE: September 13, 2023
OPENING: September 26, 2023, 11:00 am***

Bid Category: 22- Public Works, Park Equipment and Construction Services

NOTICE TO BIDDERS

NOTICE IS HEREBY GIVEN that sealed bids for the furnishing and delivery of LONG TERM SERVICE AND MAINTENANCE CONTRACT FOR COGENERATION SYSTEM AT THE COUNTY JUSTICE COMPLEX NO. II for the County of Ocean, will be received by the Purchasing Agent of the County of Ocean on Tuesday, September 26, 2023 at 11:00 am, prevailing time.

Bids will be received electronically via the [County's OpenGov Electronic Bid Portal \(https://procurement.opengov.com/portal/oceancounty/\)](https://procurement.opengov.com/portal/oceancounty/)

Specifications and form of proposal are on the **Procurement Portal (Link Above)** or available for viewing in the Department of Purchase, Room #224, Administration Building, 101 Hooper Avenue, Toms River, New Jersey. Direct all inquiries to Jennifer L. Bowens, Purchasing Agent.

Bidders are required to comply with the requirements of N.J.S.A. 10:5-31 et seq. and P.L. 1975 C. 127 (N.J.A.C. 17:27-1 et seq.) regarding equal employment opportunities and with the requirements of P.L. 1977 C.33 regarding corporate and/or partnership ownership.

The right to reject any and all bids is reserved in accordance with applicable law.

By order of the Board of Commissioners of the County of Ocean.

Signed:

JOSEPH H. VICARI, Director

JENNIFER L. BOWENS, Purchasing Agent

CONTACT INFORMATION AND PROJECT TIMELINE

Summary

The purpose of this bid package is to provide the County of Ocean with a Contractor who will supply the goods or services described and specified herein.

Contact Information

For further information regarding these specifications, contact

Jessica Hannold

Buyer

101 Hooper Ave.

Room 224

Toms River, NJ 08753

Email: ocpurchasing@co.ocean.nj.us

Phone: [\(732\) 929-2103](tel:(732)929-2103)

Department:

Buildings and Grounds

Timeline

Advertising Date	September 13, 2023
Bid Opening Date	September 26, 2023, 11:00am Administration Building, 101 Hooper Ave., Room 119, Toms River, NJ, 08753

IMPORTANT INSTRUCTIONS FOR ELECTRONIC SUBMITTAL

Instructions for Electronic Bid Submission

The County is accepting electronic bid submissions with ProcureNow by following these instructions:

Sign up for a FREE account at <https://secure.procurenow.com/signup>.

Once you have completed account registration, browse back to this page: [County's OpenGov Electronic Bid Portal \(https://procurement.opengov.com/portal/oceancounty/\)](https://procurement.opengov.com/portal/oceancounty/)

Click on the bid of interest, then click "Draft Response".

Follow the instructions to submit the electronic bid.

It is important to note that this process should be completed well in advance of the bid deadline / bid opening. DO NOT WAIT UNTIL THE LAST MINUTE. The County's electronic submission system will not allow electronic bids to be submitted once the deadline has passed, even if you've already started the process. The deadline is based on the countdown timer found on the ProcureNow bid submission page.

INSTRUCTIONS TO BIDDERS

Bid Opening

All bids will be opened publicly in the Administration Building, Room 119, 101 Hooper Avenue, Toms River, New Jersey, commencing at 11:00 am, prevailing time on Tuesday, September 26, 2023.

Electronic Bid Submissions

Bids must be submitted electronically through Ocean County's Procurement Portal by the date and time stipulated in the Notice to Bidders.

Deadline Instructions

The County will not be responsible for late bids, and no bids will be accepted if received after the time stipulated in the notice to bidders.

Completion of all Documents

Bidders shall complete all documents and acknowledge all terms included with the bid package. All documents should be from this bid package and must not be dated or executed prior to the date of advertising. Failure to follow these instructions is cause for rejection.

NOTE: In order to access any DocuSign forms in this solicitation, you must first click "Draft Response".

Instructions on how to access the forms through DocuSign are available in the Attachments. Please note that in order to view the forms as a .pdf document, you must access DocuSign first. Once you access DocuSign, the option to download, save, print and complete the forms becomes available

Right to Reject

The County reserves the right to reject all bids in accordance with N.J.S.A. 40A:11-13.2, to waive any informalities in the bid and to accept the lowest responsible bid in accordance with applicable law.

Bidder Default

In case of default by the bidder or contractor, the County of Ocean may procure the articles or services from other sources and hold the bidder or contractor responsible for any excess cost occasioned thereby.

Indemnity

The bidder, if awarded a contract, agrees to protect, defend and save harmless the County against any damage for payment for the use of any patented material process, article or device that may

enter into the manufacture, construction or form a part of the work covered by either order or contract, and he further agrees to indemnify and save harmless the County from suits or actions of every nature and description brought against it, for, or on account of injuries or damages received or sustained by any party or parties by, or from any of the negligent acts of the contractor, his servants or agents.

Specifications

It is to be understood by the bidder that this bid is submitted on the basis of specifications prepared by the County and the fact that any bidder is not familiar with these specifications or conditions will not be accepted as an excuse.

Bid Security

NO BID SECURITY

Performance Bond

NO PERFORMANCE BOND

Pricing Proposal

Bidders must use the pricing proposal provided in the bid specifications. Failure to use the pricing proposal in the bid specifications shall be cause for rejection of the bid.

Pricing

Insert prices for furnishing all of the material and/or labor described or required. Prices shall be net, including any charges for packing, crating, containers, etc. and all transportation charges fully prepaid by the contractor F.O.B. destination and placement at locations specified by the County. No additional charges will be allowed for any transportation costs resulting from partial shipments made at the vendor's convenience when a single shipment is ordered.

Payment

Payments will be made upon the approval of vouchers submitted by the successful bidders in accordance with the requirements of the Board of Commissioners and subject to the Board of Commissioners customary procedures. The County will not pay interest or late fees regardless of language provided.

Discrepancy in Pricing

In the event that there is a discrepancy between the unit prices and the extended totals, the unit prices shall prevail. In the event there is an error of the summation of the extended totals, the computation by the OWNER of the extended totals shall govern.

Award Timeframe

Award will be made by Ocean County Board of Commissioners within sixty (60) days after receipt of bids.

Equal or Tie Bids

The County of Ocean reserves the right to award at their discretion to any one of the tie bidders where it is most advantageous for the County to do so, pursuant to N.J.S.A. 40A:11-6.1.

Tax Exempt

The County of Ocean is exempt from any State sales tax or Federal excise tax.

Equivalent Product

For purpose of evaluation where an equivalent product is being furnished, bidder must indicate any variation to our specifications no matter how slight. If no variations are indicated, it will be construed that the bid fully complies with our specifications.

Quantities

Quantities shown are approximate and the County reserves the right to decrease or omit quantities. The County will not consider minimums placed on order quantities. The County also reserves the right to increase quantities to twenty (20) percent of the maximum quantities listed at the unit price bid, in accordance with N.J.A.C. 5:30-11.3.

Delivery of Goods and Services

Delivery shall be made upon receipt of a Purchase Order issued by the Ocean County Department of Purchase, upon which delivery locations and needed quantities shall be indicated.

American Goods and Products

All contractors must comply with the provisions of New Jersey Statute Title 40A:11-18, when applicable.

Assignment

This agreement shall not be assigned without the written consent of the County of Ocean.

NJ One Call

By presenting a bid, contractor declares that he is aware of and, if required, will comply with the requirements of the "Underground Facility Protection Act (Public Law 1994, Chapter 118)" prior to commencing any intended excavation. The telephone number to call is 1-800-272-1000.

Public Works Contractor Registration Act, N.J.S.A. 34:11-56.48 et seq

The bidder must comply with the provisions of "The Public Works Contractor Registration Act", if applicable.

- All named contractors must be registered with the Department of Labor and Workforce Development pursuant to the Public Works Contractor Registration Act at the time the proposal is received, or the proposal will be determined to be non-responsive.
- Any non-listed contractor must be registered with the Department of Labor and Workforce Development prior to physically starting work. It is the responsibility of the General Contractor to insure that all non-listed sub-contractors comply.
- Contractors are encouraged to submit their and all named sub-contractors' Public Works Contractor Registration Certificates with the bid.

Prevailing Wage & Labor Laws

The New Jersey Prevailing Wage Act (P.L. 1963, Chapter 150) and provisions of the State Labor Laws must be complied with by the successful bidder, if applicable. The current Prevailing Wage Rates can be found online at <https://www.nj.gov/labor/wageandhour/prevailing-rates/public-works/currentprevailingwage.shtml>

Special Surety Bid Requirements for Certain Construction Projects

The attention of the bidder is called to the provisions of N.J.S.A. 2A:44-143 which requires that the County of Ocean shall only accept performance and payment bonds from surety companies meeting the requirements of that statute. The bidder shall deliver with its bid a Consent of Surety. The Bidder's Surety Company shall complete the "Certificate of Surety Company" which bidder shall submit with its bid.

New Jersey Business Registration Requirements

Pursuant to N.J.S.A. 52:32-44, Ocean County ("Contracting Agency") is prohibited from entering into a contract with an entity unless the bidder/proposer/contractor, and each subcontractor that is required by law to be named in a bid/proposal/contract has a valid Business Registration Certificate on file with the Division of Revenue and Enterprise Services within the Department of the Treasury.

Prior to contract award or authorization, the contractor shall provide the Contracting Agency with its proof of business registration and that of any named subcontractor(s).

Subcontractors named in a bid or other proposal shall provide proof of business registration to the bidder, who in turn, shall provide it to the Contracting Agency prior to the time a contract, purchase order, or other contracting document is awarded or authorized.

During the course of contract performance:

- (1) the contractor shall not enter into a contract with a subcontractor unless the subcontractor first provides the contractor with a valid proof of business registration.

(2) the contractor shall maintain and submit to the Contracting Agency a list of subcontractors and their addresses that may be updated from time to time.

(3) the contractor and any subcontractor providing goods or performing services under the contract, and each of their affiliates, shall collect and remit to the Director of the Division of Taxation in the Department of the Treasury, the use tax due pursuant to the Sales and Use Tax Act, (N.J.S.A. 54:32B-1 et seq.) on all sales of tangible personal property delivered into the State. Any questions in this regard can be directed to the Division of Taxation at (609)292-6400. Form NJ-REG can be filed online at <http://www.state.nj.treasury/revenue/busregcert.shtml>.

Before final payment is made under the contract, the contractor shall submit to the Contracting Agency a complete and accurate list of all subcontractors used and their addresses.

Pursuant to N.J.S.A. 54:49-4.1, a business organization that fails to provide a copy of a business registration as required, or that provides false business registration information, shall be liable for a penalty of \$25 for each day of violation, not to exceed \$50,000, for each proof of business registration not properly provided under a contract with a contracting agency.

Pay to Play Requirements

Starting in January 2007, all business entities are advised of their responsibility to file an annual disclosure statement of political contributions with the New Jersey Election Law Enforcement Commission (ELEC) pursuant to N.J.S.A. 19:44A-20.27 if they receive contracts in excess of \$50,000 from public entities in a calendar year. Business entities are responsible for determining if filing is necessary. Additional information on this requirement is available from ELEC at 888-313-3532 or at www.elec.state.nj.us.

Statement of Ownership

The provisions of N.J.S.A. 52:25-24.2 applies to all forms of corporations and partnerships, including, but not limited to, limited partnerships, limited liability corporations, limited liability partnerships, and Subchapter S corporations.

Certification of Non-Involvement in Prohibited Activities in Iran

Certification of Non-Involvement in Prohibited Activities in Iran. Pursuant to N.J.S.A. 52:32-58, the proposer must certify that neither the proposer, nor one of its parents, subsidiaries, and/or affiliates (as defined in N.J.S.A. 52:32-56(e)(3)), is listed on the Department of the Treasury's List of Persons or Entities Engaging in Prohibited Investment Activities in Iran and that neither is involved in any of the investment activities set forth in N.J.S.A. 52:32-56(f). If the proposer is unable to so certify, the proposer shall provide a detailed and precise description of such activities. Prior to contract award or authorization, the contractor shall provide the Contracting Agency with a completed Certification on Non-Involvement in Prohibited Activities in Iran.

Certification of Non-Involvement In Prohibited Activities in Russia or Belarus

Pursuant to N.J.S.A. 52:32-60.1, the "person or entity" (as defined in N.J.S.A. 52:32-60.1, et seq) seeking to enter into or renew a contract for the provision of goods or services or the purchase of bonds or other obligations shall certify that it is not "engaging in prohibited activities in Russia

or Belarus” (as such term is defined in as defined in N.J.S.A. 52:32-60.1, et seq. If the person or entity is unable to certify, the person or entity shall provide a detailed and precise description of such activities. The N.J.S.A. 52:32-60.1 certification form must be completed prior to contract award and is provided in the specification documents (DocuSign).

Vendors may view the Precluded Entities List Here:

<https://www.nj.gov/treasury/administration/pdf/RussiaBelarusEntityList.pdf>

Insurance Requirements

The contractor shall maintain primary insurance to protect against all claims under Workmen's Compensation, Comprehensive General Liability and Automobile. Except for Workmen's Compensation, all coverage shall apply as primary coverage with respect to any other insurance or self-insurance program afforded to the County. There shall be no endorsement or modification of this coverage to make it excess over other available insurance/coverage; alternatively, if the CGL and umbrella, excess of reinsurance states that it is pro rata, it shall be endorsed to be primary with respect to the County. Primary Coverage shall be subject to approval for adequacy of protection as per the following limits:

Worker's Compensation

1. Limits according to Worker's compensation Laws of the State of New Jersey.
2. Contractor's Liability not less than \$100,000.

Comprehensive General Liability

1. Bodily Injury - \$500,000 per person; \$1,000,000 per occurrence.
2. Property Damage - \$1,000,000 per occurrence.

Comprehensive Automobile Liability Details

Comprehensive Automobile Liability shall include the following:

Business auto liability insurance or its equivalent with a minimum limit of \$1,000,000 per accident and including coverage for all of the following:

- A. Liability arising out of the ownership, maintenance or use of any auto;
- B. Auto non-ownership and hired car coverage.
- C. Contractor's Worker's Compensation, Comprehensive General Liability and
- D. Comprehensive Automobile Liability arising out of subcontractor's operations shall be identical as that listed above.

Proof of Insurance

Copies of each insurance certificate shall be furnished to the County when requested.

AWARD METHOD

Contract will be awarded on a lump sum basis.

VENDOR QUESTIONNAIRE

BID DOCUMENTS TO BE EXECUTED*

Documents include:

- Signature Page
- Non Collusion Certification
- Affirmative Action Questionnaire
- **Statement of Ownership (N.J.S.A. 52:25-24.2) (Mandatory Document)**
- Prohibited Russia-Belarus Activities & Iran Investment Activities

FAILURE TO SUBMIT ANY OF THESE DOCUMENTS MAY BE CAUSE FOR REJECTION OF YOUR PROPOSAL.

All documents should be from this proposal package as forms change frequently and the most updated forms are provided in this specification. The forms must not be dated or executed prior to the date of advertising.

NOTE: For detailed instructions on how to complete the forms via DocuSign, please access the "Instructions for Completing Forms in DocuSign" document available in the Attachments.

Please note: The County's preferred method of submission is DocuSign.

[Click here to go to the form](#)

*Response required

Copy of Bidder's Certificate of Employee Information Report

Within seven (7) days after receipt of the notification of intent to award the contract or receipt of the contract, whichever is sooner, a Contractor should present one of the following to the County of Ocean:

- (a) An existing federally approved or sanctioned affirmative action program.
- (b) A New Jersey Certificate of Employee Information Report Approval.
- (c) **If the Contractor cannot present "a" or "b", the Contractor is required to submit a completed Employee Information Report (Form AA302). This form will be made available to the Contractor by the County of Ocean.**

QUESTIONS BELOW MUST BE ANSWERED BY ALL CONTRACTORS ON THE AFFIRMATIVE ACTION DOCUMENT:

1. Do you have a Federally approved or sanctioned Affirmative Action Program?

If yes, please upload a photocopy of such approval.

2. Do you have a State of New Jersey "Certificate of Employee Information Report" approval?

If yes, please upload a photocopy of such certificate.

Please note, the only acceptable file forms are as follows:

Documents (doc, docx, rtf, txt, xls, xlsx, pdf)

Images (jpg, png, bmp, tif)

Copy of Bidder's New Jersey Business Registration Certificate

Please use this area to upload your company's BRC.

Use this link to verify your company's BRC:

https://www1.state.nj.us/TYTR_BRC/jsp/BRCLoginJsp.jsp

Please note that a BRC is not required at the time of bid submission but shall be required prior to the award of a contract.

Please note, the only acceptable file forms are as follows:

Documents (doc, docx, rtf, txt, xls, xlsx, pdf)

Images (jpg, png, bmp, tif)

Mandatory Equal Employment Opportunity Statement*

Does the BIDDER comply with the [#Mandatory Equal Employment Opportunity Statement?](#)

Yes

No

*Response required

Americans with Disabilities Act Provisions*

Does the BIDDER comply with the [#Americans with Disabilities Act Provisions?](#)

Yes

No

*Response required

Public Works Registration Certificate

The bidder must comply with the provisions of "The Public Works Contractor Registration Act," P.L. 1999, c.238 (C.34:11-56.48 et seq.):

- All named contractors must be registered with the Department of Labor and Workforce Development pursuant to the Public Works Contractor Registration Act at the time the proposal is received, or the proposal will be determined to be non-responsive.
- Any non-listed contractor must be registered with the Department of Labor and Workforce Development prior to physically starting work. It is the responsibility of the General Contractor to insure that all non-listed sub-contractors comply.
- Contractors are encouraged to submit their and all named sub-contractors' Public Works Contractor Registration Certificates with the bid.

Please note, the only acceptable file forms are as follows:

Documents (doc, docx, rtf, txt, xls, xlsx, pdf)

Images (jpg, png, bmp, tif)

Certificate of Insurance

Please upload your company's certificate of insurance.

CERTIFICATION OF NON-DEBARMENT FOR PUBLIC WORKS CONTRACTS*

Before a contracting agency can award a contract for public work as defined in P.L. 2019, c.406, the contractor must provide a written certification to the contracting unit that neither the contractor nor the contractor's affiliates are debarred by the federal government from contracting with a federal agency. The term "affiliate" means any entity that directly, indirectly, or constructively controls the contractor, or any entity that the contractor directly, indirectly, or constructively controls, or is subject to the control of a common entity. The law considers an entity to be in control of another entity if it owns, directly or indirectly, more than 50% of the ownership.

Please complete the Certification of Non-Debarment form by clicking on the link. Make sure that the email you complete the form with matches the email of your vendor account.

NOTE: For detailed instructions on how to complete the forms via DocuSign, please access the "Instructions for Completing Forms in DocuSign" document available in the Attachments.

Please note: The County's preferred method of submission is DocuSign.

[Click here to go to the form](#)

*Response required

Contractor's Data Sheet*

As evidence of the bidder's qualifications, (s)he shall be required to submit with this bid proposal information requested on the Contractor's Data Sheet.

Please complete the form by clicking on the link. Make sure that the email you complete the form with matches the email of your vendor account.

NOTE: For detailed instructions on how to complete the forms via DocuSign, please access the "Instructions for Completing Forms in DocuSign" document available in the Attachments.

Please note: The County's preferred method of submission is DocuSign.

[Click here to go to the form](#)

*Response required

Required Qualifications (As defined under Technical Specifications Attachment page 3 of 6)*

Upload your Required Qualifications (As defined under Technical Specifications Attachment page 3 of 6) here.

*Response required

References*

Upload your References here.

*Response required

ADDITIONAL VENDOR DOCUMENTATION

Please submit any additional information you wish to be considered as part of your bid package.

Please note, the only acceptable file forms are as follows:

Documents (doc, docx, rtf, txt, xls, xlsx, pdf)

Images (jpg, png, bmp, tif)

Acknowledgement of Submission of Forms from Current Bid Package*

Bidders shall complete all documents and acknowledge all terms included with the bid package. All documents should be from this bid package as forms change frequently and the most updated forms are provided in this specification. The forms must not be dated or executed prior to the date of advertising. Failure to follow these instructions is cause for rejection.

Please confirm

*Response required

Submission of Bid Package*

By submitting a response to this solicitation, the Vendor understands and acknowledges that all required documents to this solicitation must be submitted and that failure to do so may be cause for rejection.

Bidder also understands that only one (1) bid submission shall be considered. Please DO NOT Submit a manual bid response. Submitting a manual response in addition to the electronic response is cause for rejection of your bid.

Please confirm

*Response required

MANDATORY EQUAL EMPLOYMENT OPPORTUNITY

N.J.S.A. 10:5-31 et seq. (P.L. 1975, C. 127)

N.J.A.C. 17:27

GOODS, PROFESSIONAL SERVICE AND GENERAL SERVICE CONTRACTS

During the performance of this contract, the contractor agrees as follows:

The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause.

The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.

The contractor or subcontractor will send to each labor union, with which it has a collective bargaining agreement, a notice, to be provided by the agency contracting officer, advising the labor union of the contractor's commitments under this chapter and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

The contractor or subcontractor agrees to make good faith efforts to meet targeted county employment goals established in accordance with N.J.A.C. 17:27-5.2.

The contractor or subcontractor agrees to inform in writing its appropriate recruitment agencies including, but not limited to, employment agencies, placement bureaus, colleges, universities, and labor unions, that it does not discriminate on the basis of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex, and that it will discontinue the use of any recruitment agency which engages in direct or indirect discriminatory practices.

The contractor or subcontractor agrees to revise any of its testing procedures, if necessary, to assure that all personnel testing conforms with the principles of job-related testing, as established by the statutes and court decisions of the State of New Jersey and as established by applicable Federal law and applicable Federal court decisions.

In conforming with the targeted employment goals, the contractor or subcontractor agrees to review all procedures relating to transfer, upgrading, downgrading and layoff to ensure that all such actions are taken without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex, consistent with the statutes and court decisions of the State of New Jersey, and applicable Federal law and applicable Federal court decisions.

The contractor shall submit to the public agency, after notification of award but prior to execution of a goods and services contract, one of the following three documents:

- Letter of Federal Affirmative Action Plan Approval
- Certificate of Employee Information Report
- Employee Information Report Form AA302 (electronically provided by the Division and distributed to the public agency through the Division's website at www.state.nj.us/treasury/contract_compliance)

The contractor and its subcontractors shall furnish such reports or other documents to the Division of Purchase & Property, CCAU, EEO Monitoring Program as may be requested by the office from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Division of Purchase & Property, CCAU, EEO Monitoring Program for conducting a compliance investigation pursuant to **Subchapter 10 of the Administrative Code at N.J.A.C. 17:27.**

AMERICANS WITH DISABILITIES ACT

Equal Opportunity For Individuals With Disabilities

The CONTRACTOR and the COUNTY do hereby agree that the provisions of title II of the Americans with Disabilities Act of 1990 (the "Act") (42 U.S.C. 12101 et seq.), which prohibits discrimination on the basis of disability by public entities in all services, programs and activities provided or made available by public entities, and the rules and regulations promulgated pursuant thereto, are made a part of this contract. In providing any aid, benefit, or service on behalf of the COUNTY pursuant to this contract, the CONTRACTOR agrees that the performance shall be in strict compliance with the Act. In the event that the CONTRACTOR, its agents, servants, employees, or subcontractors violate or are alleged to have violated the Act during the performance of this contract, the CONTRACTOR shall defend the COUNTY in any action or administrative proceeding commenced pursuant to this Act. The CONTRACTOR shall indemnify, protect and save harmless the COUNTY, its agents, servants and employees from and against any and all suits, claims, losses, demands, or damages of whatever kind or nature arising out of or claimed to arise out of the alleged violation. The CONTRACTOR shall, at its own expense, appear, defend and pay any and all charges for legal services and any and all costs and other expenses arising from such action or administrative proceeding or incurred in connection therewith. In any and all complaints brought pursuant to the COUNTY'S grievance procedure, the CONTRACTOR agrees to abide by any decision of the COUNTY which is rendered pursuant to said grievance procedure. If any action or administrative proceeding results in an award of damages against the COUNTY or if the COUNTY incurs any expense to cure a violation of the ADA which has been brought pursuant to its grievance procedure, the CONTRACTOR shall satisfy and discharge the same at its own expense.

The COUNTY shall, as soon as practicable after a claim has been made against it, give written notice thereof to the CONTRACTOR along with full and complete particulars of the claim. If any action or administrative proceeding is brought against the COUNTY or any of its agents, servants and employees, the COUNTY shall expeditiously forward or have forwarded to the CONTRACTOR every demand, complaint, notice, summons, pleading, or other process received by the COUNTY or its representatives.

It is expressly agreed and understood that any approval by the COUNTY of the services provided by the CONTRACTOR pursuant to this contract will not relieve the CONTRACTOR of the obligation to comply with the Act and to defend, indemnify, protect and save harmless the COUNTY pursuant to this paragraph.

It is further agreed and understood that the COUNTY assumes no obligation to indemnify or save harmless the CONTRACTOR, its agents, servants, employees and subcontractors for any claim which may arise out of their performance of this Agreement. Furthermore, the CONTRACTOR expressly understands and agrees that the provision of this indemnification clause shall in no way limit the CONTRACTOR'S obligations assumed in this Agreement, nor shall they be construed to relieve the CONTRACTOR from any liability, nor preclude the COUNTY from taking any other actions available to it under any other provisions of this Agreement or otherwise at law.

INTENT

CONTRACT TERMS

The contract shall be for two (2) years from date of award, or until delivery is complete unless otherwise stated. The County reserves the right to extend the term of the contract pursuant to N.J.S.A. 40A:11-15.

INTENT

The purpose of this bid package is to provide the County of Ocean with a Contractor who will supply the materials described and specified herein.

NO ASSIGNMENT

This agreement shall not be assigned without the written consent of the County of Ocean which consent shall not be unreasonably withheld. Assignee shall promptly prepare and complete such documents as the County shall require.

OWNERSHIP DISCLOSURE

All contractors shall comply with all laws governing the disclosure of all stockholders or partners, as included in N.J.S.A. 52:25-24.2.

BID REVIEW

Bids may be reviewed at the bid opening and results will be made available online through the County's procurement portal once the bid meeting has concluded. Additionally, bid results are available in the Ocean County Purchasing Department on the day following the bid openings for any interested party that may wish to review them.

EVALUATION

The quality of the equipment supplied, their conformity with the specifications, their suitability to requirements, delivery terms, guaranty clauses, price of the materials shall all be taken into consideration. Where equivalent equipment is offered, the County will determine if the proposed item is equal or better than that specified.

AVAILABILITY OF FUNDS

The County's obligation hereunder is contingent upon the availability of appropriated funds from which payment for contract purposes can be made. No legal liability on the part of the County for payment of any money shall arise unless, and until funds are made available each year to the Ocean County Purchasing Agent.

MODIFICATIONS AND WITHDRAWALS

Bids may be withdrawn from the bidder prior to the time fixed for opening. No right for withdrawal exists after the bid has been opened. Written request for withdrawal shall be signed by the bidder or proper corporate officers.

USE OF OTHER NAMES AND REFERENCES

Unless otherwise stated, the use of manufacturers' names and product numbers are for descriptive purposes, and establishing general quality levels only. They are not intended to be restrictive. Bidders are required to state exactly what they intend to furnish, otherwise it is fully understood that they shall furnish all items as stated.

QUALITY

The materials and supplies called for herein, shall be the best of their grade and types, prepared according to the best available standards or accepted formulas, and thoroughly tested and subjected to rigid examinations and standardization. Items not meeting these requirements shall be replaced at no cost to the County upon due notice of deficiency.

WARRANTY

Manufacturer's warranty shall apply.

AVAILABILITY AND DELIVERY

The bidder should indicate the number of days required for the delivery After Receipt of Order (A.R.O.). If not submitted with the bid proposal, the County reserves the right to request this information prior to the award of contract.

TRANSITIONAL PERIOD

In the event services are terminated by contract expiration or by voluntary termination by either the Contractor or the County of Ocean, the Contractor shall continue all terms and conditions of said contract for a period not to exceed one (1) month at the County's request.

CURRENT BID RESULTS

If there is a current contract in place for this bid, those results may be obtained by accessing our legacy portal at the below link:

<http://webhost.co.ocean.nj.us/ocbidportal.nsf>

Once you have clicked the link, click "Formal Bids", "Awarded Formal Bids". There you will be able to see all active contracts.

SPECIFICATIONS AND SCOPE OF WORK

SCOPE OF WORK

Please see “Attachments”, “Project Documents” for detailed project specifications.

PRICING PROPOSAL

LONG TERM SERVICE AND MAINTENANCE CONTRACT FOR COGENERATION SYSTEM AT THE COUNTY JUSTICE COMPLEX NO. II

Line Item	Description	2 Year Quantity	Unit of Measure	Unit Cost	Total	Percentage (%) Markup :	Comments:
MAINTENANCE							
1	E30 - Refer to CAT Maintenance Schedule	5	EA				
2	E40 - Refer to CAT Maintenance Schedule	5	EA				
3	EL6 - Refer to CAT Maintenance Schedule	5	EA				
4	EL12 - Refer to CAT Maintenance Schedule	3	EA				
5	EL24 - Refer to CAT Maintenance Schedule	2	EA				
6	SCR-A - Refer to CAT Maintenance Schedule	5	EA				
7	NJDEP - Refer to CAT Maintenance Schedule	2	EA				
8	CATALYST ELEMENTS, Exchange ever 16,000 Run Hours, All Inclusive	2	EA				
9	NJDEP, Refer to CAT Maintenance Schedule	2	EA				
10	Coolant, Replace according to Technical Bulletin 2091	2	EA				
11	Turbocharger, Exchange Exhaust Turbocharger	2	EA				
LABOR							
12	Estimated Labor for Service Technician with any required workman class	200	HR				
Material/Rental Cost Markup							
13	For Bid Purposes assume estimated costs of \$15,000. Costs shall be for materials required other than routine maintenance supplies. Cost shall also be for Lube Oil. Calculate percentage of mark-up charges on wholesale cost of Materials/Rental Costs by multiplying \$15,000.00 by your standard mark-up % (show bid % mark-up in "PERCENTAGE MARK-UP" field). Wholesale cost of Parts / Materials plus mark-up %. $(\$15,000.00 \times \text{mark-up \%}) + \$15,000.00 = \text{ENTER RESULT IN UNIT COST COLUMN. ENTER MARK-UP IN PERCENTAGE MARK-UP COLUMN.}$	1	LS				

Line Item	Description	2 Year Quantity	Unit of Measure	Unit Cost	Total	Percentage (%) Markup :	Comments:
ALLOWANCES							
14	Allowance for the Rental of Equipment As Needed, No Markup Permitted, Taxes Applicable. This line item will be used as needed.	1	LS	\$5,000.00			
15	Allowance for additional permitting services, if and where directed by the Buildings and Grounds Department. % Markup shall be permitted. Indicated Mark-Up % in the Mark-Up % Column. This line item will be used as needed.	1	LS	\$5,000.00			
TOTAL							

TECHNICAL SPECIFICATION FOR LONG TERM SERVICE AND MAINTENANCE CONTRACT FOR
COGENERATION SYSTEM AT THE COUNTY JUSTICE COMPLEX NO. II

GENERAL

The County is engaged in a Long Term Service Agreement required by BPU which will run for a total of ten (10) years from 2019 to 2029.

The County of Ocean owns and operates a Combined Heat and Power (CHP) system located within the parking lot North of Ocean County Justice Complex located at 120 Hooper Avenue, Toms River, New Jersey 08754. This Contract includes maintenance, testing, service calls, remote assistance and startups as needed for the CHP system.

The CHP systems includes a natural gas fired genset rated at 600 kWe consisting of CAT CG132B-12-EPG engine as the prime mover. The CHP system is a preassembled, walk-in enclosure housing all CHP equipment including engine generator, exhaust heat recovery, emissions treatment, engine heat recovery, electrical switchgear, instrumentation, automation and control, human machine interface, and other balance of plant equipment.

The duration of this contract shall be two (2) years from date of award.

The CHP system began operation in December 2019 and has had approximately four (4) years of run time.

The duration of this contract shall be two (2) years from the date of award and shall cover years 5 and 6 of the 10-year agreement with BPU.

Contractor shall, at the onset of the contract, survey the equipment and confirm in writing as to the operational condition of the equipment, in that the CHP system is satisfactory for the purpose of fulfilling all obligations stated in this contract. The contractor shall verify the CHP system performs as intended and in accordance with the manufacturer specifications, representation and warranties.

MAINTENANCE

This maintenance contract covers all scheduled service, repair and scheduled preventative maintenance operations required per CHP manufacturer supplied information. The services under this contract are required by the manufacturer to ensure that the CHP system maximizes the number and availability of Operational Hours, and ensures the reliable, efficient and cost-effective operation of the CHP system as installed. This includes all parts, materials, equipment, consumable lube oil and labor necessary for the safe and efficient operation of the CHP systems and compliance with all performance assurances stated herein as it pertains to a scheduled maintenance program.

- A. Contractor shall provide all required maintenance and repair work for the following:
 1. Complete Combined Heat and Power (CHP) system including, but not limited to, all components of:
 - i. Genset (CAT CG132B)
 - ii. Lube Oil System
 - iii. Coolant and Recooler Systems
 - iv. Heat rejection and recovery systems

- v. Combustion gas system
- vi. Ventilation system
- vii. Switchgear
- viii. Air Conditioner
- ix. Exhaust system
- x. Emissions treatment systems, Converter – Catalyst Elements
- xi. Control System
- xii. Auxiliary Drive Cabinet
- xiii. Electrical starting system
- xiv. Lighting
- xv. Pumps
- xvi. Other balance of plant equipment

CHP – CAT Energy Solutions. The brief descriptions of tasks required under each service levels are included in tables provided herein for reference. It shall be contractor's responsibility to obtain most recent and accurate service details and intervals/frequency directly from the manufacturer. The Contractor shall be required to perform the most stringent, and generally considered to be more expensive, service tasks in case of any conflicts. The pricing shall include tasks required by E1 Common provisions as applicable to respective service levels as noted in CHP 132B Maintenance Schedule Tables.

The following addition technical information from CAT has been included:

- Maintenance for gas engines TR 2167
- Specification for Lubricating Oil TR 2105
- TR 2091 - Coolant Specification
- TR 3017 - Combustion Gas Specification

Abbreviations used:

- a. EL-*: CHP Electrical Systems Maintenance – Frequency
- b. SCR: Selective Catalytic Reduction
- c. E** : CAT designated maintenance level

SCR SYSTEMS MAINTENANCE

Inspection

Inspection shall be understood to be the identification and judgement of the actual status of the exhaust gas purification system and/or its components. If necessary, further actions can be initiated additionally.

Maintenance

Service shall be understood as actions in order to prevent, restore and maintain the nominal situation of the exhaust gas purification system and/or its components. In case of necessity these defects must be rectified by service.

In order to keep the exhaust gas purification system and its components in optimal shape, they must be kept clean. Especially dust has a negative impact on the capability of heat radiation of the system components and may lead to defects or malfunctions due to overheating. Clean the housings with water and acid-free detergent in order not to damage the stickers and decals.

Repair/Exchange

Repair/Exchange includes all actions that are necessary to restore the nominal situation of the exhaust gas purification system and its components. Wear and tear parts must be exchanged without delay.

Converter – Catalyst Elements in the SCR shall be exchanged/replaced every 16,000 run hours. The price submitted on the cost proposal page shall be all inclusive of all activities necessary, to perform the removal, replacement and reassembly of the following included, but not limited to, components:

Item	Quantity
1303.0018-MIS DOOR GASKET	1.00
1401.0002-MIS FIBER GLASS ROLL 15 X 15	1.00
3010.0007-MIS FIBER GLASS ROLL 20 X 20	1.00
6000.2678-MIS EXPANSION MAT	40.00
6001.5395-MIS SCR MODULE	40.00
7000.1142-MIS EXPANSION MAT	25.00
7001.6377-MIS OXI MODULE	20.00

REQUIRED QUALIFICATIONS

- A. Contractor shall be a manufacturer's authorized representative, shall have provided gas engine generator sales and field service for CHP projects in New Jersey for minimum 5 years. Submit evidence with bid.
- B. The contractor shall guarantee certified technician(s) can be at the jobsite within four (4) hours after customer contact on a 365 days and 24 hours a day and 7 days a week basis.
- C. Serviceable component parts representing 95% economic value of the engine generator shall be stocked by the contractor within the United States to assure availability at jobsite in 24 hours.
- D. Generator set technicians: minimum of two (2) CAT certified technicians shall be employed by the supplying dealer and routinely service manufacturer's equipment in New Jersey. They shall be CAT certified for diagnosis and repair of the engine generator set, balance of CHP equipment, paralleling switchgear and controls being provided. Submit CAT training/qualification certificates with bid and submit technician resumes with bid.
- E. All work performed under this contract shall be performed by certified technical professionals with minimum levels of qualifications as required by CAT. Training specifications are provided by the CHP supplier.
- F. Contractor, at its own cost and expense, shall procure all licenses, permits and inspections necessary to perform all work required by this contract.

WARRANTY

- A. All material, equipment and workmanship provided by this Contractor, shall be guaranteed for one (1) year from date of installation and acceptance against any and all defects. If any defects occur, they shall be repaired or replaced at no cost to the County.
- B. Work performed under this contract shall not void the manufacturer's warranty, extended warranty or any custom warranty provisions

GENERAL SERVICE REQUIREMENTS

- A. All work shall be performed with care, skill and diligence and in accordance with generally accepted industry standards and practices
- B. Contractor shall schedule and perform all required services under the scope of his contract without any notification by the County. County shall request If and Where Directed items only. Coordinate service with Department of Buildings and Grounds Phone number 732-929-2039.
- C. Contractor may engage subcontractors for performance of activities in relation to services under this contract at no extra cost to the County provided subcontractors, their work and their personnel comply with all provisions of this contract.
- D. It is the Contractor's responsibility to provide all labor, materials and equipment that are required to perform the scheduled services, repairs and scheduled preventative maintenance operations required per CHP manufacturer supplied information. The County will not pay separately for such materials and equipment.
- E. Service and repairs outside of scheduled maintenance and preventative maintenance activities required by the County shall be billed at labor, material or rental equipment rates. Costs to the contractor for driving time, vehicle, mileage, material and equipment ordering time, shipping, transportation, boarding, lodging and entertainment costs shall be included within the proposed cost proposal line items and shall not be billed separately.
- F. A written report is to be submitted to the County within three (3) business days after each service and/or repair visit. This report shall contain a precise description of service provided.
- G. SDS forms must be provided for all chemicals used and stored under this contract.
- H. Service representatives are required to check-in and check-out with designated Ocean County personnel for each service visit. Contact Buildings and Grounds at 732-929-2039 for access.
- I. Contractor will respond by telephone to emergency calls 24 hours a day, 7 days a week, within ½ hour and have qualified staff en-route to site within 4 hours.
- J. Failure to respond within 1 hour will be grounds for termination of this contract.
- K. Contractor shall stock all consumables and parts that require annual service or replacement at Contractor's local office or shop.
- L. Contractor to have the ability to obtain and transport to site, any major or minor component of the CHP in case of a failure, within 5 business days.
- M. All service representatives must wear distinctive clothing that is readily identifiable. All representatives must bear valid photo ID.
- N. Service representatives must drive an official contractor's vehicle which must be clearly lettered with company name and phone number.
- O. The County reserves the right to levy any damages, loss of revenue etc. that may result from lack of performance and/or on-time performance of work under this contract, to the Contractor.

CONFLICTS BETWEEN SPECIFICATIONS AND MAINTENANCE REQUIREMENTS

In case of conflict between provisions of scope of work listed under these specifications and CHP or subcomponent manufacturers, the more stringent and more expensive requirement shall apply.

MEASUREMENT AND PAYMENT

The invoices shall contain the following information at a minimum:

- A. Service logs, check-in and check-out forms for the invoiced period.
- B. Invoices for any material and/or rental equipment used for service or repair outside of the scope of services defined under this contract.
- C. No escalation of prices will be allowed on any item included within this contract.
- D. Contractor's signed affidavit stating that all required maintenance activities have been performed in accordance with CHP manufacturer's instructions and in accordance with provisions of this contract.
- E. Each invoice shall have attached final service report referencing all service activity with dates and times (in/out) of work, total hours worked and type of work performed.
- F. Pricing shall be provided for maintenance levels E10 through E70, EL-6 thru EL-48, SCR-A, NJDEP and If and When Directed Items. The service levels are as defined by manufacturer of the CHP – CAT Energy Solutions.

HOURLY LABOR RATE

Labor hours shown in the proposal page are for bid purposes only. This County does not guarantee any minimum number of hours and will pay only for actual number of hours authorized and worked.

The labor charge should include all travel time. No additional travel time will be honored. Contractor travel costs must be incorporated in the bid proposal price. Hourly labor rates begin with Contractor's arrival at the site and end when Contractor Leaves the site. After the first full hour, hourly rates shall be prorated to the closest fifteen (15) minute interval.

MATERIALS

All parts and materials shall be invoiced at actual wholesale cost plus a percentage (%) markup. Copies of contractor's own purchase invoices reflecting actual costs shall accompany each invoice to the County.

The County will only pay for materials that have been authorized and used. The County does not pay for shipping charges from Contractor's vendors nor for drop shipments from Contract's vendor to the County.

Only Original Equipment Manufacturer's (OEM) parts shall be used, unless otherwise approved in advance of order and installation.

RENTAL EQUIPMENT

Rentals are not considered part of parts/materials and shall not be subject to mark-up. Sales tax is allowed on rental equipment per New Jersey Law.

INVOICING

An invoice shall be generated after each Preventative Maintenance service has been performed. Invoices for Preventative Maintenance and associated materials shall be billed at the applicable contract rates of which shall not be exceeded.

Each Service Call or additional work request shall generate a separate invoice detailing the labor charge and the parts and materials.

All invoices must be separated by service class and each invoice shall reference the corresponding bid item number for each separate amount billed.

EVALUATION

The quality of the equipment supplied, their conformity with the specifications, their suitability to requirements, delivery terms, guaranty clauses, price of the materials shall all be taken into consideration. Where equivalent equipment is offered, the County will determine if the proposed item is equal or better than that specified.

QUALITY

The materials and supplies called for herein, shall be the best of their grade and types, prepared according to the best available standards or accepted formulas, and thoroughly tested and subjected to rigid examinations and standardization. Items not meeting these requirements shall be replaced at no cost to the County upon due notice of deficiency.

WARRANTY

Manufacturer's warranty shall apply.

AVAILABILITY AND DELIVERY

The bidder should indicate the number of days required for the delivery After Receipt of Orders (A.R.O.). If not submitted with the bid proposal, the County reserves the right to request this information prior to the award of contract.

COORDINATION

Contractor shall provide cellular phone numbers for managers, supervisors and assigned technicians as requested by the using Department Head or his designee. Emergency cell phone number shall also be provided.

END OF SECTION

**APPENDIX:
REFERENCE DOCUMENTS FOR SERVICE AND MAINTENANCE CONTRACT FOR
COGENERATION SYSTEM AT THE COUNTY JUSTICE COMPLEX**

Maintenance Schedule Tables

Technical Bulletin TR 2167

Technical Bulletin TR 2105

Technical Bulletin TR 2091

Technical Bulletin TR 3017

CHP Electrical Systems Maintenance Schedule

Item	Maintenance Level	Service	Frequency
Auxiliary Drive Cabinet	EL-6	Check switch cabinet housing for corrosion	Every 6 Months
Auxiliary Drive Cabinet	EL-6	Clean switch cabinet housing and control elements	Every 6 Months
Auxiliary Drive Cabinet	EL-6	Clean filter mats of fan/outlet filter (interval applies for normal operating conditions)	Every 6 Months
Auxiliary Drive Cabinet	EL-12	Check switch cabinet door: hinges, lock, seal	Every 12 Months
Auxiliary Drive Cabinet	EL-12	Check screw connections of switch cabinet housing, mounting board, mounting rails	Every 12 Months
Auxiliary Drive Cabinet	EL-12	Check switch cabinet mountings	Every 12 Months
Auxiliary Drive Cabinet	EL-12	Check all screw terminals, lines, covers and cable ducts	Every 12 Months
Auxiliary Drive Cabinet	EL-12	Check frequently switching relays	Every 12 Months
Auxiliary Drive Cabinet	EL-12	Switch all control switches	Every 12 Months
Auxiliary Drive Cabinet	EL-12	Check control batteries	Every 12 Months
Auxiliary Drive Cabinet	EL-12	Check touch panel buffer battery	Every 12 Months
Auxiliary Drive Cabinet	EL-24	Replace filter mats of fan/outlet filter (interval applies for normal operating conditions)	Every 24 Months
Auxiliary Drive Cabinet	EL-48	Replace control batteries	Every 48 Months
Generator Power Field Cabinet	EL-6	Check switch cabinet housing for corrosion	Every 6 Months
Generator Power Field Cabinet	EL-6	Clean switch cabinet housing and operating elements	Every 6 Months
Generator Power Field Cabinet	EL-6	Clean filter mats of fan/outlet filter (interval applies for normal operating conditions)	Every 6 Months
Generator Power Field Cabinet	EL-12	Check switch cabinet door: hinges, lock, seal	Every 12 Months
Generator Power Field Cabinet	EL-12	Check screw connections of switch cabinet housing, mounting plate, mounting rails	Every 12 Months
Generator Power Field Cabinet	EL-12	Check screw connections of power part	Every 12 Months
Generator Power Field Cabinet	EL-12	Check switch cabinet mountings	Every 12 Months
Generator Power Field Cabinet	EL-12	Check all screw terminals, lines, covers and cable ducts	Every 12 Months
Generator Power Field Cabinet	EL-12	Check frequently switching relays	Every 12 Months
Generator Power Field Cabinet	EL-12	Switch all control switches	Every 12 Months
Generator Power Field Cabinet	EL-24	Replace filter mats of fan/outlet filter (interval applies for normal operating conditions)	Every 24 Months
Control and Monitoring	EL-12	Functional Testing of the switching channels: Test bridging device for differential pressure sensor	Every 12 Months
Control and Monitoring	EL-12	Functional Testing of the switching channels: Test reset device of the emergency-off module	Every 12 Months
TPEM Control Cabinet	EL-6	Check switch cabinet housing for corrosion	Every 6 Months
TPEM Control Cabinet	EL-6	Clean switch cabinet housing and control elements	Every 6 Months
TPEM Control Cabinet	EL-12	Check switch cabinet door: hinges, lock, seal	Every 12 Months
TPEM Control Cabinet	EL-12	Check screw connections of switch cabinet housing, mounting board, mounting rails	Every 12 Months
TPEM Control Cabinet	EL-12	Check switch cabinet mountings	Every 12 Months
TPEM Control Cabinet	EL-12	Check all screw terminals, lines, covers and cable ducts	Every 12 Months
TPEM Control Cabinet	EL-12	Check frequently switching relays	Every 12 Months
TPEM Control Cabinet	EL-12	Switch all control switches	Every 12 Months
TPEM Control Cabinet	EL-12	Check TPEM TP buffer battery	Every 12 Months

CHP SCR System Maintenance Schedule

Maintenance Level	CHP Run Hours (Cumulative)	Designation	Sub-Component	Description	Task
SCR-A	4000	Converter	Catalyst Elements	Emissions Measurements	Inspection
SCR-A	4000	Converter	Catalyst Elements	Cleaning	Maintenance
SCR-A	4000	Control Cabinet	Cooling Air Filter	Exchange	Repair
SCR-A	4000	Control Cabinet	Sample Gas Cooler	Functionality Test	Inspection
SCR-A	4000	Control Cabinet	Measuring Gas Cooler	Cleaning	Maintenance
SCR-A	4000	Control Cabinet	Climatisation	Functionality Test	Inspection
SCR-A	4000	Control Cabinet	Air Conition - filter mat	Exchange	Repair
SCR-A	4000	Control Cabinet	Condensate Pump Head	Exchange	Repair
SCR-A	4000	Control Cabinet	Pressure Switch	Exchange	Repair
SCR-A	4000	Control Cabinet	Measuring gas filter / scavenging air filter	Exchange	Repair
SCR-A	4000	Control Cabinet	Measuring Block	Check	Inspection
SCR-A	4000	Control Cabinet	Measuring Block	Cleaning	Maintenance
SCR-A	4000	Control Cabinet	Measuring gas pumps	Functionality test	Inspection
SCR-A	4000	Control Cabinet	Measuring gas pumps membranes	Exchange	Repair
SCR-A	4000	Control Cabinet	Measuring gas pipe / Valve	Exchange	Repair
SCR-A	4000	Control Cabinet	Measuring cells	Functionality test	Inspection
SCR-A	4000	Control Cabinet	Measuring cells	Exchange	Repair
SCR-A	4000	Control Cabinet	Parameter and regulator settings	Check	Inspection
SCR-A	4000	Reactant Dosing Unit	Pipes and connections - elements	Tightness / loose screws and glands	Inspection
SCR-A	4000	Reactant Dosing Unit	Non Return Valve Air	Functionality test	Inspection
SCR-A	4000	Reactant Dosing Unit	Non Return Valve Air	Exchange	Repair
SCR-A	4000	Reactant Dosing Unit	Pressure Switch air	Functionality test	Inspection
SCR-A	4000	Reactant Dosing Unit	Rotary drive	Function / Tightness	Inspection
SCR-A	4000	Compressor Unit	Pipes and connection-elements	Tightness / loose screws and glands	Inspection
SCR-A	4000	Compressor Unit	Vanes	Check / measure	Inspection
SCR-A	4000	Compressor Unit	Vanes	Exchange	Maintenance
SCR-A	4000	Compressor Unit	Filter	Exchange	Repair
SCR-A	4000	Low pressure reactant injector	Pipes and connection-elements	Tightness / loose screws and glands	Inspection
SCR-A	4000	Low pressure reactant injector	Injector body	Cleaning	Maintenance
SCR-A	4000	Low pressure reactant injector	Nozzle head	Soiling / damage	Inspection
SCR-A	4000	Low pressure reactant injector	Nozzle insert / Nozzle cap / Seal	Exchange	Repair
SCR-A	4000	Low pressure reactant injector	Flange Seal	Exchange	Repair
SCR-A	4000	Perforated Sampling Probe	Probe	Soiling / damage	Inspection
SCR-A	4000	Temperature Sensor	Sensor	Functionality Test	Inspection
SCR-A	4000	Temperature Sensor	Sensor	Exchange	Repair
SCR-A	4000	Reactant Supply Unit	General components	Functionality test	Inspection

CHP SCR System Maintenance Schedule

Maintenance Level	CHP Run Hours (Cumulative)	Designation	Sub-Component	Description	Task
SCR-A	4000	Reactant Supply Unit	Reactant	Cleaning	Maintenance
SCR-A	4000	Reactant Supply Unit	Reactant Pump	Exchange	Repair

CHP CG132B Maintenance Schedule (MAINTENANCE LEVEL/SERVICE CLASSIFICATIONS)

CHP Run Hours (Cumulative)	Service Type	CAT Service Category/Maintenance Level	Service Description
50	Initial Run	E10	Complete test and functioning run
50	Initial Run	E10	Inlet and Outlet Valves, check valve clearance and set
50	Initial Run	E10	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted
2000	Regular Maintenance	E30	Complete auxiliary device test
2000	Regular Maintenance	E30	Complete test & functioning run
2000	Regular Maintenance	E30	Check starting system
2000	Regular Maintenance	E30	Inlet & outlet valves, check valve clearance & set
2000	Regular Maintenance	E30	Check throttle valve
2000	Regular Maintenance	E30	Check ignition timing
2000	Regular Maintenance	E30	Check spark plug
4000	Regular Maintenance	E40	Complete test & functioning run
4000	Regular Maintenance	E40	Check starting system
4000	Regular Maintenance	E40	Exhaust gas system, check pollutant emissions
4000	Regular Maintenance	E40	Check starting system
4000	Regular Maintenance	E40	Inlet & outlet valves, check valve clearance & set
4000	Regular Maintenance	E40	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted
4000	Regular Maintenance	E40	Check throttle valve
4000	Regular Maintenance	E40	Lube oil system, replace lube oil filter
4000	Regular Maintenance	E40	Check ignition timing
4000	Regular Maintenance	E40	Replace spark plug
6000	Regular Maintenance	E30	Complete auxiliary device test
6000	Regular Maintenance	E30	Complete test & functioning run
6000	Regular Maintenance	E30	Check starting system
6000	Regular Maintenance	E30	Inlet & outlet valves, check valve clearance & set
6000	Regular Maintenance	E30	Check throttle valve
6000	Regular Maintenance	E30	Check ignition timing
6000	Regular Maintenance	E30	Check spark plug
8000	Regular Maintenance	E40	Complete test & functioning run
8000	Regular Maintenance	E40	Check starting system
8000	Regular Maintenance	E40	Exhaust gas system, check pollutant emissions
8000	Regular Maintenance	E40	Check starting system
8000	Regular Maintenance	E40	Inlet & outlet valves, check valve clearance & set
8000	Regular Maintenance	E40	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted

CHP CG132B Maintenance Schedule (MAINTENANCE LEVEL/SERVICE CLASSIFICATIONS)

CHP Run Hours (Cumulative)	Service Type	CAT Service Category/Maintenance Level	Service Description
8000	Regular Maintenance	E40	Check throttle valve
8000	Regular Maintenance	E40	Lube oil system, replace lube oil filter
8000	Regular Maintenance	E40	Check ignition timing
8000	Regular Maintenance	E40	Replace spark plug
10000	Regular Maintenance	E30	Complete auxiliary device test
10000	Regular Maintenance	E30	Complete test & functioning run
10000	Regular Maintenance	E30	Check starting system
10000	Regular Maintenance	E30	Inlet & outlet valves, check valve clearance & set
10000	Regular Maintenance	E30	Check throttle valve
10000	Regular Maintenance	E30	Check ignition timing
10000	Regular Maintenance	E30	Check spark plug
12000	Regular Maintenance	E40	Complete test & functioning run
12000	Regular Maintenance	E40	Check starting system
12000	Regular Maintenance	E40	Exhaust gas system, check pollutant emissions
12000	Regular Maintenance	E40	Check starting system
12000	Regular Maintenance	E40	Inlet & outlet valves, check valve clearance & set
12000	Regular Maintenance	E40	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted
12000	Regular Maintenance	E40	Check throttle valve
12000	Regular Maintenance	E40	Lube oil system, replace lube oil filter
12000	Regular Maintenance	E40	Check ignition timing
12000	Regular Maintenance	E40	Replace spark plug
14000	Regular Maintenance	E30	Complete auxiliary device test
14000	Regular Maintenance	E30	Complete test & functioning run
14000	Regular Maintenance	E30	Check starting system
14000	Regular Maintenance	E30	Inlet & outlet valves, check valve clearance & set
14000	Regular Maintenance	E30	Check throttle valve
14000	Regular Maintenance	E30	Check ignition timing
14000	Regular Maintenance	E30	Check spark plug
16000	Regular Maintenance	E40	Complete test & functioning run
16000	Regular Maintenance	E40	Check starting system
16000	Regular Maintenance	E40	Exhaust gas system, check pollutant emissions
16000	Regular Maintenance	E40	Check starting system
16000	Regular Maintenance	E40	Inlet & outlet valves, check valve clearance & set

CHP CG132B Maintenance Schedule (MAINTENANCE LEVEL/SERVICE CLASSIFICATIONS)

CHP Run Hours (Cumulative)	Service Type	CAT Service Category/Maintenance Level	Service Description
16000	Regular Maintenance	E40	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted
16000	Regular Maintenance	E40	Check throttle valve
16000	Regular Maintenance	E40	Lube oil system, replace lube oil filter
16000	Regular Maintenance	E40	Check ignition timing
16000	Regular Maintenance	E40	Replace spark plug
18000	Regular Maintenance	E30	Complete auxiliary device test
18000	Regular Maintenance	E30	Complete test & functioning run
18000	Regular Maintenance	E30	Check starting system
18000	Regular Maintenance	E30	Inlet & outlet valves, check valve clearance & set
18000	Regular Maintenance	E30	Check throttle valve
18000	Regular Maintenance	E30	Check ignition timing
18000	Regular Maintenance	E30	Check spark plug
20000	Regular Maintenance	E50	Complete auxiliary device test
20000	Regular Maintenance	E50	Complete test & functioning run
20000	Regular Maintenance	E50	Exhaust gas system, check pollutant emissions
20000	Regular Maintenance	E50	Check starting system
20000	Regular Maintenance	E50	Inlet & outlet valves, check valve clearance & set
20000	Regular Maintenance	E50	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted
20000	Regular Maintenance	E50	Check Engine Mount
20000	Regular Maintenance	E50	Visually Inspect mixture cooler
20000	Regular Maintenance	E50	Clean gas/air mixture
20000	Regular Maintenance	E50	Check throttle valve
20000	Regular Maintenance	E50	Lube oil system, replace lube oil filter
20000	Regular Maintenance	E50	Check ignition timing
20000	Regular Maintenance	E50	Replace spark plug
20000	Regular Maintenance	E50	Check starter pinion and gear ring on the flywheel
22000	Regular Maintenance	E30	Complete auxiliary device test
22000	Regular Maintenance	E30	Complete test & functioning run
22000	Regular Maintenance	E30	Check starting system
22000	Regular Maintenance	E30	Inlet & outlet valves, check valve clearance & set
22000	Regular Maintenance	E30	Check throttle valve
22000	Regular Maintenance	E30	Check ignition timing
22000	Regular Maintenance	E30	Check spark plug

CHP CG132B Maintenance Schedule (MAINTENANCE LEVEL/SERVICE CLASSIFICATIONS)

CHP Run Hours (Cumulative)	Service Type	CAT Service Category/Maintenance Level	Service Description
24000	Regular Maintenance	E40	Complete test & functioning run
24000	Regular Maintenance	E40	Check starting system
24000	Regular Maintenance	E40	Exhaust gas system, check pollutant emissions
24000	Regular Maintenance	E40	Check starting system
24000	Regular Maintenance	E40	Inlet & outlet valves, check valve clearance & set
24000	Regular Maintenance	E40	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted
24000	Regular Maintenance	E40	Check throttle valve
24000	Regular Maintenance	E40	Lube oil system, replace lube oil filter
24000	Regular Maintenance	E40	Check ignition timing
24000	Regular Maintenance	E40	Replace spark plug
26000	Regular Maintenance	E30	Complete auxiliary device test
26000	Regular Maintenance	E30	Complete test & functioning run
26000	Regular Maintenance	E30	Check starting system
26000	Regular Maintenance	E30	Inlet & outlet valves, check valve clearance & set
26000	Regular Maintenance	E30	Check throttle valve
26000	Regular Maintenance	E30	Check ignition timing
26000	Regular Maintenance	E30	Check spark plug
28000	Regular Maintenance	E40	Complete test & functioning run
28000	Regular Maintenance	E40	Check starting system
28000	Regular Maintenance	E40	Exhaust gas system, check pollutant emissions
28000	Regular Maintenance	E40	Check starting system
28000	Regular Maintenance	E40	Inlet & outlet valves, check valve clearance & set
28000	Regular Maintenance	E40	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted
28000	Regular Maintenance	E40	Check throttle valve
28000	Regular Maintenance	E40	Lube oil system, replace lube oil filter
28000	Regular Maintenance	E40	Check ignition timing
28000	Regular Maintenance	E40	Replace spark plug
30000	Regular Maintenance	E30	Complete auxiliary device test
30000	Regular Maintenance	E30	Complete test & functioning run
30000	Regular Maintenance	E30	Check starting system
30000	Regular Maintenance	E30	Inlet & outlet valves, check valve clearance & set
30000	Regular Maintenance	E30	Check throttle valve
30000	Regular Maintenance	E30	Check ignition timing

CHP CG132B Maintenance Schedule (MAINTENANCE LEVEL/SERVICE CLASSIFICATIONS)

CHP Run Hours (Cumulative)	Service Type	CAT Service Category/Maintenance Level	Service Description
30000	Regular Maintenance	E30	Check spark plug
32000	Regular Maintenance	E40	Complete test & functioning run
32000	Regular Maintenance	E40	Check starting system
32000	Regular Maintenance	E40	Exhaust gas system, check pollutant emissions
32000	Regular Maintenance	E40	Check starting system
32000	Regular Maintenance	E40	Inlet & outlet valves, check valve clearance & set
32000	Regular Maintenance	E40	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted
32000	Regular Maintenance	E40	Check throttle valve
32000	Regular Maintenance	E40	Lube oil system, replace lube oil filter
32000	Regular Maintenance	E40	Check ignition timing
32000	Regular Maintenance	E40	Replace spark plug
34000	Regular Maintenance	E30	Complete auxiliary device test
34000	Regular Maintenance	E30	Complete test & functioning run
34000	Regular Maintenance	E30	Check starting system
34000	Regular Maintenance	E30	Inlet & outlet valves, check valve clearance & set
34000	Regular Maintenance	E30	Check throttle valve
34000	Regular Maintenance	E30	Check ignition timing
34000	Regular Maintenance	E30	Check spark plug
36000	Regular Maintenance	E40	Complete test & functioning run
36000	Regular Maintenance	E40	Check starting system
36000	Regular Maintenance	E40	Exhaust gas system, check pollutant emissions
36000	Regular Maintenance	E40	Check starting system
36000	Regular Maintenance	E40	Inlet & outlet valves, check valve clearance & set
36000	Regular Maintenance	E40	Inlet and Outlet Valves, check valve clearance and set - cylinder head mounted
36000	Regular Maintenance	E40	Check throttle valve
36000	Regular Maintenance	E40	Lube oil system, replace lube oil filter
36000	Regular Maintenance	E40	Check ignition timing
36000	Regular Maintenance	E40	Replace spark plug

E1 - COMMON PROVISIONS

All Items Listed in the Table below are applicable to all service levels as specified and/or required/recommended by manufacturer within service instructions

Service	Frequency
Clean Genset	if required
Run in the engine after replacing pistons or cylinder liner	if required
Replace or exchange starter	if required
Exchange cylinder heads when the max. valve clearance in accordance with technical specifications is reached	between every 20000-40000 hours
Lube oil system-complete lube oil analysis & replace lube oil	see TR-2105
Visually inspect the cylinder liner Cylinder head removed	when replacing the cylinder heads
Visually inspect coke scraper ring Cylinder head removed	when replacing the cylinder heads
Carry out test run If the engine was not run in operational readiness within a month	Monthly
Combustion gas system, sample taking and gas analysis according to Technical Bulletin (TR) 3017	every 4000 hours
Check coolant• according to Technical Bulletin (TR) 2091	every 4000 hours
Replace coolant• according to Technical Bulletin (TR) 2091	every 24000 hours min.
Exchange exhaust turbocharger, standard overhaul	every 20000 hours
Exchange exhaust turbocharger, major overhaul	every 60000 hours
Check wastegate• only V16 engine	when replacing the exhaust turbocharger
Lube oil system-completely replace lube oil	Every 8000 Hours or once a year whichever sooner
Lube oil system-complete lube oil analysis	After initial 100 hours
Lube oil system-complete lube oil analysis and renew lube oil	After initial 250 hours
Every 4000 hour service, test the complete CHP system to verify continued performance within tolerances as specified on manufacturers' data sheets	every 4000 hours

Emissions Testing Requirements (MAINTENANCE LEVEL)

County currently holds a CHP-02-1 General permit issued by NJ DEP to operate the CHP system. The CHP is subject to a facility specific compliance plan. The following items from the compliance plan shall be the Contractor's responsibility. For further details refer to NJ DEP GP-022 permit requirements

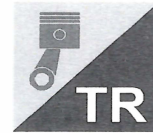
Service Classification/Maintenance Level	Item	Frequency	Responsibility
NJDEP	Maintain the manufacturer's specifications showing maximum heat input for the CHP on site for the life of equipment.	-	Owner
NJDEP	Recordkeeping of stack test results. Keep for five years	12 Months	Owner
NJDEP	Annual adjustment of combustion process per NJDEP requirements, recordkeeping, submittals	12 Months	Contractor
NJDEP	Stack emission testing per NJ DEP requirements for min. CO, NOx, VOC, Formaldehyde, Ammonia recordkeeping, submittals, transmittals	12 Months	Contractor
NJDEP	Fuel usage data - monthly, annually and keep on site for 5 years	Monthly	Owner
NJDEP	Maintain manufacturer's recommended maintenance procedures on site for life of equipment	-	Owner
NJDEP	Measure the stack height of CHP and keep record on site for life of equipment	-	Owner
NJDEP	Maintain record of occurrence and duration of any startup, shutdown or malfunction of CHP	as required	Owner



Technical Bulletin

2167/04 EN

This circular replaces:
2167/03



Maintenance for gas engines

Valid for: CG132, CG132B, CG170, CG170 (1.0), CG260, CG260 (4.5)

The 4th replacement was made because of:

- Type error in assignment table CG132B
 - Document code adjustment for Medium and Low gas quality
 - Flexible operation omitted

Contents:

- General information
- Definition of the mode of operation
- Document code (coding)
- Assignment table per engine type
 - CG132
 - CG132B
 - CG170
 - CG170 (K)
 - CG170 (1.0)
 - CG260
 - CG260 (4.5)
- Maintenance schedule
- Personnel
- Definition of the maintenance work

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Note:
There is no revision service for the parts numbers specified in this document. Only the spare parts documentation is binding for the identification of spare parts.

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Technical Bulletin



2167/04 EN

General information

The product is intended exclusively for the contractually agreed use. Any other use, or use exceeding this, does not qualify as intended use.

The intended use of the engine is indicated by a power code that is engraved on the rating plate.

The maintenance work required to maintain the target state and thus the operational safety is detailed in the maintenance schedule.

The maintenance intervals indicated in the maintenance schedule are maximum values, and it is presupposed that the installation, intended use and operating conditions comply with all requirements stated.

The maintenance work must be completed by specialist personnel with the corresponding competencies.

To avoid any operating faults and/or premature wear, it must be ensured that all operating media comply with the required specification. The operating media are indicated in the operating media specifications. The figures mentioned therein are binding unless otherwise specified in the system-specific contracts.



The date for shutting down the system must be scheduled in good time to ensure that maintenance work is completed in a timely manner.

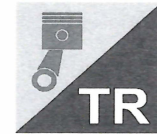
Any provisional dates for shutting down the system must be agreed with the responsible Caterpillar dealer at an early stage. Any malfunctions which might have occurred on your genset must be reported when arranging the date.

Detailed information can be obtained from the responsible Caterpillar dealer.



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Definition of the mode of operation

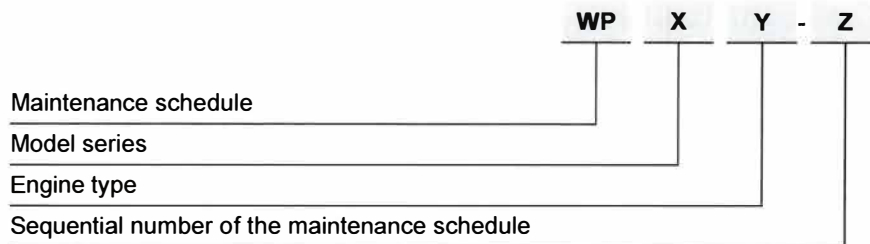
Different maintenance plans are assigned to the engine depending on the usage type, mode of operation and option such as Fast Ramp-Up.

The modes of operation are defined as follows:

- Continuous operation
 - more than 3000 operating hours per year **and**
 - less than 1200 engine starts per year **and**
 - more than 2 operating hours per engine start

- Flexible operation
 - less than 3000 operating hours per year **or**
 - more than 1200 engine starts per year **or**
 - less than 2 operating hours per engine start **or**
 - with the option Fast Ramp-Up

Document code (coding)



Coding list

CG132	WP 1 1 - z
CG132B	WP 1 2 - z
CG170	WP 2 1 - z
CG170 (K)	WP 2 2 - z
CG170 (1.0)	WP 2 4 - z
CG260	WP 3 1 - z
CG260 (4. 5)	WP 3 2 - z



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Assignment table per engine type

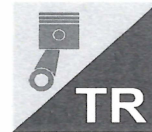
Engine type	Mode of operation	Speed (Hz)	Gas quality	Maintenance schedule
CG132	Continuous operation	1500 (50)	High	WP 11-1
			Medium	WP 11-1
			Low	WP 11-2
		1800 (60)	High	WP 11-1
			Medium	WP 11-1
			Low	WP 11-2
	Flexible operation	1500 (50)	High	WP 11-3
			Medium	WP 11-3
			Low	
		1800 (60)	High	WP 11-3
			Medium	WP 11-3
			Low	

Engine type	Mode of operation	Speed (Hz)	Gas quality	Maintenance schedule
CG170	Continuous operation	1500 (50/60)	High	WP 21-1
			Medium	WP 21-1
			Low	WP 21-2
	Flexible operation	1500 (50/60)	High	WP 21-3
			Medium	WP 21-3
			Low	
	Flexible operation with the option Fast Ramp-Up	1500 (50)	High	WP 21-3
			Medium	WP 21-3
			Low	



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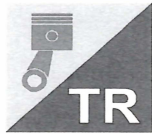


Engine type	Mode of operation	Speed (Hz)	Gas quality	Maintenance schedule
CG170 (K)	Continuous operation	1500 (50/60)	High	WP 22-1
			Medium	-----
			Low	-----
	Flexible operation	1500 (50/60)	High	WP 22-2
			Medium	-----
			Low	-----

Engine type	Mode of operation	Speed (Hz)	Gas quality	Maintenance schedule
CG170 (1.0)	Continuous operation	1500 (50/60)	High	WP 24-1
			Medium	WP 24-2
			Low	WP 24-3
	Flexible operation	1500 (50/60)	High	WP 24-4
			Medium	WP 24-4
			Low	-----



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Engine type	Mode of operation	Speed (Hz)	Gas quality	Maintenance schedule
CG260	Continuous operation	1000 (50)	High	WP 31-1
			Medium	WP 31-2
			Low	WP 31-3
		900 (60)	High	WP 31-1
			Medium	WP 31-2
			Low	WP 31-3

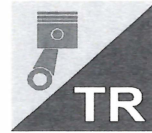
Engine type	Mode of operation	Speed (Hz)	Gas quality	Maintenance schedule
CG260 (4.5)	Continuous operation	1000 (50)	High	WP 32-1
			Medium	----
			Low	----
		900 (60)	High	WP 32-1
			Medium	----
			Low	----

Engine type	Mode of operation	Speed (Hz)	Gas quality	Maintenance schedule
CG132B	Continuous operation	1500 (50)	High	WP 12-1
			Medium	WP 12-2
			Low	WP 12-3
		1800 (60)	High	WP 12-1
			Medium	WP 12-2
			Low	WP 12-3



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Maintenance schedule

The maintenance work indicated in the maintenance schedule presupposes that the installation, intended use and operating conditions comply with all requirements stated.

The local operating conditions must be taken into account right from the projection phase.

The combustion gases are classified into various gas quality groups by their accompanying substances and their effects on the wear.



For more information on the gas qualities and limit values of the combustion gases, see

- Operating Manual ⇒ General ⇒ Operating media regulations
 - Technical Bulletin (TR) 3017 Specification for combustion gas
-

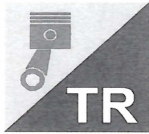
To guarantee the service lives, the composition of the combustion gas must be determined at regular intervals by means of a comprehensive gas analysis. The maintenance intervals may need to be shortened accordingly depending on the results of the gas analysis.

The specified maintenance work must be completed once the specified maintenance intervals have elapsed.

The maintenance work is illustrated on separate pages to improve readability. These can be used as the master copy.



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Personnel

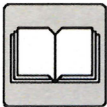
A range of competence classes (CC) have been introduced to be able to provide the specialist personnel with appropriate information.

The maintenance work must only be carried out by specialist personnel with the corresponding competence class or qualification.

The maintenance work is indicated accordingly in the maintenance schedule.

- 1** are maintenance activities for which the specialist personnel must have the minimum requirement CC1
- 2** are maintenance and repair activities for which the specialist personnel must have the minimum requirement CC2
- 3** are maintenance and repair activities for which the specialist personnel must have the minimum requirement CC3
- Q** are assembly and repair activities for which the specialist personnel must have the minimum requirement for qualified specialist personnel

The job card numbers are specified in the maintenance schedule. The operational procedures are described on the corresponding job cards.



For further information on the specialist personnel and competence classes, see:

- Service Info Technology (SIT) 7011 Services and competencies for the maintenance of products of Caterpillar Energy Solutions GmbH
 - Operating Manual ⇒ General ⇒ Safety regulations
 - Personnel - Qualifications and Duties
-



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Definition of the maintenance work

Exchanging

Replacing components with new and exchange parts.

Adjusting

Setting dimensions, pressures, etc.

Additional work to replace components may be necessary.

Draining

Draining liquids (e.g. condensation).

Replacing

Replacing components, operating materials, etc.

Reworking

Material removal within the permitted tolerances for maintaining a required condition.

Checking

Checking according to criteria on the job card.

If one or more criteria are not satisfied, the cause must be determined and the required target state reinstated.

Cleaning

Clean components manually or automatically.

Additional work to replace components may be necessary.

Visually inspecting

Visual inspection according to criteria on the job card.

If one or more criteria are not satisfied, the cause must be determined and the required target state reinstated.

Overhauling

Reworking of components by qualified specialist personnel.

Maintaining

Carrying out maintenance according to job card.

Additional work to replace components may be necessary.

Changing

Changing components, operating media, etc. (e.g. lube oil).



Technical Bulletin



2167/04 EN

Service Information

This document was created digitally and is valid without a signature.

This is a translation of the German original. All translations are based on the German original.



Technical Bulletin

2105/20 EN

This circular replaces:
2105/19



Specification for Lubricating Oil

Valid for: **CG132, CG132B, CG170, CG260, CG260 (4.5)**

The 20th replacement is made on account of:

- Revision of the Technical Bulletin
- List of approved lube oils in separate documents
- Updating the released lubricating oils

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Note:
There is no revision service for the parts numbers specified in this document. Only the spare parts documentation is binding for the identification of spare parts.

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Technical Bulletin



2105/20 EN

Contents:

- General information
- Lubricating oil selection
- Lubricating oil sampling
- Lubricating oil analysis
- Lubricating oil change
- Lubricating oil filter change
- Limit values
- Wear metals
- Lubricating oil consumption
- Interpretation of parameters of the lubricating oil analysis
- Interpretation of elements of the lubricating oil analysis
- Interpretation of the optionally analyzed elements of the lubricating oil analysis
- Appendix
 - Approved lube oils CG132
 - Approved lube oils CG132B
 - Approved lube oils CG170
 - Approved lube oils CG260
 - Approved lube oils CG260 (4.5)



Technical Bulletin

2105/20 EN



General information



Risk of destruction of components

From non-approved lubricating oils

- Only use released lubricating oils
-



The owner is solely responsible for observing the lubricating oil specification described.

The operator must be able to demonstrate his maintenance obligation by analyzing the lubricating oils in accordance with this lubricating oil specification.

The manufacturer accepts no liability for damage caused by the use of non-approved lubricating oils or by improper operation.

Lubricating oils for combustion engines are exposed to extreme mechanical and thermal stress. The lubricating oil should not evaporate at the high temperatures of the cylinder liners but should form a sufficiently tenacious, pressure-stable, well adhesive lubricating film. It should be thin enough in the cold state to enable starting of the cold engine. The sliding surfaces of the engine components should remain wet for restarting the engine when the engine is shut down.

The lubricating oils must generally have the following properties:

- stable lubricating film at all operating temperatures
- optimal viscosity at all operating temperatures
- high thermal stability
- high resistance to aging
- wear-preventing properties
- neutralizing properties against corrosive materials
- balanced ratio of ash-forming active ingredients
- high safety reserves for long lubricating oil change intervals

Economic operation is achieved by as long a lubricating oil change interval of the lubricating oil filling as possible. The emphasis is always on the avoidance of damage and achievement of the expected service lives of important engine components.



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2105/20 EN

Lubricating oil selection

Lubricating oils (sulfate ash content up to 0.6 wt. %)

The lubricating oils listed in the section **Approved lubricating oils (sulfate ash content up to 0.6 wt. %)** must be used for operating gas engines.

Lubricating oils (sulfate ash content 0.6 - 1.0 wt. %)

Other lube oils are approved specially for operation with combustion gases with a higher pollution load (see also Technical Bulletin (TR) 3017). These are listed in the section **Approved lubricating oils (sulfate ash content 0.6 - 1.0 wt. %)**.

These lubricating oils are recognizable according to the manufacturer's data sheet by their high TBN and sulfate ash values and have a higher neutralization reserve against acids which are produced by the burning of pollutants in the combustive gas. These acids are produced, for example, from chlorine (Cl), fluoride (F) and sulfur (S). The neutralization of the acids protects the engine from corrosion.

Larger amounts of lubricating oil additives are necessary to ensure neutralization. However, this means the higher the neutralization potential of a lubricating oil, the higher the tendency for deposits to form during combustion.

If such lube oils are used in combustive gases which exhibit no continuously high pollutant loads (in accordance with the values permitted in the Technical Bulletin (TR) 3017), the additives are not consumed because no or only small amounts of acids are produced which have to be neutralized.

Here, the advantages of these special lubricating oils become clear disadvantages.

- The unused additives form deposits in the combustion chamber and in the following system parts such as exhaust gas heat exchanger, silencer etc.
- These deposits can bond with elements in the combustive gas, e.g. silicon (Si), in the combustion chamber. These compounds are very hard and lead to abrasive wear on pistons, piston rings, cylinder liners, valves and valve seat rings.

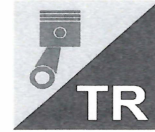
We therefore recommend that you operate all engines with lubricating oils according to section **Approved lubricating oils (sulfate ash content up to 0.6%)** until a stable combustive gas generation has been achieved. During this time, the boundary conditions and effects of the used combustive gas on economical and reliable operation of the engine must be determined by lubricating oil and gas analyses.

If, at the end of the system start-up process, the concentration of pollutants in the combustive gas should remain continuously high and no economical lube oil change intervals reached as a result, you can convert to lube oils in accordance with section **Approved lube oils (sulfate ash content 0.6 - 1.0 wt. %)** in agreement with the Caterpillar dealer.



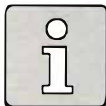
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Lubricating oil sampling

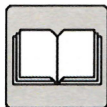
A careful preparation and execution of the the lubricating oil sampling is a prerequisite for useful analysis values.



Make sure that the lubricating oil sample is not falsified by dirt or residue lubricating oil in the additives.

About 100 ml of lubricating oil is sufficient for a routine analysis.

The lube oil sample must be taken from the lube oil circuit whilst the engine is running and warm.



For further information on the lubricating oil sampling, see

- Genset Operating Manual ⇒ Job cards
 - B 8-1-1 Sampling the lubricating oil

At least 100 ml of lubricating oil must be drained and properly disposed of before taking the sample. Then the necessary amount of lubricating oil for the lubricating oil sample must be taken.

Changes in the lubricating oil due to sampling and transport are to be avoided.

The samples must be clearly identified and the following minimum information contained:

- Operator
- Engine type
- Engine serial number
- Manufacturer of the lubricating oil
- Designation of the lubricating oil
- Date of the sampling
- Operating hours of the engine
- Operating hours of the lubricating oil
- Filling amount / lubricating oil consumption
- Total lubricating oil volume



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Lubricating oil analysis



The operator must guarantee that the analysis values necessary for choosing the lubricating oil change intervals are available on schedule.

The analysis values must be presented to the operator as quickly as possible (maximum half of the lubricating oil analysis interval).

Perform the first lubricating oil analysis independently of the combustion gas type after 100 operating hours.

A detailed lubricating oil analysis must ensure that the engine is operated with lubricating oil according to the specification in this technical bulletin. Lubricating oil analysis reports must be kept to provide proof of this proper operation of the engine.

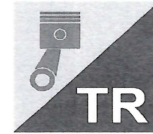
In case of abnormal wear values within an analysis series, the analysis must be provided to the Caterpillar dealer for engine still under guarantee.

The trend analysis is most suitable for monitoring the analysis values over a longer period of time. The individual analysis values are recorded here in tables or graphs. This allows an assessment of the condition of the lubricating oil and the engine (trend detection).



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Lubricating oil change

Lubricating oil change

The entire amount of lubricating oil must be replaced when performing a lubricating oil change. The remaining lubricating oil volume in the engine and add-on parts should be kept as low as possible.

The lubricating oil change is necessary when one of the following criteria is satisfied:

- upon approximation to the permissible limit value
- after penetration of the lubricating oil system by coolant
- after maintenance work of the maintenance and service schedule E60 and E70
- after service work of a scope E60 or E70
- at least once a year

This does not include gensets with a lube oil change interval as per lube oil analysis greater than 10000 oh.

Lubricating oil change intervals

In addition to the lubricating oil quality, the lubricating oil change intervals are dependent on:

- the combustion gas quality
- the ambient conditions
- the operating principle of the engine

As a rule, these influences lead to a change in the lubricating oil parameters.

It is therefore necessary to determine the lubricating oil change intervals by lubricating oil analyses for every system.

By suitable choice of the time intervals for the lubricating oil analyses, the lubricating oil can be used until reaching the limit values.

The lubricating oil change intervals must always be re-determined when:

- commissioning the system
- changing the type of operation
- after maintenance work of the maintenance and service schedule E60 and E70
- after service work of a scope E60 or E70

Under unchanged operating conditions, the further lubricating oil analysis intervals and the necessary lubricating oil change must be agreed between the operator and the caterpillar dealer on the basis of this technical bulletin.



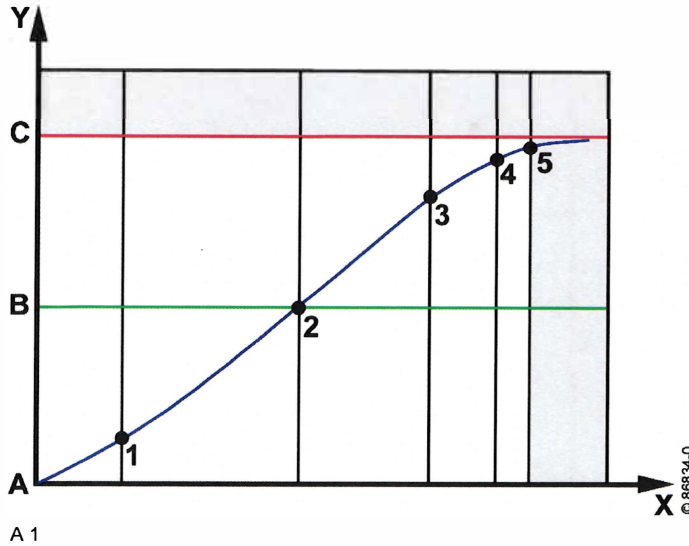
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The lubricating oil change intervals must be determined as follows:

Example 1:



- X axis: Time period
- Y axis: Numeric value of the analysis result
- A: Initial value
- B: Half of limit value
- C: Limit value
- Position 1-5: Time of the lubricating oil analysis
- Position 5: Time of the next lubricating oil change

- First lubricating oil filling
 - If the analysis values (position 1) are well below half the permissible limit values B, the timer interval before the next lubricating oil analysis (position 2) can be doubled.
 - If individual analysis values reach half the permissible limit value B, the time interval before the next analysis (position 3) must be reduced.



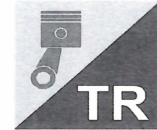
On approaching the permitted limit value C, the time intervals from analysis to analysis (position 4 and 5) must be halved respectively.

- Second and further lubricating oil fillings
 - After the first determination of the lubricating oil change interval, the first lubricating oil analysis can be taken after a greater interval (position 3) for the second lubricating oil filling.



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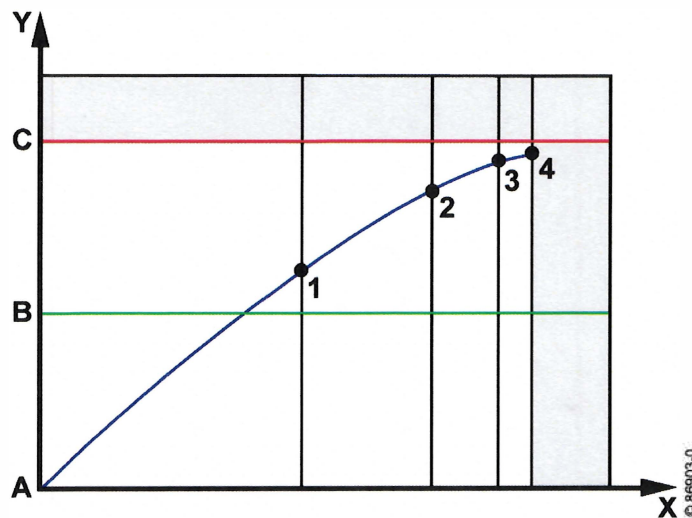


- Another lubricating oil analysis (position 4) is taken if comparable analysis results with the first lubricating oil filling are obtained.
- If, on the other hand, the same analysis values are reached, the same lubricating oil change interval as in the first lubricating oil filling can be determined.
- In case of unchanged operating conditions, the lubricating oil analyses for the following lubricating oil fillings can be taken at the same interval (position 4).



If the analysis results deviate from the previous results, the lubricating oil change intervals must be re-determined until repeatable results are achieved.

Example 2:



A 2

- X axis: Time period
- Y axis: Numeric value of the analysis result
- A: Initial value
- B: Half of limit value
- C: Limit value
- Position 1-4: Time of the lubricating oil analysis
- Position 4: Time of the next lubricating oil change

- If the analysis values of the first lubricating oil sample are already close to the permitted limit values (position 1), the operating time until the next lubricating oil analysis must be reduced (position 2).
- If the short distance from the limit values is confirmed, the last analysis period (position 3 to 4) must be halved.



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Lube oil change intervals for CG132 without increased lube oil volume

Due to the time delay between taking the lube oil sample and the availability of the analysis results (due to posting and processing times), the procedure that has already been described can only be applied to a limited extent for CG132 without increased lube oil volume.

To prevent limit values from being exceeded in all cases during the analysis period, the following procedure must be applied:

- After 100 oh
 - First lubricating oil sample
- At 250 oh
 - Second lubricating oil sample, then renew lubricating oil

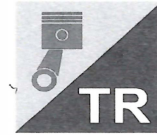
Depending on the results of the lubricating oil sampling, the change time can now be gradually increased by 50 operating hours, if the limit values have not yet been exceeded by the change time.

Analogous to this, the change interval must be reduced if the limit values are exceeded.



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Lubricating oil filter change

All lubricating oil filters must always be replaced when performing a lubricating oil filter change.

The lubricating oil filter change is necessary:

- after 4000 operating hours at the latest - unless otherwise indicated in the maintenance plan
- with the first lubricating oil change after commissioning
- with the first lubricating oil change after maintenance work of maintenance level E60 and E70, or after repair work of a scope E60 or E70
- at least once a year
- if a SAN has been detected in the lubricating oil - see limit values
- after penetration of the lubricating oil system by coolant



After coolant has entered the lube oil system, all filter elements in the crankcase breather and the sub-stream lube oil filter (CG260, CG260 (4.5)) must be replaced.



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Limit values



Risk of destruction of components

Due to failure to comply with the limit values

- If one of the following limit values is not complied with, the lubricating oil must be changed immediately.

During operation

Properties	Limit value	Test method
Increase in viscosity in comparison with the new condition at 100 °C	max. 3 mm ² /s (cSt)	
Viscosity at 100 °C	min. 12 mm ² /s (cSt) max. 18 mm ² /s (cSt)	DIN 51366, ASTM D445, DIN EN ISO 3104
Water content	max. 0.2 %	DIN 51777, ASTM D1744, DIN ISO 12937
Glycol content	max. 500 ppm	DIN 51375, ASTM D4291
Total base number TBN	min. 2.0 mg KOH/g	ISO 3771, ASTM D4739
ON	not greater than the TBN	DIN EN 12634, ASTM 664
SAN ¹⁾	max. 0.2 mg KOH/g	ASTM 664
i pH value	min. 4.5	ASTM D7946
Oxidation ²⁾	max. 20 A/cm	DIN 51453
Nitration	max. 20 A/cm	DIN 51453
Silicon	max. 300 mg/kg	DIN 51396, ASTM D5185

¹⁾ The SAN must only be determined for Low gas quality combustion gases.

²⁾ Determining the oxidation for lubricating oils that contain synthetic esters does not apply.

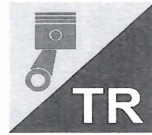


If a wear metal exceeds its permissible limit value, then the limit value for silicon decreases to max. 15 mg/kg (DIN 51396, ASTM D 5185)



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During decommissioning

When decommissioning, the acidity of the lubricating oil can cause non-usage damage to parts carrying lubricating oil. The acidity is characterized by the alkaline reserve (TBN, Total Base Number) and the pH value.

To avoid damage during non-use, the following limit values must not be fallen below.

Properties	Limit value	Test method
Total base number TBN	min. 3.5 mg KOH/g	ISO 3771, ASTM D4739
i pH value	min. 5.0	ASTM D7946

If the analysis values are above the values indicated, the lubricating oil can remain in the genset during the shutdown phase and be used when putting into operation again.

If measured values from the lubricating oil analysis fall below the limit values indicated above, the lubricating oil must be replaced.

Then operate the genset for at least 12 hours.



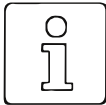
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Wear metals

The wear metals data provides an aid for engine assessment. In this way, changes in the engine conditions can be detected at an early stage.



For analysis, the temporal concentration progression of every individual wear metal must be monitored in several lubricating oil analyses (trend analyses).

The wear rate of every individual value, and not its absolute value, is the decisive factor here.

If a wear metal exceeds 50% of the analysis value listed below, the time intervals for the sampling must be halved.

If the increased wear values are confirmed, the responsible Caterpillar dealer must be consulted.

All measurements must be made according to DIN 51396 (ICP OES / RFA).

Example:

Calculate wear rates

$$v_v = (c_1 - c_2) / (t_1 - t_2)$$

v_v = wear rate

c_1 = new concentration

c_2 = old concentration

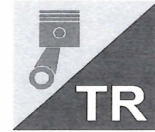
t_1 = new operating hours

t_2 = old operating hours



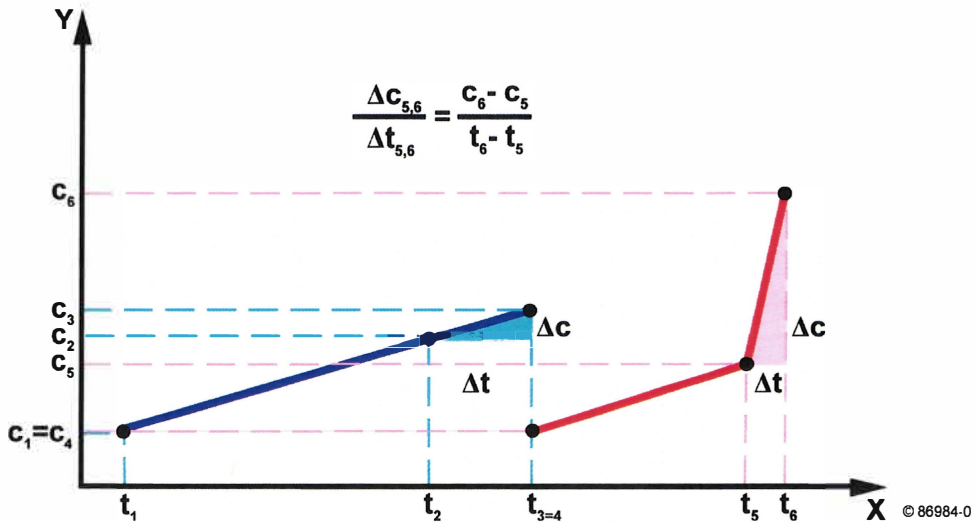
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Six lubricating oil samples were analyzed for an engine. Lubricating oil was changed after the 3rd lubricating oil analysis $t_{3=4}$. From the penultimate lubricating oil analysis t_5 to the last t_6 , the wear metal concentration c_6 increases considerably faster than expected from earlier lubricating oil analyses.

Since the last rate of increase ($\Delta c_{5,6} / \Delta t_{5,6}$) is above 50% of the limit value, the time interval up to the next lubricating oil analysis must be halved.



- X axis: Time period
- Y axis: Numeric value of the analysis result
- $t_{3=4}$: Time of changing the lubricating oil
- $c_1=c_4$: Concentration in the new lubricating oil



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Limit values for wear rate

CG132

Aluminum	max. 1 mg/kg per 100 oh
Chrome	max. 0.5 mg/kg per 100 oh
Copper	max. 2.5 mg/kg per 100 oh
Iron	max. 3 mg/kg per 100 oh
Lead	max. 2 mg/kg per 100 oh
Tin	max. 1 mg/kg per 100 oh

CG132B

Aluminum	max. 0.5 mg/kg per 100 oh
Chrome	max. 0.3 mg/kg per 100 oh
Copper	max. 1.0 mg/kg per 100 oh
Iron	max. 1.0 mg/kg per 100 oh
Lead	max. 1.0 mg/kg per 100 oh
Tin	max. 0.5 mg/kg per 100 oh

CG170

Aluminum	max. 1 mg/kg per 100 oh
Chrome	max. 0.5 mg/kg per 100 oh
Copper	max. 1.5 mg/kg per 100 oh
Iron	max. 2 mg/kg per 100 oh
Lead	max. 2 mg/kg per 100 oh
Tin	max. 0.5 mg/kg per 100 oh

CG260 / CG260 (4.5)

Aluminum	max. 0.5 mg/kg per 100 oh
Chrome	max. 0.5 mg/kg per 100 oh
Copper	max. 1 mg/kg per 100 oh
Iron	max. 2 mg/kg per 100 oh
Lead	max. 1 mg/kg per 100 oh
Tin	max. 0.5 mg/kg per 100 oh

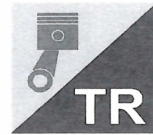
Conversion table

1 mg/kg	1 ppm	0.0001 %
10 mg/kg	10 ppm	0.001 %
100 mg/kg	100 ppm	0.01 %
1000 mg/kg	1000 ppm	0.1 %
10000 mg/kg	10000 ppm	1.0 %



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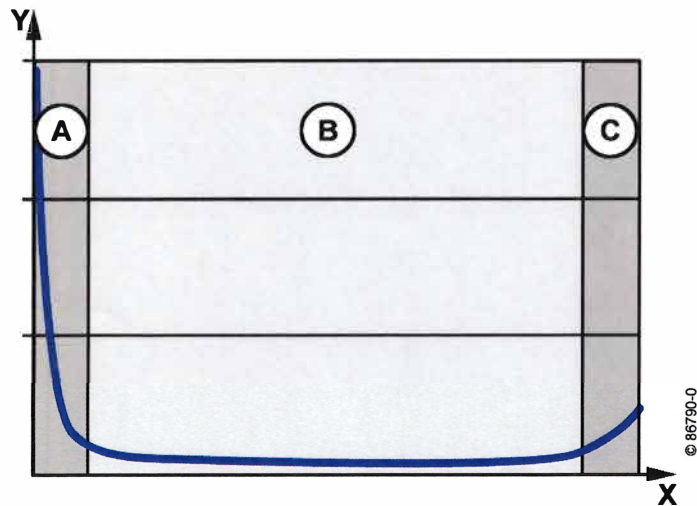


Lubricating oil consumption

The specific lubricating oil consumption is to be understood as the lubricating oil volume which is consumed per unit of time at a definite power.

The lubricating oil consumption is determined over a longer period in the same type of operation in continuous operation.

The lubricating oil consumption drops after the first few operating hours (run-in time). Then it should remain constantly low for a longer period. The wear in the engine increases with a very long running time and with it the lubricating oil consumption.



A 4

- X axis: Period
- Y axis: Lubricating oil consumption
- Range A: Run-in time
- Range B: Operating period
- Range C: Period of rising lubricating oil consumption due to increasing material wear



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Interpretation of parameters of the lubricating oil analysis

Viscosity

Unit: mm²/s

The viscosity indicates the flow capacity of the lubricating oil (resistance to shift of two adjacent layers, inner friction). The viscosity is temperature-dependent.

The viscosity is increased by:

- Ageing/oxidation
- Soot/solid foreign bodies
- Evaporation of lightly boiling components

Total Base Number (TBN)

Unit: mgKOH/g

The TBN indicates the alkaline reserve of the lubricating oil and characterizes the chemical neutralization capacity.

This is a necessary property of the lubricating oil to check the corrosive wear.

With the use of the lubricating oil, the alkaline reserve is reduced by reaction with acids. The acids are ultimately reaction products of the combustion process as well as ageing/oil oxidation and nitration.

In operation with acid forming combustive gases (especially landfill, sewage and bio-gases), a fast decomposition of the TBN is to be expected.

Acid Number (AN, formerly TAN) or Neutralization Number (Nz)

Unit: mgKOH/g

The method covers the strong and weak acids. The strong acids are recorded separately as Strong Acid Number (SAN). Lubricating oil ingredients influence the value of the AN which may be between 0.5 and 2 mgKOH/g in new lubricating oils.

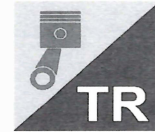
Oxidation and nitration processes can produce weak organic acids. These are only partially neutralized by the alkaline properties of the lubricating oil. If the lubricating oil has a sufficient alkaline reserve, the AN only records the weak organic acids.

There is a rough correlation between AN rise, lubricating oil ageing and lubricating oil nitration.



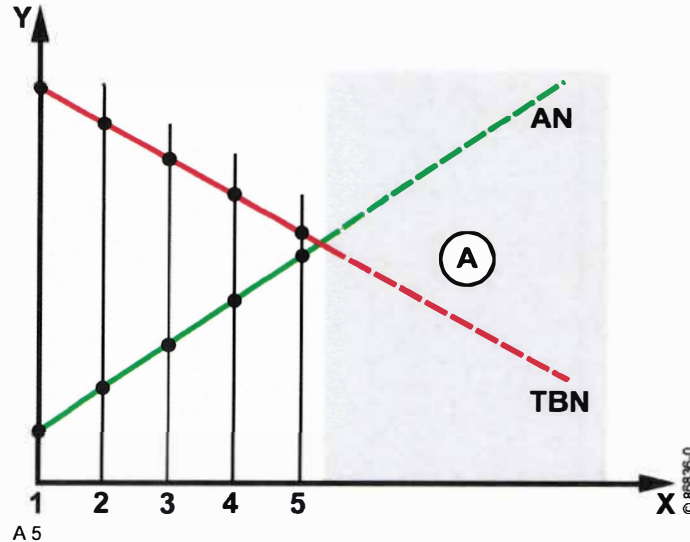
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Explanation of the relation between TBN and AN.

The TBN falls whilst the AN rises. Since, according to the limit value list, the AN must always be smaller than the TBN, no engine operation is permitted in range A.



- X axis: Period
- Y axis: Numeric value of the analysis result
- Range A: non-permitted operating period
- Position 1-5: Time of the lubricating oil analysis
- Position 5: Time of the next lubricating oil change

Strong Acid Number (SAN)

Unit: mgKOH/g

The method only covers strong acids (e.g. sulfuric acid). If a SAN is proven, there is a risk of corrosion. The determination of the SAN is only necessary for combustion gases of the Low gas quality.

Ageing/oxidation

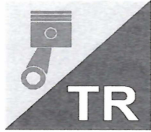
Unit: A/cm

Ageing/oxidation is caused by reaction of the basic oil and ingredient molecules with oxygen which leads to an increase in the viscosity and the Acid Number. Component smearing and sludge deposits can occur. The oxidation products can form organic acids which lead to corrosion even when the lubricating oil still has alkaline reserves.

The extinction at the wave number 1710 cm^{-1} in the infrared light spectrum is measured whereby the carbonyl compounds formed in the oxidation are measured.



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Nitration

Unit: A/cm

Nitration is caused by reactions of the basic oil and ingredient molecules with nitrogen oxides. The influences are comparable with those of the ageing/oxidation. They lead to changes in the lubricating oil parameters. However, the risk of corrosive reaction products is higher in comparison. In the case of strong nitration, a strong decomposition of the alkaline reserve usually also occurs.

The extinction at the wave factor cm^{-1} in the infrared light spectrum is measured.

i pH

Unit: none

The method serves to determine the pH value of the lubricating oil. The measurement result is specified in dimensionless pH value units. Over-acidification of the lubricating oil leads to corrosive wear.

Water

Unit: wt. %

Water in the lubricating oil generally leads to an emulsion which leads on the whole to increased wear and corrosion risk.

Water increases the viscosity of the lubricating oil.

Possible causes:

- Leaks in the coolant system
- Condensation processes in the lubricating oil system by frequent starts and emergency stops
- Improper storage of the lubricating oil
- Insufficient ventilation of the crankcase or lubricating oil tank
- Penetration of rain water into the exhaust system

Glycol

Unit: ppm

Glycol leads to formation of sludge and filter blockage due to reaction with the lubricating oil ingredients.

Glycol is incompatible with mineral oil.

Possible causes:

- Leaks in the coolant system
- Contamination with a lubricating oil based on polyglycol



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Interpretation of elements of the lubricating oil analysis

Silicon

Unit: mg/kg

Possible origin:

- Component in antifoaming ingredients
- Dust from the sucked-in air
 - leads to abrasive wear even in the smallest of amounts.
- Compounds of combustive gases (e.g. landfill, sewage and bio-gases)

The silicon load in the lubricating oil also gives an indirect indication of the silicon load of the combustive gas.

Sodium

Unit: mg/kg

Typical element of ingredients for corrosion protection in the coolant. Strong increase in the sodium content is a sign of contaminated coolant. The engine must be checked continuously for possible coolant leaks in the course of further operation.

In many cases no water can be found in the lubricating oil despite high sodium values and the associated contamination because this evaporates due to the lubricating oil temperature in engine operation.

Aluminum

Unit: mg/kg

Typical wear element of pistons and slide bearings for example.

Aluminum may also be a part of contaminated suction intake air under certain circumstances.

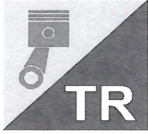
Iron

Unit: mg/kg

Typical wear element of cylinder liners, cams/tappets, shaft journals, piston rings and toothed wheels.



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Chrome

Unit: mg/kg

Typical wear element of piston rings, valve stems, cams/tappets and other high alloyed engine components.

Copper

Unit: mg/kg

Typical wear element of bearings and corrosion product of lubricating oil coolers and lubricating oil lines.

Copper is also part of different mounting compounds.

Lead

Unit: mg/kg

Typical wear element of slide bearings and solder from lubricating oil coolers and lubricating oil lines.



The cause of a rapid change in the wear rate for lead and copper is frequently chemically corrosive wear (note limit value for i pH value).

Tin

Unit: mg/kg

Typical wear element of slide bearings.

Molybdenum

Unit: mg/kg

May be part of lubricating oil ingredients as well as different mounting compounds.

Also used as a running surface coating for sliding bearings.

Interpretation of optionally analyzed elements of the lubricating oil analysis

Potassium and boron

Unit: mg/kg

Typical elements of ingredients for corrosion protection in the coolant. An increase in the lubricating oil is a sign of a contamination by coolant.

However, boron is a typical element of frequently used ingredients in the lubricating oil.

Calcium, zinc, phosphorus, sulfur

Unit: mg/kg

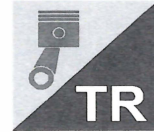
Typical elements of ingredients in the lubricating oil.

Sulfur is also a part of the lubricating oil and combustive gases.



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This circular replaces:
2091/13



Specification for Coolant

Valid for: CG132, CG132B, CG170, CG260, CG260 (4.5), Power Units and Systems

The 14th replacement is made because of

- Revision of the Technical Bulletin
- List of approved cooling system protection agents in a separate document
- Updating the approved cooling system protection agents

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2018-03-01

Note:
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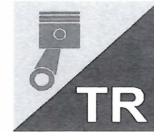
Contents:

- General information
- Cooling systems
- Cooling system protection agents
 - Chemical corrosion protection agents
 - Antifreezes with corrosion inhibitors
- Preparing the coolant
 - Cooling water properties
 - Addition of chemical corrosion protection agents
 - Addition of antifreezes with corrosion inhibitors
- Limit values of the coolant
 - Engine cooling circuit
 - Heating circuit
- Testing and replacing the coolant
- Cleaning the cooling system
- Disposal of the coolant
- Appendix
 - Released cooling system protection agents



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General information



Risk of destruction of components

Due to non-approved cooling system protection agents

- The engine or system may only be operated with the approved cooling system protection agents



The owner is solely responsible for observing the coolant oil specification described.

The manufacturer accepts no liability for damage caused by the use of non-approved cooling system protection agents or by improper operation.

The owner is responsible for observance of the respective national legal provisions.



All the data in this Technical Bulletin corresponds to the latest state of knowledge. If you have any queries, please contact your Caterpillar dealer.

The cooling water referred to in this bulletin is water with suitable properties for preparing the coolant ⇒ see chapter Cooling water properties.

The coolant consists of cooling water with the admixture of cooling system protection agents ⇒ see chapter Preparing the coolant.

The coolant must be suitable for all the components in the engine (different metals, elastomers) and meet the different requirements in the engine cooling circuit, heating circuit and mixture cooling circuit or charge air cooling circuit. Appropriate properties of the coolant are necessary to avoid damage especially to the exhaust heat exchanger due to poor quality of the coolant ⇒ see chapter Limit values of the coolant.

The products which are released as cooling system protection agents are listed in the chapter Cooling system protection agents.



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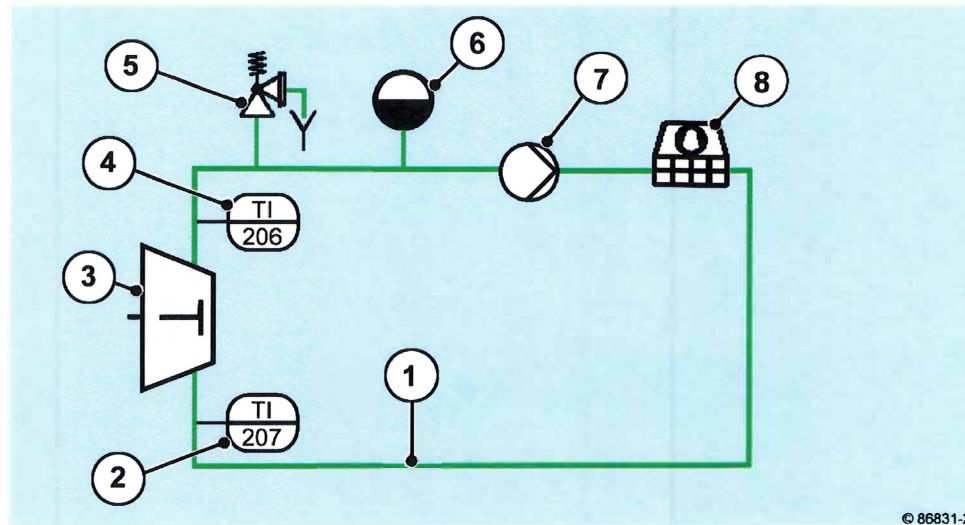
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Cooling systems

Cooling systems are designed differently depending on the requirements.

The designs of cooling circuits are shown in simplified terms below:

A) Cooling system without heat utilization:



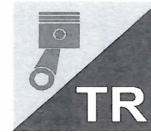
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- 1 Engine cooling circuit
- 2 Temperature sensor at engine inlet
- 3 Engine
- 4 Temperature sensor at engine outlet
- 5 Safety valve
- 6 Diaphragm expansion vessel
- 7 Coolant pump
- 8 Coolers

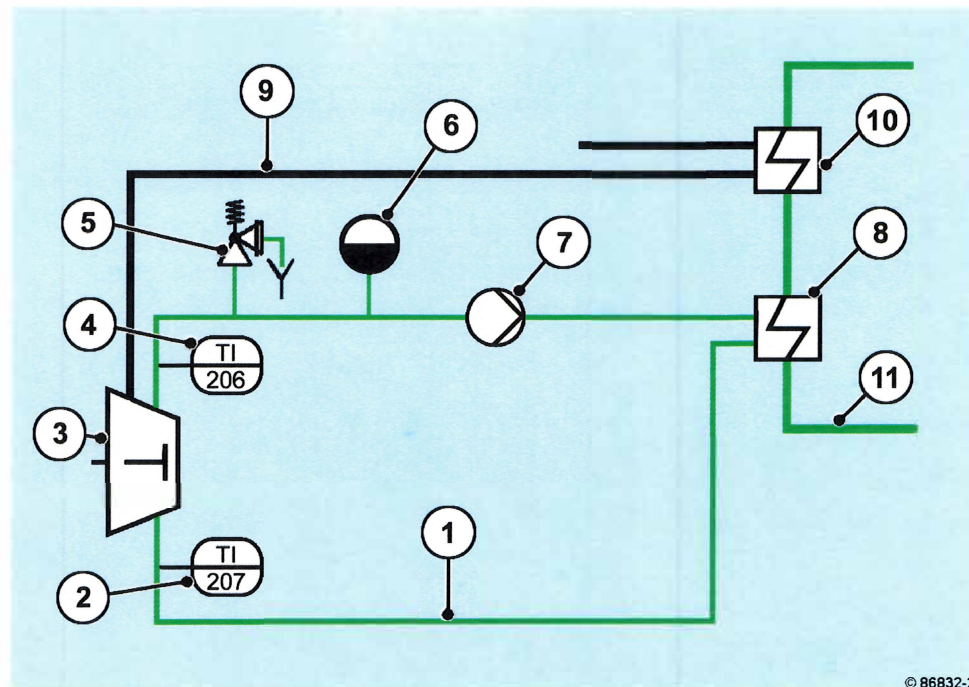


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B) Cooling system with exhaust heat exchanger in the heating circuit:



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- 1 Engine cooling circuit
- 2 Temperature sensor at engine inlet
- 3 Engine
- 4 Temperature sensor at engine outlet
- 5 Safety valve
- 6 Diaphragm expansion vessel
- 7 Coolant pump
- 8 Heat exchanger
- 9 Exhaust gas
- 10 Exhaust heat exchanger
- 11 Heating circuit

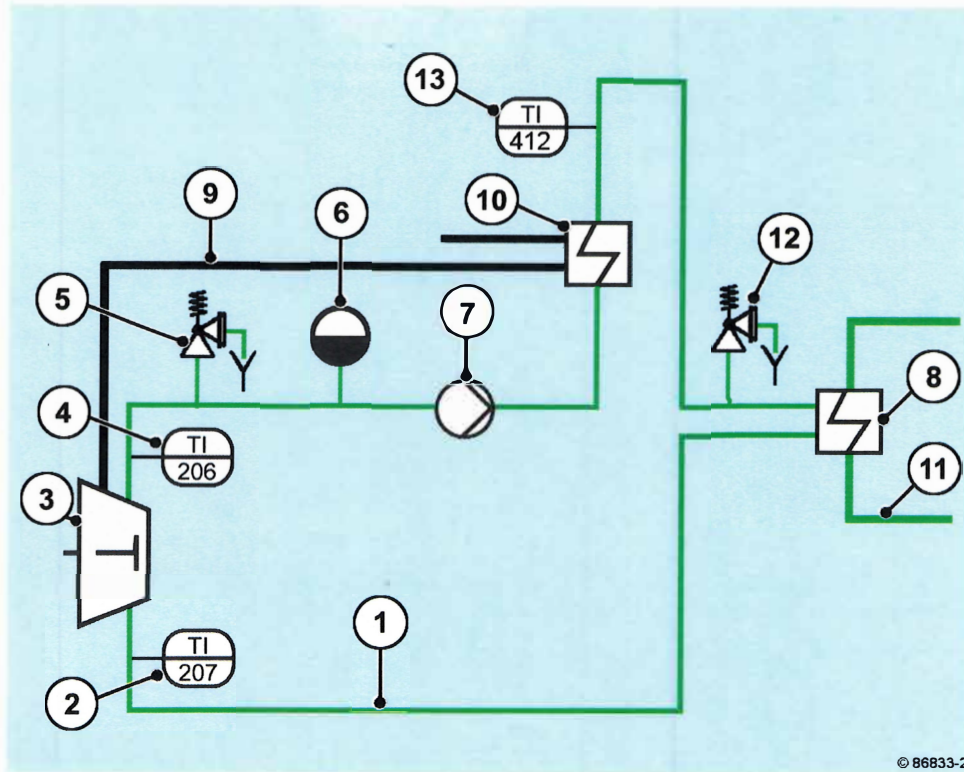


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C) Cooling system with exhaust heat exchanger in the engine cooling circuit:

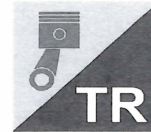


- 1 Engine cooling circuit
- 2 Temperature sensor at engine inlet
- 3 Engine
- 4 Temperature sensor at engine outlet
- 5 Safety valve
- 6 Diaphragm expansion vessel
- 7 Coolant pump
- 8 Heat exchanger
- 9 Exhaust gas
- 10 Exhaust heat exchanger
- 11 Heating circuit
- 12 Safety valve
- 13 Temperature sensor at exhaust heat exchanger outlet



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Cooling system protection agents



Risk of destruction of components

Cooling system protection agents which are made from different raw products may not be mixed.

- When changing over the cooling circuit to a different product, the compatibility of the products must be ensured. If necessary, the cooling system must be purged before conversion



WARNING

Danger of poisoning

Due to the mixing of agents containing amine and nitrite

This can lead to severe injuries and even death.

- Do not mix agents containing amine and nitrite, as carcinogenic nitrosamines can result from this

In the system protection agents a distinction is made between:

- Chemical corrosion protection agents which form a protective film on metal surfaces by chemical reactions and therefore prevent damage such as corrosion and cavitation on the cooling system, but do not act as an antifreeze
- Antifreezes with corrosion inhibitors which avoid freezing of the coolant and also offer corrosion protection

Chemical corrosion protection agents

Chemical corrosion protection agents have the following properties:

Properties	
Corrosion protection	good
Cavitation protection	satisfactory
Antifreeze	none
Care	low
Operational safety	good

Chemical corrosion protection agents that contain silicates can damage the mechanical seals of the coolant pumps. These agents are therefore not listed under the approved products.



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Antifreezes with corrosion inhibitors

When using antifreezes the heat transition value (heat capacity and heat conductance) of the coolant is reduced.

Make sure that the cooling system is designed for this.

Antifreezes with corrosion inhibitors have the following properties:

Properties	
Corrosion protection	good
Cavitation protection	satisfactory
Antifreeze	depending on the mixing ratio
Care	low
Operational safety	good

Antifreezes with corrosion protection are used when sub-zero ambient temperatures can occur.



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Preparing the coolant

The coolant is prepared by adding a chemical corrosion protection agent or an antifreeze with corrosion inhibitors to the cooling water.

Cooling water properties



Risk of destruction of components

- Sea water, river water, brackish water or industrial waste water is unsuitable as cooling water for engines and systems
- Depending on the structure of the cooling circuit, the following limit values must be observed when preparing the cooling water

Information about the properties of the water can be provided by the local waterworks or can be determined with the test set for cooling water or in a suitable chemical laboratory.

Sampling and water analysis must be carried out with great care and accuracy.

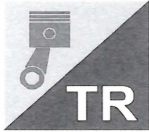
Only clean and odorless water with the following properties may be used as a cooling water for engines and systems:

Limit values of the cooling water for cooling systems A and B without exhaust heat exchanger

pH value at 25 °C	6.5 to 8.5
Chloride ion content	maximum 100 mg/L
Sulfate ion content	maximum 100 mg/L
Total hardness	less than 1 to 12°dH
Carbonate hardness proportion of the total hardness	less than 1 to 12°dH

Limit values of the cooling water for cooling system C with exhaust heat exchanger

pH value at 25 °C	6.5 to 8.5
Chloride ion content	less than 20 mg/L
Sulfate ion content	maximum 100 mg/L
Total hardness	less than 1 °dH
Carbonate hardness proportion of the total hardness	less than 1 °dH

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The water hardness is specified in mol per liter or, for low concentrations, in millimol per liter (mmol/L).

The unit degree German hardness (°dH) is still the most commonly used in Germany.

The degree German hardness (°dH) is converted into mmol/L as follows:

$$1 \text{ °dH} = 0.178 \text{ mmol/L}, \quad 1 \text{ mmol/L} = 5.6 \text{ °dH}$$

In case of deviation from the limit values listed, the cooling water is prepared as follows:

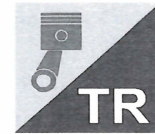
- pH value too low:
Addition of diluted sodium or potassium lye.
It is advisable to make small sample mixtures before adding.
- Total hardness and/or carbonate hardness too low:
Mixing with harder water
Harder water is usually available in the form of drinking water (city mains water).
- Total hardness, chloride and/or sulfates too high:
Mixing with softened water
Softened water is distilled water or water treated with an ion exchanger.

Another water analysis must be carried out after preparing the cooling water.



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Addition of chemical corrosion protection agents



Risk of destruction of components

- An under-concentration of the chemical corrosion protection agent has a damaging effect on the cooling system, especially aluminum parts
- Observe the correct dosing of the chemical corrosion protection agent

The corrosion protection agent is mixed with the cooling water first and then filled into the cooling system as described in job card **B 9-0-4 Emptying and filling the cooling system** in the appropriate operating manual.

The necessary concentrations of the chemical corrosion protection agent in cooling circuits are determined according to the specifications of the manufacturer or supplier.

Addition of antifreezes with corrosion inhibitors

The antifreeze is mixed with the cooling water first and then filled into the cooling system as described in job card **B 9-0-4 Emptying and filling the cooling system** in the appropriate operating manual.

The coolant must be inspected for the necessary freezing protection after preparation.

The freezing protection of the antifreeze depends on the mixing ratio with the cooling water:

Antifreeze	Cooling water	Freezing protection up to
33%	67%	-21 °C
40%	60%	-29 °C
45%	55%	-35 °C
50%	50%	-40°C



The concentration of the antifreeze must be at least 33% to ensure an adequate corrosion protection.

When using an antifreeze with corrosion inhibitors for corrosion protection the antifreeze must stay in the cooling system even at temperatures above freezing point.



Risk of destruction of components

- Pure antifreeze may not be filled into the cooling system
- Please contact your Caterpillar dealer if antifreeze below -40 °C is required
- The limits values listed for the coolant must be observed



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Limit values of the coolant

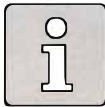
Engine cooling circuit

Limit values of the coolant for cooling systems A and B without exhaust heat exchanger in the engine cooling circuit

If the specifications for cooling water quality of the cooling system protection agent are complied with, the quality of the coolant is sufficient.

Limit values of the coolant for cooling system C with exhaust heat exchanger in the engine cooling circuit

pH value at 25 °C	7.5 to 8.5
Chloride ion content	less than 20 mg/L
Total hardness	less than 1 °dH
Filling volumes	maximum 2 m ³
Temperature at exhaust heat exchanger outlet	maximum 110 °C



The filling volume is limited to 2 m³ to avoid heat build-up deposits due to escaping carbonate at the limit surfaces of the exhaust heat exchanger.

Heating circuit



Risk of destruction of components

- The coolant, which is exclusively for use in heating circuits of iron materials, is unsuitable for the engine cooling circuit
- The manufacturer will not be liable for damage caused by using this coolant in the engine cooling circuit

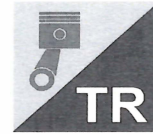
Limit values of the coolant for the heating circuit

pH value at 25 °C	9 to 10.5
Electrical conductivity	less than 0.1 mS/cm
Oxygen (O ₂)	less than 0.05 mg/L
Chloride	less than 20 mg/L
Copper (Cu)	less than 0.05 mg/L
Total iron (Fe)	less than 0.05 mg/L
Phosphate (PO ₄)	5 to 10 mg/L
Earth alkalis	less than 0.02 mmol/L
Total hardness	less than 0.1 °dH



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Testing and replacing the coolant

The cooling system must be inspected and serviced at the specified intervals. This also includes inspecting the properties of the coolant and the concentrations of the cooling system protection agents in cooling systems as well as refilling and changing the coolant.

The cooling system protection agent in the coolant must be checked according to job card **B 9-1-1 Checking the percentage of corrosion protection agent or antifreeze in the coolant** in the appropriate operating manual.

When determining the concentration of corrosion protection and antifreeze agents in the coolant, the plant specifications must be followed. The application concentration of anti-freeze agents in the coolant can alternately be measured by using the gravimetric analysis method.



The specifications of the cooling system protection agent manufacturer must be observed when checking the coolant.

All inspections must be carried out according to the maintenance schedule and documented in the operation log.

The coolant's period of use has been specified in the maintenance schedule.

The coolant must also be changed in the following circumstances:

- after 36 months at the latest - unless otherwise indicated in the maintenance plan
- Penetration by water from outside
- Lubricating oil penetration
- Conspicuous turbidity due to corrosion residues or other suspended particles



Risk of destruction of components

Due to failure to comply with the information and specifications for the production and use of coolants.

- The same product must be used again when refilling the coolant
- The compatibility of the products must be checked if a product needs to be changed
- In case of incompatibility the entire cooling system must be cleaned thoroughly before changing the product
- The engine or system may only be operated with the approved cooling system protection agents



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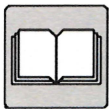
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Cleaning the cooling system

The complete cooling system must be cleaned in the following circumstances:

- Contamination with dirt
- Lubricating oil penetration
- Penetration by water from outside
- Product change (incompatible products)
- Maintenance work

The coolant must be completely drained and purged with an approved cleaning agent.



For more information on the cleaning agents, see

- Operating Manual ⇒ General ⇒ Operating media regulations
 - Technical Bulletin (TR) 2147 Specification for auxiliary media
-

Disposal of the coolant

Coolant and cooling system protection agents must be disposed of properly according to the respective national, legal regulations and specifications of the manufacturer or supplier by a licensed disposal company.

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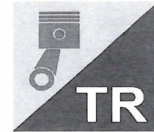
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This circular replaces:
0199-99-13017/05



Specification for combustion gas

Valid for: CG132, CG132B, CG170, CG260, CG260 (4.5)

The 6th replacement is made because of:

- Introduction of new engine types
 - CG132B
 - CG260 (4.5)

Contents:

- General information
- General requirements
- Classification of the gas qualities for the maintenance schedules
- Definitions of the combustion gas types
- Methane number
- Limit values of combustion gases
- Sampling and gas analysis

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Note:
There is no revision service for the parts numbers specified in this document. Only the spare parts documentation is binding for the identification of spare parts.

Copies to:
- TR
- According to SIT 7010



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General information

Combustion gas

Combustion gas refers to gas mixtures which are suitable for genset operation and which differ in their composition.

The most important main components are:

- Methane (CH_4)
 - as an essential heating value carrier of the usual combustion gases,
- chained hydrocarbons (C_nH_m with n greater than 1)
 - which have a strong tendency towards knocking combustion,
- inert gases (N_2 and CO_2)
 - which do not actively participate in the combustion. Inert gases increase the methane number in a combustion gas. This increases the methane number in CO_2 with the triple effect of N_2 ,
- Hydrogen (H_2)
 - which considerably reduces the methane number of the combustion gas.

Accompanying substances

The gas accompanying substances are also very important in the assessment of suitability as a combustion gas. They make no significant contribution to the combustion energetically. However, these gas accompanying substances must be taken into account with regard to the reliable operation of the overall system.

In addition to the gas accompanying substances which do not change the combustion process, there are also substances which lead to a change in the ignition properties (such as oil fumes).

Other gas accompanying substances are significant because of the combustion products such as ashes or deposits. These are elements and compounds which contain silicon, halogens, metals, etc.

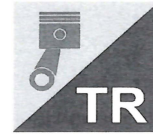
Although the accompanying substances only occur in traces, the combustion products can cause wear.

Depending on the amount and damage effect, these gas accompanying substances must be eliminated from the combustion gas before entering the gas control line.



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Examples:

- Hydrogen sulfide H_2S from e.g. biogas combusts to SO_2 and H_2O . These two intermediate products react to sulfurous acid H_2SO_3 . A further reaction to sulfuric acid H_2SO_4 is possible in the oxidation catalyst. The acids formed in the combustion cause the lube oil to become acidified, which leads to the lube oil replacement intervals becoming shorter. Furthermore, sulfurous and sulfuric acid can condense in the exhaust heat exchanger and lead to deposits and corrosion occurring there.
- The silicon connection hexamethylcyclotrisiloxane D3 $(CH_3)_6Si_3O_3$ e.g. from landfill and sewage gas combusts to silicon dioxide SiO_2 (quartz sand), CO_2 and steam. Silicon dioxide forms deposits on all components surrounding the combustion chamber, which leads to abrasive wear. Furthermore, the deposits cover the exhaust catalyst and deactivate it.
- Chloroform $CHCl_3$ e.g. from landfill gas reacts to hydrochloric acid, carbon dioxide and steam. This hydrochloric acid pressurizes the lube oil and corrodes components.

General requirements



If the designated combustion gas does not satisfy the minimum requirements described in this bulletin or the combustion gas contains by-products which are not specified without the particular combustion gas analysis having been granted written release, all warranty claims against MWM will be voided.

Failure of a combustion gas to comply with the minimum requirements or its contamination by unspecified ingredients will lead to a reduction in the life of the genset and all components affected. The regular maintenance intervals for operation according to specifications listed in the regular maintenance schedule are sometimes much too early and lose all their reference value.

During commissioning, a gas analysis must always be submitted to the manufacturer (not older than 2 weeks) and documented in the commissioning report. After commissioning, a gas analysis must be made according to the maintenance schedule and compliance with the minimum requirements checked.

All gas analyses must be presented to the manufacturer in a warranty case.



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Classification of the gas qualities for the maintenance schedules

The combustion gases are classified into various gas quality groups by their accompanying substances and their effects on the wear.

The maintenance schedule must be assigned to the corresponding gas quality for maintenance of the genset.



Note

Because of the different composition of the combustion gases, not every engine in a series achieves the maximum possible power for the series with every approved combustion gas.

Delivered gensets may only be operated with the combustion gas prescribed according to the contract.

If the genset is to be operated with another combustion gas, the service partner must be contacted before changing the combustion gas.

Low gas quality

according to the limit values of this bulletin, such as:

Sewage gas

Landfill gas

Biogas

Associated gas (petroleum gas)

Coke oven gas

Medium gas quality

according to the limit values of this bulletin, such as:

Biogas after precision cleaning

Mine gas

High gas quality

according to the limit values of this bulletin, such as:

Natural gas

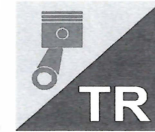
Liquefied gas such as propane, LNG (liquefied natural gas)

Mine gas after precision cleaning



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Definitions of the combustion gas types

General

The gas types suitable for operation are explained below.

Restrictions on which genset is released for which gas type are specified in the sales literature.

For a better understanding, a typical combination of components is defined for every gas type in addition to the permissible spectrum range as far as this is useful and possible.



Note

The components listed in the following tables are to be seen respectively in combination and only give 100% in the **typical composition**. Totaling of the Min and Max values is not useful. These values only serve to limit the spectrum range.

All values refer to a totally dry gas. The real steam proportion must be taken into account in the design of gas systems.

Sewage gas

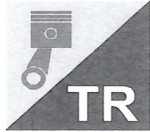
Sewage sludge collects during waste water purification in the sedimentation basins (sewage basins) of a sewage plant. The sewage gas is formed during the anaerobic (oxygen-free) sewage sludge fermentation in fermentation towers.

Composition

Component	Min.	Typical	Max.
Methane (CH ₄) in %	57	65	72
Carbon dioxide (CO ₂) in %	28	34	43
Nitrogen (N ₂) in %	0	1	20
Oxygen (O ₂) in %	0	0.5	2
Silicon compounds in mg/10kWh	0	4	20
Hydrosulfide (H ₂ S) in ppm based on 10kWh	0	60	1500



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Landfill gas

Landfill gas is formed as a result of biochemical decomposition processes of organic compounds and materials in the refuse body. The processes are divided into aerobic and anaerobic (oxygen-free) decomposition processes which can be divided into chronological phases at the beginning and which run simultaneously towards the end of the process.

Composition

Component	Min.	Typical	Max.
Methane (CH ₄) in %	45	50	65
Nitrogen (N ₂) in %	10	23	34
Carbon dioxide (CO ₂) in %	20	27	45
Oxygen (O ₂) in %	0	0	10
Silicon compounds in mg/10kWh	0	12	20
Hydrosulfide (H ₂ S) in ppm based on 10kWh	0	300	1000
Chlorine (Cl) in mg/10kWh	0	20	100
Fluorine (F) in mg/10kWh	0	10	50

Biogas

Biogases are gases with a plant or animal origin.

Biogas is produced in the anaerobic (oxygen-free) fermentation of organic material. The following are suitable as initial materials for the technical production of biogas:

- fermentable waste containing biomass such as biological waste or leftover food
- commercial fertilizers such as liquid manure or dung
- specially cultivated energy plants (regrowable raw materials)

Composition

Component	Min.	Typical	Max.
Methane (CH ₄) in %	45	55	70
Nitrogen (N ₂) in %	0.01	4.5	10
Carbon dioxide (CO ₂) in %	20	40	55
Oxygen (O ₂) in %	0.01	0.5	2
Hydrosulfide (H ₂ S) in ppm based on 10kWh	0	60	1500



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Associated gas

Associated gas is a by-product of mineral oil production. Due to reductions in pressure, the solubility for gases in the liquid phase of the mineral oil drops and these gases pearl off. The concentration may vary considerably depending on the mineral oil source.

When using as a combustion gas, you must ensure that no increase in concentration of longer-chained hydrocarbons can take place.

Coke oven gas

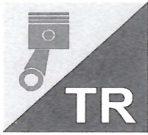
Coke oven gas forms as a by-product when producing coke. The high dust, tar and contaminant concentrations make a laborious pre-connected gas processing necessary.

Composition

Component	Min.	Typical	Max.
Hydrogen (H ₂) in %	52	56	60
Methane (CH ₄) in %	22	25	28
Ethane (C ₂ H ₆) in %	0.5	1.5	3
Nitrogen (N ₂) in %	8	10	12
Oxygen (O ₂) in %	0	0.5	2
Carbon dioxide (CO ₂) in %	1	2	4
Carbon monoxide (CO) in %	3	5	7



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Mine gas

Mine gas is discharged for underground mining. In coal mining, it is mainly methane (CH₄) which is used as a heating value carrier.

Composition

Active mine

Component	Min.	Typical	Max.
Methane (CH ₄) in %	25	40	70
Nitrogen (N ₂) in %	4	47	68
Carbon dioxide (CO ₂) in %	0	3	20
Oxygen (O ₂) in %	0	10	17
Dust in mg/10kWh	0	5	10

Composition

Shut down shafts

Component	Min.	Typical	Max.
Methane (CH ₄) in %	40	65	80
Nitrogen (N ₂) in %	4	28	68
Carbon dioxide (CO ₂) in %	0	4	25
Oxygen (O ₂) in %	0	3	15
Dust in mg/10kWh	0	1	10

Natural gas

Natural gas is a combustible gas found in underground deposits. It is often found together with mineral oil as it evolves in a similar way. Natural gas is a gas mixture whose composition varies considerably depending on where it is found. Natural gases consist mainly of methane but differ in their further chemical composition.

Composition

Component	Min.	Typical	Max.
Methane (CH ₄) in %	85	90.6	98
Ethane (C ₂ H ₆) in %	0	3	10.3
Propane (C ₃ H ₈) in %	0	1.6	2
Butane (C ₄ H ₁₀) in %	0	0.5	0.7
Pentane (C ₅ H ₁₂) in %	0	0.1	0.15
Nitrogen (N ₂) in %	0	3.7	11
Carbon dioxide (CO ₂) in %	0	0.5	2



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Liquefied Natural Gas (LNG)

LNG (Liquefied Natural Gas) is natural gas in a liquid form. The gas is liquefied by compression and cooling. The values depend on the natural gas base.

Through extraction from the liquid phase of the tank and complete evaporation, an increase in concentration of liquid components can be counteracted.

Liquefied gas (propane)

Propane is a colorless, odorless gas which belongs to the alkanes. Since propane liquefies at relatively low pressures even at normal temperatures, large amounts of energy can be stored in the liquid phase.

Because of the solubility of alkanes in one another, DIN 51622 defines the common technical propane on the market as a mixture of at least 95% propane and the rest a mixture of ethane, ethene, butane and butene.

Through extraction from the liquid phase of the tank and complete evaporation, an increase in concentration of liquid components can be counteracted.



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Methane number

The methane number (MN) describes the knocking resistance of the combustion gas. It is defined by the mixing ratio of a mixture of hydrogen and methane which has the same knocking tendency as the available combustion gas.

The MN 100 is knocking-resistant (for methane CH_4) and MN 0 high knocking (for hydrogen H_2).

The MN can increase to more than 100 in mixtures with CO_2 .

The methane number MN depends on the content of various components. Even the smallest concentrations of long chained hydrocarbons lead to a drastic drop in the methane number MN.

Examples:

- Propane has the same knocking behavior as a mixture of 33% methane and 67% hydrogen. Therefore, propane gas is assigned the MN 33.
- A mixture of 10% butane (MN 10) and 90% methane (MN 100) leads to an MN 51 and not to MN 91 (no linear curve).

The basis for calculation and evaluation of the methane number is the computing program of MWM.



Note

For combustion gases with a fluctuating or low methane number, there is a danger of a knocking combustion. The consequences are extreme mechanical and thermal stresses which can cause damage.

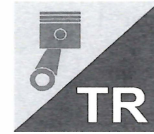
Examples for the methane number (MN) of some gases:

Biogas	MN greater than 120
Mine gas (active mine)	MN approx. 100
Mine gas (shut down shafts)	MN approx. 120
Methane (CH_4)	MN 100 (definition)
Natural gas	MN 65 to 95
Propane (C_3H_8)	MN 33
Butane (C_4H_{10})	MN 10
Hydrogen (H_2)	MN 0 (definition)



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Limit values of combustion gases

The limit values for operation of the gas engines CG132, CG170, CG260 are specified in the following table.

If the values on site deviate from the limit values, contact your Service Partner.



Note

Condensation of water and hydrocarbons in the gas control line and the feeding lines is generally impermissible.

Standard reference conditions

For the conversion to standard reference conditions, a temperature t_n of 0 °C (corresponding to 273.15 K) and an absolute pressure p_n of 1013.25 mbar must be used.

Calculation examples

Standard cubic meters:

One thousand cubic meters of gas V_b at a temperature t_b of 35 °C, an overpressure $p_{b,\bar{u}}$ of 100 mbar and an ambient pressure $p_{\text{barometer}}$ of 970 mbar are converted to the standard condition according to the following formula.

$$V_n = V_b \times ((p_{b,\bar{u}} + p_{\text{Barometer}}) / p_n) \times ((t_n + 273.15 \text{ K}) / (t_b + 273.15 \text{ K}))$$

$$936 \text{ m}^3_n = 1000 \text{ m}^3 \times ((100 + 970) / 1013.25) \times ((0 + 273.15) / (35 + 273.15))$$

Calorific value reference:

At a measured CH_4 concentration of 50 vol% (corresponds to 5 kWh/m³), a concentration of 500 ppm H_2S is measured.

This gives a concentration of 1000 ppm H_2S based on 10 kWh/m³.



Note

For combustion gases, the calorific value carrier of which is methane, the methane concentrations can also be used alternatively for concentration references for pollutant gases.

e.g. 100 mg/m³_n CH_4 correspond to 100 mg/10 kWh.



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Value limit list for combustion properties

Methane number

Methane number (MN)	33 to 150
Rate of change	less than 5 MN/min

Heat value

lower heat value H _i	4.5 kWh/Nm ³ to 26 kWh/Nm ³
Rate of change	less than 5%/min

Value limit list for combustion properties

Gas quality	Low	Medium	High
Sulphur (total S)			
per 10 kWh	less than 2200 mg	less than 440 mg	less than 15 mg
Hydrosulfide (total H ₂ S)			
based on 10 kWh	less than 1500 ppm <small>(corresponds to 0.15 Vol%)</small>	less than 300 ppm <small>(corresponds to 0.03 Vol%)</small>	10 ppm <small>(corresponds to 0.001 Vol%)</small>
Chlorine (total Cl)			
per 10 kWh	less than 100 mg	less than 20 mg	less than 2 mg
Fluorine (total F)			
per 10 kWh	less than 50 mg	less than 10 mg	less than 1 mg
Chlorine and fluorine (Sum Cl and F)			
per 10 kWh	less than 100 mg	less than 20 mg	less than 2 mg
Ammonia (total NH ₃)			
per 10 kWh	less than 150 mg	less than 30 mg	less than 2 mg
Humidity* (relative humidity φ)	less than 80 %	less than 50 %	less than 50 %
<small>* at lowest temperature of the entire gas pipe system</small>			
Silicon compounds (total VOSiC)			
per 10 kWh	less than 20 mg	less than 1 mg	0 mg
Dust content			
total per 10 kWh	less than 10 mg	less than 2 mg	less than 0.5 mg
Grain size	greater than 3 μm	greater than 2 μm	greater than 2 μm



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Gas quality	Low	Medium	High
Higher hydrocarbon compounds and tars			
greater than C5 / less than C10			
per 10 kWh	less than 3000 mg	less than 600 mg	less than 100 mg
greater/equal to C10			
per 10 kWh	less than 250 mg	less than 50 mg	less than 10 mg
greater/equal to C12			
per Nm ³	less than 0.5 mg	0 mg	0 mg

Notes for system components



Note

Combustion gas components which have no significant effects on genset operation on compliance with the limit value specifications may still have a considerable effect on the other district heating power station components.

Exact specifications of permissible concentrations of traces and the warranty conditions are provided in the Caterpillar documentation **Power plants layout (Planning and Installation Notes), chapter Exhaust System.**



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Limit values for zero-pressure control lines



Note

The design of the gas control line is always project-related depending on the heating value. At a pre-pressure of over 200 mbar, a project-related pre-pressure control system with safety shutoff valve and safety blow-off valve is necessary.

If the values on site deviate from the limit values, contact your Service Partner.

Limit value list

Pre-pressure (inlet gas control line)

20 to 200 mbar

Gas pressure fluctuations

+/- 10 % of the setting value

Fluctuation frequency

less than 10/h

Gas temperature

10 to 50 °C

for liquefied propane gas (according to DIN 51622), LNG (liquefied natural gas), coke oven gas and associated gas, the following deviation applies.

Gas temperature

greater than 35 °C

Sampling and gas analysis

Sampling and gas analysis must be performed according to the valid standards and regulations.

See job card B 7-18-1, Combustion gas sampling, for further information.



Note

A detailed gas analysis must ensure that the genset is operated with combustion gas according to the specification in this Technical Bulletin.

Gas analyses must be kept so that proof of the proper operation of the genset can be presented.



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